

ISBN 978-969-8858-04-9

May 9 - 11, 2008

4th PROCEEDINGS of International Conference on Statistical Sciences

Jointly organized by



**Islamic Countries
Society of
Statistical Sciences**

Plot # 426, Block J/3,
M.A. Johar Town
Lahore (Pakistan)
Tel: +92-42-5314437-5314438
Fax: +92-42-5752547
Email: secretary@isoss.com.pk
URL: www.isoss.com.pk



University of Gujrat

Hafiz Hayat Campus
Gujrat (Pakistan)
Tel: +92-53-3643112/118/408/097
Fax: +92-53-3643167
Email: info@uog.edu.pk
URL: www.uog.edu.pk

Editor: **DR. MUNIR AHMAD**

Volume

15 & 16

Venue:

University of Gujrat, Hafiz Hayat Campus

*The Executive Board
of
Islamic Countries Society of
Statistical Sciences (ISOSS)*

*is grateful to the
Higher Education Commission, Islamabad
for partial grant to bring out the
Proceedings*

Published by : ISOSS, Lahore.

Printed by : Izharsons Printers, 9-Rattigan Road, Lahore (Pakistan).

CONTENTS (Vol. 15)

Address by Dr. Munir Ahmad, Patron ISOSS vii

PAPERS

1. 019: Statistical Semantic Modeling of Preprocessed Source Code to Identify, Measure and Visualize the Complexities in Software Product Line Applications by Zeeshan Ahmed, Austria 1
2. 026: On Certain Characterizations of Distributions by Masood Anwar and Munir Ahmad 13
3. 028: Characterization of Some Discrete Distributions by Kalsoom Akhtar Chaudhry and Munir Ahmad 19
4. 030: Digital Signatures Processes and its Authentication Systems by Nadia Qasim, S.M. Saleem, and Muhammad Qasim Rind 27
5. 031: Concerning Generalization of Darboux Integral by Abdul Rauf Khan, Muhammad Qasim Rind and Abdul Qayyum 37
6. 036: On Coefficients of the Laurent Series of the Alpha-Probability Functions and its Application to Fatigue Life of Aircraft Structural Aluminum Alloy by Munir Ahmad 41
7. 038: Simulation Analysis of Generalized Exponential Models by Muhammad Shuaib Khan, Muhammad Aleem and Zafar Iqbal 49
8. 042: Design Artifacts, Principles, Goals, Problems and Importance by Zeeshan Ahmed, Austria and Sudhir Kumar Ghanti, Sweden. 57
9. 045: A Chain Ratio Type Estimator Using Two Auxiliary Attributes by Inam-ul-Haq 69
10. 047: Dissimilarity Based Mining for Finding Frequent Itemsets by Abdus Salam, Saif-ur-Rehman, and Irshadullah 73
11. 050: Open Architecture Robotic Manipulator Design Philosophy by Syed Wahab-ul-Hassan 81
12. 051: On Construction of One Dimensional Partially Neighbor Balanced Designs (PNBD) by Rashid Ahmed and Munir Akhtar 89
13. 057: A Study of the Effects of Internet Usage of Teenagers by Hina Rana and Itrat Batool Naqvi 97
14. 061: A Statistical Study on the Cellular Mobile Industry of Pakistan by Mehreen Ashraf and Waqas Samiullah Mahmood 103
15. 062: Review of Applications of Intelligent Methods in Physics by Adeel Akram, Rana Usman Ali, Muhayyuddin Gillani, Khalil Ahmed, M. Saleem Khan and Wajahat M. Qazi 109
16. 063: A Conceptual Framework For Woman Poverty Alleviation Using Decision Support Strategies by Tooba Batool and Khalil Ahmed 113

17. 064: Generation of Emotions in Neural Networks based on Experience by Atifa Athar and Khalil Ahmed	119
18. 066: A New Conceptual Model of Machine Translation by Muhammad Anwar Saeed and Khalil Ahmed	125
19. 068: Wild Bootstrap Technique for Finding Confidence Interval of Truncated Negative Binomial Parameter 'p' by Muhammad Ibrahim Shamsi and Ghulam Hussain	133
20. 072: Augmented Box-Behnken Third Order Response Surface Designs by Hafiz Muhammad Arshad and Munir Akhtar	143
21. 074: On a Class of Powered Non-Central Weibull Random Variables by Abdur-Razaq and Ahmed Zogo Memon	151
22. 075: Distribution of the Number of Rectangles arising in Binomial Trials by Zafar Iqbal and Ahmed Zogo Memon	155
23. 076: Some Remarks on David & Johnson Method for Finding Moments of Order Statistics Based on Uniform and Exponential Distributions by Hafiz M. Salman and Ahmed Zogo Memon	161
24. 083: Role of SMS/Mobile Marketing and its Gainsays-A New Horizon for Micro Marketing by Muhammad Mazhar Manzoor	169
25. 090: A Study on the Effects of Using Cell Phones on the Studies of Students by Sonia Anjum and Nikhat Khan	179
26. 101: Bayesian analysis of the two component mixture of the Exponential distribution assuming the uninformative and informative priors Under the censored sampling scheme by Mirza Naveed Shahzad, Muhammad Aslam and Muhammad Saleem	185
27. 104: Some New Methods to Reduce the Number of Blocks Required for Neighbor Designs by Rashid Ahmed and Munir Akhtar	193
28. 113: Emerging Trends in Temporal Databases with Illustrations by S.M. Aqil Burney and Nadeem Mahmood	201
29. 114: Lossless Progressive Coding for Grayscale Images Using JBIG Standard by Ahmed M. Abushaala, Libya.	213
30. 122: Educated Illiterates Practicing Freedom with Necessary Evil, Cellular Phone Etiquette among College and University Students of Pakistan by Khurram Aziz Fani, Faiza Muzaffar, Maryum Arif, Waqas Ilyas, Sana Zafar and Atif Amin	219
31. 147: Generating A Family of SCUI Distributions by Saleha Naghmi Habibullah, Ahmad Zogo Memon and Munir Ahmad	227
32. 149: Cell-Phone Usage Preferences Amongst Educated Youth by Khurram Aziz Fani, Usman Ehsan, Sumra Anwar and Nazia Saeed	235
33. 152: Estimation of Mean in Two-phase sampling Using One Auxiliary Variable by Asma Tahir	243

34. 155: Exploring Data Analysis Using Statistical Softwares by Sara Azher, Sana Riaz and Riffat Shoaib	253
35. 157: A Class of Regression cum Ratio-Product Estimators (Using Two Auxiliary Variables) by Hamad Sarwar Shaw and Muhammad Hanif	267
36. 159: Data Mining on Heart Diseases Record Sampling by Naveed Ahsan	279
37. 161: Measuring Customer Satisfaction from Nokia Mobile Phones in Pakistan by Shoaib Nawaz and Sania Kanwal	285
38. 170: Estimation Methods of Kumarasway Distribution by M. Shuaib Khan, G.R. Pasha and Ahmed Hesham Pasha	293
39. 173: ARCH-M Model for Benchmark Index of Pakistan Stock Market by Samreen Fatima	297
40. 115: The Robustness of Mixed Renewal Models to Misspecifications by Najeeb Haider	303

CONTENTS (Vol. 16)

PAPERS

1. 001: Development of Simplified Equation for Wind Load Calculation for Tall Buildings
by Muhammad A. Saleem, USA 313
2. 007: Fluctuating Dynamics of Stratospheric Ozone with reference to Atmospheric region of Pakistan
by M. Ayub Khan Yousuf Zai, M. Rashid Kamal Ansari, Jawaid Quamar, M. Arif Hussain and Jawaid Iqbal 321
3. 008: Stochastic Analysis of effect of Solar Flare Occurrence on Ozone Layer Depletion
by Saifuddin Ahmed Jilani and M. Ayub Khan Yousuf Zai 333
4. 009: Estimating the Effect of Ozone Layer Depletion on Land Plants
by S.M. Zia-ul-Haque and M. Ayub Khan Yousuf Zai 341
5. 010: Dividend Policy in Pakistan and Signaling Theory
by Choudhary Slahudin 347
6. 020: Statistical Trading Using Target Oriented Trading Agent
by Zeeshan Ahmed, Austria 355
7. 021: Professional and Executive Skills Required in Organisational Development
by Sadia Qasim and Muhammad Qasim Rind 359
8. 029: Job Embeddedness and Turnover Intention of Teaching Faculty of Chartered Institutions in Lahore
by Muhammad Shafique, Munir Ahmad and Rashid Rahman 367
9. 032: Quranic Studies: A Statistical Profile
by Muhammad Khyzer Bin Dost and Munir Ahmad 375
10. 033: Strategic Integration and Devolvement of Human Resource Management in Public and Private Chartered Institutes of Pakistan
by Muhammad Faisal Qadeer, Munir Ahmad and Rashid Rehman 383
11. 040: Skill Based Management Paradigm: A Comparative Study of Askari Commercial Bank and Bank Alfalah Ltd
by Neelum Noureen, Shehryar Naveed and Shaoib Akhter 391
12. 041: Entrepreneurial Achievements and Higher Education (A Survey Study of Small Business Establishments)
by Nida Rehman, Shehryar Naveed and Shoaib Akhter 399
13. 043: Real causes of sickness in Small-Scale Industries: Problems and Remedies (A Case Study of Sukkur Estate Area Since 1990 to 2004)
by Mumtaz Ali Junejo, Muhammad Nawaz Chand and M. Abdul Majid Makki 409
14. 046: A Time-Series Analysis of PSO and Shell Volume Indices at KSE-100
by Asia Catherine and Kalsoom Akhtar Chaudhry 417
15. 048: The Factors Influence the Life Satisfaction in Pakistan
by Zahid Iqbal and Junaid Saghir Siddiqi 423

16. 054: A Study as the Career and Domestic Responsibilities of Working Women by Muhammad Azhar Sheikh and Jamal Abdul Nasir	433
17. 055: A Study of Residents of An Orphanage Home by Haleema Azhar and Saleha Naghmi Habibullah	441
18. 056: A Study of the Problems Faced By Physically Handicapped Children in Pakistani Society by Amina Zahoor	447
19. 058: A Study on Foreign Tourists' Perception Regarding Facilities and Behaviour of Local Population by Asenath Naeem	451
20. 059: A Study on Life in Women Welfare Center by Bushra Mukhtar and Farah Anjum	455
21. 060: A Study on Harassment Faced by Female Students at Their Co-Education Institute by Aisha Ehtisham and Kalsoom Akhtar Chaudhry	461
22. 069: A Review on Grid Computing Architecture by Muhammad Qasim Sadiq and Abdus Salam	465
23. 082: Modeling and Forecasting Gross Domestic Product Deflator for Pakistan by Ghulam Mustafa, Iram Yasmin, Muhammad Yaseen and Sami Ullah	475
24. 087: Seasonal Adjustment of Financial Time Series Using the X-12-ARIMA Procedure by Riaz Riazuddin and S.M. Husnain Bokhari	479
25. 088: Stock Market Daily Returns Volatility: A Case study of Pakistan(1993-2007) by Khalid Sarwar Qureshi and Saghir Pervaiz Ghauri	489
26. 091: Inflation and inflation uncertainty in Pakistan: Evidence from GARCH modeling by Ikramullah, Waliullah and Mehmood Khan Kakar	497
27. 093: A Study on the Life of A Diabetic Teenager by Samia Tanveer and Asifa Arif	503
28. 094: A Study on Parent–Daughter Relationship by Khadija Tariq Cheema and Asifa Arif	507
29. 103: Process Capability Indices: A Simulation Based Study by Suboohi Safdar	513
30. 107: Gini's Mean Difference Based Time Varying EWMA Charts by Muhammad Riaz and Saddam Akbar Abbasi	521
31. 119: Eruption Time of Permanent Teeth in Schoolchildren of Karachi by Nazeer Khan	527
32. 121: Factors that Motivate Business Faculty to Conduct Research by Ansa Mahmood, Ammara Noshin, Muhammad Rehman, Rizwan Altaf Hussein and Moneeb Qamar	533

33.	123: On the Need of Developing Valid Data Capacity Building in the Developing Countries by Muhammad Tufail Jarral	541
34.	124: The Role of Discipline in Organizations by Zareen Abbasi and F.M. Shaikh	545
35.	125: A Study to Analyze and Forecast the Customer Turn-over for a Shopping Mall by Ismat Fatima	551
36.	129: Econometric Analysis of income of nomads in irrigated areas of Cholistan Desert by Mariam Abbas, Karamat Ali and Jamal Abdul Nasir	555
37.	131: Revolutionary Changes give Supremacy to HRM in Pakistan by Zareen Abbasi, Seema Khoja and F.M. Shaikh	563
38.	136: Role of Globalization in Poverty Alleviation of Pakistan by Using CGE Model by F.M. Shaikh	567
39.	137: The Role of Culture in Advertising Effectiveness by Yaseen Ahmed Meenai and Salma Mirza	573
40.	138: Nexus Between Social Exclusion and Reproductive Health Behavior of Women in Pakistan by Fauzia Maqsood	579
41.	139: An Integrated Framework for Visualizing Intellectual Capital to Meet for Strategic Management Challenges by Mumtaz Muhammad Khan and Suleman Aziz Lodhi	585
42.	140: Quality Assurance (QA) in Pakistani Higher Education Institutions by Sumia Mumtaz	593
43.	142: Evaluating the Effectiveness of Teachers Training Programs in F.G. and Model Schools and Colleges in Islamabad by Mohammad Waqas Raja	603
44.	144: Role of Entrepreneurship in Poverty Reduction in Pakistan by Farid Zafar and Mohamed Nasr	611
45.	145: The Impact of Bonus Issues on Stock Prices by Usman Ayub and Mohamed Nasr	619
46.	146: Banking Segment and Cell Phone Inclination by Ahmed F. Siddiqi, Suneela Azeem, Maryam Mustafa, Jamil Javaid and Hassan Sabir	629
47.	156: A Prime on SAS and Time Series Forecasting by Sara Azher, Sana Riaz and Zakia Hassan	631
48.	162: Relationship between Exchange Rate, Exports and Imports: Analysis in the form of Co-integration and Bi-Variate Causality Empirical Evidence from Pakistan by Qazi Muhammad Adnan Hye, Uzma Iram and Muhammad S. Butt	645
49.	163: Perceived Supervisor Support and Employees Motivation in Textile Sector of Pakistan by Ahmad Qammar, Faheem Ghazanfar and Muhammad Siddique	653

50. 164: Arsenic in the Ground Water of Pakistan by Khurshed Ahmed and Sidra Karim	661
51. 167: Household Characteristics: How Much They Affect A Woman's Contribution in Household Budget? by Rana Ejaz Ali Khan and Tasnim Khan	667
52. 168: An Investigation of Influencing Factors of Blood Donation Motivation, Blood Donors a Survey-Based Questionnaire Study by Khurram Aziz Fani, Kaleem Ashraf, M. Ahmad Tauqir, Anam Khan and Sidra Mehboob	673
53. 171: Health Care Analysis and Regional Disparities in Different States of Iran by Hamid Sepehrdoust, Iran.	679
Author Index	691

Address By
Dr. Munir Ahmad, Patron ISOSS

- Hon. Tanveer Ashraf Kaira,
Minister of Finance, Planning & Development, Govt. of the Punjab
- Prof. Dr. Muhammad Nizamuddin,
Vice-Chancellor, University of Gujrat
- Respected delegates from Iran, Germany, Libya, USA
- My colleagues, Students, Ladies and Gentlemen,

I, on my behalf and on behalf of Islamic Countries Society of Statistical Sciences take this opportunity to thank you for sparing your precious time from such a busy schedule. I know that you are visiting around the Province of Punjab for improving its infrastructure, governance and removing numerous ills that itch public in general and government in particular.

I congratulate Dr. Muhammad Nizamuddin, Vice-Chancellor a strong administrator, for making strenuous efforts to develop this newly established University of Gujrat at par with any international university. His proven track record shows his capabilities, competence and will to work for the university.

I deeply appreciate University's programmes to create alliances amongst statisticians by organizing seminars for exchange of knowledge and experiences for better understanding and advancement of progressing areas of engineering, health, industrial, computer and telecom technology. It is our Government's cherished desire that we must make intensive and sustained struggle to expand the horizons of Statistics and Social Sciences which facilitate building of a system free of exploitation, inequality and repression and helps to formulate plans and policies to eliminate poverty from the Society and to improve standards of living of the people.

Statistical scientists of academia should share their scientific potential and expand their database. This will help Pakistan by bringing technology to their door-steps which, of course, could be utilized for the betterment of the Muslim Ummah.

The society, while celebrating its 20 years journey, was established way back in 1988, during the first Islamic Countries Conference on Statistical Sciences held at Lahore with the objectives to:

- bring together research workers and practitioners in statistical sciences from Islamic Countries through mutual exchange program,
- organize and strengthen a central information system by establishing data banks and centres of information.
- associate statistically developed countries to help in developing and transferring statistical technology to Islamic Countries.
- organize conferences, seminars, colloquia, workshops, short courses, and any other means of communication helpful in exchanging scientific ideas.

I feel really proud of its existence, as the society had held nine International Conferences at Lahore, Morocco, Malaysia, and Indonesia, and numerous national

conferences, seminars and workshops. The 10th Conference will hopefully be held in Egypt some time in 2009.

The Society had the honour of organizing Fourth Meeting of Heads of National Statistical Organizations of the OIC Member Countries at Lahore on behalf of Statistics Division, Government of Pakistan and Statistical, Economic & Social Research and Training Centre (SESRIC-OIC), Ankara, Turkey. At each conference more than 30 countries had been taking active part.

I feel pride to inform that ISOSS is the only society that helps and encourages researchers and M.Phil. / Ph.D. students around Pakistan. So far, more than 40 students have completed their M.Phil./Ph.D. Degrees under the guidance of the Research Guidance Cell and about more than 50 students are in the process of finalizing their M.Phil./Ph.D. researches.

Another landmark of the society, Pakistan Journal of Statistics (PJS) is an internationally recognized journal which is the only Pakistani journal recognized by Higher Education Commission, Government of Pakistan on the basis of its impact factor 1.2 (2004). The Pakistan Journal of Statistics has been graded "B" by FIDES Journal Rating 2002 among 2000 journals in all disciplines.

There are 57 Muslim countries with more than one billion population, which account for more than 25% of the World population with a very low GNP. Everywhere the physical and human resources remain under-utilized. We need collective self-reliance in the Islamic Community, mutual cooperation and extensive exchange of scientists. Hence statistics plays a key role in the socio-economic and scientific development of a country. The current state of Muslim world under-development is due to decline in the knowledge of science and technology where Muslims had played a leading role in the past. Let me share the administrative capabilities of Hazrat Omar (R) who conducted household expenditure survey of different strata of people to find out the household expenditure so that he could fix scholarships and benefits for the needy. In one of the Scandinavian countries, they introduced social security system called Omar Social Security System. I don't know if Pakistan ever institute Social Security System. If the government wishes, ISOSS can help in developing such as system atleast for Punjab.

I find this opportunity to narrate some of the experiences, the society had met with the ideological organizations like Pakistan Muslim League (Nawaz). The society had done marvelous works in the field of research and statistics and had will to do a lot more. Society had a dream of establishing a Statistics House in Lahore, which would provide state of the art facilities for research under one roof. In 1990 delegation of ISOSS headed by its Pattern-in-Chief H.E. Dr. Abdullah Bin Omar Nasseef, Ex-Vice-President Majlis A Shoura, and President, World Muslim Congress, Jeddah, Saudi Arabia met Mr. Muhammad Nawaz Sharif, the then Chief Minister Punjab who was very pleased to sanction a piece of two kanals land in Sabzazar Scheme, Lahore for establishing the Statistics House to be named as Nawaz Sharif Statistics House. The resources for construction of building were committed to be provided by the Muslim World League, Saudi Arabia. Incidentally, the dream of the society became under clouds due to Kuwait War, which consumed a lot of resources of Islamic countries and organizations leaving very less for organization of Islamic research.

The society believes that the dream of having a Statistics House will come true one day and with this dream society is working and progressing into a professional organization, which has hundreds of professional statisticians working for the betterment of Muslim Ummah, in general and Pakistan in particular. I request Honourable Sirdar Dost Muhammad Khan Khosa and Honourable Tanveer Ashraf Kaira to sanction an amount of Rupees Five Million to build “Sharif Statistics House”.

As I said earlier, statistics and information are the basic ingredients of any development plan. It is my august opinion that a Council of Statisticians be set up to look into various aspects of economic, technological, scientific and agro-development of Muslim Ummah. I believe the basic informations, accurately collected and scientifically analyzed are the imperatives of planning in the countries.

I see ISOSS as a World Forum that can be managed on a collected vision of its active members. Dignity of top statisticians both in public and private sectors is a pre-requisite to Society’s strategy and action plans.

We need to strengthen ISOSS by establishing chapters in various areas and different cities and countries, so as to make it a responsible part of sharing in upgradation of Statistical Systems. ISOSS may be made an authentic statistical voice of Pakistani Statisticians.

In the past, I proposed to institute a number of awards for young statisticians which could not be implemented for want of responses from statisticians, students, teachers and professionals. I am going to propose in the business session a few awards in the names of Dr. Zia-ud-Din – Dr. Iqbal, Col. Nazir Ahmad – S.M. Ishaq, Sultan S. Hashmi – Muhammad Afzal and moreover ISOSS Awards and hope that this time, help will be received from public, government and statisticians for these awards.

At the end, I thank my team of volunteers mostly students, from National College of Business Administration and Economics, especially Dr. Muhammad Hanif, Prof. Akhlaq Ahmad, Dr. Suleman Aziz Lodhi, Dr. Ghulam Mustafa Habibullah, Dr. A.R. Chaudhry, Muhammad Iftikhar, Muhammad Imtiaz and Saif-ur-Rehman for their untiring work. I also thank members of the University of Gujrat team who worked hard in organizing the Conference under the leadership of Dr. Mohammad Nizamuddin. Special thanks are due to Mr. Zahoor Ahmad, Miss Atia Hanif, Miss Fozia Maqsood and others.

We are all grateful to Chief Minister Punjab and Minister of Finance and Planning & Development for sparing their precious time to inaugurate the Conference.

**STATISTICAL SEMANTIC MODELING OF PREPROCESSED SOURCE
CODE TO IDENTIFY, MEASURE AND VISUALIZE THE COMPLEXITIES
IN SOFTWARE PRODUCT LINE APPLICATIONS**

Zeeshan Ahmed

Vienna University of Technology, Getreidemarkt 9/307 1060, Vienna, Austria
Email: zeeshan.ahmed@tuwien.ac.at; zeeshan.ahmed@hotmail.com

ABSTRACT

In this article a measurement analysis based approach is discussed to help software practitioners in managing the additional level complexities and variabilities in software product line applications. To meet aforementioned research goals, the conceptual architecture of proposed approach is designed which is based on the preprocessed source code analysis, calculation of several traditional and product line metrics and visualization of obtained results in two and three dimensional diagrams. Furthermore, the proposed approach is implemented as software application and its capabilities, features and potentials are validated by means of an experiment. Moreover using experimental statistical results we presented the correlation between traditional and product line measures.

Keywords — analysis, measurement, software product lines, variability

1. INTRODUCTION

Driven by the problems raised in software industry, especially maintenance of the success rate of software products based on product line architecture. Due the high expectations of customers for high quality product in short time and in possible minimum budget, software practitioners are now more focused on the use of product line architectures instead of single line product engineering and development. Product line is defined as the family of products designed to take the advantage of their common aspects and predicted variability [3]. For the time being product line approach was considered as the good solution to adopt but with the passage of time some feature interaction, process management, product integration and composition problems are identified [16] which are currently present without any solid solution. These problems requiring quantitative management based comprehensive solutions are the major responsible reasons of getting unsatisfactory results. A number of measurement analysis based solutions have been developed, including *Relation based approach* [6], *Static Scanning Approach* [10], *Columbus* [14], *TUAnalyser & Visualization* [19], *CodeCrawler* [13], *Polymorphism Measure* [1], *Assessing reusability of C++ Code* [5] and *Evaluation of Object Oriented Metrics* [7], but still the problems are alive.

In order to provide quantitative management based solutions to the effected products, it is mandatory to first analyze all the components and features to identify the variation points. Because without knowing the actual disease its very hard to cure and the wrong diagnose may lead to a disaster.

Moreover, quantitative management is actually the way towards the successful project management. It applies measurement analysis to analyze product, predict the minimum possible cost and time required for software application development [18]. Measurement analysis can be applied to all artifacts of the software development life cycle to measure the performance and improve the quality. Measurement analysis allows stating quantitative organizational improvement objectives and decomposes them down to measurable software process and product characteristics. Moreover measurement analysis allows characterizing and controlling in a quantitative manner to achieve the organization's business goals by mapping them to software and measurement goals by using such approaches as for example GQM [20]. This can help project managers to track their improvements and mitigate potential risks.

In this research paper we discuss some already proposed solutions in section 2 to identified aforementioned problems and support software practitioners with effective and efficient quantitative management based approach in section 3 and 4. Moreover we perform empirical evaluation to evaluate the feature, functionality and strength of proposed solution in section 5 using real time data sets.

2. RELATED RESEARCH WORK

A. Review Design

We decided to review only the most relevant and up-to-date literature with respect to the goal and scope of our research. We started looking for explicitly available relevant literature from different sources like internet, proceedings of some software engineering conferences and journal publications. As the outcome, we resulted with almost more than 100 relevant research papers, which created a review population. Therefore, we defined review criteria to filter the research papers based on the conclusive outputs obtained from abstract, summary and conclusion. While reading the abstract we were looking for the keywords like software product line, quantitative management, preprocessed code, analysis, visualization, measurement and variability. After the implementation of defined review criteria, 8 research papers were selected for detailed review. During detailed review, we put emphasis on the validity of the proposed solutions in literature. We have briefly described the methods discussed by the authors in the selected literature and up to what extent they can be used to solve our problem.

B. Reviewed Literature

We have reviewed Relation-based approach [6], Static Scanning Approach [10] and Columbus [14] as the methodologies to quantitatively analyze the C++ source code. Then we have reviewed TUAnalyser & Visualization [19] and CodeCrawler [13] to produce visualization of obtained results from quantitative analysis. Then we have reviewed Polymorphism Measure [1], Assessing reusability of C++ Code: [5] and Evaluation of Object Oriented Metrics: [7] methodologies to perform measurement analysis.

Relation-based approach is used for simplifying the process of metrics extraction from the C++ object oriented code [6]. In this approach relations are designed like prolog clauses to describe the language entity relationship and to increases the code readability, optimization and search speed.

Static scanning approach breaks non-preprocessed C/C++ code file into a series of lexical tokens and then matches already existing vulnerable patterns with series of tokens [10]. Furthermore the approach was validated with the implementation of ITS4¹.

Columbus is a reverse engineering framework to extract the facts from preprocessed C++ code by acquiring the project information is indispensable way [14]. The major strengths of this approach are, this method can be used for reverse-engineering purposes to study the structure, behavior and quality of the C++ code and can also be used to track the evolution of design decisions between the architectural level and the implementation level of a software system written in C++ [15].

TUAnalyser & Visualization approach is used to visualize the extracted information from C++ source code by first storing the extracted information into RSF format which then passed as input to Graphviz² to produce visual output [19].

Code Crawler is used to visualize the C++ object oriented source code semantics in lightweight 2D & 3D and polymeric views by using a tool called FAMIX³ [13].

Polymorphism measure is used to identify the software reliability problems in the early stages of software development life cycle [1]. This measurement approach has been categorized into two categories Static polymorphism and Dynamic polymorphism. Static polymorphism based on the compile time and dynamic is based on the runtime binding decisions. Furthermore five metrics are initiated to combine the early identified polymorphism forms with inheritance relationship.

Assessing reusability of C++ Code is a method for judging the reusability of C++ code components and assessing indirect quality attributes from the direct attributes [5]. This method has been divided into two phases. First phase is used to identify and analytically validate a set of measurements for assessing direct quality attributes. The second phase identifies and validates a set of measurements for assessing indirect quality attributes. Moreover, a set of relations is also provided which maps directly measurable software quality attributes to another set of quality attributes that can only be measured indirectly.

Evaluation of Object Oriented Metrics approach is used to analyze the measures and their relationship with each other from object oriented code metrics defined by Chidamber and Kemerer [17] and fault-proneness across three different versions of this target application [7]. Proposed approach concluded with the result, that none of the object oriented metrics performs better than LOC in anticipating fault-proneness.

C. Review Conclusions

The reviewed literature doesn't provide much information about the comprehensive management for product line management, analysis of generic software and visualization for obtained results of measurement analysis from generic software components made in

¹ ITS4: A tool for statistical scanning to find out the vulnerabilities from C source code

² Graphviz is a tool to visualize data [8]

³ FAMIX is implemented in the Moose reengineering environment and used to models object oriented languages such as C++ and Java [4]

C++. Discussed related research work does, however, help and provide some approaches in analyzing the C++ code, visualizing the data and calculating the measures. Yet, none of the reviewed research directly deals with the target solution of our research.

3. PROPOSED SOLUTION

We propose and present a quantitative management based approach consisting of three main components .i.e., Analysis, Visualization, Measurement [23] shown in Fig 1.

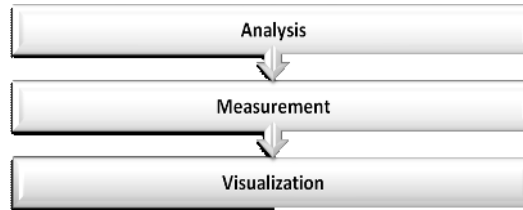


Fig 1. Measurement Analysis and Visualization

During analysis the preprocessed source code of product line based application is analyzed to identify the software single and product line source code characteristics, then in measurement several traditional and product line measures are calculated to identify the behavior and the rate of complexity and then in the end qualitative visualization support is provided to obtained results.

To provide a comprehensive solution to the software practitioners, based on above discussed three components in analyzing the software product preprocessed source code, identifying software level complexities and variabilities, measuring performance by calculating source code metrics we have proposed a solution called *Zeeshan Ahmed - C++ Preprocessed source code analyzer (ZAC)* [23]. To fulfill the desired jobs and obtain required result the conceptual model of ZAC is divided in to five main components i.e., C++ Source Code, ZAC-Analyser, ZAC-Data Manager, ZAC-Measurer, and ZAC-Visualizer which works in cyclic fashion as shown in Fig 2.

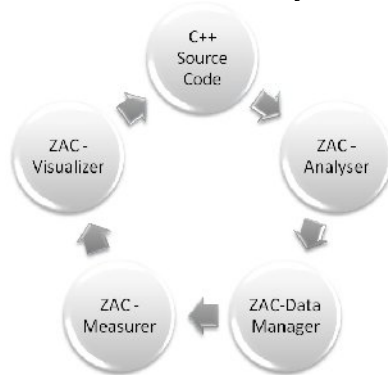


Fig 2. ZAC Conceptual Model

In the first component preprocessed source code of software product written in C++ programming language is treated as input context. In second component internal source code characteristics .i.e., namespace, includes, macros, class, methods, functions, declarations, expressions and conditions are analyzed. In third component the resultant

information is stored and managed in a relational data base called ZAC-Data Manager. In fourth component ZAC-Measurer using Goal Question Metrics (GQM) [20] will calculate source code metrics. In the last component, as the last step ZAJ-Visualizer will produce visualization of obtained results in different 2D and 3D diagrams e.g. graphs, line charts, bar charts and tree map with respect to the context and semantic.

4. ZAC – Tool

To empirically evaluate the real time strength of proposed solution, we have implemented the proposed conceptual design of ZAC as software application .i.e., ZAC-Tool [23] as shown in Fig 5. ZAC-Tool is implemented using open source and freely available development tools and technologies as shown in Fig 3.

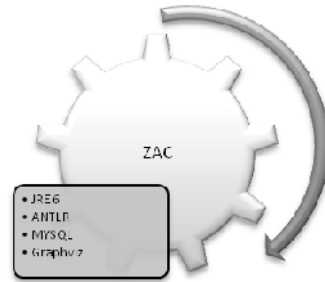


Fig. 3 ZAC - Involved Technologies

According to the scope of our research, application is capable of treating preprocessed C++ source code as an input. The designed and implemented system sequence model of application is consists of six main components i.e., ZAC- Source Code Analyser, ZAC-Semantic Modeler, ZAC-Data Manager, ZAC-Measurer, ZAC-Visualizer and ZAC-Editor as shown in Fig 4.

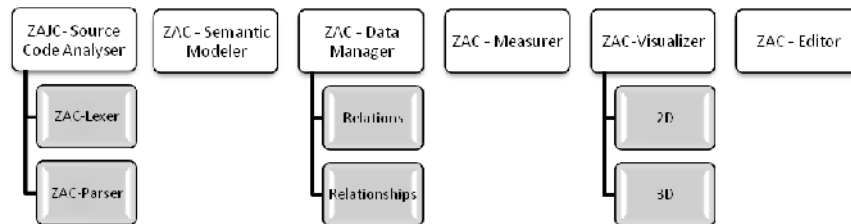


Fig 4. ZAC System Sequence Design

Preprocessed C++ source code is given to the application as an input. ZAC-Analyser first treats the input source code and analyzes the source code. To analyze preprocessed source ZAC-Analyser is divided into further two internal sub-components .i.e., ZAC-Lexer and ZAC-Parser. In ZAC-Lexer the whole application is divided into possible number of lexical tokens where as in ZAC-Parser parsing is performed using generated lexical tokens to understand and validate the syntax and semantic of the input preprocessed source code with respect to the parser rules based on grammar of used programming language used in application development. The resultant output of ZAC-Analyser consisting of the information about the total number of artifacts, classes,

components, control flows, decisions, defines, directives, parameters, exceptions, expressions, features, headers, macro expressions and namespaces is used by ZAC-Semantic Modeler, which will generate a semantic based object oriented preprocessed source code model as shown in Fig 5.

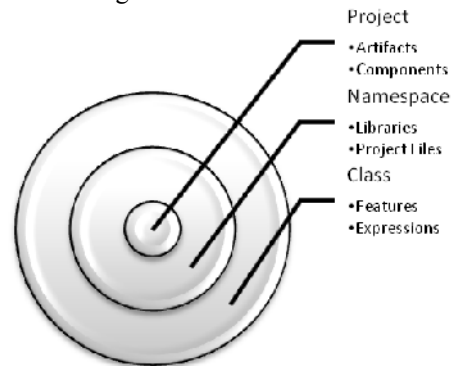


Fig 5. ZAC Object Oriented Preprocessed Source Code Model

This model is further stored in database in the form of relations and relationships using ZAC-Data Manager. Moreover generated semantic based object oriented preprocessed source code model is also used by ZAC-Measure to calculate traditional and product line measures metrics. The output of the ZAC-Analyser and ZAC-Measures is visualized in visual diagrams .i.e., tree maps, tree graphs and pie charts in two dimensional effects using ZAC-Visualizer. This all process above discussed process is based on automatic operational processing but as the last component ZAC-Editor provides several different options to manually operate analyze the software characteristics and calculate metrics.

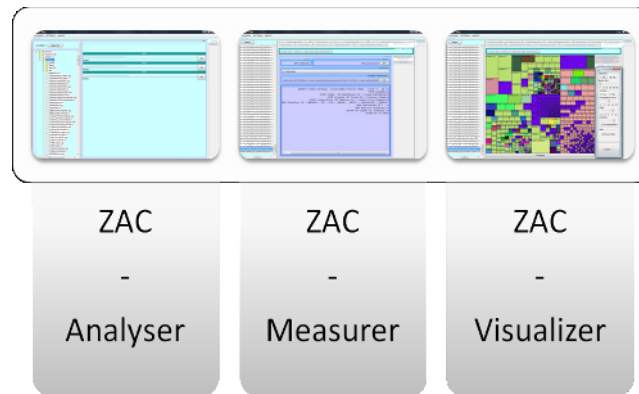


Fig. 6 ZAC-Tool Screen Shots

5. EMPIRICAL EVALUATION

The main goal of our empirical evaluation is to evaluate the feature, functionality and strength of ZAC-Tool by performing experiments using real time software product line

application developed in C++ programming language as an input context. We have to first analyze software preprocessed source code characteristics, then calculate the traditional and product line measures and visualize the results. Moreover using the outcome of this experiment we try to observe and present the correlation between traditional and product line applications.

A. Context of empirical evaluation

Two available different source code versions (1.0 & 1.1) of an open source product line application Irrlicht are used as the context for the evaluation. Irrlicht is a cross-platform high performance real time 3D application (engine) developed in C++ language [9].

B. Defined measures for empirical evaluation

It is quite difficult and time consuming to calculate all the traditional and product line measures, so, we have defined some traditional and product line measures which will be calculated from input preprocessed source code during the empirical evaluation. We have selected three relevant measures from over all currently available traditional and product line measures. The information about the selected traditional and product line measure is given in Table-I and Table-II.

Table-I
Defined Traditional Measure

Traditional Measures	Definition	Comments
CLD (Class Leaf Depth)	CLD is used to measure maximum number of levels in the hierarchy of classes that are below the class.	We expect that the CLD helps in the indication of fault proneness. Because a class with many ancestors is more likely to be fault-prone than a class with few ancestors [12]. So Increase in the number CLD can cause the increase in the complexity of the software which then can be resulted in more fault proneness.
NOC (Number of children)	NOC is used to measure the number of direct descendent for each class.	NOC helps in the indication of the fault proneness. Lower the rate of fault proneness if higher the rate of NOC [21].
DIT (Depth of inheritance)	DIT is used to measure the ancestors of the class.	DIT helps in the indication of fault proneness. The DIT was found to be very significant in [21], it means that the larger the DIT, the larger the probability of fault-proneness in the software.

Table-II
Defined Product Line Measure

Product Line Measures	Definition	Comments
NIT (Namespace Inheritance Tree)	NIT is used to measure the number of ancestors of the name spaces.	NIT can also be very helpful in the indication of fault proneness. Because namespace is one of the major components of any product line software application. Every component of project like class, library etc exists inside the namespace. If the number of namespace will increase, then the number of ancestor namespaces will also be increased which will result in much complexity. So if the NIT will increase it may possible then the number fault proneness will also increase.
NOA (Number of Artifacts)	NOA is used to measure the number of artifacts used and to measure the direct ancestors for each artifacts.	Each artifact of system represents the each file of the system, like class and include file. If the number of artifacts will increase most probably the number of dependencies between the artifacts will also be increase, which ultimately causes the increase in complexity. So higher the number of NOA higher will be the probability of fault proneness in the product line system.
CIR (Class Inheritance Relationship)	CIR measures the relationship of each class with other class.	CIR becomes more complex if the number of ancestor classes will increase, especially in the case of multiple inheritances when a child class will be having more than one parent. So, CIR can be very helpful in the indication of fault proneness because if the number of CIR will increase the probability of fault proneness will also be increased.

C. Defined visualization modes for empirical evaluation

We have defined some modes of visualization to present the obtained results using ZAC-Tool during the empirical evaluation. We have selected three modes of visualization Graph, Bar chart and Tree map for the visual representation of results.

D. Evaluation

1) Static Source Code Analysis

During the static analysis both the versions 1.0 and 1.1 of Irrlicht are analyzed using ZAC-NT and observed experimental units of the source code are presented in Table III.

Table-III
General and Product Line Software Characteristic s

Characteristic	Irrlicht 1.0	Irrlicht 1.1	Relative Difference between Irrlicht 1.0 and 1.1
Artifacts	776	698	10.51 %
Namespaces	8	7	12.50 %
Components	561	482	14.08 %
Decisions	703	445	36.70 %
Define Macros	609	447	26.60 %
Pragma Directives	11	10	9.09 %
Macro Expressions	402	276	31.34 %
Classes	333	207	37.84 %
Include	1027	532	48.20 %

2) Traditional and Product line measures

We have calculated the already defined traditional and product line measures of Irrlicht 1.0 and 1.1, results are presented in Table IV and Table V.

Table-IV
Traditional Measure

Traditional Measure	Irrlicht 1.0	Irrlicht 1.1	Relative Difference between Irrlicht 1.0 and 1.1
CLD	66	21	68.18 %
DIT	232	145	37.50 %
NOC	64	21	67.18 %

Table-V
Product Line Measure

Product Line Measure	Irrlicht 1.0	Irrlicht 1.1	Relative Difference between Irrlicht 1.0 and 1.1
NIT	7	6	14.28 %
NOA	783	704	10.08 %
CIR	160	97	39.37 %

The results presented above in the table IV and table V are individually consisting on the total number obtained measures from Irrlicht 1.0 and 1.1.

3) Visualization of software characteristics

We have presented defined visual diagrams of the results based on the static source code analysis of the Irrlicht 1.0 and 1.1. These diagrams present some of the whole results of visualization produced by the ZAC-Tool. This visual representation can be helpful for the software practitioners in observing the overall structure and complexity of relationships between attributes namespaces and classes etc.

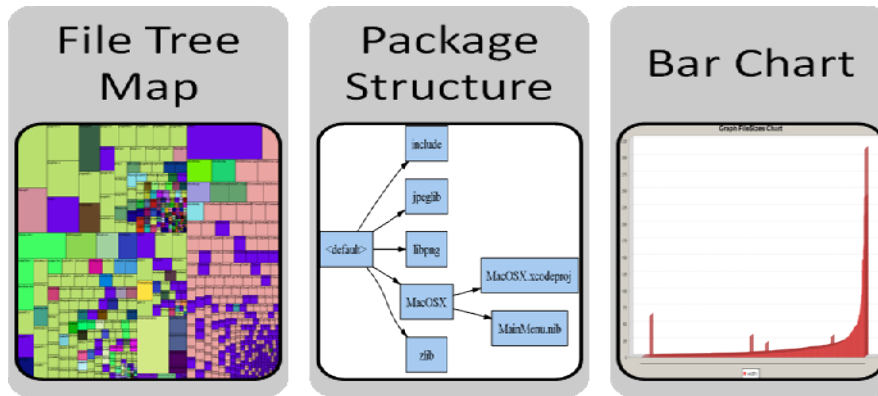


Fig. 7: Statistical Analysis & Visualization

Fig. 7 File Tree Map presents the number of files used in Irrlicht 1.1, drawn in a tree map with respect to their type and size, likewise files represented in the pink color presents the CPP files (“`.cpp`” files), green colored files represents doc files (“`.doc`” files). Whereas the placement of each file is with respect to the association of files with each other and directory structure. This visual representation is helpful for the software practitioners in analyzing the over structure of the whole project.

Fig. 7 Package Structure presents the graph of namespaces used Irrlicht 1.0. There are 8 namespaces, default namespace behaving as the parent namespace for his children namespaces include, jpeglib, libpng, MacOSX and zlib. Furthermore MacOSX is also behaving as the parent to his child namespaces MacOSX.xcodeproj and MainMenu.nib. This visual representation is helpful for the practitioners to analyze the overall structure of the namespaces used in the project; moreover software practitioners can also take advantage in analyzing the complexity in namespace relationship.

Fig. 7 File bar Chart presents the total number of artifacts used in Irrlicht 1.0, drawn in a bar chart. The bar chart consists of 775 red lines and each red line is representing an artifact and the length of each red line is representing the size of each artifact. This kind of visual representation is very helpful for the overall source code analysis. Because some time even the rate of increase or decrease in some source code elements with respect to class or namespace can also play a vital role in increasing or decreasing the complexity e.g. cohesive or coupled code.

E. Analysis on Results

First of all preprocessed source code of Irrlicht 1.0 & 1.1 was analyzed; the outcome of analysis was concluded with information about the decrease in each characteristic of Irrlicht version 1.1 as compared to version 1.0. Then traditional and product line measures of both the versions 1.0 and 1.1 of Irrlicht were calculated, which resulted with the information, that the number of traditional as well as the product line measures has been decreased in Irrlicht version 1.1 as compared to version 1.0. As the last step, the correlation [2] between traditional and product line measures was calculated. This resultant correlation +0.93 show the strong correlation between calculated traditional and product line measures. As the resultant value is positive “+”, so we can say higher the

rate of traditional measures higher will be the rate of product line measure. Furthermore, we have also produced the visualization of some source code characteristics in graph, bar chart and tree maps, which helps the software practitioners in understanding the overall structure and complexity of product line applications.

F. Limitations

During the static analysis of Irrlicht 1.0 & 1.1 some experimental units were dropped and not considered, because currently available version of ZAC-Tool is not capable of completely resolving all the experimental units of Irrlicht 1.0 and 1.1.

6. FUTURE RECOMMENDATIONS

As this is an ongoing in process research, in future, we are aiming to focus on the improvement of quality of ZAC-Tool and extension of the functionalities of the application with respect to the proposed approach.

7. CONCLUSION

The aim of this research work was to provide the effective support to software practitioners in quantitatively managing the software product line applications by analyzing software preprocessed code characteristics, measuring complexity which may indicate the potential reliability and maintainability problems in delivered software [11] and producing visualization of results. To achieve the aforementioned research goals we have discussed some already proposed approaches by some other authors and proposed our own quantitative analysis based solution. In the end we have performed empirical evaluation to evaluate the feature, functionality and strength of ZAC-Tool by performing experiments using real time data set and concluded with results that ZAC-Tool can be very helpful for the software practitioners in understanding the overall structure and complexity of product line applications. Moreover we have also proved using obtained results in empirical evaluation that there is a strong positive correlation between calculated traditional and product line measures.

REFERENCES

1. Benlarbi S. and Melo W. (1999). Polymorphism Measure for Early Risk Prediction. *In Proceeding of 21st international conference on software engineering, ICSE 99*, Los Angeles USA.
2. *Correlation* (2006). <http://www.socialresearchmethods.net/kb/statcorr.htm>
3. Weiss, D.M. and Lai C.T.R (1999). *Software Product-Line Engineering: A Family-based Software Development process*. MA: Addison Wesley: Reading MA.
4. Ducasse, T. Girba, M. Lanza, and S. Demeyer (2004). *Moose: a Collaborative Reengineering and Extensible Reengineering Environment*. In *Tools for Software Maintenance and Reengineering*, Liguori, Napoli, Italy.
5. Fatma Dandashi and David C. Rine (2002). A Method for Assessing the Reusability of Object- Oriented Code Using a Validated Set of Automated Measurements. *In the proceedings of the 2002 ACM symposium on Applied computing*, 997-1003, ISBN:1-58113-445-2.

6. Giancarlo Succi and Eric Liu (1999). *A Relations-Based Approach for Simplifying Metrics Extraction*. In Department of Electrical and Computer Engineering, University of Calgary. 2500 University Drive NW, Calgary, AB T2N 1N4.
7. Giovanni Denaro, Mauro Pezz'e and Luigi Lavazza (2003). *An Empirical Evaluation of Object Oriented Metrics in Industrial Setting*. In The 5th Caber Net Plenary Workshop.
8. Graphviz, Graph (2006). *Visualization Software*. <http://www.graphviz.org>
9. Irrlicht (2006). <http://irrlicht.sourceforge.net>
10. Viega J.; Bloch J.T.; Kohno, Y. and McGraw G. (2000). ITS4: A static vulnerability scanner for C and C++ code. 16th Annual Computer Security Applications Conference (ACSAC). p.257.
11. Briand, L. and Wüst J. (2001). The Impact of Design Properties on Development Cost in Object-Oriented System. *IEEE Transactions on Software Engineering*. 27(11).
12. Briand, L.; Wuest, J. and Lounis H. (2001). Replicated Case Studies for Investigating Quality Factors in Object-Oriented Designs. *Empirical Software Engineering: An International Journal*.
13. Michele Lanza, St'ephane Ducasse, Harald Gall and Martin Pinzger (2005). CodeCrawler: An Information Visualization Tool for Program Comprehension. *Proceedings of the 27th international conference on Software, ICSE 2005*: 672-673.
14. Rudolf Ferenc, Arp'ad Besz'edes and Tibor Gyim'othy (2002). Extracting Facts with Columbus from C++ Code. *In proceedings of the 6th International Conference on Software*.
15. Rudolf Ferenc, Juha Gustafsson, L'aszl'o M'ullerz, and Jukka Paakkix (2002). Recognizing Design Patterns in C++ Programs with the Integration of Columbus and Maisa, *Acta Cybern.* 15(4), 669-682.
16. Silva Robak and Bogdan Franczyk (2001). Feature interaction product lines. *In Proceedings of Feature Interaction in Composed Systems*.
17. S. Chidamber and C. Kemerer (1994). A metrics suite for object oriented design. *IEEE Transactions on Software Engineering*. 20(6): 476-493.
18. The Standish Group Report (2005). http://www.standishgroup.com/quarterly_reports/index.php
19. Thomas Gschwind, Martin Pinzger and Harald Gall, (2004). TUNalyzer-Analyzing Templates in C++ Cod. *In Proceedings of the 11th Working Conference on Reverse Engineering (WCRE'04)*.
20. Victor R. Basili, Gianluigi Caldieram and H. Dieter Rombach (1994). The Goal Question Metric Approach. *Encyclopedia of Software Engineering*. 528-532. John Wiley & Sons, Inc.
21. Basili V.R.; Briand L.C. and Melo W.L. (1996). A Validation of Object-Oriented Design Metrics as Quality Indicators. *IEEE Transactions on Software Engineering*. Vol. 22, 751-761.
22. Wickenkamp Axel (2004). *Maturing a prototype of a code measurement system*. Diploma Thesis, Version 1.0. University of Kaiserslautern.
23. Zeeshan Ahmed (2007). Measurement Analysis and Fault Proneness Indication in Product Line Applications (PLA). *In the proceedings of 6th International Conference on New Software Methodologies, Tools, and Techniques (SOMET-07)*, ISSN 0922-6389, Rome Italy.

ON CERTAIN CHARACTERIZATIONS OF BETA-BINOMIAL DISTRIBUTION

Masood Anwar¹ and Munir Ahmad²

¹ Government Gordon College, Rawalpindi, Pakistan,
Email: msdnwr@yahoo.com

² National College of Business Administration & Economics,
Lahore, Pakistan, Email: drmunir@brain.net.pk

ABSTRACT

In this paper negative moments of beta-binomial distribution in terms of hypergeometric series functions is obtained. Using the properties of hypergeometric series functions the recurrence relation between negative moments is developed. The relations are used to characterize beta-binomial distribution. Also its characterization is done through factorial moments.

KEYWORDS

Beta-binomial, Characterization, Factorial moments, Negative moments.

1. INTRODUCTION

Characterization of statistical distributions is an important tool for studying structural properties, chance mechanisms of different distributions and their interrelations. The theory of characterizations has an important role to play in problems like floods, reliability, effects of chemicals and food additives, fatigue failure of metals. For a detailed account of history of the theory of characterizations; see Kagan (1973), Galambos and Kotz (1978), Kakosyan et al. (1984). The survey paper by Kotz (1974) covers a substantial number of results in the field.

Roohi (2003), Ahmad and Roohi (2004) obtained negative moments of some discrete distributions in terms of hypergeometric series functions. Using the properties of hypergeometric series functions, the recurrence relations between negative moments are developed. The recurrence relations are used to characterize binomial, Poisson, negative binomial, geometric, hyper-Poisson and logarithmic distributions. Kemp and Kemp (2004) characterize binomial, Grassia I-binomial and randomized occupancy distributions via their factorial moments. A key feature of this type of characterization is the finite support of the underlying distribution.

In this paper we have characterized beta-binomial distribution in two different ways.

2. CHARACTERIZATIONS OF BETA-BINOMIAL DISTRIBUTION

The negative moments of beta-binomial distribution is obtained in terms of hypergeometric series function and using the properties of hypergeometric series functions the recurrence relation between negative moments are obtained and then used to characterize beta-binomial distribution. Characterization of beta-binomial distribution is also done via their factorial moments.

Theorem 2.1

Let X be a beta-binomial random variable with parameters $\alpha > 0$ and $\beta > 0$. The probability function is

$$P(X = x) = \binom{n}{x} \frac{\Gamma(\alpha + \beta) \Gamma(x + \alpha) \Gamma(n + \beta - x)}{\Gamma\alpha \Gamma\beta \Gamma(n + \alpha + \beta)}, \quad x = 0, 1, 2, \dots, n. \quad (2.1)$$

The negative moment of first order is given by

$$E(X + A)^{-1} = \frac{P_0}{A} {}_3F_2(A, \alpha, -n; A + 1, -n - \beta + 1; 1), \quad A > 0, \quad (2.2)$$

where $P_0 = P(X = 0) = \frac{\Gamma(\alpha + \beta)\Gamma(n + \beta)}{\Gamma\beta\Gamma(n + \alpha + \beta)}$.

Proof.

Suppose X is a beta-binomial random variable with parameters α and β then

$$\begin{aligned} E(X + A)^{-1} &= \frac{\Gamma(\alpha + \beta)}{\Gamma\alpha\Gamma\beta\Gamma(n + \alpha + \beta)} \sum_{x=0}^n \binom{n}{x} \frac{\Gamma(\alpha + x)\Gamma(n + \beta - x)}{(x + A)}, \\ &= \frac{\Gamma(\alpha + \beta)}{\Gamma\alpha\Gamma\beta\Gamma(n + \alpha + \beta)} \left[\frac{\Gamma\alpha\Gamma(n + \beta)}{A} + \frac{\Gamma(\alpha + 1)\Gamma(n + \beta - 1)n}{(A + 1)} + \right. \\ &\quad \left. \frac{n(n - 1)\Gamma(\alpha + 2)\Gamma(n + \beta - 2)}{(A + 2)2!} + \dots \right], \\ &= \frac{\Gamma(\alpha + \beta)\Gamma(n + \beta)}{A\Gamma\beta\Gamma(n + \alpha + \beta)} \left[1 + \frac{A\alpha(-n)}{(A + 1)(-n - \beta + 1)} + \right. \\ &\quad \left. \frac{A(A + 1)\alpha(\alpha + 1)(-n)(-n + 1)}{(A + 1)(A + 2)(-n - \beta + 1)(-n - \beta + 2)} \frac{1}{2!} + \dots \right] \\ &= \frac{P_0}{A} {}_3F_2(A, \alpha, -n; A + 1, -n - \beta + 1; 1). \end{aligned}$$

Theorem 2.2

The random variable X has a beta-binomial distribution with pmf (2.1) and parameters α and β if and only if

$$(\alpha - A)(n + A)E(X + A)^{-1} + (A - 1)(n + \beta + A - 1)E(X + A - 1)^{-1} = (\alpha + \beta - 1) \quad (2.3)$$

holds with $\alpha > 0$, $\beta > 0$, $A > 0$, where $x = 0, 1, 2, \dots, n$.

Proof.

Suppose X has beta-binomial distribution (2.1)

Now replacing A by $(A - 1)$ in (2.2), we get

$$E(X + A - 1)^{-1} = \frac{P_0}{A - 1} {}_3F_2(A - 1, \alpha, -n; A, -n - \beta + 1; 1),$$

Using the recursive relation (Rainville, 1960),

$$(1-z) {}_3F_2(\alpha_1, \alpha_2, \alpha_3; \beta_1, \beta_2; z) = {}_3F_2(\alpha_1 - 1, \alpha_2, \alpha_3; \beta_1, \beta_2; z) + z \left\{ \begin{aligned} & \frac{(\alpha_2 - \beta_1)(\alpha_3 - \beta_1)}{\beta_1(\beta_2 - \beta_1)} {}_3F_2(\alpha_1, \alpha_2, \alpha_3; \beta_1 + 1, \beta_2; z) - \\ & \frac{(\alpha_2 - \beta_2)(\alpha_3 - \beta_2)}{\beta_2(\beta_2 - \beta_1)} {}_3F_2(\alpha_1, \alpha_2, \alpha_3; \beta_1, \beta_2 + 1; z) \end{aligned} \right\}, \quad (2.4)$$

Put $\alpha_1 = A$, $\alpha_2 = \alpha$, $\alpha_3 = -n$, $\beta_1 = A$, $\beta_2 = -n - \beta + 1$ and $z = 1$, we have

$$\begin{aligned} 0 &= F(A-1, \alpha, -n; A, -n - \beta + 1; 1) + \\ &+ \frac{(\alpha - A)(n + A)}{A(n + \beta + A - 1)} {}_3F_2(A, \alpha, -n; A + 1, -n - \beta + 1; 1) \\ &- \frac{(\alpha + \beta + n - 1)(\beta - 1)}{(n + \beta - 1)(n + \beta + A - 1)} {}_2F_1(\alpha, -n; -n - \beta + 2; 1), \end{aligned}$$

then after simple algebraic manipulation gives (2.3).

Suppose (2.3) holds, where P_x is any probability function;

$$\begin{aligned} (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + (A - 1)(n + \beta + A - 1) \times \\ \left[\frac{P_0}{(A - 1)} + \sum_{x=1}^n \frac{1}{x + A - 1} P_x \right] &= (\alpha + \beta - 1), \\ (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + (n + \beta + A - 1) P_0 + \\ (A - 1)(n + \beta + A - 1) \sum_{x=0}^{n-1} \frac{1}{x + A} P_{x+1} &= (\alpha + \beta - 1), \\ (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + (n + \beta + A - 1) (1 - \sum_{x=0}^{n-1} P_{x+1}) + \\ (A - 1)(n + \beta + A - 1) \sum_{x=0}^{n-1} \frac{1}{x + A} P_{x+1} &= (\alpha + \beta - 1), \\ (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + n + \beta + A - 1 - (n + \beta + A - 1) \sum_{x=0}^{n-1} P_{x+1} + \\ (A - 1)(n + \beta + A - 1) \sum_{x=0}^{n-1} \frac{1}{x + A} P_{x+1} &= \alpha + \beta - 1, \\ (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + n + A + (n + \beta + A - 1) \sum_{x=0}^{n-1} \left(\frac{A - 1}{x + A} - 1 \right) P_{x+1} &= \alpha, \\ (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + n + A - (n + \beta + A - 1) \sum_{x=0}^{n-1} \left(\frac{x + 1}{x + A} \right) P_{x+1} &= \alpha, \end{aligned}$$

$$\begin{aligned}
& (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + n + A - \\
& \sum_{x=0}^{n-1} \left(\frac{(x+1)(n+\beta-x-1+x+A)}{x+A} \right) P_{x+1} = \alpha, \\
& (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + n + A - \sum_{x=0}^{n-1} \left(\frac{(x+1)(n+\beta-x-1)}{x+A} \right) P_{x+1} - \\
& \sum_{x=0}^{n-1} (x+1) P_{x+1} = \alpha, \\
& (\alpha - A)(n + A) \sum_{x=0}^n \frac{1}{x + A} P_x + n + A - \alpha - \sum_{x=0}^n x P_x = \\
& \sum_{x=0}^{n-1} \left(\frac{(x+1)(n+\beta-x-1)}{x+A} \right) P_{x+1}, \\
& \sum_{x=0}^n \frac{(\alpha+x)(n-x)}{x+A} P_x = \sum_{x=0}^{n-1} \left(\frac{(x+1)(n+\beta-x-1)}{x+A} \right) P_{x+1}.
\end{aligned}$$

At $x = n$,

$$\begin{aligned}
& \sum_{x=0}^{n-1} \frac{(\alpha+x)(n-x)}{x+A} P_x = \sum_{x=0}^{n-1} \left(\frac{(x+1)(n+\beta-x-1)}{x+A} \right) P_{x+1}, \\
& \sum_{x=0}^{n-1} \frac{(x+1)(n+\beta-x-1) P_{x+1} - (\alpha+x)(n-x) P_x}{(x+A)} = 0,
\end{aligned}$$

which provides

$$P_{x+1} = \frac{(n-x)(\alpha+x)P_x}{(x+1)(n+\beta-x-1)},$$

which is a recursive formula whose solution is (2.1).

Theorem 2.3

Let $G(z) = \sum_{x=0}^n z^x P(X=x)$ be the probability generating function (pgf) of a distribution

with support $0, 1, 2, \dots, n$, $n \in \mathbf{Z}^+$ and parameters $a, a > 0$ and $b, b > 0$, such that

$\lim_{\substack{a \rightarrow 0 \\ b \rightarrow 0}} G(z) = z^n$. Then

$$\frac{d \ln \mu'_r}{da} = b \sum_{j=0}^{r-1} \frac{1}{(a+j)(a+b+j)}, \quad 1 \leq r \leq n \quad (2.5)$$

if and only if X has beta-binomial (negative hyper-geometric) distribution with pmf (2.1).

Proof.

Suppose X has beta-binomial distribution with pmf (2.1), then by definition

$$\begin{aligned}
G(1+t) &= \sum_{x=0}^n (1+t)^x P_x, \\
&= \sum_{x=0}^n (1+t)^x \binom{-a}{x} \binom{-b}{n-x} / \binom{-a-b}{n}, \\
&= \frac{n!(a+b-1)!}{(-1)^n (a+b+n-1)!} \left[\binom{-b}{n} + \binom{-a}{1} \binom{-b}{n-1} (1+t) + \binom{-a}{2} \binom{-b}{n-2} (1+t)^2 + \dots + \binom{-a}{n} (1+t)^n \right], \\
&= \frac{(b+n-1)!(a+b-1)!}{(b-1)!(a+b+n-1)!} \left[1 + \frac{a(-n)}{(-n-b+1)} (1+t) + \frac{a(a+1)(-n)(-n+1)}{(-n-b+1)(-n-b+2)} \frac{(1+t)^2}{2!} + \dots \right], \\
G(1+t) &= \frac{(b+n-1)!(a+b-1)!}{(b-1)!(a+b+n-1)!} {}_2F_1(-n, a; -n-b+1; 1+t),
\end{aligned}$$

$G(z) = \frac{(b+n-1)!(a+b-1)!}{(b-1)!(a+b+n-1)!} {}_2F_1(-n, a; -n-b+1; z)$, [see also Kemp and Kemp (1956)] as

$$\mu'_{[r]} = \left(\frac{d^r G(z)}{dz^r} \right)_{z=1}, \quad r = 0, 1, \dots, n$$

and

$$\begin{aligned}
\mu'_{[r]} &= \frac{n!}{(n-r)!} \frac{(a+r-1)!(a+b-1)!}{(a-1)!(a+b+r-1)!}, \\
\mu'_{[r]} &= \frac{n!}{(n-r)!} \frac{a(a+1)\cdots(a+r-1)}{(a+b)(a+b+1)\cdots(a+b+r-1)},
\end{aligned}$$

Taking ln on both sides and differentiating w.r.t. 'a' we get (2.5).

Suppose (2.5) holds and after integrating we have

$$\ln \mu'_{[r]} = \ln(a(a+1)\cdots(a+r-1)) - \ln((a+b)(a+b+1)\cdots(a+b+r-1)) + c_r,$$

where c_r is a constant of integration.

$$\begin{aligned}
\text{i.e. } \mu'_{[r]} &= C_r \frac{a(a+1)\cdots(a+r-1)}{(a+b)(a+b+1)\cdots(a+b+r-1)}, \\
\mu'_{[r]} &= C_r \frac{(a+r-1)!(a+b-1)!}{(a-1)!(a+b+r-1)!},
\end{aligned}$$

Since, $\lim_{\substack{a \rightarrow 0 \\ b \rightarrow 0}} G(z) = z^n$ the limiting factorial moment generating function (fmgf) is

$$\lim_{\substack{a \rightarrow 0 \\ b \rightarrow 0}} \sum_{r=0}^n C_r \frac{(a+r-1)!(a+b-1)! t^r}{(a-1)!(a+b+r-1)! r!} = (1+t)^n,$$

$$= \sum_{r=0}^n \frac{n!}{(n-r)!} \frac{t^r}{r!},$$

and $C_r = \frac{n!}{(n-r)!}$, $0 \leq r \leq n$. Hence factorial moment generating function (fmfgf) is

$$G(1+t) = \sum_{r=0}^n \frac{n!}{(n-r)!} \frac{(a+r-1)!}{(a-1)!} \frac{(a+b-1)!}{(a+b+r-1)!} \frac{t^r}{r!},$$

$$= 1 + \frac{(n)(a)}{(a+b)} t + \frac{n(n-1)a(a+1)}{(a+b)(a+b+1)} \frac{t^2}{2!} + \dots + \frac{(a+n-1)!(a+b-1)!}{(a-1)!(a+b+n-1)!} \frac{t^n}{n!},$$

$$= 1 + \frac{(-n)(a)}{(a+b)} (-t) + \frac{-n(-n+1)(a)(a+1)}{(a+b)(a+b+1)} \frac{(-t)^2}{2!} + \dots,$$

$$G(1+t) = {}_2F_1(-n, a; a+b; -t),$$

$$G(z) = {}_2F_1(-n, a; a+b; 1-z),$$

as $P(X = x) = \left(\frac{1}{x!} \frac{d^x G(z)}{dz^x} \right)_{z=0}$, and we get (2.1).

REFERENCES

1. Ahmad, M. and Roohi, A. (2004). Characterization of the Poisson probability distribution. *Pak. J. Statist.* 20(2), 301-304.
2. Galambos, J. and Kotz, S. (1978). *Characterization of Probability Distributions*. Lecture Notes in Math. 675. Springer-Verlag, New York.
3. Kagan, A.M. Linnik, Y.V. and Rao, C.R. (1973). *Characterization Problems of Mathematical Statistics*. John Wiley and Sons, New York.
4. Kakosyan, F.V., Klebanov, L.B. and Melamed, J.A. (1984). *Characterizations of Distributions by the Methods of Intensively Monotone Operators*. Springer-Verlag, New York.
5. Kemp, A.W. and Kemp, C.D. (2004). Factorial moment characterizations for certain binomial-type distributions. *Communications in Statistics-Theory and Methods*. 33(12), 3059-3068.
6. Kemp, C.D. and Kemp, A.W. (1956). Generalized hypergeometric distributions. *J. Roy. Statist. Soc. Series B*, 18, 202-211.
7. Kotz, S. (1974). Characterizations of statistical distributions: A supplement to recent surveys. *International Statistical Review*. 42, 39-65.
8. Rainville, E.D. (1960). *Special Functions*. Chelsea Publication Co. Bornmx. USA.
9. Roohi, A. (2003). *Negative and Factorial Moments of Discrete Distributions Involving Hyper-Geometric Series Functions*. Unpublished Ph.D. dissertation submitted to National College of Business Administration and Economics, Lahore.

CHARACTERIZATION OF SOME DISCRETE DISTRIBUTIONS

Kalsoom Akhtar Chaudhry¹ and Munir Ahmad²

¹ Kinnaird College for Women, Lahore.

Email: kalsoomkc@yahoo.com

² National College of Business Administration &
Economics, Lahore, Email: drmunir@brain.net.pk

1.1 ABSTRACT

Conway and Maxwell (1962) generalize the Poisson distribution to a two-parameter distribution, named as Conway-Maxwell Poisson distribution. Shmueli, et al. (2005) explored the Conway-Maxwell Poisson distribution and discuss its utility for fitting discrete data. Ahmad (2007) generalized the Conway-Maxwell Poisson distribution to Conway-Maxwell hyper Poisson (CMHP) distribution using hypergeometric series function. In this paper, the probability generating function of class of power-series distribution is developed along with its special cases. Further, some statistical properties of one of the special case of power-series function, Conway-Maxwell hyper Poisson distribution are developed. It is observed that the mean and variance of the CMHP distribution is same. Another important property of CMHP distribution is that, CMHP distribution truncated at left and translated to the origin is itself a CMHP distribution. In past, efforts were made to characterize the discrete distributions using different properties of the distributions. We characterize some discrete distributions using property of proportions.

KEY WORDS

H-Power series function, Conway-Maxwell Poisson, Truncation

1.2 INTRODUCTION

Conway and Maxwell (1962) generalize the Poisson distribution to a two-parameter distribution, named as Conway-Maxwell Poisson distribution. Boatwright, et al. (2003) apply the Conway-Maxwell Poisson distribution to the marketing data because the marketing data has heavy tails, so Poisson distribution have not provided the best fit. Shmueli, et al. (2005) discussed the Conway-Maxwell Poisson distribution and discuss its utility for fitting discrete data. Ahmad (2007) generalized the Conway-Maxwell Poisson distribution to Conway-Maxwell hyper-Poisson distribution using H-power series function and discussed some properties of Conway- Maxwell hyper-Poisson distribution. It is natural to explore some more statistical properties of Conway- Maxwell hyper-Poisson distribution. Further the probability generating function of a class of discrete power-series distribution is developed. Conway-Maxwell Poisson, Conway-Maxwell hyper Poisson and Poisson distribution are some of its special cases. We have also made generalization to some standard distributions like generalized Poisson, general class of generalized Poisson, geometric series, general class of geometric distribution and Conway-Maxwell hyper Poisson distributions respectively. Further, the characterization of these distributions is made using property of proportions.

1.3 PROBABILITY GENERATING FUNCTION OF FAMILY OF UNIVARIATE DISCRETE DISTRIBUTIONS

The probability generating function of family of discrete distributions is developed, using the H-power series functions (See Ahmad (2007)).

$$g(z) = \frac{{}_2H_2 \left[\left(\frac{\theta}{\beta}, 1 \right), (v, 1); (\lambda, 1), (1, k); \beta z \right]}{{}_2H_2 \left[\left(\frac{\theta}{\beta}, 1 \right), (v, 1); (\lambda, 1), (1, k); \beta \right]}, \quad (1.3.1)$$

where

$${}_2H_2 \left[\left(\frac{\theta}{\beta}, 1 \right), (v, 1); (\lambda, 1), (1, k); \beta z \right] = \sum_{x=0}^{\infty} \frac{\Gamma \left(\frac{\theta}{\beta} + x \right) \Gamma(v+x) \Gamma(\lambda) (\beta z)^x}{\Gamma(\lambda+x) \Gamma(v) \Gamma \left(\frac{\theta}{\beta} \right) (x!)^k};$$

$$|z| < 1, \theta > 0, \beta, v, \lambda, k > 0 \quad (1.3.2)$$

Case-I:

When $\beta \rightarrow 0$ and $v = \lambda = 1$, (1.3.1) reduces to the probability generating function of Conway-Maxwell hyper-Poisson distribution, with parameters (λ, θ, v, k) .

Case-II:

When $\beta \rightarrow 0$, $v = \lambda = \theta = 1$, (1.3.1) reduces to Conway-Maxwell Poisson generating function.

Case-III:

When $\beta \rightarrow 0$, $v = \lambda = k = 1$, (1.3.1) the probability generating function of Poisson distribution with parameter θ is obtained.

1.4 CONWAY MAXWELL HYPER-POISSON (CMHP) DISTRIBUTION AND ITS PROPERTIES

Ahmad (2007) has generalized Conway Maxwell Poisson distribution to CMHP distribution. The univariate CMHP distribution is given by:

$$P(X = x) = \frac{(\theta!)^v \lambda^x}{{}_1H_1((1, 1); (\theta, v); \lambda) ((x + \theta)!)^v}; \quad x = 0, 1, 2, \dots$$

$$; \theta, v \geq 0 \text{ and } \lambda > 0 \quad (1.4.1)$$

$$\text{where } {}_1H_1((1, 1); (\theta, v); \lambda) = \sum_{i=0}^{\infty} \frac{(\theta!)^v \lambda^i}{[(\theta + i)!]^v}$$

In this section, some statistical properties of CMHP are discussed and are given below. The moment generating function of (1.4.1) is given as:

$$M(t) = \frac{{}_1H_1((1, 1); ((\theta + 1), v); \lambda e^t)}{{}_1H_1((1, 1); (\theta, v); \lambda)} \quad (1.4.2)$$

The first four moments about mean of CMHP distribution are derived below from (1.4.2):

$$\mu_1 = \frac{\lambda}{(\theta+1)^v} {}_1H_1[(1,1);(\theta,v);\lambda] {}_1H_1[(2,1);(\theta+2,v);\lambda] \quad (1.4.3)$$

$$\mu_2 = \frac{\lambda}{(\theta+1)^v} {}_1H_1[(1,1);(\theta,v);\lambda] \left[{}_1H_1[(2,1);(\theta+2,v);\lambda] + \frac{2}{(\theta+2)^v} {}_1H_1[(3,1);(\theta+3,v);\lambda] \right] \quad (1.4.4)$$

$$\mu_3 = \frac{\lambda}{(\theta+1)^v} {}_1H_1[(1,1);(\theta,v);\lambda] \left[{}_1H_1[(2,1);(\theta+2,v);\lambda] + \frac{2\lambda}{(\theta+2)^v} {}_1H_1[(3,1);(\theta+3,v);\lambda] + \frac{2}{(\theta+2)^v} {}_1H_1[(3,1);(\theta+3,v);\lambda] + \frac{6\lambda}{(\theta+3)^v} {}_1H_1[(4,1);(\theta+4,v);\lambda] \right] \quad (1.4.5)$$

$$\mu_4 = \frac{\lambda}{(\theta+1)^v} {}_1H_1[(1,1);(\theta,v);\lambda] \left[{}_1H_1[(2,1);(\theta+2,v);\lambda] + \frac{2\lambda}{(\theta+2)^v} {}_1H_1[(3,1);(\theta+3,v);\lambda] + \frac{4\lambda}{(\theta+2)^v} {}_1H_1[(3,1);(\theta+3,v);\lambda] + \frac{6\lambda^2}{(\theta+2)^v (\theta+3)^v} {}_1H_1[(4,1);(\theta+4,v);\lambda] + \frac{2}{(\theta+2)^v} {}_1H_1[(3,1);(\theta+3,v);\lambda] + \frac{6\lambda}{(\theta+2)^v (\theta+3)^v} {}_1H_1[(4,1);(\theta+4,v);\lambda] + \frac{12\lambda}{(\theta+3)^v} {}_1H_1[(4,1);(\theta+4,v);\lambda] + \frac{24\lambda^2}{(\theta+3)^v (\theta+4)^v} {}_1H_1[(5,1);(\theta+5,v);\lambda] \right] \quad (1.4.6)$$

The two moments ratios are

$$\beta_1 = \frac{\left[{}_1H_1[(2,1);(\theta+2,v);\lambda] + \frac{2}{(\theta+2)^v} (\lambda+1) {}_1H_1[(3,1);(\theta+3,v);\lambda] + \frac{6\lambda}{(\theta+3)^v} {}_1H_1[(4,1);(\theta+4,v);\lambda]^2 (\theta+1)^v {}_1H_1[(1,1);(\theta,v);\lambda] \right]}{\lambda \left[{}_1H_1[(2,1);(\theta+2,v);\lambda] + \frac{2}{(\theta+2)^v} {}_1H_1[(3,1);(\theta+3,v);\lambda] \right]^3} \quad (1.4.7)$$

$$\beta_2 = \frac{(\theta+1)^\nu {}_1H_1[(1,1);(\theta,\nu);\lambda]}{\lambda} \frac{\left[\begin{aligned} &{}_1H_1[(2,1);(\theta+2,\nu);\lambda] + \frac{2}{(\theta+2)^\nu} (\lambda+1) {}_1H_1[(3,1);(\theta+3,\nu);\lambda] \\ &+ \frac{6\lambda}{(\theta+3)^\nu} \left(\frac{(\lambda+1)}{(\theta+2)^\nu} + 2 \right) {}_1H_1[(4,1);(\theta+4,\nu);\lambda] \\ &+ \frac{24\lambda^2}{(\theta+3)^\nu (\theta+4)^\nu} {}_1H_1[(5,1);(\theta+5,\nu);\lambda] \end{aligned} \right]}{\left[{}_1H_1[(2,1);(\theta+2,\nu);\lambda] + \frac{2}{(\theta+2)^\nu} {}_1H_1[(3,1);(\theta+3,\nu);\lambda] \right]^2} \quad (1.4.8)$$

The expression for the negative moments of CMHP distribution is given as:

$$E\left(\frac{1}{X+A}\right) = \frac{1}{A} \frac{{}_2H_2[(1,1),(A,1);((\theta+1),\nu);(A+1,1);\lambda]}{{}_1H_1[(1,1);(\theta,\nu);\lambda]} \quad (1.4.9)$$

where ${}_rH_s[(a_1, m_1), (a_2, m_2), \dots, (a_r, m_r); (b_1, n_1), (b_2, n_2), \dots, (b_s, n_s); z]$

$$= \sum_{i=0}^{\infty} \frac{\prod_{k=0}^r \Gamma_{(a_k)_i}^{m_k} z^i}{\prod_{j=0}^s \Gamma_{(b_j)_i}^{n_j} i!}; a_k \in R, |z| < 1, b_j \neq 0, -1, -2, \dots$$

The first negative moment of CMHP, truncated at point $X=0$ is

$$E\left(\frac{1}{X}\right) = \frac{\lambda {}_1H_1[(1,1);((\theta+2),\nu);\lambda]}{(\theta+1)^\nu ({}_1H_1[(1,1);(\theta,\nu);\lambda]-1)} \quad (1.4.10)$$

For CMHP distribution, the relations for moments are given as:

$$E(X+\theta)^{r+1} = \begin{cases} \lambda E(X+\theta-1)^{1-\nu} + \frac{\theta}{\lambda {}_1H_1[(1,1);(\theta,\nu);\lambda]} & ; r=0 \\ \lambda \frac{d}{d\lambda} E(X+\theta)^r + E(X+\theta)^r E(X+\theta) & ; r>0 \end{cases} \quad (1.4.12)$$

For $\theta=0$ and $r=0,1$ respectively, the expression for the mean and variance is obtained as:

$$E(X) = \lambda E(X-1)^{1-\nu} \quad (1.4.13)$$

$$Var(X) = \lambda E(X-1)^{1-\nu} \quad (1.4.14)$$

It may be seen from (1.4.13) and (1.4.14) that the mean and variance of the CMHP is the same, so CMHP shares the same property as of Poisson (i.e.) the mean and variance of the Poisson distribution are equal.

The left truncated CMHP distribution is

$$P(X=x) = \frac{\lambda^x}{((x+\theta)!)^\nu P_t(\lambda, \theta)}; x=t, t+1, \dots \quad (1.4.15)$$

where t is known and

$$P_t(\lambda, \theta) = \frac{\lambda^t}{((x+\theta)!)^v} {}_1H_1[(1,1);(t+\theta+1, v); \lambda] \quad (1.4.16)$$

Using (1.4.16) in (1.4.15) and let $y = x - t$, then

$$f_y(y; \lambda, \theta') = \frac{(\theta')^v \lambda^y}{((\theta' + y)!)^v {}_1H_1[(1,1);(\theta', v); \lambda]}; y = 0, 1, 2, \dots \quad (1.4.17)$$

where $\theta' = \theta + t$.

So, a CMHP distribution truncated at left and translated to the origin is itself a CMHP distribution.

1.5 CHARACTERIZATION OF DISTRIBUTIONS THROUGH PROPERTY OF PROPORTIONS

The following distributions are characterizing using property of proportions:

1.5.1 Generalized Poisson distribution

Following Shmueli et al. (2005), we redefine the Consul and Jain's (1973) generalized Poisson distribution with three parameters λ_1 , λ_2 , and v as:

$$P(X = x) = \frac{\lambda_1 (\lambda_1 + x\lambda)^{x-1} e^{-(\lambda_1 + x\lambda)}}{(x!)^v}, \quad x = 0, 1, 2, \dots, v \geq 0$$

$$, \lambda_1 > 0, |\lambda_1| < 1 \quad (1.5.1.1)$$

Theorem: Suppose X has the prob. mass function (1.5.1.1) if and only if

$$P(X = x) = \frac{(\lambda_1 + x\lambda)^{x-1} e^{-\lambda}}{(\lambda_1 + (x-1)\lambda)^{x-2} x^v} P(X = x-1) \quad (1.5.1.2)$$

Proof:

Taking $x = 1, 2, \dots$ in (1.5.1.2)

$$P_1 = \lambda_1 e^{-\lambda} P_0$$

$$P_2 = \frac{(\lambda_1 + 2\lambda)\lambda_1 e^{-2\lambda}}{2^v} P_0$$

$$P_3 = \frac{(\lambda_1 + 3\lambda)\lambda_1 e^{-3\lambda}}{3^v \cdot 2^v} P_0$$

$$\vdots$$

$$\vdots$$

$$P_x = \frac{(\lambda_1 + x\lambda)^{x-1} e^{-x\lambda}}{2^v 3^v \dots x^v} P_0$$

$$\sum P_x = 1 = \sum_{x=0}^{\infty} \frac{\lambda_1 (\lambda_1 + x\lambda)^{x-1} e^{-x\lambda}}{(x!)^v} P_0 \quad (1.5.1.3)$$

So:

$$P(X = x) = c^{-1}(\lambda_1, \lambda, \nu) \frac{\lambda_1 (\lambda_1 + x\lambda)^{x-1} e^{-x\lambda}}{(x!)^\nu}; \quad x = 0, 1, 2, \dots \quad (1.5.1.4)$$

1.5.2 General class of Generalized Poisson distribution

Hassan et al. (2007) proposed a general class of generalized Poisson distribution, with two parameters λ_1 and λ_2 ,

$$P_1(X = x) = \frac{\lambda (\lambda_1 + x\lambda_1)^{x-1} e^{-(\lambda+x\lambda_1)}}{(x!)}; \quad x = 0, 1, 2, \dots, \lambda > 0, |\lambda_1| < 1$$

The distribution is redefined by introducing a third parameter ν and is given as:

$$P_j(X = x) = \frac{\lambda^{j+1} (\lambda + x\lambda_1)^{x-j-1} e^{-(\lambda+x\lambda_1)}}{C_j(\lambda_1, \lambda, \nu) (x!)^\nu}; \quad x = 0, 1, 2, \dots; \nu \geq 0$$

$$; \lambda > 0, |\lambda_1| < 1 \text{ and } j \text{ is a given integer.} \quad (1.5.2.1)$$

$$\text{where } C_j(\lambda_1, \lambda, \nu) = \sum_{x=0}^{\infty} \frac{\lambda^{j+1} (\lambda + x\lambda_1)^{x-j-1} e^{-(\lambda+x\lambda_1)}}{(x!)^\nu}$$

Theorem: Suppose X has the prob. mass function (1.5.2.1) if and only if

$$P_j(X = x) = \frac{(\lambda + x\lambda_1)^{x-j-1} e^{-\lambda_1}}{x^\nu (\lambda + (x-1)\lambda_1)^{x-j-2}} P_j(X = x-1) \quad (1.5.2.2)$$

Proof:

Putting $x = 0, 1, 2, \dots$ in (1.5.2.2)

$$P_{j1} = \lambda^{j+1} (\lambda + \lambda_1)^{-j} e^{-\lambda_1} P_0$$

$$P_{j2} = \frac{\lambda^{j+1}}{2^\nu} (\lambda + 2\lambda_1)^{-j+1} e^{-2\lambda_1} P_0$$

$$P_{j3} = \frac{\lambda^{j+1}}{3^\nu} (\lambda + 3\lambda_1)^{-j+2} e^{-3\lambda_1} P_0$$

$$\vdots \quad \quad \quad \vdots$$

$$\vdots \quad \quad \quad \vdots$$

$$P_{jx} = \frac{(\lambda + x\lambda_1)^{x-j+1}}{2^\nu 3^\nu \dots x^\nu} P_0$$

$$\sum P_{jx} = 1 = \sum_{x=0}^{\infty} \frac{\lambda^{j+1} (\lambda + x\lambda_1)^{x-j+1}}{(x!)^\nu} e^{-x\lambda_1} P_0 \quad (1.5.2.3)$$

So:

$$P(X = x) = c_j^{-1}(\lambda_1, \lambda, \nu) \frac{\lambda^{j+1} (\lambda + x\lambda_1)^{x-j-1} e^{-x\lambda_1}}{(x!)^\nu}; \quad x = 0, 1, 2, \dots \quad (1.5.2.4)$$

The characterization holds for all the special cases of class of generalized Poisson distribution.

1.5.3 Generalized Geometric Series distribution

Mishra (1982) obtained a two-parameter generalized geometric series distribution. The distribution is generalized by taking another parameter ν and is given as:

$$P(X = x) = \frac{\Gamma(1 + \beta x) \alpha^x (1 - \alpha)^{1 + \beta x - x}}{(x!)^\nu \Gamma(\beta x - x + 2)}; x = 0, 1, 2, \dots; \nu \geq 0$$

$$; 0 < \alpha < 1, |\alpha\beta| < 1 \quad (1.5.3.1)$$

Theorem: Suppose X has the prob. mass function (1.5.3.1) if and only if

$$P(X = x) = \frac{\Gamma(1 + \beta x) \Gamma(\beta x - \beta - x + 3) \alpha (1 - \alpha)^{\beta - 1}}{x^\nu \Gamma(1 + \beta x - \beta) \Gamma(\beta x - x + 2)} P(X = x - 1) \quad (1.5.3.2)$$

Proof:

Taking $x = 0, 1, 2, \dots$ in (1.5.3.2)

$$P_1 = \alpha (1 - \alpha)^{\beta - 1} P_0$$

$$P_2 = \frac{2\beta \alpha^2 (1 - \alpha)^{2(\beta - 1)}}{2^\nu} P_0$$

$$P_3 = \frac{1}{3^\nu} \frac{\Gamma(3\beta + 1)}{2^\nu \Gamma(3\beta - 1)} \alpha^3 (1 - \alpha)^{3(\beta - 1)} P_0$$

$$\vdots \quad \quad \quad \vdots \quad \quad \quad \vdots$$

$$P_x = \frac{\Gamma(\beta x + 1) \alpha^x (1 - \alpha)^{x(\beta - 1)}}{\Gamma((\beta - 1)x + 2) 2^\nu \cdot 3^\nu \dots x^\nu} P_0$$

$$\sum P_x = 1 = \sum_{x=0}^{\infty} \frac{\Gamma(\beta x + 1) \alpha^x (1 - \alpha)^{x(\beta - 1)}}{\Gamma((\beta - 1)x + 2) (x!)^\nu} P_0 \quad (1.5.3.3)$$

So:

$$P(X = x) = M^{-1}(\alpha, \beta, \nu) \frac{\Gamma(\beta x + 1) \alpha^x (1 - \alpha)^{\beta x - x + 1}}{\Gamma(\beta x - x + 2) (x!)^\nu} \quad (1.5.3.4)$$

1.5.4 General class of Conway-Maxwell Poisson distribution

We have proposed a three-parameter general class of Conway-Maxwell Poisson distribution

$$P(X = x) = \frac{\lambda_1 (\lambda_1 + x\lambda)^{x-1} e^{-(\lambda_1 + x\lambda)}}{Z(\lambda_1, \lambda, \nu) (x!)^\nu}; x = 0, 1, 2, \dots$$

$$; \lambda_1 > 0, \nu \geq 0, |\lambda_1| < 1 \quad (1.5.4.1)$$

Theorem: Suppose X has the prob. mass function (1.5.4.1) if and only if the relation between successive probabilities is given below

$$P(X = x) = \frac{(\lambda_1 + x\lambda)^{x-1}}{e^\lambda x^v (\lambda_1 + (x-1)\lambda)^{x-2}} P(X = x-1) \quad (1.5.4.2)$$

Proof:

$$\begin{aligned} P_1 &= \lambda_1 e^{-\lambda} P_0 \\ P_2 &= \frac{\lambda_1 (\lambda_1 + 2\lambda) e^{-2\lambda}}{2^v} P_0 \\ P_3 &= \frac{\lambda_1 (\lambda_1 + 3\lambda)^2 e^{-3\lambda}}{2^v \cdot 3^v} P_0 \\ &\vdots \\ &\vdots \\ P_x &= \frac{\lambda_1 (\lambda_1 + x\lambda)^{x-1} e^{-x\lambda}}{2^v \cdot 3^v \cdots x^v} P_0 \\ \sum P_x &= 1 = \sum_{x=0}^{\infty} \frac{\lambda_1 (\lambda_1 + x\lambda)^{x-1}}{(x!)^v} e^{-x\lambda} P_0 \end{aligned}$$

$$\text{So: } P(X = x) = \frac{\lambda_1 (\lambda_1 + x\lambda)^{x-1} e^{-x\lambda}}{Z(\lambda_1, \lambda, v)(x!)^v} \quad (1.5.4.3)$$

The characterization holds for all the special cases of general class of Conway-Maxwell Poisson distribution.

REFERENCES

1. Ahmad, M. (2007). On the Theory of Inversion, *International Journal of Statistical Sciences (I.J.S.S.)*, USA.
2. Boatwright, P., Borle, S. and Kadane, J.B. (2003). A model of the joint distribution of purchase quantity and timing, *J. Amer. Statist. Assoc.* 98, 564-572
3. Conway, R.W. and Maxwell, W.L. (1962). A queuing model with state dependent service rates, *J. Indstrl. Engg.*, 12, 132-136.
4. Consul, P.C. and Jain, G.C. (1973). A generalization of the Poisson distribution, *Technometrics*, 15, 791-799.
5. Hassan, A., Mir, K.A. and Ahmad, M. (2007). Bayesian Analysis and Reliability Function of Decapitated Generalized Poisson Distribution. *Pak. J. Statist.* Vol. 23(3), 221-230.
6. Mishra(1982) A generalization of geometric series distribution. *J. Bihar Math. Soc.*, (6), 18-22.
7. Shmueli, G., Minka, T.P., Kadane, J.B. Borle, S. and Boatwright, P. (2005). A useful distribution for fitting discrete data: revival of the Conway-Maxwell-Poisson distribution, *Appl. Statist.*, 54, Part 1, 127-142.

DIGITAL SIGNATURES PROCESSES AND ITS AUTHENTICATION SYSTEMS

Nadia Qasim¹, S.M. Saleem² and Muhammad Qasim Rind³

¹ Kings College, London U.K, Email: nadia.qasim@kcl.ac.uk

² Preston University, Islamabad, Email: drsmsaleem@yahoo.com

³ Preston University, Islamabad, Email: dr.qasim1@gmail.com

ABSTRACT

Digital authentication systems enable individuals and organizations to have confidence in electronic transfer of privacy related information, by providing a trust infrastructure that enables confidentiality, integrity, and non-repudiation of communications. The authentication structure must ensure that procedures are in place to control access to critical components of the system. Government must create and enforce laws to protect the public and build public confidence. The general populous should be made aware of their responsibilities in the management of their key material.

The Public-Key Infrastructure is capable of providing the biggest and most trustworthy authentication mechanism that is currently used in most of the countries. Opportunities for implementing of public key technology applications have improved the delivery of services both internally as well as externally and have improved work processes with existing business partners.

INTRODUCTION

Digital signature is a cryptographic technique that enables to protect digital information from undesirable modification. The result of a transformation of a message by means of a cryptographic system using keys such that a person who has the initial message can determine that:

- a) Whether the transformation was created using the key that corresponds to the signer's key; and
- b) Whether the message has been altered since the transformation was made.

The Authentication relates to the process where one party has presented an identity and claims to be that identity. Authentication of a subscriber by a Certification Authority (CA) or Registration Authority (RA) enables the Relying Party to be confident that the assertion is legitimate.

The Verification of a digital signature means to determine for a given digital signature and message that the digital signature was created while the Certificate was valid and the message has not been altered since the digital signature was created. Some Certificate Policies will also require Confirmation of the Certificate Chain, that is, that each Certificate in the chain was valid at the time the digital signature was created.

A traditional signature serves three purposes: i) authentication (establishing the identity of the author), ii) integrity (that the document signed is unchanged), and iii) non-repudiation (so that the author can't deny it). These three functions work well with top

copy documents, but in a world full of photocopies all sort of changes could have been made or signatures added from other documents, etc., unless the parties involved verify the copies.

A digital signature is designed to serve the three purposes, rather than to look like a traditional signature. It relies on an action being performed using something that only the signatory has access to combined with a unique attribute of the item to be signed. A digital signature contains a date and time stamp, but this may not be reliable since it is taken from the computer's clock, which may be set incorrectly. These facets are of course no different from traditional signatures. The technique used to produce a digital signature involves Public Key Encryption and works like this.

The digital signatures for authentication must have the following attributes

- **Signer authentication:** A signature should indicate who signed a document, message or record, and should be difficult for another person to produce without authorization.
- **Document authentication:** A signature should identify what is signed, making it impracticable to falsify or alter either the signed matter or the signature without detection.

Thus, use of digital signatures usually involves two processes, one performed by the signer and the other by the receiver of the digital signature. First process is digital signature creation uses a hash result derived from and unique to both the signed message and a given private key. For the hash result to be secure there must be only a negligible possibility that the same digital signature could be created by the combination of any other message or private key. Secondly, digital signature verification is the process of checking the digital signature by reference to the original message and a given public key, thereby determining whether the digital signature was created for that same message using the private key which corresponds to the referenced public key.

PURPOSE OF A DIGITAL SIGNATURE

The purpose of a digital signature is the same as your handwritten signature. Instead of using pen and paper, a digital signature uses digital keys (public-key cryptology). Like the pen and paper method, a digital signature attaches the identity of the signer to the document and records a binding commitment to the document. Unlike a handwritten signature, it is considered impossible to forge a digital signature the way a written signature might be. The real value is in avoiding the paper and keeping your data electronic.

To use digital signature software requires some initial setup. You will need a signing certificate. If in your business you commonly sign documents or need to verify the authenticity of documents, then digital signatures can help you save time and paper-handling costs.

NEED TO CREATE A DIGITAL SIGNATURE

You will need to get your personal signing certificate. Creating your certificate involves creating a public-private digital key pair and a Certificate Authority. The private key is something you keep only to yourself. You sign a document with your private key,

then, you give your public key to anyone who wants to verify your signature. The process of creating your public-private key pair is easy and quick.

Public Keys. The public key certificate creates proof of the identity of the signer by using the services of a certificate authority. A certificate authority uses a variety of processes to associate the particular public key with an individual. You give your public key to anyone who wants to verify your signature. The combination of your public key and proof of identity result in a public key certificate - also called a signer's certificate.

Private Keys. The private key is something you keep only to yourself. You sign a document with your private key. The public and private keys are related mathematically. Knowing the public key allows a signature to be verified but does not allow new signatures to be created. If your private key is not kept "private," then someone could maliciously create your signature on a document without your consent. It is critical to keep your private key secret.

WORKING OF DIGITAL SIGNATURE TECHNOLOGY

Digital signatures are created and verified by cryptography, the branch of applied mathematics that concerns itself with transforming messages into seemingly unintelligible forms and back again. Digital signatures use what is known as "public key cryptography", which employs an algorithm using two different but mathematically related "keys", one for creating a digital signature or transforming data into a seemingly unintelligible form, and another key for verifying a digital signature or returning the message to its original form. Computer equipment and software utilizing two such keys are often collectively termed an "asymmetric cryptosystem".

Thus, use of digital signatures usually involves two processes, one performed by the signer and the other by the receiver of the digital signature:

- **Digital signature creation** uses a hash result derived from and unique to both the signed message and a given private key. For the hash result to be secure there must be only a negligible possibility that the same digital signature could be created by the combination of any other message or private key.
- **Digital signature verification** is the process of checking the digital signature by reference to the original message and a given public key, thereby determining whether the digital signature was created for that same message using the private key that corresponds to the referenced public key.

The processes of creating a digital signature and verifying it accomplish the essential effects desired of a signature for many legal purposes:

- **Signer authentication:** If a public and private key pair is associated with an identified signer, the digital signature attributes the message to the signer. The digital signature cannot be forged, unless the signer loses control of the private key (a "compromise" of the private key), such as by divulging it or losing the media or device in which it is contained.
- **Message authentication:** The digital signature also identifies the signed message, typically with far greater certainty and precision than paper signatures. Verification reveals any tampering, since the comparison of the hash results (one

made at signing and the other made at verifying) shows whether the message is the same as when signed.

- **Affirmative act:** Creating a digital signature requires the signer to use the signer's private key. This act can perform the "ceremonial" function of alerting the signer to the fact that the signer is consummating a transaction with legal consequences.
- **Efficiency:** The processes of creating and verifying a digital signature provide a high level of assurance that the digital signature is genuinely the signer's. As with the case of modern electronic data interchange (EDI) the creation and verification processes are capable of complete automation, with human interaction required on an exception basis only.

The processes used for digital signatures have undergone thorough technological peer review for over a decade. Digital signatures have been accepted in several national and international standards developed in cooperation with and accepted by many corporations, banks, and government agencies.

PROGRAMME FOR DIGITAL SIGNATURES

Encryption and digital signatures have been available in principle for quite a long time, but the stumbling block has always been easy-to-use software to generate keys, manage keys, and carry out the encryption/decryption of files or e-mails and produce/validate digital signatures. In the last few years such a programme has become available for PCs, Macs and many other types of computer. This programme is called **Pretty Good Privacy (PGP)** and is available free to anyone who wants to use it for non-commercial purposes. All the operations such as encryption, signature, decryption and verification of signature are carried out automatically once the user has indicated their intentions.

The minimum that you need to use PGP is to have it installed on your computer and to create a key pair (matching Private and Public Keys) for yourself. The installation process for PGP guides you through both installation and key pair creation. After that you need to swap public keys with other people who you wish to exchange files or e-mail with and who have also installed PGP on their computers. You can send people your Public Key by e-mail, but you should then verify that it really is your key. If the recipient of your key telephones you, you can both examine your copies of the key in PGP and check that its unique fingerprint is the same. In this way you can be sure that you have exchanged the correct Public Key.

KEY MANAGEMENT

The easiest way to break encrypted text is to have the key. Security of keys is the most important factor with a form of digital signature. All security mechanisms are worthless if secret or private keys are not protected and a perfect duplicate is created and used in the wrong hands. Loss or theft of an electronic identity is greater than any other privacy issue within the any digital authentication system. It can interfere with our lives, as a trivial nuisance, or it can completely change everything. A trivial example would be the current credit card scams that exist and the likely financial losses that could occur. On the other end of the scale the granting of access to restricted resources (i.e. bank account transfers, company forecasts) via an entity that has destructive and harmful intentions.

DIGITAL SIGNATURES, AUTHENTICATION AND THE LAW

A signature is not part of the substance of a transaction, but rather of its representation or form. Signing writings serve the following general purposes:

- **Evidence:** A signature authenticates writing by identifying the signer with the signed document. When the signer makes a mark in a distinctive manner, the writing becomes attributable to the signer.
- **Ceremony:** The act of signing a document calls to the signer's attention the legal significance of the signer's act, and thereby helps prevent "inconsiderate engagements.
- **Approval:** In certain contexts defined by law or custom, a signature expresses the signer's approval or authorization of the writing, or the signer's intention that it has legal effect.
- **Efficiency and logistics:** A signature on a written document often imparts a sense of clarity and finality to the transaction and may lessen the subsequent need to inquire beyond the face of a document. Negotiable instruments, for example, rely upon formal requirements, including a signature, for their ability to change hands with ease, rapidity, and minimal interruption.

The formal requirements for legal transactions, including the need for signatures, vary in different legal systems, and also vary with the passage of time. There is also variance in the legal consequences of failure to cast the transaction in a required form. The statute of frauds of the common law tradition, for example, does not render a transaction invalid for lack of a "writing signed by the party to be charged," but rather makes it unenforceable in court, a distinction which has caused the practical application of the statute to be greatly limited in case law.

Although the basic nature of transactions has not changed, the law has only begun to adapt to advances in technology. The legal and business communities must develop rules and practices, which use new technology to achieve and surpass the effects historically expected from paper forms.

To achieve the basic purposes of signatures outlined above, a signature should indicate who signed a document, message or record, and should be difficult for another person to produce without authorization. And should identify what is signed, making it impracticable to falsify or alter either the signed matter or the signature without detection.

Signer authentication and document authentication are tools used to exclude impersonators and forgers and are essential ingredients of what is often called a "nonrepudiation service" in the terminology of the information security profession. A nonrepudiation service provides assurance of the origin or delivery of data in order to protect the sender against false denial by the recipient that the data has been received, or to protect the recipient against false denial by the sender that the data has been sent. Thus, a nonrepudiation service provides evidence to prevent a person from unilaterally modifying or terminating legal obligations arising out of a transaction effected by computer-based means.

- **Affirmative act:** The affixing of the signature should be an affirmative act which serves the ceremonial and approval functions of a signature and establishes the sense of having legally consummated a transaction.
- **Efficiency:** Optimally, a signature and its creation and verification processes should provide the greatest possible assurance of both signer authenticity and document authenticity, with the least possible expenditure of resources.

Digital signature technology generally surpasses paper technology in all these attributes.

CORE FUNCTIONALITY OF DIGITAL SIGNATURES AND AUTHENTICATION

Digital Signatures and Authentication is an enhanced Web security solution that leverages the advanced public-key infrastructure (PKI) capabilities provided by the Digital Signatures and Authentication Security Manager. It enables the protection of Web site resources and applications, securely authenticating end-users, and adding accountability and privacy to online transactions.

REQUIREMENTS FOR IMPLEMENTING DIGITAL SIGNATURES AND AUTHENTICATION

Many of the requirements and considerations for Digital Signatures and Authentication as developed by each agency to implement A-130 and the Computer Security Act of 1987. This includes evaluating aspects such as the full life cycle cost of the system using digital signatures, system maintenance, facilities, training, backup, auditing, personnel needs, and other factors. Agencies should apply the same analytical methodology in evaluating the use of digital signatures for their electronic processes. Requirements are following:

INTEGRITY OF PUBLIC AND PRIVATE KEYS

Public and private keys must be managed properly to ensure their integrity. The key owner is responsible for protecting private keys. The private signature key must be kept under the sole control of the owner to prevent its misuse. The integrity of the public key, by contrast, is established through a digital certificate issued by a Certification Authority (CA) that cryptographically binds the individual's identity to his or her public key. Binding the individual's identity to the public key corresponds to the protection afforded to an individual's private signature key.

QUANTIFICATION OF POTENTIAL RISKS

The use of digital signatures entails potential risks, some of which are known and understood, others of which are known and less well understood and still others that may not yet be known. The consequences of each risk may be related in principle to a potential cost to the agency. For example, the agency may conclude that a higher incidence of fraud is likely. This may or may not be true since many believe that the use of public key technology may actually reduce the incidence of fraud. Depending upon the particular situation and the way an agency implements its program; the agency may be

able to define possible financial impacts by extrapolating losses due to fraud without digital signatures. To the extent that the consequences of a potential risk can be identified, an agency should consider whether its financial impacts could be quantified.

POLICY, PRACTICES, AND PROCEDURES

Policies, practices, and procedures for the use of public key technology need to be developed for the application at issue. Indeed, the starting place on a policy level for a public-key infrastructure is the development of a Certificate Policy (CP). If the agency has decided to run its own public-key infrastructure, it should prepare a Certification Practices Statement (CPS). Writing these documents is likely to consume substantial resources, but those resources are well spent since they create the entire framework for the agency's public-key infrastructure, including the issuance, revocation, and use of certificates. Beyond the Certificate Policy (CP) and Certification Practices Statement (CPS), existing agency policy, practices, and procedures may have to be altered or amended. Ideally, these processes should apply broadly to an agency's electronic transactions as a whole, or to classes of transactions, and there should be some consistency or common elements across the Federal Government.

CONNECTIVITY TO EXISTING AGENCY INFRASTRUCTURE

To use public key technology properly in an application, including establishing the PKI itself, proper connectivity must be provided to the agency's existing electronic infrastructure. This infrastructure may include extensive mainframe and other "backend" information processing systems. Many of the infrastructure's systems employ security devices such as firewalls aimed at providing proper segregation and security. Virtually all devices have databases that may need to be used to support a PKI while maintaining their integrity

RECORDS MANAGEMENT

Proper management of electronic records maintained or used, as part of the application must be ensured. This entails:

- i) Retaining those records necessary for long-term system operation including, where appropriate, all certificates or Certificate Revocation Lists (CRLs), Produced by a Certification Authority;
- ii) Retaining audit records and other materials necessary to establish proper system operation at any point in time as required for legal or other purposes;
- iii) Ensuring past records stored using certain electronic formats or media remain recoverable as those formats or media are replaced with newer technology.

IMPORTANCE OF DIGITAL SIGNATURES AND AUTHENTICATION

Digital signatures are widely used to protect data in secure e-mail systems. It would be desirable if digital signature could effectively substitute hand-written signatures in wherever the latter are used.

In many countries the laws and regulations have been adopted which equalize the use and functions of digital signature to handwritten signature. However, none of these countries has had any experience of using digitally signed data as evidence in the court. The most important step towards the legal use of electronic documents is to enable legal regulation of digital signatures.

BENEFITS OF USING DIGITAL SIGNATURES AND AUTHENTICATION

Benefits come in many forms. It is important for all of the benefits to be identified so that a fair comparison of costs and risks can be made many of the benefits cited below accrue from the use of electronic processes, rather than from the use of digital signatures *per se* in those processes. However, public key technology can create a trusted environment that promotes the use and growth of *all* electronic processes, so it is appropriate to attribute these benefits in substantial measure to public key technology. Potential benefits that should be evaluated include:

1. Time Savings

Use of electronic processes and digital signatures can reduce the time required to process information collections from sources inside or outside the agency. These may involve claims for financial or other benefits, bids on procurements, or simply inquiries involving private or proprietary information. Reduced response time benefits the agency by reducing per-transaction processing costs. The recipient benefits in ways that it may be difficult to measure, but which can be categorized as “increased responsiveness of Government to its citizens.”

2. Cost Savings

The long-term cost of performing agency business may be reduced. These costs reductions result from decreased transaction time and cost, increased accuracy and productivity, more effective use of staff in addressing agency priorities, reduced maintenance or operating costs associated with paper-based systems, and better and more trusted ways of allowing users to pay for services provided. These effects become more pronounced as the number of transactions increases.

3. Enhanced Service

The availability and accessibility of agency processes to users inside the agency, to the public, and to other outside entities is enhanced. The strong authentication, which digital signatures provide, allows the agency to supply broader service and to promote Administration goals and objectives to a wider audience. With the burgeoning use of the Internet and the increasing sophistication of the American public in the use of electronic processes, microcomputers, and networks, electronic accessibility to Federal agencies provides an opportunity for a member of the public to contact a Government agency when and where it is convenient for the individual. In effect, Government can serve the public 24 hours a day, seven days a week. Many private companies are already operating in this fashion over the Internet.

4. Improved Quality and Integrity of Data

With electronic processes using digital signatures, the quality and integrity of data collected are substantially improved. This reduces cost and improves process efficiency. For example, unlike paper processes, online forms can include field edit functions and

immediate data integrity and consistency checks. Thus, errors can be detected during input and corrected at that time (i.e., before transmission), saving agency and customer time and effort.

This approach also ensures the customer that the information he or she is providing will be accepted and that no errors were inadvertently introduced as a result of data-entry mistakes. These errors could be caused by poor penmanship on the part of the customer or by typographical errors on the part of the Government employee. Moreover, digital signatures provide strong authentication processes between the user and the system serving the user that help to assure users that it is safe to supply private information electronically and to receive the full benefit of electronic transactions.

These types of interactions are already becoming commonplace in the online market.

CONCLUSION

Digital authentication systems enable individuals and organizations to have confidence in electronic transfer of privacy related information, by providing a trust infrastructure that enables confidentiality, integrity, and non-repudiation of communications. The authentication structure must ensure that procedures are in place to control access to critical components of the system. Government must create and enforce laws to protect the public and build public confidence. The general populous should be made aware of their responsibilities in the management of their key material.

The public-key infrastructure is capable of providing the biggest and most trustworthy authentication mechanism that is currently used in our society. Opportunities for implementing of public key technology applications have improved the delivery of services both internally and to outside parties and to improve work processes with existing business partners.

Most of digital signature protocol has high levels of security. One-time digital signatures based on hash functions involved hundreds of hash function computations for each signature; for online access to a time stamping service, we can sign messages using only two computations of a hash function.

Digital signature implementation in existing or new database applications requires careful consideration of all the elements involved from the underlying Public Key Infrastructure (PKI) to the physical data schema of the application's database to the application software and cryptographic modules used to create and verify the digital signatures. Integrating all of the elements can be a formidable task, but with the proper planning, tools and controls in place it is achievable.

Digital Signature Algorithm (DSA) can be used to generate a digital signature. Digital signatures are used to detect unauthorized modifications to data and to authenticate the identity of the signatory. In addition, the recipient of signed data can use a digital signature in proving to a third party that the signatory in fact generated the signature. This is known as non repudiation since the signatory cannot, at a later time, repudiate the signature.

Digital Signatures and Authentication provides these strong security capabilities to Web-based applications. These capabilities provide strong authentication, Digital Signatures, and End-to-end encryption for bringing critical business functions to a Web Portal.

REFERENCES

1. Fiat A. and Shamir, A. (1986). *How to Prove Yourself: Practical Solutions to Identification and Signature problems*, in *Advances in Cryptology-CRYPTO 86*, Springer LNCS v 263, 186-194.
2. Bruce Schneier (1996). *Applied Cryptography*, 2nd Ed. Wiley & Sons. ISBN 0-471-11709-9
3. Chadwick, D.W., Tassabehji, R. and Young, A. (2000). *Experiences of using a public key infrastructure for the preparation of examination papers*, *Computers and Education* 35, Available via <http://www.sciencedirect.com/>
4. Currall, J., Blair, E. and Aiton, A. (2000). *Case studies in the use of PGP*. <http://www.gla.ac.uk/projects/scotmid/gendocs/pkicase-smp.html>
5. Greenleaf, Graham and Clarke, Roger (1997). *Privacy Implications of Digital Signatures*, IBC Conference on Digital Signatures. <HTTP://www.anu.edu.au/people/Roger.Clarke/DV/DigSig.html>
6. John C. Mitchell, Mark Mitchell and Ulrich Stern (1997). *Automated Analysis of Cryptographic Protocols*, Using Mur.In Proceedings of the 1997 IEEE Symposium on Security and Privacy, 141-151. IEEE Computer Society Press.
7. RC Merkle (1989). *A Certified Digital Signature*, in *Advances in Cryptology-Crypto 89* (Springer LNCS v 435) 218-238.
8. Rivest, Ronald L. (2000). *Cryptography and Security Links*, <http://theory.lcs.mit.edu/~rivest/crypto-security.html>
9. Kemmerer, R.; Meadows, C. and Millen, J. (1994). Three systems for cryptographic protocol analysis. *Journal of Cryptology*. 7(2), 79-130.
10. VeriSign, (1997). VeriSign's Certification Practice Statement-Quick Summary of Important CPS Rights and Obligations, <http://www.verisign.com/repository/summary.html>

CONCERNING GENERALIZATION OF DARBOUX INTEGRAL

Abdul Rauf Khan¹, Muhammad Qasim Rind² and Abdul Qayyum³
 Department of Mathematics and Statistics, Preston University, Islamabad.

Email: ¹kasim_rind@gmail.com
²dr.qasim1@gmail.com
³drrind42@gmail.com

ABSTRACT

It is shown among others that if $\int f(x) P(dx)$ is a Darboux integral where P denotes probability measure defined on all right closed intervals (a,b] under δ -fine tagged partition $t_i \in I_i \subset [t_i - \delta(t_i), t_i + \delta(t_i)]$, $i = 1,2,3, n$; where t_i , s are tags, $\delta(t_i)$ is a positive function on $I \subset [a, b]$ and δ is a gauge on I. Further if $R^*[a,b]$ denotes the class of generalized Darboux integrable functions, $f : [a,b] \rightarrow R$ continuous function, $f : [a,b]$ is compact $R^*[a, b]$ is uniquely determined containing Lebesgue integral as a corollary.

INTRODUCTION

The integral $\int f(x) P(dx)$ was first of all [5: p. 205] introduced by J.G. Darboux in 1875. In the integral $\int f(x) P(dx)$, P denotes the probability measure. This integral plays a very important role in engineering, science, statistics and mathematics. We begin with probability measure P which is defined on all right closed intervals; (a, b] in R^n and if a right closed interval A is the union of a pair wise disjoint right closed intervals $A_1, A_2, A_3, \dots, A_n$ then $P(A) = P(A_1) + P(A_2) + P(A_3) + \dots + P(A_n)$.

Following the terminology [2], and [4], for each right closed interval A and each positive ϵ there is a right closed interval B such that $B \subset A$ and $P(B) > P(A) - \epsilon$. Substituting P for positive measure in $f(t_i) - \epsilon/2(b-a) < f(x) < f(t_i) + \epsilon/2(b-a) \dots (1)$ where $t_i \in I_i \subset [t_i - \delta(t_i), t_i + \delta(t_i)]$ where t_i, s are tags, $\delta(t_i)$ is a positive function on $I \subset [a,b]$ and δ is a gauge on I. From (1) above, follows the Darboux integral $\int f(x) P(dx)$ when $A = R^n$ and the integral if it exists is called expectation of f denoted by $E(f) = \int f(x) P(dx)$.

If c is a subset of R^n whose indicator function I_c is integrable, c in this case is called event and the assigned probability measure is given by $P(c) = \int I_c(x) P(dx)$. Following [2] and [14], we obtain:

Theorem 1:

If c_1, c_2, c_3, \dots is a countable set of events and if they are pair wise disjoint then $P(\cup_j c_j) = \sum_j P(c_j)$

Proof:

For $j=1$, the result is obviously true. Applying Mathematical Induction and supposing the result to be true for $j=k-1$.

$P[U_{ij}^{k-1} c_j] = [\sum^{k-1} P_j, (c_j)]$ since c 's are pairwise disjoint so we have:

$P_j (U_{j \rightarrow} c_j) = P [U^{kc} \cap c_k] + P [Uc \cap c_k^c]$ where c_k^c denotes the complement of c_k
Hence $P [U_{j \rightarrow} c_j] = P (c_k) + \sum (c^{k-1} (c_k)) = \sum^{k-1} P(j)$.

The result is, therefore, true for all values of $j \in N$.

It is easy to prove that step functions are integrable so we deduce that every Darboux integrable function; $\{f(x): a \leq x \leq b\}$ is also integrable determined by $f(t_i) - \epsilon/2 (b-a) < f(x) < f(t_i) + \epsilon/2 (b-a)$ where $t_i \in I_i \subset [t_i - \delta(t_i), t_i + \delta(t_i)]$ where t_i, s_i are tags, $\delta(t_i)$ is a positive function on $I = \subset [a, b]$ and δ is a gauge on I . We generalize the Darboux integral keeping the inequality $f(t_i) - \epsilon/2 (b-a) < f(x) < f(t_i) + \epsilon/2 (b-a)$ in view we have for each $\epsilon > 0$ there exists a positive constant δ such that for every partition. $(t_1, A_1), (t_2, A_2), (t_3, A_3), (t_k, A_k)$ and with each $t_i \in A_i$, and each A_i with length less than δ it is true that $\sum f(t_i) P(A_i) - \epsilon/2 < J < \sum f(t_i) P(A_i) + \epsilon/2$ where f is the expected value of generalized Darboux integral.

Let $D^x [a, b]$ denote class of generalized Darboux integrals. Following [3] and [4] we obtain.

Theorem 2:

If $f \in D^x [a, b]$ then the expected value of the integral of f is uniquely determined.

Proof:

Assuming that J', J'' are expected values of generalized Darboux integrals. Let $\epsilon \in \mathbb{R}$ then there exists gauges $\delta' \in \mathbb{R}, \delta'' \in \mathbb{R}$ for partitions P_1 and P_2 of $[a, b]$ respectively such that $1 \sum \int (t_i) P(A_i) - J' - \epsilon < \epsilon/2$ and $1 \sum \int (t_i) P(A_i) - J'' < \epsilon/2$.

Let $\delta(t) = \min [\delta' \in \mathbb{R}, \delta'' \in \mathbb{R}]$ for $t \in [a, b]$ so that $\delta(t)$ is a gauge on $[a, b]$. If P is a $\delta \in \mathbb{R}$ - fine partition then P is both $\delta' \in \mathbb{R}, \delta'' \in \mathbb{R}$ so that! $J' - J'' = J_1 - \sum \int (t_i) P(A_i) + (\sum f(t_i) P(A_i) - J'') < \epsilon/2 + \epsilon/2 = \epsilon$. Since ϵ is arbitrary, it follows that $J' = J''$, so uniqueness is proved. Following [1: p.116] the interval $[a, b]$ is closed and bounded and hence compact.

We have the following generalization:

Theorem 3:

Let $f: [a, b] \rightarrow \mathbb{R}$ be continuous mapping f is Darboux integrable w.r.t. tagged partition then $f [a, b]$ is compact.

Proof:

Since $[a, b]$ is compact and f is Darboux integrable which is uniformly continuous function with respect to δ -fine tagged partition, $f[a, b]$ is continuous image of $[a, b]$ implying thereby $f[a, b]$ is compact.

Definition:

A function $f \in \mathbf{R}^*[a, b]$ such that $|f| \in \mathbf{R}[a, b]$ is said to be Lebesgue integrable on $[a, b]$.

Theorem 4: Let $\mathbf{R}^*[a, b]$ denote class of generalized Darboux integrable functions and $L[a, b]$ family of lebesgue integrable functions then for $f, w \in \mathbf{R}^*[a, b]$ and $|f(x)| < w(x)$ all $x \in [a, b]$ then $f \in L[a, b]$ and $|\int_a^b f| < \int_a^b |f| < \int_a^b w$.

Proof:

Since $[a, b]$ is compact and f is Darboux is integrable which is uniformly continuous function with respect to δ fine tagged partition, $f[a, b]$ is continuous image of $[a, b]$ implying thereby $f[a, b]$ is compact.

Definition:

A function $\mathbf{f} \in \mathbf{R}^*[a, b]$ such that $|\mathbf{f}| \in \mathbf{R}^*[a, b]$ is said to be Lebesgue integrable on $[a, b]$.

Theorem-4:

Let $\mathbf{R}^*[a, b]$ denote class of generalized Darboux integrable functions and $L[a, b]$ be family of Lebesgue integrable functions then for $f, w \in \mathbf{R}^*[a, b]$ and $|f(x)| < w(x)$ all $x \in [a, b]$ then $f \in L[a, b]$ and $|\int_a^b f| \leq \int_a^b |f| \leq \int_a^b w$.

Proof: Since $|f| \geq 0 \Rightarrow f \in L[a, b]$ and $-|f| \leq f \leq |f|$ implies that $|\int_a^b f| \leq \int_a^b |f| \leq \int_a^b w$ and $|\int_a^b f| \leq \int_a^b |f| \leq \int_a^b w$.

REFERENCES

1. Apostol, T.M. (1973). *Mathematical Analysis*, Addison Wesley Publishing Company, page 205.
2. Bartle, R.G. (1996). Return to the Riemann Integral, *Amer. Math. Monthly*. 103, 625-632.
3. Gordon, R.A. (1998). The use of tagged partitions in Elementary Real Analysis, *Amer. Math. Monthly*. 105, 107-117.
4. McShane, E.J. (1973). A United Theory of Integration, *Amer. Math. Monthly*. 80, 349-359.
5. Pervin, W.J. (1972). *Foundations of General Topology*, Academic Press, New York.

**ON COEFFICIENTS OF THE LAURENT SERIES OF THE
ALPHA-PROBABILITY FUNCTIONS AND ITS APPLICATION TO
FATIGUE LIFE OF AIRCRAFT STRUCTURAL ALUMINUM ALLOY**

Munir Ahmad

National College of Business Administration & Economics, Lahore, Pakistan
Email: drmunir@brain.net.pk

ABSTRACT

Alpha-distribution also known as Bernstein or Inverted Normal Distribution has been scarcely discussed in the literature. The distribution has been derived by Gertsbakh et al (1969), and independently developed by Vysokovskii (1966) as a result of wear analysis of broad nosed cutting tools. The distribution has been further discussed by Pandit and Sheikh (1980), Kendall and Sheikh (1979) and Ahmad and Sheikh (1981 a, b, c).

In this paper we obtain the Laurent-series expansion of Alpha probability function of a complex variable and coefficients of nth power of the variable are derived in terms of Hermite polynomials. We use the method of steepest descent to obtain moments of Alpha-distribution and used the moments to estimate the parameters. An example from the engineering design is given to illustrate the estimation procedure.

KEY WORDS

Bernstein Distribution, Fatigue Life, Hermite Polynomials, Inverted Normal, Log-Normal, Steepest Descent Method.

1. INTRODUCTION

The Alpha-probability function has been developed to model the life characteristics of machine components which deteriorate according to a scheme of non-stationary linear random wear processes (Ahmad and Sheikh, 1981 a and b and Ahmad et al., 1981). The two parameters of Alpha probability function considered in this paper is

$$f(x) = \frac{\alpha\beta}{\sqrt{\pi}} \frac{1}{x^2} \exp\left[-\alpha^2(1-\beta/x)^2\right], \quad x \neq 0 \quad (1.1)$$

where $\beta > 0$ is the location parameter and $\alpha > 0$ is the shape parameter. The probability density model (1.1) can also be derived as the probability function of the reciprocal of the normal random variate (Ahmad and Sheikh, 1981a). The function $f(x)$ is a bimodal function. The two modes are given by $X_{\text{mode}} = \frac{1}{2}\beta\left[1 \pm \sqrt{1+4/\alpha^2}\right]$. The function becomes unimodal for large value of α when positive root of the equation is considered. The mean and higher moments of (1.1) do not exist.

In this paper we obtain the Laurent series expansion of $f(x)$, $f(x)$ being a function of a complex variable x for $|x| > 0$. We show that the coefficient $B_n(\alpha, \beta)$ of the Laurent expansion involve Hermite polynomials. We derive the recurrence relations and the difference equations satisfied by $B_n(\alpha, \beta)$ and use the method of steepest descent to find the asymptotic moments of the Alpha probability distribution for large α , which are used to estimate parameters. An example from the engineering design is given to illustrate the estimation procedure.

2. LAURENT SERIES EXPANSION

Consider the function when $\alpha, \beta > 0$ and x is a complex variable. The function has an essential singularity at $x = 0$. The Laurent series expansion for $f(x)$ in the domain $|x| > 0$ is given by $f(x) = \sum_{n=-\infty}^{\infty} B_n x^n$, where

$$B_n = \frac{1}{2\pi i} \int_c \frac{f(s) ds}{s^{n+1}}, \quad n = 0, \pm 1, \pm 2, \dots \quad (2.2)$$

and c is any simply closed contour enclosing the origin (See also Abian, 1981). We find

$$B_n = \frac{1}{2\pi} \int_0^{2\pi} \exp[-\alpha^2 A(\beta, \theta)] \cos[D(\alpha, \beta, \theta)] d\theta, \quad (2.3)$$

where $A(\beta, \theta) = 1 + 2\beta \cos \theta + \beta^2 \cos 2\theta$

and $D(\alpha, \beta, \theta) = 2\alpha^2 \beta \sin \theta - \alpha^2 \beta^2 \sin 2\theta + (n+2)\theta$.

3. RECURRENCE RELATION FOR B_n

Consider the function (1.1) in terms of its Laurent series expansion

$$f(t) = \sum_{n=-\infty}^{\infty} B_n t^n. \quad (3.1)$$

Differentiating (3.1) with respect to t , we have

$$2y \left[\frac{1}{t} - \frac{\alpha^2 \beta}{t^2} + \frac{\alpha^2 \beta^2}{t^3} \right] = \sum_{n=-\infty}^{\infty} n B_n t^{n-1} \quad (3.2)$$

where $y = f(t)$,

and (3.2) is written as

$$-2 \sum_n B_n t^{n-1} - 2\alpha^2 \beta \sum_n B_n t^{n-2} + 2\alpha^2 \beta^2 \sum_n B_n t^{n-3} = \sum_n n B_n t^{n-1}. \quad (3.3)$$

Equating the coefficient of t^{n-1} from both sides of (3.3), we obtain the recurrence relation:

$$(n+2)B_n + 2\alpha^2\beta B_{n+1} - 2\alpha^2\beta^2 B_{n+2} = 0. \quad (3.4)$$

Replacing t by βt in (3.1), we have

$$\frac{1}{\beta^2 t^2} \exp\left[-\alpha^2(1-1/t)^2\right] = \sum B_n(\alpha, \beta) \beta^n t^n \quad (3.5)$$

where $B_n = B_n(\alpha, \beta)$.

Comparing the coefficients of t^n in (3.5), we obtain the relation

$$B_n(\alpha, \beta) = \beta^{-(n+2)} B_n(\alpha, 1), \quad \beta \neq 0. \quad (3.6)$$

The relation (3.6) is important for computational purpose.

Consider (3.1) again. Expand the right-hand side of the function at (3.1) and equate it to the Laurent series expansion, we get

$$\begin{aligned} \sum_{n=-\infty}^{\infty} B_n(\alpha, 1) x^n &= x^{-2} \left[1 - \alpha^2(1-x^{-2})^2 + \frac{\alpha^4}{2!}(1-x^{-1})^4 + \dots \right] \\ &= \frac{1}{x^2} \left[1 - \alpha^2 \left(1 - \frac{2}{x} + \frac{1}{x^2} \right) + \frac{\alpha^4}{2!} \left\{ 1 - \binom{4}{1} \frac{1}{x} + \binom{4}{2} \frac{1}{x^2} - \binom{4}{3} \frac{1}{x^3} + \frac{1}{x^4} \right\} - \dots \right] \end{aligned} \quad (3.7)$$

Comparing the coefficients of x^j , we get

$$B_i(\alpha, 1) = 0, \quad i = 0, 1, 2, 3, \dots$$

$$B_{-1}(\alpha, 1) = 0$$

$$B_{-2}(\alpha, 1) = 1 - \alpha^2 + \frac{\alpha^4}{2!} - \dots = e^{-\alpha^2}$$

$$B_{-3}(\alpha, 1) = 2\alpha^2 \beta e^{-\alpha^2}$$

and so on.

4. REPRESENTATION $B_n(\alpha, 1)$ IN TERMS OF HERMITE POLYNOMIALS

Since Hermite polynomials are well tabulated in literature, we may express $B_n(\alpha, 1)$ in terms of Hermite polynomials. Replacing t by $\frac{\alpha}{t}$ and $\beta = 1$ in (3.1) and multiplying it by $\exp(\alpha^2)$, we get

$$\begin{aligned} f(1/t) &= t^2 \exp\left[-\alpha(1-t)^2\right] \\ \exp(\alpha^2) f(1/t) &= t^2 \exp\left[-\alpha^2 t^2 + 2\alpha^2 t\right] \end{aligned}$$

Let $u = \alpha t$, then

$$\alpha^2 \exp(\alpha^2) f\left(\frac{t}{u}\right) = u^2 \exp[-u^2 + 2\alpha u] = u^2 \sum_{n=0}^{\infty} H_n(\alpha) \frac{u^n}{n!}$$

where $H_n(\alpha)$ is Hermite polynomial of degree n .

Replacing x for x^{-1} , we find

$$f(x) = \sum_{n=-\infty}^{\infty} B_n x^n = e^{-\alpha^2} \sum_{n=0}^{\infty} \alpha^n H_n(\alpha) \frac{x^{-(n+2)}}{n!} \quad (4.1)$$

Comparing coefficient of t^i from (4.1), we obtain

$$B_i(\alpha, 1) = 0, \quad i = -1, 0, 1, 2, 3, \dots \quad (4.2)$$

$$B_{-2}(\alpha, 1) = e^{-\alpha^2} H_0(\alpha)$$

$$B_{-3}(\alpha, 1) = \alpha e^{-\alpha^2} H_1(\alpha)$$

and so on. In general, we have

$$B_{-(n+2)} = e^{-\alpha^2} \frac{\alpha^n}{n!} H_n(\alpha), \quad n = 0, 1, 2, 3, \dots \quad (4.3)$$

We write the Laurent series $\sum_{n=-\infty}^{\infty} B_n(\alpha, 1) t^n$ as $\sum_{n=-\infty}^{-1} B_n(\alpha, 1) t^n$.

Thus

$$\begin{aligned} f(t) &= \sum_{n=-\infty}^{-2} B_n(\alpha, 1) t^n \\ &= \sum_{n=2}^{\infty} A_n(\alpha, 1) t^{-n} \end{aligned}$$

where

$$A_{n+2}(\alpha, 1) = e^{-\alpha^2} \frac{\alpha^n}{n!} H_n(\alpha), \quad n = 0, 1, 2, \dots \quad (4.4)$$

$A_{n+2}(\alpha, 1)$ can be evaluated using the relation (3.6)

5. ASYMPTOTIC EXPANSIONS FOR THE MOMENTS

Since mean and higher moments of the Alpha distribution do not exist, it is of interest to derive asymptotic expressions for moments of the Alpha random variable for large values of the parameter α by using the steepest descent method. For details of the method reference may be made to Daniel (1954).

Consider the moment generating function of the Alpha random variable:

$$g(\theta) = \frac{\alpha\beta}{\sqrt{\pi}} \int_c \frac{e^{\theta x}}{x^2} \exp\left[-\frac{(1-\beta/x)^2}{2\alpha^2\beta^2}\right] dx. \quad (5.1)$$

It can be shown that for large values of the parameter α , the method of steepest descent leads to the following asymptotic expression for $g(x)$;

$$f(x) = \sum_{k=0}^{\infty} \frac{(x\beta)^k}{k!} + \sum_{m=1}^{\infty} \frac{1}{2m(2\alpha^2)^m} \sum_{k=1}^{\infty} \frac{(k+2m-1)!}{(k-1)!} \frac{(x\beta)^k}{k!} \quad (5.2)$$

Differentiating (5.2) r -times with respect to x and equating $x = 0$, we obtain asymptotic expansion for the r th moment about origin

$$\mu'_r = \beta^r \left[1 + \sum_{m=1}^{\infty} \frac{(2m+r-1)!}{2m(2\alpha^2)^m} \right] \quad (5.3)$$

If $r = 1$ and $r = 2$, the asymptotic expressions for the first two moments are

$$\mu'_1 \simeq \beta \left[1 + \frac{1}{2\alpha^2} \right] \quad (5.4)$$

and
$$\mu'_2 \simeq \beta^2 \left[1 + \frac{3}{2\alpha^2} \right] \quad (5.5)$$

The variance is approximated by

$$\mu_2 \simeq \frac{1}{2} \beta^2 / \alpha^2 \quad (5.6)$$

Further results can be obtained by introducing more terms from the expansion (5.3).

Let m_1 and m_2 be two sample moments using the two-moment equations (5.4) and (5.5). The moment estimating equations are

$$m_1 = \tilde{\beta} \left(1 + \frac{1}{2\alpha^2} \right) \quad (5.7)$$

and
$$m_2 = \beta^2 / 2\alpha^2 \quad (5.8)$$

Eliminating β from the equations, and solving for α , we have

$$\tilde{\beta} = \frac{m_1}{2} \left(1 + \sqrt{1 - \frac{4m_2}{m_1^2}} \right) \quad (5.9)$$

and
$$\tilde{\alpha} = \frac{1}{\sqrt{2m_2}} \tilde{\beta}. \quad (5.10)$$

In view of relations (5.4) and (5.6), $\frac{\mu_2}{\mu_1^2} < 1/4$.

The asymptotic variances of the moment estimates (5.9) and (5.10) are given by (See Stuart and Ord, 1977),

$$Var(\tilde{\beta}) \approx \beta^2 \left[\frac{Var(m_1)}{\mu_1^2} + \frac{Var(m_2)}{\mu_2} - \frac{2Cov(m_1, m_2)}{\mu_1 \mu_2} \right]$$

$$\text{and } Var(\hat{\alpha}) \approx \frac{\alpha^2}{4(\mu_1^2 - \mu_2^2)} \left[Var(m_1) + \{\mu_1^2 - \mu_2^2\} + \mu_2^2 Var(m_2) - 4Cov(m_1, m_2) \right]$$

where $Var(m_1)$, $Var(m_2)$ and $Cov(m_1, m_2)$ are given by Stuart and Ord (1987).

6. ILLUSTRATIVE EXAMPLE

We consider the data on fatigue life of aircraft aluminum alloy from Shimokawa and Hamaguchi (1977) obtained as a result of fatigue life testing conducted on 2024-T4 aircraft structure aluminum alloy specimens. The distribution model for the data as suggested by Shimokawa and Hamaguchi (1977) is the lognormal model. They validated their proposed model by plotting the data on a lognormal paper.

We show that the Alpha distribution is also a very suitable candidate for the type of failure data and may show to be even better than the lognormal model. We estimate α and β by moment method. The sample moments are $m_1 = 21063.332$ and $m_2 = 3198257.00$. Thus the estimated values of the parameters are $\tilde{\beta} = 20910.381$ and $\tilde{\alpha} = 2.82677$. Using these estimates of the parameters, we obtain the distribution function, $F(x) = \Phi \left\{ \sqrt{2} (8.2677) \left[1 - \frac{20910.381}{x} \right] \right\}$. The adequacy of the Alpha as well as the lognormal model is checked by Kolmogorov-Smirnov test (using the K-statistic) which indicate that both models are acceptable. The calculated value of K-statistic for Alpha model is 0.1367 which is less than the K-statistic for the lognormal model (K = .01479), indicating that Alpha model provides a better fit to the fatigue life data.

REFERENCES

1. Abian, Abnexander (1981). Two theorems on truncations of the Laurent series. *J. Applied Mathematics*. Vol. 27(4), 477-479.
2. Ahmad, M. and Sheikh, A.K. (1981a). *Detecting shifts of a parameter in Bernstein distribution with applications to weather modifications experiments*. Seventh Conference on Probability and Statistics in Atmospheric Science, Boston, Mass., USA, 19-21.
3. Ahmad, M., and A.K. Sheikh (1981b), *Estimation of the Parameters of the Bernstein Population From Complete and Censored Samples*. 43rd Session of the International

- Statistical Institute, Buenos Aires, Argentina, November 30 to December 11, 1981, Vol. 1 of Contributed Papers, pp. 225-228.
4. Ahmad, M., Sheikh, A.K. and T.S. Mirza (1981), Renewal Analysis Using Bernstein Distribution. *Journal of Reliability Engineering*, Vol. 5, No. 1, 1-19, (1983). (Paper presented at the 9th Triennial Conference on Operational Research. IFORS 81, held at Hamburg, Germany, July 20-24, 1981).
 5. Daniel, H.E. (1954). Saddle point approximations in statistics. *Ann. Math. Statist.* Vol. 25, 631-650.
 6. Gertshakh, I.B. and Kordonskey, Kh. R. (1969). *Models of failure*. Springer-Verlag, New York, Inc., pp 28-30.
 7. Iseghem, Jeannette Van and Graves-Morris, Peter, R. (1996). Approximation of a function given by its Laurent series. *Numerical Algorithms*. Vol. 11(1), 339-351 (On line November 07, 2005).
 8. Pandit, S.M. and Sheikh, A.K. (1980). Reliability and optimal replacement via coefficient of variation. *Transactions ASME, Jour. of Mechanical Design*, Vol. 102, 761-768.
 9. Sheikh, A.K., Kendall, L.A. and Pandit, S.M. (1979). Probabilistic optimization of multi tool machining operations. *Transactions ASME, Jour. of Engg. for Industry*, Vol. 102B, 239-246.
 10. Shimokawa, T. and Hamaguchi, Y. (1977). *Relationship between scatter of fatigue life and S-N curve of 2024-T4 aircraft structural aluminum alloy specimens with a sharp notch ($K_t=8.25$) under a constant temperature and humidity condition*. Technical Report of National Aerospace Laboratory (TR-412T), CHOFU, Tokyo, Japan.
 11. Stankus, E.P. (1985). A note concerning the coefficients of the Laurent series of the Riemann Zeta function. *J. Mathematical Sciences*. Vol. 29(3) 1302-1305 (On line November 07, 2005).
 12. Stuart, Alan and Ord, J. Keith (1987). *Kendall's Advanced Theory of Statistics*. (5th Ed.) Charles Griffin & Company Limited, London. UK.
 13. Vysokovskii, E.S. (1966). Reliability of tools used of semi automatic lathes. *Russian Engineering Journal*, Vol. XLVI, No. 6, 46-59.

SIMULATION ANALYSIS OF GENERALIZED EXPONENTIAL MODELS

M. Shuaib Khan¹, M. Aleem² and Zafar Iqbal³

Department of statistics The Islamia university of Bahawalpur.

Email: ¹ skn_801@yahoo.com

² draleemiub@Hotmail.com

³ zafariqbal101@hotmail.com

ABSTRACT

This article presents the simulation analysis of three parameter Generalized Exponential Models. The two-parameter generalized exponential distribution was recently introduced by Gupta and Kundu (1999). We presented the relationship of between shape parameter and other properties such as in probability function, cumulative distribution function, reliability function, hazard function, cumulative hazard function, median life, mode life and point of inflexion models are presented graphically and mathematically. Here we compare these relevant parameters such as shape, scale parameters by using Monte carol simulation.

1. INTRODUCTION

The Generalized Exponential models are the reliability models can be used in the reliability engineering discipline. This paper presents the relationship between shape parameter and other properties such as probability function, cumulative distribution function, reliability function, hazard function, cumulative hazard function, median life, mode life and point of inflexion models are presented graphically and mathematically. The Generalized Exponential distribution will be suitable for modeling for the applications of mechanical or electrical components lying in the life testing experiment. Some works has already been done on Generalized Exponential distribution by Gupta and Kundu (2003). Debasis Kundu, Rameshwar D. Gupta and Anubhav Manglick (2005) presented the Discriminating between the log-normal and generalized exponential distributions. Gupta, R. D; Kundu, D (2001 b) also derived Generalized exponential distributions for different methods of estimation.

2. GENERALIZED EXPONENTIAL MODELS ANALYSIS

2.1 Generalized Exponential Probability Distribution

The Generalized Exponential probability distribution has three parameters η, β and t_0 . It can be used to represent the failure probability density function (PDF) is given by:

$$f_{GEP}(t) = \frac{\beta}{\eta} \left[1 - \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right] \right]^{\beta-1} \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right], \eta > 0, \beta > 0, t_0 > 0, -\infty < t_0 < t \quad (2.1)$$

where β is the shape parameter representing the different pattern of the Generalized Exponential PDF and is positive and η is a scale parameter representing the characteristic life at which $(63.2)^\beta$ % of the population can be expected to have failed and is also positive, t_0 is a location or shift or threshold parameter (sometimes called a guarantee time, failure-free time or minimum life).

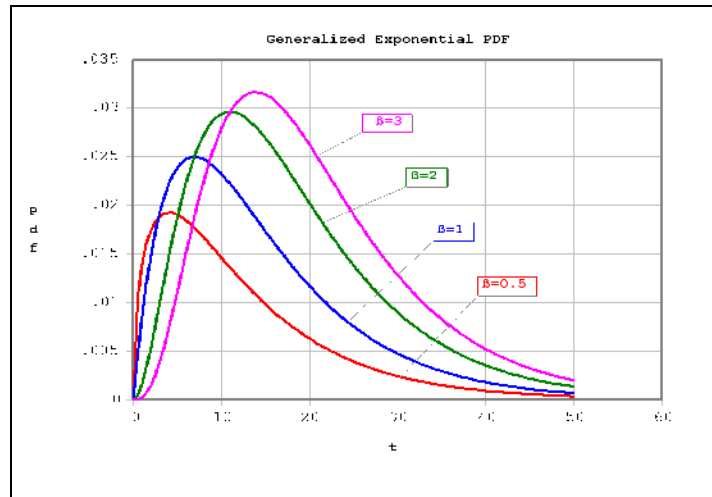


Fig 2.1: The Generalized Exponential PDF

If $t_0 = 0$ then the Generalized Exponential distribution is said to be two-parameter Generalized Exponential distribution. In the life testing process if $t_0 > 0$ then the origin of the PDF lies to the left of the PDF of the recorded life time data. For the recorded life time data when $t_0 < 0$ then the origin of the PDF of Generalized Exponential distribution lies to the right of the PDF. In practical terms which may be explained as there being some delay before the duty actually starts. It is important to note that the restrictions in equation (2.1) on the values of t_0, η, β are always the same for the Generalized Exponential distribution. Fig. 2.1 shows the diverse shape of the Generalized Exponential PDF with $t_0 = 0$ and value of $\eta = 10$ and $\beta (=0.5, 1, 2, 3)$. Fig. 2.1 shows the diverse shape of the Generalized Exponential PDF which is quite similar with the weibull distribution probability density functions. The Generalized Exponential and the weibull distributions are both the generalization of an exponential distribution. From the results of Gupta and Kundu (2003) it is observed that in many situations Generalized Exponential distribution provide better results than the weibull distribution. Therefore for skewed life time data experimenter prefer Generalized Exponential distribution than the weibull distribution.

2.2 Cumulative Distribution Function

The cumulative distribution function (CDF) of Generalized Exponential distribution is denoted by $F_{GEP}(t)$ and is defined as

$$F_{GEP}(t) = \left[1 - \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right] \right]^\beta \quad (2.2)$$

When the CDF of the Generalized Exponential distribution has zero value then it represents no failure components by t_0 . When $t = t_0 + \eta$ then $F_{GEP}(t_0 + \eta) = (1 - e^{-1})^\beta$ and for $\eta = 10$ then it also gives $F_{GEP}(t_0 + \eta) = (1 - e^{-1})^\beta = (0.63212)^\beta$, it represents the characteristic life' or 'characteristic value.. Fig. 2.2 shows the special case of Generalized Exponential CDF with $t_0 = 0$ and for the value of $\eta = 10$ and $\beta (=0.5, 1, 2, 3)$. It is clear from the Fig. 2.2 that all curves started from the point of origin the characteristic point for the Generalized Exponential CDF.

2.3 Reliability Function

The reliability function (RF), denoted by $R_{GEP}(t)$ (also known as the survivor function) is defined as $1 - F_{GEP}(t)$

$$R_{GEP}(t) = 1 - \left[1 - \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right] \right]^\beta \quad (2.3)$$

We see that $R_{GEP}(t) + F_{GEP}(t) = 1$. Fig. 2.3 shows the Generalized Exponential RF with $t_0 = 0$ and value of $\eta = 10$ and $\beta (=0.5, 1, 2, 3)$. It is clear that all curves intersect at the point of one the characteristic point for the Generalized Exponential $R_{GEP}(t)$.

2.4 Hazard Function

The hazard function (HF) (also known as instantaneous failure rate) denoted by $h_{GEP}(t)$ and is defined as $f_{GEP}(t) / R_{GEP}(t)$

$$h_{GEP}(t) = \frac{\frac{\beta}{\eta} \left[1 - \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right] \right]^{\beta-1} \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right]}{1 - \left[1 - \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right] \right]^\beta} \quad (2.4)$$

When $\beta = 1$, the distribution is the same as the exponential distribution for a constant hazard function and $h_{GEP}(t) = \frac{1}{\eta}$ so the exponential distribution is a special case of the

Generalized Exponential distribution and the Generalized Exponential distribution can be treated as a generalization of the exponential distribution. When $\beta < 1$, the hazard function is continually decreasing which represents early failures. When $\beta > 1$, the hazard function is continually increasing which represents wear-out failures. So the Generalized Exponential is a very flexible distribution. Two main reasons for the popularity of the Generalized Exponential distribution are that it has simple expressions and closed forms to model the probability density function (PDF), reliability function, cumulative distribution function (CDF) and hazard function. It can be used to represent a wide variety of in-service life failure patterns for many types of products. Fig. 2.4 shows the Generalized Exponential HF with $t_0 = 0$ and value of $\eta = 10$ and $\beta (=0.5, 1, 2, 3)$.

2.5 Cumulative Hazard Function

The cumulative hazard function (CHF), denoted by $H_{GEP}(t)$ and is defined as

$$H_{GEP}(t) = -\ln \left| 1 - \left[1 - \text{Exp} \left[- \left(\frac{t-t_0}{\eta} \right) \right] \right]^\beta \right| \quad (2.5)$$

The relationships between CDF and CHF of the Generalized Exponential distribution are represented as

$$F_{GEP}(t) = 1 - e^{-H_{GEP}(t)} \quad \text{or} \quad H_{GEP}(t) = -\ln[1 - F_{GEP}(t)]$$

The Generalized Exponential CHF with $t_0 = 0$ and $\eta = 10$ and $\beta (=0.5, 1, 2, 3)$. It is important note that the entire curve started through pints of origin on the graph of Generalized Exponential CHF.

3. GENERALIZED EXPONENTIAL MODELS AND SIMULATION ANALYSIS

Here every Generalized Exponential model is in a form of simulation analysis. The process of designing Generalized Exponential models of a real system and then we have conducting computer-based experiments with these models to describe, explain and predicting the behaviors of the real system over extended periods of real time. Other important properties of the Generalized Exponential distribution are summarized as follows. It is important to note that figures 3.1 to 3.3 are all based on the assumption that $t_0 = 0$.

3.1 Median Life

The median life (50^{th} percentile) of the Generalized Exponential distribution is defined as

$$\text{Median}_{GEP} = t_0 + \eta \ln \left| \frac{2^{1/\beta}}{2^{1/\beta} - 1} \right| \quad (3.1)$$

This is the life by which 50% of the units will be expected to have failed, and so it is also the life at which 50% of the units would be expected to still survive. The relationship between β and (median life/ η) is shown in Fig. 3.2. Taking the first derivative of equation (3.1) and equating it to 0, an extremely large value can be obtained: as $\beta \rightarrow \infty$, median life/ $\eta \rightarrow 1$. Fig. 3.1 shows that β and median life/ η have a positive proportion.

3.2 Mode Life

The mode life of the Generalized Exponential distribution is defined as

$$Mode_{GEP} = t_0 + \eta \ln|\beta| \quad (3.2)$$

The relationship between β and (mode life/ η) is shown in Fig 3.2. It is clear that there is no mode life when $\beta = 0$. Mode life/ η becomes asymptotically increasing as $\beta \rightarrow \infty$. Again β and mode life/ η have a positive proportion when $\beta > 0$.

3.3 Point of Inflexion

The Point of Inflexion of the Generalized Exponential distribution is defined as

$$t_{GEP} = t_0 + \eta \ln \left| \frac{1}{1 - \sqrt{1 - \beta}} \right| \quad (3.3)$$

The Point of Inflexion of the Generalized Exponential distribution means a point at which the concavity changes. It is clear that there when $\beta < 0.1$ then the value becomes very high approximately 141 and when $\beta > 1$ the curve changes its position and becomes negative. So between $0.1 < \beta < 1$ is the main phase in which the curve shows its concavity changes for the Point of Inflexion of the Generalized Exponential distribution.

5. SUMMARY AND CONCLUSIONS

In this study we have seen that the Generalized Exponential distribution is the flexible distribution model that approaches to exponential distributions when its shape parameter changes. The comparative comprehensive study of the reliability modeling is predicted from hazard analysis. When $\beta = 1$, the distribution is the same as the exponential distribution for a constant hazard function so the Generalized exponential distribution is a special case of the exponential distribution and the exponential distribution can be treated as a generalization of the Generalized exponential distribution. So it concludes that the Generalized Exponential distribution is a very flexible reliability model that approaches to exponential distributions.

6. GRAPHICALLY ANALYSIS OF GENERALIZED EXPONENTIAL DISTRIBUTION

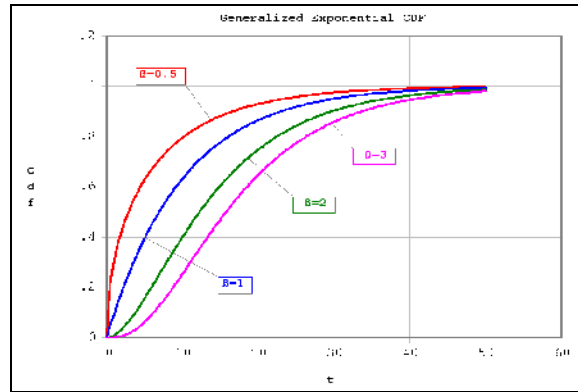


Fig. 2.2 The Generalized Exponential CDF

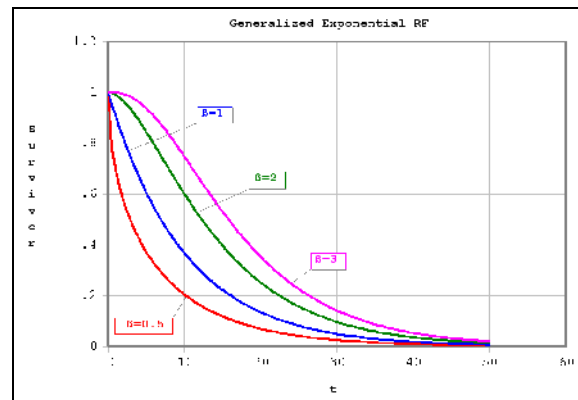


Fig. 2.3 The Generalized Exponential reliability function

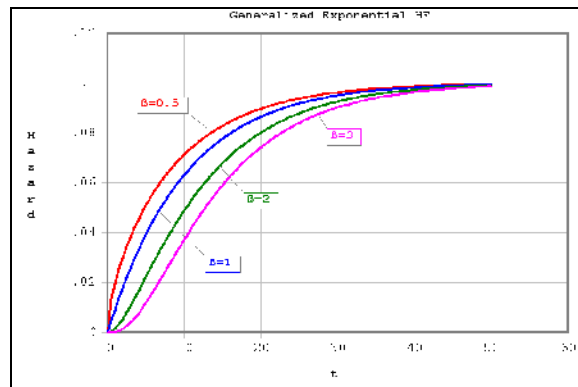


Fig. 2.4 The Generalized Exponential Distribution hazard function

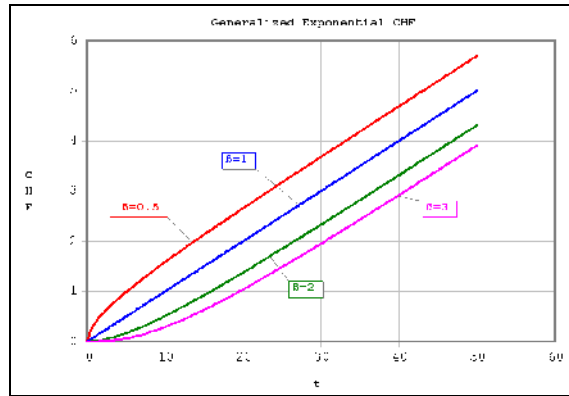


Fig. 2.5 The Generalized Exponential cumulative hazard function

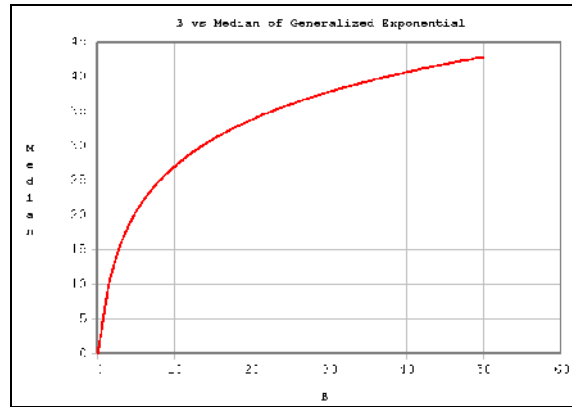


Fig. 3.1 β vs median life/ η

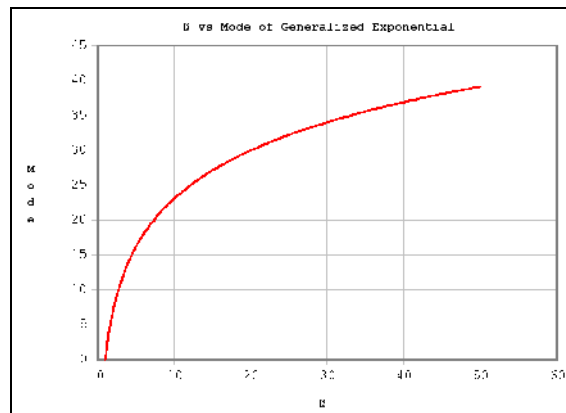


Fig. 3.2 β vs mode life/ η

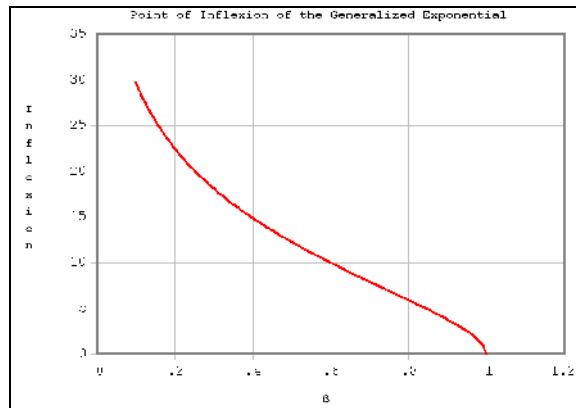


Fig. 3.3 β vs Point of Inflexion

REFERENCES

1. Debasis Kundu, Rameshwar D. Gupta and Anubhav Manglick (2005). Discriminating between the log-normal and generalized exponential distributions. *J. Statist. Plan. and Infer.* 127(1-2), 213-227.
2. Gupta, R.D. and Kundu, D. (1999). Generalized exponential distributions. *Austral. N. Z. J. Statist.* 41(2), 173-188.
3. Gupta, R.D. and Kundu, D. (2001a). Exponentiated exponential distribution: an alternative to gamma and weibull distributions. *Biometrical J.* 43(1), 117-130.
4. Gupta, R.D. and Kundu, D. (2001b). Generalized exponential distributions: different methods of estimation. *J. Statist. Comput. Simulations* 69(4), 315-338.
5. Gupta, R.D. and Kundu, D. (2003). Discrimination between Weibull and generalized exponential distributions. *Computational statistics & Data Analysis* 43, 179-196.
6. Liu, Chi-chao, (1997). *A Comparison between the Weibull and Lognormal Models used to Analyze Reliability Data*. University of Nottingham, UK.
7. M. Z. Raqab (2002). Inferences for generalized exponential distribution based on record statistics. *J. Statist. and Plann. Infer.* 104(2), 339-350.

DESIGN ARTIFACT'S, DESIGN PRINCIPLES, PROBLEMS, GOALS AND IMPORTANCE

Zeeshan Ahmed¹ Sudhir Kumar Ganti² and Hans Kyhlbäck³

¹ Vienna University of Technology, Getreidemarkt 9/307 1060,
Vienna, Austria. Email: zeeshan.ahmed@tuwien.ac.at

² Securitas Direct AB, härds väg 6B, lgh 847 21367 Malmo, Sweden.
Email: sudhir.ganti@securitas-direct.com

³ Department of interaction and system design, Blekinge Institute of
Technology, School of Engineering, Ronneby, Sweden.
Email: hky@bth.se

ABSTRACT

Designing human computer interaction interface is an important and a complex task, but it could be simplified by decomposing task into subcomponents and maintaining relationships among those subcomponents. Task decomposition is a structured approach, applicable in both Software Engineering and Human Computer Interaction (HCI) fields depending on specific processes and design artifacts. Using design artifacts applications could be made for analysis and design by making the hand draw sketches to provide high level of logical design based on user requirements, usage scenarios and essential use cases. To design hand draw sketches there are some strategies to be followed i.e., planning, sequential work flow, and levels of details. In this research paper we are presenting design artifacts, goals, principles, guidelines and currently faced problems to human computer interaction design community. Moreover in the end concluded with assessed observations in a case study

Keywords: Artifacts, Design

1. INTRODUCTION

This report focuses on the design, design Goals, some major principles, some currently faced problems and importance of the Design Artifacts. "Design" as a verb refers to the process of originating and developing a plan for a new object i.e., machine, building, product etc. As a noun, "design" is used both for the final plan or proposal i.e., a drawing, model or the produced object. The design of graphical user interface of especially big software is not only expensive and time-consuming, but it is also critical for effective system performance. Design is driven by the requirements like what artifacts is for and how is to be implemented. Design represents the artifacts as story boards, screen sketches, tasks flow diagrams and finally in executable prototypes[8]. Moreover, Design keeps the understanding of the role of the task for which the interface will be used and the work environment in which the interface will be applied. Experience various approaches to the identification of critical factors influencing interface design and development.

Artifact document is the design decision and the architecture leading to the required design. Artifact is mainly divided into two categories .i.e., requirement specification and system architecture [1]. Requirements specification is the description of functional and non functional requirements whereas system architecture includes context, archetypes, structure and design decisions. Context is the interfaces defined to the external entities, archetypes are the core abstractions on which the system is build, structure is the component that constitutes the system and finally the design decisions are the rules, constraints and transformation of the system architecture.

In this research article we first present an introduction to Human Computer Interaction (HCI), briefly describing its three main design ideologies in section II. Then we provide the information about design principles in section III, design patterns in section IV, design guild lines in section V, basic design goals in section VI, currently faced major design based problems in section VII and in the end we have presented a real time case study describing the whole software application development process emphasizing on the design of graphical user interface in section VIII.

2. HUMAN COMPUTER INTERACTION (HCI)

Human Computer Interaction (HCI) is the study of design, evaluation and implementation of interactive computing systems for human use [7]. HCI mainly consists of three ideologies .i.e., Design idea, design activity and design learning. Design Idea is the tradition of arts where as design activity is the action performed by artifact(s). Design learning is the main and important ideology comprises of three important elements i.e., iDeas notebook, the iDeas blog, and iDeas wall. [10].

A) iDeas notebook

iDeas notebook extends the traditional notebook design by merging the physical and electronic input in to sketches. The main activities of iDeas notebook are electronic file based activities which are automatically created by notebook page photographs and while retaining the physical aspects of the idea log. There are some advantages of iDeas notebook that they are rapidly capturing rich amounts of data, ready at hand and familiar interaction, permitting designers to focus on tasks rather than tools, and accompanying users in the field and wherever, whenever design happens.

B) iDeas blog

iDeas blog serves as a digital store of collected and generated information. There are two sources of inspiration for iDeas blog .i.e., traditional blog and shared electronic portfolios. Traditional blog, are primarily text based and require lots of interactions to add visual information where as shared electronic portfolios follows highly formalized way to explicitly support visual and textual information. The iDeas blog is the extension of lightweight, automatic integration and archival of iDeas notebook inputs.

C) iDeas wall

iDeas wall provides an interactive surface to present and create ideas and general purpose contents. It is a vertical display surface with direct manipulation capability which can afford collocated group interactions, including the presentation interaction style and the whiteboard interaction style of brainstorming sessions. The iDeas wall provides three methods for users to create and import content: they can sketch and write on the wall as

they would on a whiteboard; they can import content from the iDeas blog; or they can bring up an iDeas notebook page directly by using the pen as a command device. Content created on the wall is saved to the iDeas blog.

3. DESIGN PRINCIPLES

There are four main design principles [9] [11].

A) Cooperation

Cooperation plays a vital role in software project development. The important and primitive principle of design process is the cooperation between both developers and the end users. Because in the design process with respect to the participatory design point of view there exists an uncommon principle .i.e., presenting the same issues with completely different perspectives and dimensions.

B) Experimentation

Generally experimentation is performed in the middle of recently acquired possibilities and the currently existing conditions. To assure that the present conditions are in conjunction with new ideas and supported by two primitive principles .i.e., concretization and contextualization of design, Principles are in associated with the above mentioned visions performing experiments with visions and hand on experience.

C) Contextualization

Design hooks its initial point with a particular configuration in which new computer based applications put into practice. Participatory design emphasizes on situations based on the implementation of iterative designs. The design composition of use is tied up with numerous social and technical issues. Generally participatory design of the development will specifically includes different kinds of participants i.e. Users, Managers and the design developers.

D) Iteration

In design process, we should hang on to some issues which are not yet revealed, which are visioning the future product from design point of view and the construction of work from use point of view. But participatory design puts a controversial statement in accomplishing the same by making use of artifacts i.e. Prototype. Designers with cooperation will make use of the artifacts as a source for delegation of work. Participatory design also ends up with a controversial statement for trivial division of work in the process of development, which pleads overlap among the members of analysis, design and realization groups.

4. DESIGN PATTERNS

Like software engineering design patterns there are also some graphical user interface design patterns [12] .i.e., Window Per Task, Interaction Style, Explorable Interface, Conversational Text, Selection, Form, Direct Manipulation, Limited Selection Size, Ephemeral Feedback, Disabled Irrelevant Things, Supplementary Window, Step-by-Step Instructions [13].

A) Window Per Task

This design pattern specifies organization of the user interface into windows dedicated into different tasks. This organizes all the user interface components.[2]

B) Interaction Style

This pattern helps in selecting the primary way in which users interact with windows. This pattern is also identifies the interaction style for the users in the form of Selection, Direct Manipulation. [4]

C) Explorable Interface

This pattern provides the guidance on minimizing the cost of user's mistakes by providing the information about exceptions and errors. [4]

D) Conversational Text

This pattern provides information about designing a GUI to accept commands in the form of textual input. [13]

E) Selection

This pattern describes a style of user interaction where the user chooses selection from the list. [6]

F) Form

This pattern allows a user to input discrete structured data as in put into the GUI. [13]

G) Direct Manipulation

This pattern provides guidance on how to structure user interactions. [6]

H) Limited Selection Size

This pattern provides the guidance on how to structure sets of selection. [6]

I) Ephemeral Feedback

This pattern without interfering with the natural flow of applications provides feedback to users about the current status of the work. [13]

J) Disabled Irrelevant Things

This pattern provides guidance on how to hide or disable GUI elements that are not relevant to current context. [13]

K) Supplementary Windows

This pattern provides information about supplementary window. [6]

L) Step-by-Step Instructions

This pattern helps the user in performing the required task by performing certain actions in a sequence using applications. [13]

5. DESIGN GUIDELINES

A successful design interface can be implementable using the following guidelines i.e.

- Design should be presentable
- Criteria / principles should be applied
- Prepared according to the project proposal
- Specified according to the requirements
- Should be evaluated
- Assessed by mental work load
- Design mock-ups should be implemented

- A safe analysis should be performed
- Should be flexible enough to adopt rapidly prototyped changes and modifications
- Design should be iterative.
- Use case modeling¹ should be used with the identification of user interface elements

6. BASIC DESIGN GOALS

A successful design interface has three main primary design goals .i.e., high resolution, clean screen and fluid interaction.

A) High Resolution

An interactive design must display required quantitative material including images and application windows at an appropriate resolution for the user standing at the board (a resolution comparable to workstation monitors). To provide a smooth wall like environment, it needs to be flat, continuous surfaced and without physical seam interruption. In the future most probably large high resolution based flat panels will be available.

B) Clean Screen

There is a striking difference between the visual look of a paper based project and a standard GUI screen. The GUI intersperses the user's content with a profusion of visual “widgets” for control: window boundaries, title bars, scroll bars, tool bars, icon trays, view selection buttons, and many more. A whiteboard or project wall, on the other hand, provides a uniform blank surface whose content is the user's marks or posted pieces of paper. To capture the feel of a wall we want to reserve the visual space for content, with an absolute minimum of visual distraction associated with interaction mechanics. We organize our display as an arbitrary collection of opaque and translucent “sheets,” which can be created, drawn on, and moved independently. Sheets have only content on them, without visual affordances for actions.

C) Fluid Interaction

Along with the visual clutter of GUI interfaces, there are continual interruptions to the flow of activity. Dialog boxes pop up, windows and tools are selected, object handles of various kinds appear and are grabbed, and so on. To some degree this is inevitable to provide complex functionality. The traditional workstation GUI is oriented toward facilitating the speed of highly differentiated actions done by experienced users whose attention focus is entirely on the current computer activity. But users of a wall display are often engaged in simultaneous conversation with people in the room, so their focus on the board is episodic. They do not have the additional cognitive capacity to cope with complex state differences, or have a high tolerance for having their attention distracted to the interaction with the board instead of with the people.

An interactive wall interface needs to provide more functionality than a whiteboard, but this need not call for widgets, modes, dialogs, and the other apparatus of complex interaction.

¹ UML can be used for use case modeling [3]

7. DESIGN PROBLEMS

These days high quality HCI Design is difficult to implement because of many reasons [5] i.e.

- Market pressure of less time development
- Rapid functionality addition during development
- Excessive several iterations
- Competitive general purpose software
- Expensive errors
- Creativity
- Human behavior analysis

8. CASE STUDY

In this case study we try to limit the software engineering specific issues and we have concentrated on general issues of any interactive system by keeping a general reader in our mind set but some software design specific information is included as a part of our case study especially the sections followed by Class Descriptions, any non software engineer can skip that section as a part of his reading. Case study consists of a process including requirements, finalized requirements, use cases, conceptual class diagrams, class descriptions, physical sketch, identification of GUI design patterns and implemented user interface.

A) Requirements Specification

According to the user's requirements, we have to implement a chat application for two more than two user text based communication consisting of some basic but main requirements i.e.

- There should be a logging process (user login and logoff).
- Login user can
 - View already online/connected users.
 - Write messages
 - Send that messages to other users
 - Select one user individually or all the users at a time to send or broadcast the messages to all the connected users.
 - Receive and read the responses coming from the other connected users.
 - Attach or upload picture (any) of jpeg format which will be visible to all the connected users.
 - See the picture of selected user in picture window.
 - Picture window should be like optional, I.e. If user doesn't want to see or have picture window then an option is to be provided to close that window.
 - Log off when he wants
 - Quit the application.
- Application should be very simple and interactive.
- Application should be flexible enough so then in future of some changes are needed then can be performed easily without interrupting already implemented stuff.

B) Finalized Requirements

From above discussed specified requirements here are some listed finalized functional requirements for HCI Chat application .i.e.,

1. Logging
2. View already connected users
3. Write Message
4. Send message to a particular selected user as well as can broadcast the
5. Message to all connected users
6. Read the responses coming from other users
7. Upload the .jpg picture, which all the connected users can view
8. Also see the other connected user's uploaded picture
9. Can close & open the picture window

C) Use cases:

The following illustration shown in Fig 1 is the snapshot of manually designed Use Case diagram of HCI chat application. Below is the list of actions to be performed by the user.

1. Login
2. View Users
3. Write Message
4. Send Message
5. View Response
6. Upload Picture
7. View Uploaded Picture
8. Close / Open Picture Window
9. Logout

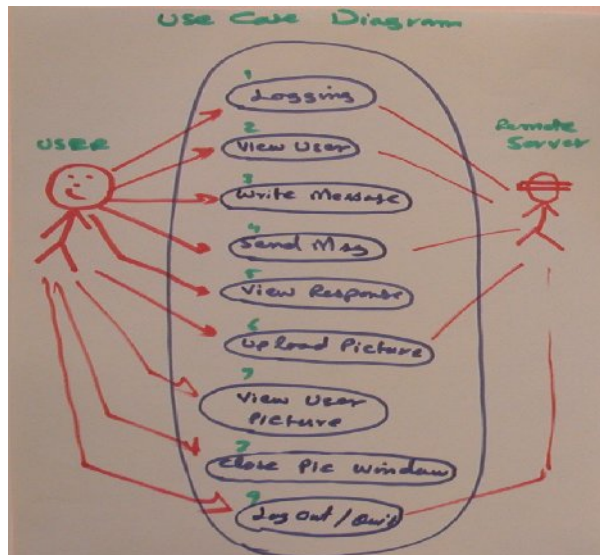


Fig 1. Manually deigned Use Case diagram of HCI Chat

D) Conceptual Diagram

The following illustration shown in Fig 2 is the snapshot of manually designed Class diagram of HCI chat application's java based classes .i.e., First, Pool, Server, Implementer, PicDialog, UploadImage, Options, AddMenuBar, PicPanel, Listner,

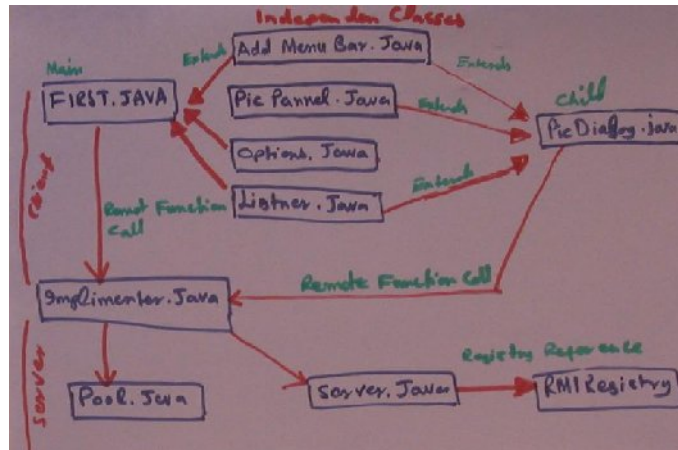


Fig 2. Manually deigned Class Diagram of HCI Chat

1. First. JAVA: This is the top level class which instantiates other class based on the user requirement. This is the class responsible for generating the parent window responsible for chatting. This class also in turn instantiates many components on the parent window and also spawn the child windows for uploading the pictures of the relevant users of both the ends.

2. Pool. JAVA: This is the remote interface which contains the declarations of the function only. This interface is the main interface which provides the information about server's functionality. All the clients are provided with the remote reference to have access to this functionality of the remote Server. In order to access these remote functions every client is provided with the "STUB" and "SKELETON".

3. Server. JAVA: This is the remote server class binding the remote object to a "Global Name" in a registry for client access, provides a copy of that registered object to all the clients. Clients can issues a remote call on a function using global name by performing a process called "LOOK UP". The default registry used with this application for binding objects is "RMI REGISTRY".

4. Implementer. JAVA: This class provides the definitions for all the functions declared in the "Pool. JAVA". This is the class which actually implements the remote interface and provides the definitions for all the functions declarations in the remote interface. The object bounded in the registry is the object this class. This object is also responsible for exporting the bounded reference. It extends the class "UNICAST REMOTE OBJECT".

5. PicDialog.JAVA: This is the window which will display the picture in child window. This window is spawn out by the main window depending upon the user's

chosen option. This is also the class which uploads the picture of every user to the server and displays the uploaded image at the connected user's panel. This will also automatically update the panel of the connected user with updated. A dedicated thread is running to monitor automatic change of the picture of the connected users.

6. UploadImage.JAVA: Sending & Receiving the images from source and destination. This is the dedicated class running at the client side called by the "Pic Dialog" class when the image of particular user is uploaded or an image of a connected user to be downloaded. In turn the dedicated thread will also continuously accessing this class for downloading the picture from the connected user at regular intervals.

7. Options. JAVA: This is an independent class which exclusively provides options to the classes that extends this class. This is designed flexible enough to extend application with new options in future.

8. AddMenuBar.JAVA: This is also an independent class which provides the feature 'Menu Bar' with specified menu items to every class that extends this class. Adding Menu bar with specific options of a particular window is very flexible simply by calling a function of this class with new Menu Items. This change will be immediately reflected on the GUI with ease.

9. PicPanel.JAVA: This is another independent class which contains panels that could display images on those panels. This class provides any number of panels by simply creating instance of this class. This independent class also provides the panels with picture uploading capability.

10. Listner.JAVA: This is the last but most important and independent class which registers the Listener for handling Action Events the application.

E) Physical Sketch & Implemented GUI

Using the design ideologies, principles, patterns and guild lines we have sketched the graphical user interface of HCI Chat using manual drawing process as shown in Fig 3.

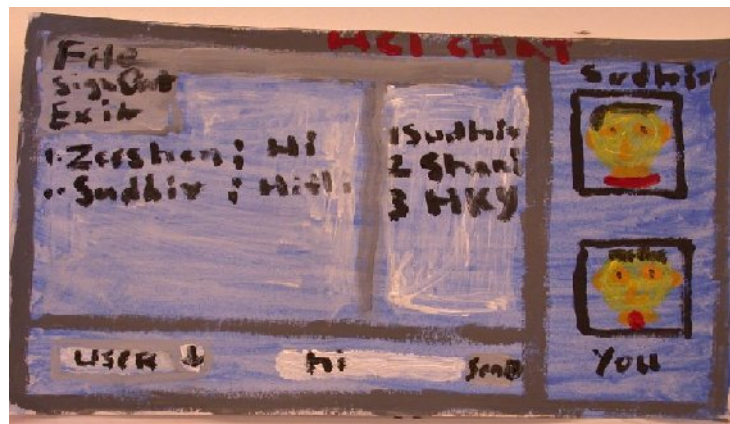


Fig 3. Manually deigned HCI Chat Sketch

Then keeping above shown in Fig. 3 manually sketched graphical user interface we designed and implemented real time software graphical user interface of HCI Chat as shown in Fig. 4.

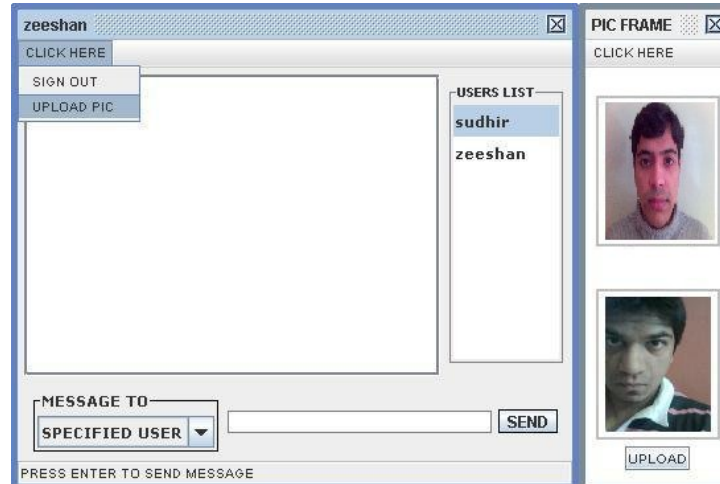


Fig 4. Implemented HCI Chat Sketch

F) Identified GUI Design Patterns in HCI Chat

These are some identified GUI Design Patterns in HCI Chat as shown in Fig .5 which are i.e.,

- 1. Window Per Task:** This pattern is identified in the above figure as a window designed for chat application. This window will also organize all the user interface components required for chatting. There are two different windows which are performing two different tasks (Chat & Picture).
- 2. Interaction Style:** This pattern is also identified in the above application as it provides the interaction style for the users in the form of Selection, Direct Manipulation.
- 3. Explorable Interface:** This pattern is identified in the above application as it provides an information message to the user before they sign out from the application. This warning is provided because that operation is an undoable operation. Sign out option which asks user, that he really wants to sign out or by mistake he did. More over application will never allow user to select the image other than .jpg and if by mistake he selects other than .jpg file it will prompt him and ask him to select valid one or he has selected the wrong one.
- 4. Selection:** This pattern is identified in the above application in the form of single selection. The “Message To” and “List of users” in the above window allows users to select an option among the list of options. Both the selections are single selections.
- 5. Direct Manipulation:** This pattern is identified in the above window as the pressing “ENTER Key” allows sending message rather than pressing the “SEND”

button on the window, and the “Arrow Keys” allows selecting the options from the “Message To” selection list apart from the mouse selection.

6. Limited Selection Size: This pattern is identified in the above window in the case of Group Messaging. To send a group Message definitely the “Message To” options list provides guidance to send group message.

7. Disabled Irrelevant Things: This pattern is identified in the above window, as the option “To all Users” from the “Message To” options list is selected then the “Users List” will be disabled. This is to ensure that the message will be sent to all the users in the list but not to a specific user.

8. Supplementary Windows: This pattern is identified in Picture Window as well as the dialog window present as the supplementary window.

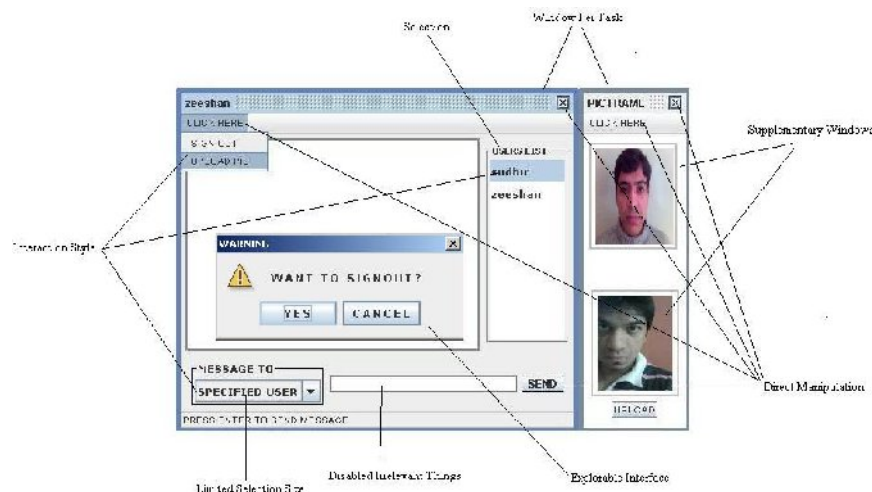


Fig 5. Design Pattern Identification in HCI Chat GUI

9. CONCLUSION

Our main intention of writing this research paper is to aware graphical user interface designers of almost all the aspects in designing interactive Systems. We have stated our research consisting on the investigation of currently faced major problem to HCI field, brief description of Human Computer Interaction ideologies, design principles, design patterns, design guild lines and basic design goals. Moreover in the end we have presented a case study describing the whole software application development process emphasizing on the design of graphical user interface.

10. REFERENCES

1. Andrew Dillon (1995). Artifacts as Theories: Convergence through User-Centered Design, *In the Proceeding of the 58th Annual ASIS Conference*, Medford NJ: ASIS, 208-210.
2. Kent Beck (2008) <http://c2.com/ppr/about/author/kent.html>

3. Chris Phillips, Elizabeth Kemp, Sai Mei Kek (2001). Extending UML Use Case Modelling to Support Graphical User Interface Design, *In 13th Australian Software Engineering Conference (ASWEC'01)*.
4. Tom Erickson (2008). The Interaction Design Patterns Page. <http://www.vision.com/~snowfall/InteractionPatterns.html>
5. George Casaday (1995). Cynthia Rainis: Models, prototypes, and evaluations for HCI design: making the structured approach practical. *In Conference on Human Factors in Computing Systems*, ACM, 397-398, New York, USA.
6. Thomas T. Hewett (1992). ACM SIGCHI curricula for human-computer interaction. *Technical Report*, 162. ISBN:0-89791-474-0, ACM New York, USA.
7. Judy Brown, Stuart Marshall (1998). Sharing Human-Computer Interaction and Software Engineering Design Artifacts. *In the Proceedings of Computer Human Interaction Conference*, ISBN: 0-8186-9206-5, SA, Australia.
8. James Hobart President (1995). Principles of Good GUI Design. Classis System Solutions. http://www.classicsys.com/css06/cfm/article_1995_10.cfm
9. Klemmer, S.R. and Lee, B (2005). Notebooks that Share and Walls that Remember: Electronic Capture of Design Education Artifacts. *In Conference Supplement to UIST*, ACM Symposium on User Interface Software and Technology. October 23-26, 2005, Seattle, WA.
10. Sidney L. Smith and Jane N. Mosier (1986). Guidelines for designing user interface software. ESD-TR-86-278, The MITRE Corporation Bedford, Massachusetts USA.
11. Niels Olof Bouvin (2008). Human Computer Interaction. www.daimi.au.dk
12. Jenifer Tidwell (2008). Common Ground: A Pattern Language for Human-Computer Interface Design. http://www.mit.edu/~jtidwell/common_ground_onefile.html
13. Mark Grand (2008). Preview of Patterns in Java Volume 2. http://www.mindspring.com/~mgrand/pattern_synopses2.htm

**A CHAIN RATIO TYPE ESTIMATOR USING
 TWO AUXILIARY ATTRIBUTES**

Inam-ul-Haq

National College of Business Administration & Economics, Lahore, Pakistan
 Email: inam-ul-haq786@hotmail.com

ABSTRACT

In this paper we have suggested a new estimators and improved version of Naik and Gupta (1996) estimator, using two auxiliary attributes. Empirical study has also been conducted to compare various cases considered in this paper.

KEY WORDS

Full, partial, no information, Auxiliary attribute; Efficiency, Point bi-serial correlation coefficient.

1. INTRODUCTION

Auxiliary information may increase the precision of estimator when estimand is correlated with auxiliary variables. In general these auxiliary variables are quantitative, but Naik and Gupta (1996) introduced a qualitative auxiliary information in ratio, product and regression estimators. In this paper, we have developed a chain ratio estimator for full, partial and no information. For this consider a simple random sample of size n drawn without replacement from a population of size N . Let $(y_i, \tau_{i1}, \tau_{i2})$ is point showing i th observation on main variable y_i and j th auxiliary attribute τ_j ($j=1, 2$). The complete dichotomy is recorded with respect to attributes τ_j , say $\tau_{ij} = 1$ if i th unit of population

possesses j th attribute τ_j , and 0 otherwise. Let $A_j = \sum_{i=1}^N \tau_{ij}$, $a_j = \sum_{i=1}^n \tau_{ij}$ denote total number of units possessing attribute τ_j in population and sample respectively. Let $P_j = \frac{A_j}{N}$

and $p_j = \frac{a_j}{n}$ denote proportion of units possessing attributes τ_j in population and sample respectively. $\bar{e}_y = \bar{y} - \bar{Y}$, $\bar{e}_{\tau_j} = p_j - P_j$, $E(\bar{e}_y^2) = \theta \bar{Y}^2 C_y^2$ where $\theta = \frac{1}{n} - \frac{1}{N}$,

$$E(\bar{e}_y) = 0 = E(\bar{e}_{\tau_j}), j = 1, 2, E(\bar{e}_{\tau_j}^2) = \theta P_j^2 C_{\tau_j}^2, E(\bar{e}_y \bar{e}_{\tau_j}) = \theta \rho_{pbj} \bar{Y} C_y P_j C_{\tau_j},$$

$$E(\bar{e}_{\tau_1} \bar{e}_{\tau_2}) = \theta P_1 C_{\tau_1} P_2 C_{\tau_2} Q_{12}, \text{ and } S_{\tau_j}^2 = \frac{1}{N-1} \sum_{i=1}^N (\tau_{ij} - P_j)^2,$$

$S_{y\tau_j} = \frac{1}{N-1} \sum_{i=1}^N (y_i - \bar{Y})(\tau_{ij} - P_j)$, where $\rho_{pbj} = \frac{S_{y\tau_j}}{S_y S_{\tau_j}}$, is a point bi-serial correlation coefficient and Q_{12} ($-1 \leq Q_{12} \leq +1$) is coefficient of association. Let n_1 and n_2 be size of first-phase sample and second-phase sample respectively ($n_2 < n_1$), $p_{j(1)}$, $p_{j(2)}$ are

proportion of units possessing attribute τ_j in first-phase and second-phase sample respectively. \bar{y}_2 is mean of main variable in second-phase sample.

Also

$$\begin{aligned}\bar{e}_{y_2} &= \bar{y}_2 - \bar{Y}, \bar{e}_{\tau_{j(1)}} = p_{j(1)} - P_j, j=1,2, \bar{e}_{\tau_{j(2)}} = p_{j(2)} - P_j, \theta_3 = \theta_2 - \theta_1 \\ E(\bar{e}_{y_2}) &= E(\bar{e}_{\tau_{j(1)}}) = E(\bar{e}_{\tau_{j(2)}}) = 0, E(\bar{e}_{y_2}^2) = \theta_2 \bar{Y}^2 C_y^2, E(\bar{e}_{\tau_{j(1)}} - \bar{e}_{\tau_{j(2)}})^2 = \theta_3 P_j^2 C_{\tau_j}^2 \\ E(\bar{e}_{y_2} (\bar{e}_{\tau_{j(2)}} - \bar{e}_{\tau_{j(1)}})) &= \theta_3 \bar{Y} C_y P_j C_{\tau_j} \rho_{Pb_j}, \text{ for } j=1, 2.\end{aligned}$$

Naik and Gupta developed ratio estimator only for full information i.e.

$$t_{1(1)} = \bar{y} \frac{P_1}{p_1}, \quad (1.1)$$

The mean square error of $t_{1(1)}$ is

$$MSE(t_{1(1)}) = \theta \bar{Y}^2 \left[C_y^2 + C_{\tau_1}^2 - 2\rho_{Pb_1} C_y C_{\tau_1} \right] \quad (1.2)$$

2. PROPOSED CHAIN RATIO ESTIMATOR

2.1 Single-Phase Sampling (Full Information case).

Some improvements on Naik and Gupta (1996) estimators have been suggested for single and two-phase sampling using two auxiliary attributes. For this let the population proportions P_1 and P_2 are known, say we have full information about both auxiliary attributes.

We propose a chain estimator on the line of Naik and Gupta (1996) by using two auxiliary attributes. i.e.

$$t_{2(1)} = \bar{y} \left(\frac{P_1}{p_1} \right) \left(\frac{P_2}{p_2} \right) \quad (2.1)$$

The mean square error of $t_{2(1)}$ is

$$\begin{aligned}MSE(t_{2(1)}) &\approx E(t_{2(1)} - \bar{Y})^2 \approx E\left(\bar{e}_y - \frac{\bar{Y}}{P_1} \bar{e}_{\tau_1} - \frac{\bar{Y}}{P_2} \bar{e}_{\tau_2}\right)^2 \\ MSE(t_{2(1)}) &\approx \theta \bar{Y}^2 \left[C_y^2 + C_{\tau_1}^2 + C_{\tau_2}^2 - 2C_y C_{\tau_1} \rho_{Pb_1} - 2C_y C_{\tau_2} \rho_{Pb_2} + 2C_{\tau_1} C_{\tau_2} \rho_{12} \right] \quad (2.2)\end{aligned}$$

2.2 Two-Phase Sampling (Partial Information case).

Let the population proportions P_1 is known and P_2 is not known, say we have partial information about auxiliary attributes. We propose a chain estimator on the line of Naik and Gupta (1996) by using two auxiliary attributes. i.e.

$$t_{3(2)} = \bar{y}_2 \left(\frac{P_1}{P_{1(2)}} \right) \left(\frac{P_{2(1)}}{P_{2(2)}} \right) \quad (2.3)$$

The mean square error of $t_{3(2)}$ is

$$\begin{aligned} MSE(t_{3(2)}) &\approx E(t_{3(2)} - \bar{Y})^2 \approx E\left(\bar{e}_{y_2} - \frac{\bar{Y}}{P_1} \bar{e}_{\tau_{1(2)}} - \frac{\bar{Y}}{P_2} (\bar{e}_{\tau_{2(2)}} - \bar{e}_{\tau_{2(1)}})\right)^2 \\ MSE(t_{3(2)}) &\approx \bar{Y}^2 \left[\theta_2 C_y^2 + \theta_2 C_{\tau_1}^2 + \theta_3 C_{\tau_2}^2 - 2\theta_2 C_y C_{\tau_1} \rho_{Pb_1} - 2\theta_3 C_y C_{\tau_2} \rho_{Pb_2} + 2\theta_3 C_{\tau_1} C_{\tau_2} \rho_{12} \right] \end{aligned} \quad (2.4)$$

If P_2 were also known then $\theta_2 = \theta_3 = \theta$ for this we have,

$$MSE(t_{3(2)}) \approx \theta \bar{Y}^2 \left[C_y^2 + C_{\tau_1}^2 + C_{\tau_2}^2 - 2C_y C_{\tau_1} \rho_{Pb_1} - 2C_y C_{\tau_2} \rho_{Pb_2} + 2C_{\tau_1} C_{\tau_2} \rho_{12} \right].$$

This is mean square error of full information case.

2.3 Two-Phase Sampling (No Information case).

Let the population proportions P_1 and P_2 both are not known, say we have no information about both auxiliary attributes. We propose a chain estimator on the line of Naik and Gupta (1996) by using two auxiliary attributes. i.e.

$$t_{4(2)} = \bar{y}_2 \left(\frac{P_{1(1)}}{P_{1(2)}} \right) \left(\frac{P_{2(1)}}{P_{2(2)}} \right) \quad (2.5)$$

The mean square error of $t_{4(2)}$ is

$$\begin{aligned} MSE(t_{4(2)}) &\approx E(t_{4(2)} - \bar{Y})^2 \approx E\left(\bar{e}_{y_2} - \frac{\bar{Y}}{P_1} (\bar{e}_{\tau_{1(2)}} - \bar{e}_{\tau_{1(1)}}) - \frac{\bar{Y}}{P_2} (\bar{e}_{\tau_{2(2)}} - \bar{e}_{\tau_{2(1)}})\right)^2 \\ MSE(t_{4(2)}) &\approx \bar{Y}^2 \left[\theta_2 C_y^2 + \theta_3 (C_{\tau_1}^2 + C_{\tau_2}^2 - 2C_y C_{\tau_1} \rho_{Pb_1} - 2C_y C_{\tau_2} \rho_{Pb_2} + 2C_{\tau_1} C_{\tau_2} \rho_{12}) \right] \end{aligned} \quad (2.6)$$

3. EMPIRICAL STUDIES

For the purpose of comparison real populations were obtained Govt. of Pakistan (1988) Food and Livestock Wing.

REFERENCES

1. Government of Pakistan (1998). *Crop Area Production by Districts (1995-96 to 1997-98)*. Ministry of Food, Agriculture and Livestock. Food, Agriculture and Livestock Division, Economic Wing, Islamabad.
2. Naik, V.D. and Gupta, P.C. (1996). A note on estimation of mean with known population of an auxiliary character. *Jour. Ind. Soc. Agr. Statist.* 48(2), 151-158.

APPENDIX

Table-1:
Description of Populations and Variables.

Pop #	Description	Main Variable	Attribute-I (τ_1) is present if	Attribute-II(τ_2) is present if
1	District-wise area and production of all Fruits for year 1995-96	Production of all Fruits (In tones)	Area of Districts greater than 1000 hectares	Districts of Punjab
2	District-wise area and production of Wheat for year 1997-98	Production of Wheat (In tones)	Districts of NWFP (including Fata Areas)	Area of Districts greater than 25 hectors.
3	District-wise area and production of Onion for year 1996-97	Production of Onions (In tones)	Area of Districts greater than 50 hectors	Districts of NWFP (including Fata Areas)
4	District-wise area and production of Onion for year 1997-98	Production of Onions (In tones)	Districts of Punjab	Area of Districts greater than 60 hectors.

Table-2
Relative Efficiency and Ranking of Various Estimators

Relative Efficiency of Various Estimators					Ranking of Various Estimators			
Pop #	$t_{(1)}$	$t_{2(1)}$	$t_{3(2)}$	$t_{4(2)}$	$t_{(1)}$	$t_{2(1)}$	$t_{3(2)}$	$t_{4(2)}$
1	100	41.90	55.05	54.20	1	4	2	3
2	100	100.70	100.41	121.96	4	2	3	1
3	100	137.61	118.96	188.80	4	2	3	1
4	100	119.9272	110.2074	110.231	4	1	3	2
Average Ranks					3.25	2.25	2.75	1.75
Rank of Average Ranks					4	2	3	1

$$REF = \left[\frac{MSE(t_{(1)})}{MSE(*)} \right] \times 100$$

From Table 2, one can observe that proposed estimator $t_{4(2)}$ is the most efficient estimators among four competing estimators, other two estimators ($t_{2(1)}$ and $t_{3(2)}$) are also more efficient than Naik and Gupta (1996) Estimator $t_{(1)}$.

DISSIMILARITY BASED MINING FOR FINDING FREQUENT ITEMSETS

Abdus Salam¹, Saif-ur-Rehman² and Irshadullah¹

¹City University of Science & Information Technology, Peshawar

²Sarhad University of Science & Information Technology, Peshawar

Email: hodcs@cityuniversity.edu.pk

saifeyabbas@yahoo.com

irshadullah79@gmail.com

ABSTRACT

The task of association rule mining is to find correlation among a set of items in a database. This is a two step process. First step involves finding the frequent itemsets. This step has shown to be NP-Complete. The second step derives inferences from these itemsets. Most of the popular algorithms require setting up of different kinds of heuristic thresholds. These user provided thresholds are generally inadequate because i) the user may be naïve and may not set effective thresholds and ii) the thresholds may not be optimally efficient. This may cause an algorithm to fail in finding the true patterns and may report spurious patterns that do not really exist.

We present a novel algorithm for finding frequent itemsets without user provided thresholds which is fundamentally different from the known algorithms. This method is based on measuring dissimilarity using Jaccard's dissimilarity coefficient and demonstrates that to find frequent itemsets it is not necessary to generate all candidate itemsets and also without setting support threshold. We have demonstrated that the distance based data mining technique can successfully be applied to Boolean Databases to extract frequent itemsets. This framework is a practical solution of such problems, and has shown encouraging results to generate frequent itemsets from Boolean databases.

KEYWORDS

Association rule, Frequent itemsets, Jacard's dissimilarity measure, Boolean database.

1. INTRODUCTION

Data Mining is the discovery of hidden information found in databases [6][7]. Data mining functions include clustering, classification, prediction, and associations. One of the most important data mining applications is that of mining association rules. Association rules, first introduced in 1993 [1], are used to identify relationships among a set of items in a database. These relationships are not based on inherent properties of the data themselves, but rather based on co-occurrence of the data items. Our emphasis in this paper is on the basket market analysis data. Various algorithms have been proposed to discover frequent itemsets in transaction databases.

The AIS algorithm is the first published algorithm developed to generate all large itemsets in a transaction database [1]. This algorithm has targeted to discover qualitative

rules. This technique is limited to only one item in the consequent. This algorithm makes multiple passes over the entire database.

The SETM algorithm is proposed in [2] and motivated by the desire to use SQL to calculate large itemsets [3]. In this algorithm each member of the set large itemsets, L_k , is in the form $\langle \text{TID}, \text{itemset} \rangle$ where TID is the unique identifier of a transaction. Similarly, each member of the set of candidate itemsets, C_k , is in the form $\langle \text{TID}, \text{itemset} \rangle$. Similar to [1], the SETM algorithm makes multiple passes over the database.

The Apriori algorithm [4] is a great achievement in the history of mining association rules. It is by far the most well-known association rule algorithm. This technique uses the property that any subset of a large itemset must be a large itemset.

The Off-line Candidate Determination (OCD) technique is proposed in [5], and is based on the idea that small samples are usually quite good for finding large itemsets. The OCD technique uses the results of the combinatorial analysis of the information obtained from previous passes to eliminate unnecessary candidate sets.

Sampling [8] reduces the number of database scans to one in the best case and two in the worst. A sample which can fit in the main memory is first drawn from the database. The set of large itemsets in the sample is then found from this sample by using a level-wise algorithm such as Apriori.

Each association rule mining algorithm assumes that the transactions are stored in some basic structure, usually a flat file or a TID list, whereas actual data stored in transaction databases is not in this form. All approaches are based on first finding the large itemsets. The Apriori algorithm appears to be the nucleus of all the association rule mining algorithms.

This paper proposes a novel technique which don't require that large itemsets first be found rather it is based on calculating the similarity distance among the items. The intuition behind this technique is that similar items are in close proximity to each other and dissimilar items are far a part. The distance between items approaching zero are similar and the distance between items approaching one are dissimilar.

This paper is divided into 7 sections. Section 2 formerly describes the problem of association rule mining. Section 3 discusses the logical data analysis methods. presents the proposed technique. The algorithm and conclusion are shown in section 4 and 5, respectively.

2. ASSOCIATION RULE PROBLEM

A formal statement of the association rule problem is as follows:

Definition 1: [1][9] Let $I = \{ i_1, i_2, \dots, i_m \}$ be a set of m distinct attributes. Let D be a database, where each record (tuple) T has a unique identifier, and contains a set of items such that $T \subseteq I$. An *association rule* is an implication of the form of $X \Rightarrow Y$, where $X, Y \subseteq I$ are sets of items called itemsets, and $X \cap Y = \emptyset$. Here, X is called antecedent while Y is called consequent; the rule means $X \Rightarrow Y$.

Two important measures for association rules, support (s) and confidence (α), can be defined as follows.

Definition 2: [1][9] The *support* (s) of an association rule is the ratio (in percent) of the records that contain $X \cup Y$ to the total number of records in the database.

Definition 3: [1][9] For a given number of records, *confidence* (α) is the ratio (in percent) of the number of records that contain $X \cup Y$ to the number of records that contain X .

Association rules can be classified based on the *type of vales, dimensions of data*, and *levels of abstractions* involved in the rule. If a rule concerns associations between the presence or absence of items, it is called **Boolean association rule**. And the dataset consisting of attributes which can assume only binary (0-absent, 1-present) values is called **Boolean database**.

3. LOGICAL DATA ANALYSIS

The logical analysis of data was originally developed for the analysis of datasets whose attributes take only binary (0-1) values [10, 11, 12]. Since it turned out later that most of the real-life applications include attributes taking real values, a “binarization” method was proposed in [13]. The purpose of binarization is the transformation of a database of any type into a “Boolean database”.

Table-1:
Original database

ID	Age: 20-29	Age: 30-39	m-status: single	m-status: married	...
1	1	0	1	0	...
2	0	1	0	1	...

LAD is a methodology developed since the late eighties, aimed at discovering hidden structural information in Boolean databases. LAD was originally developed for analyzing binary data by using the theory of partially defined Boolean functions. An extension of LAD for the analysis of numerical data sets is achieved through the process of “binarization” consisting in the replacement of each numerical variable by binary “indicator” variables, each showing whether the value of the original variable is present or absent, or is above or below a certain level. LAD has been applied to numerous disciplines, e.g. economics and business, seismology, oil exploration, medicine etc. [14].

Logical Analysis of Data (LAD) is one of the techniques used in data analysis. Unlike other techniques, which involve probabilistic and geometric analysis, LAD uses logical rules to analyze observations. Its main purpose is to detect hidden patterns in the data set that distinguish observations of one class from the rest of the observations.

3.1 Binarization

The methodology of LAD is extended to the case of numerical data by a process called *binarization*, consisting in the transformation of numerical (real valued) data to

binary (0, 1) ones. In this [15] transformation we map each observation $u = (u_A, u_B, \dots)$ of the given numerical data set to a binary vector $x(u) = (x_1, x_2, \dots) \in \{0, 1\}^n$ by defining e.g. $x_1 = 1$ iff $u_A \geq \alpha_1$, $x_2 = 1$ iff $u_B \geq \alpha_2$, etc, and in such a way that if u and v represent, respectively, a positive and negative observation point, then $x(u) \neq x(v)$. The binary variables x_i , $i = 1, 2, \dots, n$ associated to the real attributes are called *indicator variables*, and the real parameters α_i , $i = 1, 2, \dots, n$ used in the above process are called cut points.

The basic idea of binarization is very simple. It consists in the introduction of several binary attributes associated to each of the numerical attributes; each of these binary attributes is supposed to take the value 1 (respectively, 0) if the numerical attribute to which it is associated takes values above (respectively, below) a certain threshold. Obviously the computational problem associated to binarization is to find a minimum number of such threshold values (cutpoints) which preserve the essential information contained in the dataset, i.e. the disjointness of the sets of (binarized) positive and negative observations.

In order to illustrate the binarization of business datasets, let us consider the examples presented in Table-1. A very simple binarization procedure is used for each variable “age” and “marital status”. Quantitative attributes such as “age” is divided into different ranges like age: 20..29, 30..39, etc. The “marital status” variable is divided into binary values by converting its domain values into attributes.

Table-2:
Boolean Database

ID	Age	marital status	# cars
1	23	single	0
2	38	married	2

3.2 Binary Variables

A *binary variable* has only two states: 0 or 1, where 0 means that the variable is absent, and 1 means that it is present. If all binary variables are thought of as having the same weight, we have the 2-by-2 contingency table of Table-3, where q is the number of variables that equal 1 for both items i and j , r is the number of variables that equal 1 for item i but that are 0 for item j , s is the number of variables that equal 0 for item i but equal 1 for item j , and t is the number of variables that equal 0 for both item i and j . The total number of variables is p , where $p = q + r + s + t$.

Table-3:
A contingency table for binary variables.

		<i>Item j</i>		
		1	0	Sum
<i>Item i</i>	1	q	r	q + r
	0	s	t	s + t
Sum		q + s	r + t	P

For noninvariant similarities, the most well-known coefficient is the Jaccard dissimilarity coefficient, where the number of negative matches t is considered unimportant and thus is ignored in the computation:

$$d(i, j) = \frac{r + s}{q + r + s}$$

The measurement value 1 suggests that the objects i and j are dissimilar and the measurement value 0 suggests that the objects are similar.

4. THE ALGORITHM

This algorithm is designed to work on Boolean databases. Binarization technique must first be applied to convert transactional data into Boolean database. The algorithm can best be explained using an example. Consider the following market basket data which has been transformed into Boolean format.

Table-4:
Market basket data in Boolean format

	I₁	I₂	I₃	I₄	I₅
T₁	1	1	0	0	1
T₂	0	1	0	1	0
T₃	0	1	1	0	0
T₄	1	1	0	1	0
T₅	1	0	1	0	0
T₆	0	1	1	0	0
T₇	1	0	1	0	0
T₈	1	1	1	0	1
T₉	1	1	1	0	0

First column of the Table-4 indicates the transactions from 1 to 9 and subsequent five columns indicate the items purchased. Zero (0) means absence of the item and one (1) means it is present.

In order to use Jaccard's coefficient to find frequent itemsets we use K maps to arrange q , r and s . To find whether I_1, I_2 are frequent items we arrange K-Map for q , r and s as shown in the Table-5 below.

Table-5:
K-Map for two items

	I_1'	I_1
I_2'	0	2
I_2	3	4

Where $d(I_1, I_2) = (2+3)/(2+3+4) = 0.55$. If $d < \phi$ then I_1, I_2 are declared frequent itemsets. Similarly for other itemsets of size greater than 2, K-Maps of different sizes are constructed and their distances are computed respectively according to the technique presented in algorithm given in Figure 1.

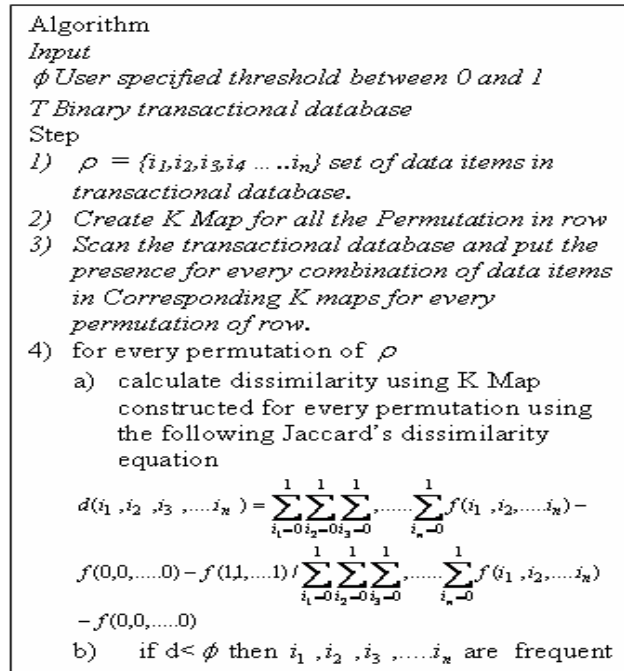


Fig. 1: Distance-based association rule mining algorithm

5. EXPERIMENTAL RESULTS

To experiment with the above algorithm we needed data sets. ARtool is an application for mining association rules in binary databases [16]. We have generated synthetic binary databases using ARtool. The generated databases are in a specific format to be used only with this tool. But we needed to have synthetic database in a different format required to be used with our algorithm. Therefore, the binary database is first converted into ASCII format by the utility available in ARtool i.e. db2asc and then this ASCII format is converted into binary database format used in our algorithm. By using the above technique we have generated databases described in the Table-6.

Table-6.
Synthetic binary databases

Database	T	AT	I	P	AP
T200AT6I10P5AP4.db	200	6	10	5	4
T500AT5I10P5AP3.db	500	5	10	5	3
T400AT6I10P5AP4.db	400	6	10	5	4

Where T is the number of transactions, AT is average size of transactions, I is the number of items, P is number of patterns and AP is average size of patterns. We have coded the algorithm in C++ language and experimented with the above data sets on 850MHZ machine with 512 MB of RAM and windows XP operating system with user supplied

dissimilarity threshold value of 0.5 to generate frequent itemsets (FIS) as shown in the Figure 2. It has been observed that lesser number of FIS are generated as the size of FIS is increased and vice versa.

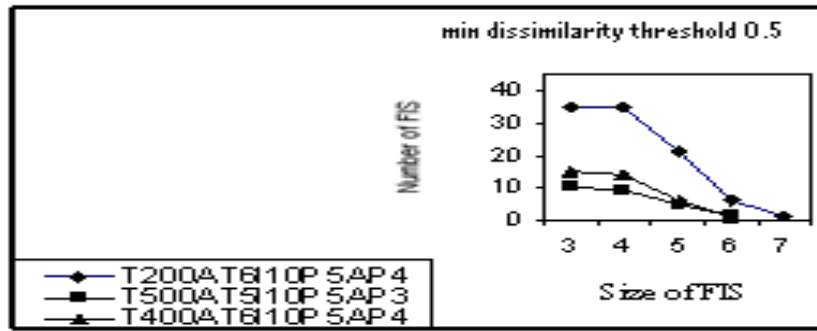


Fig. 2. FIS generation result

In order to verify the correctness of our technique we have applied apriori [4] and FPgrowth [17] on the data sets given in the Table-6 and this established that same FIS are generated with both algorithms as DB-Miner has generated are shown in the Table-7.

Table-7:
Max number of FIS (0.5 dissimilarity threshold)

Database	Algorithm	TOTAL FIS
T200AT6I10P5AP4	Apriori	98
	FP-growth	
	DB-Miner	
T500AT5I10P5AP3	Apriori	25
	FP-growth	
	DB-Miner	
T400AT6I10P5AP4	Apriori	36
	FP-growth	
	DB-Miner	

6. CONCLUSION

The objective of this research is to study distance based dissimilarity measures for ARM. [18] Discusses 21 different distance based measures. Among those distance based measures, in this paper we have studied the application and implementation of Jacquard’s dissimilarity measure for generating frequent item sets.

This also establishes that the clustering measures can also be used for association rule mining. The experiments showed the effectiveness of the technique. In future we intend to compare this algorithm with the established algorithms of association rule mining for efficiency purpose.

7. REFERENCES

1. R. Agrawal, T. Imielinski, A. Swami (1993). Mining Associations between Sets of Items in Massive Databases. *Proc. of the ACM-SIGMOD 1993 Int'l Conference on Management of Data*, Washington D.C.
2. M. Houtsmal and A. Swami (1995). Set-Oriented Mining for Association Rules in Relational Databases. *Proceedings of the 11th IEEE International Conference on Data Engineering*, 25-34, Taipei, Taiwan.
3. Ramakrishnan Srikant (1996). *Fast Algorithms for Mining Association Rules and Sequential Patterns*. Ph.D. Dissertation 1996, University of Wisconsin, Madison.
4. Rakesh Agrawal and Ramakrishnan Srikant (1994). Fast Algorithms for Mining Association Rules in Large Databases. *Proceedings of the Twentieth International Conference on Very Large Databases*, 487-499, Santiago, Chile.
5. Heikki Mannila, Hannu Toivonen, and A. Inkeri Verkamo (1994). Efficient Algorithms for Discovering Association Rules. *Proceedings of the AAAI Workshop on Knowledge Discovery in Databases (KDD-94)*, 181-192.
6. Ming-Syan Chen, Jiawei Han and Philip S. Yu (1996). Data Mining: An Overview from a Database Perspective. *IEEE Transactions on Knowledge and Data Engineering*, 8(6), 866-883.
7. Usama M. Fayyad, Gregory Piatetsky-Shapiro, and Padhraic Smyth (1996). From Data Mining to knowledge Discovery: An Overview, *Advances in Knowledge Discovery and Data Mining*, AAAI Press, 1-34.
8. Hannu Toivonen, Sampling Large Databases for Association Rules. *Proceedings of the 22nd International Conference on Very Large Databases*, 134-145, Mumbai, India.
9. David Wai-Lok Cheung, Vincent T. Ng, Ada Wai-Chee Fu, and Yongjian Fu, (1996). Efficient Mining of Association Rules in Distributed Databases, *IEEE Transactions on Knowledge and Data Engineering*, 8(6), 911-922.
10. Boros E., P.L. Hammer, T. Ibaraki, A. Kogan, E. Mayoraz, I. Muchnik. (2000). An Implementation of Logical Analysis of Data. *IEEE Transactions on knowledge and Data Engineering*, 12(2), 292-306.
11. Crama Y., P.L. Hammer, T. Ibaraki (1988). Cause-effect Relationships and Partially Defined Boolean Functions. *Annals of Operations Research*, 16, 299-325.
12. Hammer P.L. (1986). The Logic of Cause-effect Relationships. *Lecture at the International Conference on Multi-Attribute Decision Making via Operations Research-based Expert Systems*, Passau, Germany.
13. Boros E., P.L. Hammer, T. Ibaraki, and A. Kogan. (1997). Logical Analysis of Numerical Data. *Mathematical Programming*, 79, 163-190.
14. Peter L. Hammer Tiberius Bonates (2005). Logical Analysis of Data: From Combinatorial Optimization to Medical Applications, *RUTCOR Research Report RRR 10*.
15. E. Boros, P. L. Hammer, T. Ibaraki, A. Kogan, E. Mayoraz and I. Muchnik (1996). An implementation of logical analysis of data, *RUTCOR Research Report RRR 22-96*, Rutgers University.
16. <http://www.cs.umb.edu/~laur/ARtool/>
17. Han, J., J. Pei, and Y. Yin (2004). Mining frequent patterns without candidate generation: A frequent pattern tree approach. *Data mining and knowledge discovery*, 8(1), 53-87.
18. P-N. Tan, V. Kumar, J. Srivastava (2002). Selecting the right interestingness measure for association patterns. *Proc. KDD-2002*.

OPEN ARCHITECTURE ROBOTIC MANIPULATOR DESIGN PHILOSOPHY

Syed Wahab-ul-Hassan

CS&IT Department, University of Gujrat, Gujrat.

Email: wahab@uog.edu.pk

ABSTRACT

This paper presents a generic and universal architecture design for robotic manipulators. A flexible approach is taken to develop the design philosophy throughout, resulting in a hardware architecture that is portable, can be integrated and enables the implementation of advanced control methods. The application of many such controls has, traditionally, often been severely restricted in partial commercial robotic systems because of limitations associated with their controllers; rather than the arms themselves.

Beginning with an in-depth and independent study of robot controller technology and architecture, made in the context of the recent advances in the computer technology and intelligent methods in control, the concept of an open architecture controller and the various attempts to implement it both commercially and experimentally are examined. The architectural presented has three layers, each of which can be decomposed into further functional sub-modules. The high level reference model for controlling intelligent sensor based manipulators.

INTRODUCTION

Industrial robots are currently employed in a large number of applications, and are available with a wide range of configurations, drive systems, physical sizes and payloads. However, despite the perceived wide spread deployment of robots, recent surveys indicate that the number in service throughout the world are much less than predicted twenty, or even then, years ago.

In contrast, much academic research has been undertaken in recent years aimed at improving the performance of robots using a number of advanced techniques. They have included model based techniques for predictive and adaptive control, force and hybrid force position control schemes, and attempts to introduce intelligent control methods, especially using ANNs and fuzzy-logic based control Linkens & Nyongesa (1996); Renzik (1997). Whilst varying degrees of success have been demonstrated, the application of many advanced methods has often been severely restricted in practical commercial robotic systems because of limitations associated with their controllers, rather than the arms themselves Kozłowski (1997).

OPEN ARCHITECTURE

The computer workstation community first coined the phrase "open architecture" in the early 1980's Green field et al. (1989); In particular, Sun Microsystems Inc. emphasized that the 'openness' of their computers provided complete specifications to their customers and third party vendors, and openly encouraged users to understand

modify and add to the internal specification of the computer. Essentially all hardware and software was open to changes and new hardware products could be integrated and modified at will. The reason Sun promoted this idea was that system was open; research engineers and third-party companies could develop and supply hardware and software, increasing the capabilities of the product. This increased the customer's base, and both the original computer supplier & third party supplier realized greater profit, which in turn meant more work on R&D, which meant more versatile low cost devices becoming available, and so on.

The impact that 'open' system has had on the computer science culture has been remarkable. From a general computing point of view, the term 'open architecture' has been attributed the following definition:

"An architecture whose specifications are public; this includes officially approved standards as well as privately designed architectures whose specifications are made public by the designers. The opposite of open is closed or proprietary"

This definition is applicable to the general computer science community as a whole, but the phrase 'open architecture controller', which has been partly plagiarized from this definition since the late 1980s Green field et al. (1989), requires a slightly different definition.

OPEN ARCHITECTURE CONTROLLER

In general, Robot controllers can be broadly classified into three different types Ford (1994), Proctor & Albus (1997):

1. **Proprietary:** The controller structure is effectively closed. Integration of external or new hardware (including sensors) is either very difficult or impossible.
2. **Hybrid:** The majority of the system is closed (control laws etc etc.) but some aspects of the system remain open. It is possible to add new devices such as sensors.
3. **Open:** The controller design is completely available to be changed or modified by a user. The hardware and software structure can be changed such that all elements (servo laws, sensors, GUIs) can be modified without difficulty.

ENABLING TECHNOLOGIES

When considering the implementation of an open architecture controller based on the architectural specifications and models discussed In section 3.1, a particular hardware Architectural must be committed to. The high level, somewhat abstract architectural specification documents have lead developers of prototype systems to choose the following enabling technologies Ford 1994; Pfeffer & Tran (1997); Anderson et al.(1997); Schofield & Wright (1998):

1. Standard operating system (OS) like DOS or Windows.
2. Non –proprietary hardware such as PC's or SUN workstations.
3. Standard bus systems such as PCI or VME.
4. Use of standard control languages such as C or C++ or Java(3.85 mm) medium and positioned as a superscript character.

OPERATING SYSTEMS FOR OPEN ARCHITECTURE CONTROLLERS

The operating system provides a software interface to enable the user to run application program and performs tasks such as port I/O, updating the screen display and communicating with peripheral device. In general, the tasks that an open architecture controller has to manage can be split into two different categories.

1. **Direct machine control.** This encompasses drive interfacing, signal conditioning, trajectory generation, servo - control (or other joint control algorithms), sensor/transducer interfacing and co-coordinating asynchronous events.
2. **Non – machine control.** This encompasses tasks such as interpreting instruction sequences (CNC codes/robot program files), higher level communications to other systems and providing user interfaces.

We can also classify these two sets of task into real-time and non real-time. The definition of real time, which relates to the computing control systems, is given accurately by Microsoft Corporation Microsoft (1995):

“A real time system is one in which the correctness of the computation not only depends upon the logical correctness of the computation, but also upon the time at which the result is produced. If the timing constraints of the system are not met, system failure is said to have occurred”.

COTS MOTION CONTROLLERS

From the wide variety of industrial motor control equipment available a servo controller of this nature requires a minimum, for each axis under control, a 0-10 VDC analogue output channel and an encoder input channel Pires & Sa da Costa (1997). A wide variety of products exist, each with differing feature and option.

The PMAC (programmable multi-axis controller) card manufactured by Delta Tau Systems is a PC expansion card for most common local bus systems (PCI, VME etc.) and is equipped with onboard A/D and D/A converters, digital I/O, encoder inputs and PLC emulation. Many accessories are available to provide further expansion. It has a Motorola DSP 56001 Digital Signal Processor running at a clock speed of 20 MHz (standard), and up to 60MHz (enhanced). It is highly flexible system that allows many advanced custom features to be incorporated. A diverse array of options and control features is available as standard, making the card highly suited to research, robotics and machine tool applications.

Communications between the host processor and the PMAC servo controller take place via the common system bus, using ASCII character format. This is generally the case for these types of controller. The interpretation of the meaning of the information contained in each ASCII word is dependent on the manufacturer who designed the product, and it is for this reason that the OSEC committee plan to link activities with the European and American organizations responsible for OSACA and SOSAS in an attempt to globally standardize a set of software services that open controllers should be able to provide, including low-level motion control. An initial proposal has been drafted and submitted to the International Standards Organization (ISO) Sawada & Akria (1997); ISO Draft (1995).

SENSOR INTERFACING

One of the main motivating forces behind the push proprietary to open architectures was the need to add extra sensing devices to the controlled machinery, in order to improve quality and efficiency. According to the control design methodology (CDM), sensory processing in a robotic system can be sub divided in to two categories:

1. **Internal sensory feedback.** This concerns data that is an integral part of motion control aspects of the system, such as feedback from axis encoders and solvers, use of a COTS motion controller will provide appropriate interfaces to this equipment.
2. **Environmental sensory feedback.** This concerns the data comes from additional sensors not directly utilized for axis control, for example a force sensor.

PROPOSED CONTROLLER ARCHITECTURE

The architectural presented has three layers, each of which can be decomposed into further functional sub-modules. Fig. 1 shows graphically the high level reference model for controlling intelligent sensor based manipulators.

Before decomposing the levels into their more detailed sub modules, an over view of the high level model will be given. Each layer of the architecture has a general descriptive name: the top layer is called the application layer and acts to provide a high level service interface to the user. The Control layer is directly beneath the application layer and receives these requests for task services. In a similar manner to the CDM, each task has an associated mode of control that is to be performed to complete the task.

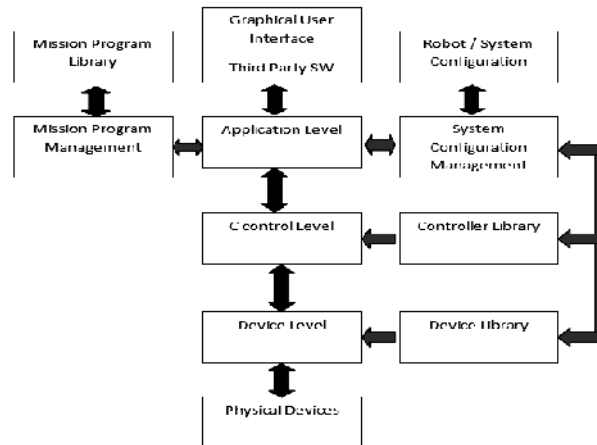


Fig. 1. High level Reference Architecture.

Below the Control Layer is the Device layer, which receives these requests and performs the necessary actions to carry them out. The device layer has the direct physical connections to the robot under control. The overall concept of the Open Controller is one of flexibility and adaptability. The hybrid elements of the controller are not designed to be configured by the third party or specialized packages, but by tools such as automatic code generators embedded in the application itself. This enables the controller to become its own development and configuration environment.

THE APPLICATION - LAYER

Two of the main features of the application layer functionality, shown in Fig. 2, are in handling a graphical interface to the user and providing a set of services that enable the application to communicate with third-party software and hardware, and allow third party software access to, and control of, its own features.

The users interface must ne intuitive and allow the user to access all of the controller’s functionality and parameters. It must provide features that enable the creation and testing of mission programs. In addition, it must allow access to design time tools for software module creation.

The application layer must also be able to interpret a mission program, break it down into tasks and request the services of the control layer. Although somewhat dependent on the chosen implementation architecture, the form of the task service requests and the data that is exchanged will, at the highest communication level, be in the form of ASCII code strings passed to and received form the OSI application level interface.

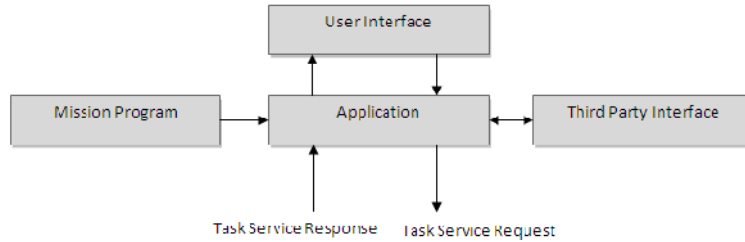


Fig. 2. The Application layer.

THE CONTROL - LAYER

When the task service request and its associated parameters arrives, Via the OSI interface, the control layer Fig. 3 must first decide on the required control strategy for each task, we can define three possible runtime states, initialization, execution and termination. Initialization involves the calibration of external sensors, loading of required modules, calculation of drive transformation etc and anything that is required for the next state, which is execution. This state involves the actual execution of the required control method in real time until a terminating condition is reached. Upon entering the termination state, the required clean-up routines can be executed to unload control modules or ‘look ahead’ to the next task to see if any can remain loaded. The control layer provides the application with any desired information as task executes, and requests the services of the device layer as required.

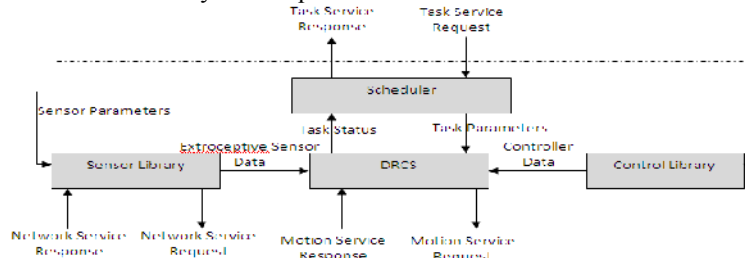


Fig. 3. The Control Layer.

To perform these functions, the primary components of the control layer are the Dynamically Reconfigurable Control System (DRCS). During initialization, required components from the controller library are configured inside the DRCS to perform the required control. During execution, its inputs are from internal and environmental sensors feed back, and task parameters. Its outputs are the internal states of its control modules that are passed to the scheduler, and motion control signals to be passed to the device layer. The scheduler is responsible for ensuring that each of the runtime states is executed correctly, and for overseeing the internal communications of the layer. It is also the scheduler that decides for the given task, which modules are to be loaded into the DRCS from the control library and what information to the sensor library in the form of requests for sensor data, or the setting of output values. The sensor library is responsible for interpreting this data, and assembling the correct request to pass to the fieldbus protocol to carry it out. It can also be configured to provide the DRCS with the required environmental sensor information at each sampling interval when executing a control mode.

Again assuming that the interface between control and device layer is implemented via OSI model, the request to, and responses from, the device layer will be in the form of ASCII code strings passed and received from the OSI application level interface.

THE DEVICE - LAYER

The interface between the device layer and the control layer is of vital importance. The interpretation of the information flowing between the application layer and the control layer is necessarily abstract, and its actual meaning depends upon the syntax of the mission program, how it is broken down into the required tasks what control method can be employed to perform tasks. This can be configured in the controller's design state. The interface to the actual devices that control the robot and provide sensory information is not abstract and must adhere to a recognized standard, and it seems this is solely dependent upon the implementation equipment.

If there was a universal protocol and set of services for fieldbus devices to adhere to, and a similar common protocol to dictate the operation of motion control equipment, this could be attached to the reference architecture. This would ensure that whatever implementation equipment was chosen, the functionality would remain identical. From the discussion of chapter three, it was seen that although there are plans for such standard protocols in the near future, none exist in practice at the time of writing. At this stage, it will be assumed that such protocols exist and design the interpretation of the device level service requests and responses. When suggesting the implementation model, suitable technologies can be chosen from those available.

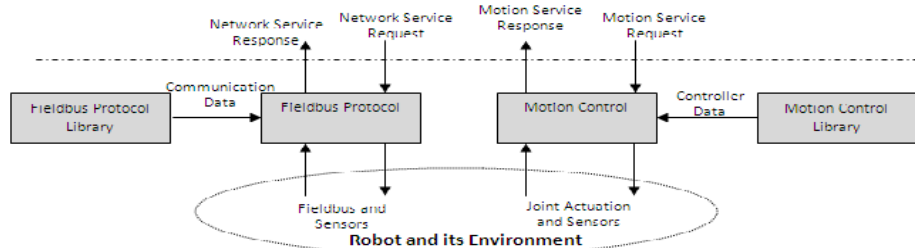


Fig. 4. The Device Layer.

Essentially, the device layer, which is shown in fig 4, receives two different types of request from the control layer interface. One is a network request, either to set or read a sensor value, or conFig. a new node via fieldbus. Form the stored routines in the protocol library, these requests are carried out physically and the resulting data/status information passed back up to the control layer. The other is a motion service request, and can take the form of data requests for the current joint angles/torques, for example, or to servo each joint to a given position. The motion control elements of the device layer perform these functions and pass measured data/status back to the control layer.

DISCUSSION

The reference model is arranged logically, with each layer having a specific group of similar functions perform. This enables the real time requirements of each layer's functions to be the same, with the tightest requirement at the device level, intermediate requirement at the control level and almost asynchronous at the application level. The intermediate requirement is still classified as hard real-time, but the sampling rate can be reduced by a factor of approximately ten from that of the device layer Khosla (1987); Chen & Parker (1994). At the application level, the information exchange is still classified as real-time, but can be considered as soft real time compared to the lower level Microsoft (1995). For example, the GUI must be updated with new information around 20Hz, but a small deviation in the update interval (so long as it doesn't exceed a pre-specified bound such as 400%), will not cause system failure.

The architecture is designed so that some of the principles of alternative reference architecture and methodologies, especially the Control Design Methodology (CDM) Putz & Elfving (1992), Can still utilize to some extent by Controller.

In particular, the activity analysis/task definition stages of the CDM can be utilized, along with the task definition from the CDM catalogue. The extended hybrid architecture of the GCA removes the need for the remaining steps of the CDM to be followed, as the implementation architecture exists and can be modified in design time to suit. The DRCS incorporates some of the concepts from the Chimera methodology Stewart & Khosla (1994), but remains abstract in implementation where as Chimera methodology could be incorporated as a DRCS implementation for the Controller, so long as a suitable interface could be designed to allow the creation and management of port objects by the application layer, and suitable run time functionality could be achieved.

HARDWARE IMPLEMENTATION ARCHITECTURE

From the reference architecture as described in section 3, suitable implementation architecture must be chosen from the multitude of enabling technologies before a prototype design can be created and tested. Suitable hardware implementation architecture is shown as Fig. 5.

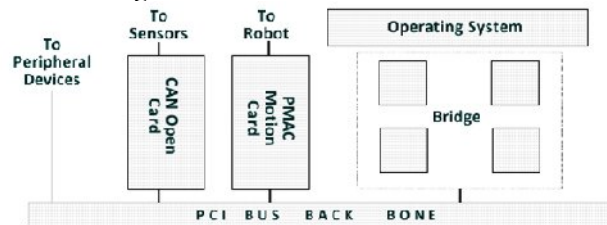


Fig. 5. Controller's Hardware implementation.

CONCLUSION

This paper has presented and discussed an architecture model for the control next generation, sensor-based robots. A suitable implementation architecture that can satisfactorily realize the Open Controller functionality has been chosen and described.

Each layer of the architecture has a general descriptive name: the top layer is called the application layer and acts to provide a high level service interface to the user. This level provides GUI and an interface to third party software. Since the model possesses extended hybrid architecture, in its un-configured state there are many 'open' slots, or modules, in the lower layers that need defining bases on the expected scope of actions the robot perform. Hence the application layer also directly provides facilities for the design and management of the functional modules that the lower layer utilize.

REFERENCES

1. Linkens, D. and Nyongesa, H. (1996). Learning Systems in Intelligent Control: An appraisal of fuzzy, neural and genetic algorithm control applications. *IEE Proceedings of the Control Theory and Application*, 143(4), 367-386.
2. Kozłowski, K. (1997). Modeling and Identification In Robotics. *Springer Verlag London Limited*, ISBN 354076240X.
3. Green Field et al. (1997). An Overview Of Robot Force Control. *Robotica*, 15, 473-482.
4. Green field et al. (1997). Open Architecture Defiantion. *Robotica*, 14, 371-380.
5. Ford (1994), Proctor and Albus (1997). *Robotics: Control, Sensing, Vision And Intelligence*. McGraw-Hill International editions, ISBN 0070226256.
6. Schofield and Wright (1989). Special Computer Architecture for Robotics: *Tutorial and Survey*. *IEEE Transactions On Robotics and Automation*, Vol. 5.
7. Microsoft Corp. (1995). Real Time systems and Microsoft Windows NT. *Microsoft MSDN Library*.
8. Pires and Sa da Costa (1997). Foundation for the Study of Software Architecture. *ACM SIGSOFT*, 17(4), 40-52.
9. Sawada and Akria (1997). ISO Draft 1995 "theory and practice of hierarchical control". *Proceedings of the 23rd IEEE Computer Society International Conference*, Washington, USA, 18-39.
10. Chen, N. and Parker, GA. (1994). Design of a robot control system architecture. *Microprocessors and Microsystems*, 18(6), 323-330.
11. Putz and Elfving (1992). Choosing sampling Rates For Robot. *Proc. IEEE Int. Conf. Robot Automation*, 169-174.
12. Stewart and Khosla (1994). Resolved Motion Adaptive Control for Mechanical Manipulators, *Trans. ASME, J. Dynamic System, Measurement and Control*, 106(2), 134-142.

**ON CONSTRUCTION OF ONE DIMENSIONAL PARTIALLY
NEIGHBOR BALANCED DESIGNS (PNBD)**

Rashid Ahmed¹ and Munir Akhtar²

¹Department of Statistics, The Islamia University of
Bahawalpur. Email: rashid701@hotmail.com

²COMSATS Institute of Information Technology, Lahore.
Email: drmunirakhtar@ciitlahore.edu.pk

ABSTRACT

Neighbor balanced designs are more useful to remove the neighbor effects but unfortunately these designs satisfy fairly restrictive combinatorial constraints, therefore, mostly such designs require large number of blocks. Partially neighbor balanced designs and generalized neighbor designs were preferred to avoid a large number of blocks. In this study, two algorithms are developed to generate partially neighbor balanced designs when v is even. Partially neighbor balanced designs are constructed for different configurations when v is odd.

KEY WORDS

Neighbor designs; Partially neighbor balanced designs; Generalized neighbor designs.

1. INTRODUCTION

Neighbor designs satisfy fairly restrictive combinatorial constraints, therefore, mostly such designs require large number of blocks. In many field experiments such as agriculture, it is impossible to have as much replication as is needed for neighbor designs. Wilkinson et al. (1983) defined a design to be partially neighbor balanced if each experimental treatment has other treatment as a neighbor, on either side, at most once. Azais et al. (1993) considered designs in linear blocks with border plots in which a treatment may affect the response on the two adjacent plots. They also constructed partially neighbor balanced designs in few complete blocks. Misra et al. (1991) and Chaure and Misra (1996) constructed generalized neighbor designs for different cases. Chan and Eccleston (1998) developed a method to construct a class of partial nearest neighbor balanced designs. Mishra (2007) constructed families of proper generalized neighbor designs. Kedia and Misra (2008) constructed some series of generalized neighbor designs which are obtained by developing the initial blocks, using the Rees (1967) principal.

In this study, partially neighbor balanced designs are constructed for different configurations. In our proposed designs v treatments are labeled as 0, 1, 2, ..., $v-1$ and v pairs of treatments do not appear as nearest neighbors when v is odd and $v/2$ pairs of treatments do not appear as nearest neighbors when v is even. Our proposed designs possess the property of balance $100[(v-3)/(v-1)]$ percent for v odd and $100[(v-2)/(v-1)]$ percent for v even. In section 2 and 3, algorithms are developed to generate partially

neighbor balanced designs for $k=4s$; $v=2(k+1)$ and for $v=2(k+1)$; $k=11+2s$ respectively. In section 4, partially neighbor balanced designs for odd v are constructed for different configurations. Designs for even v are constructed in section 5. All these designs are binary which means no treatment is repeated in the same block.

2. AN ALGORITHM TO GENERATE PNBD FOR $k=4s$; $v=2(k+1)$ IN v CIRCULAR BLOCKS.

If $v=2(k+1)$; $k=4s$; s is a natural number, the initial block $(0, 1, 3, 6, \dots, k(k-1)/2) \bmod v$ provides the partially neighbor balanced designs which saves $[100(v-3)/(v-1)]\%$ at the cost of $[100/(v-1)]\%$ lack of balance. If the sum of any two, three, \dots , $(m-2)$ successive elements of series $(2.1) \bmod v$ is zero, rearrange these elements in such a way that the sum of any two, three, \dots , $(m-2)$ successive elements $\bmod v$ is not zero to get binary block designs. If the rearranged series is a_1, a_2, \dots, a_{m-2} , then the initial block of design will be $(0, a_1, (a_1 + a_2), \dots, (a_1 + a_2 + \dots + a_{m-2})) \bmod v$. Remaining $(v-1)$ blocks are obtained cyclically $\bmod v$. A catalogue of binary block partially neighbor balanced designs generated through proposed algorithm for $v \leq 98$ is presented in table 2.1.

Example 2.1: If $v=10$ and $k=4$, then initial block of the required design is $(0, 1, 3, 6)$. Remaining nine blocks are obtained cyclically $\bmod 10$.

3. AN ALGORITHM TO GENERATE PNBD FOR $v=2(k+1)$; $k=11+2s$ IN v CIRCULAR BLOCKS.

If $v=2(k+1)$; $k=11+2s$; s is a non negative even number, consider a series:

$$1, 2, 3, \dots, k-1 \quad (3.1)$$

Replace element equal to $(k-1-s/2)$ by $v-(k-1-s/2)$ in series (3.1). Let a_1, a_2, \dots, a_{m-2} be the resultant series then initial block of design will be $(0, a_1, (a_1 + a_2), \dots, (a_1 + a_2 + \dots + a_{m-2})) \bmod v$. These partially neighbor balanced designs saves $[100(v-3)/(v-1)]\%$ at the cost of $[100/(v-1)]\%$ lack of balance. If the sum of any two, three, \dots , $(m-2)$ successive elements of $a_1, a_2, \dots, a_{m-2} \bmod v$ is zero, rearrange these elements in such a way that the sum of any two, three, \dots , $(m-2)$ successive elements $\bmod v$ is not zero to get binary block designs. Remaining $(v-1)$ blocks are obtained cyclically $\bmod v$. A catalogue of binary block partially neighbor balanced designs generated through this proposed algorithm for $v \leq 96$ is presented in table 3.1.

Example 3.1: If $v=24$ and $k=11$, replacing the number 10 by 14, the resultant elements are: 1, 2, 3, \dots , 9, 14. Rearranged values are 1, 2, 3, 4, 5, 7, 6, 8, 9, 14 for binary block design. The initial block of the required design is $(0, 1, 3, 6, 10, 15, 22, 4, 12, 21, 11)$. Remaining 23 blocks are obtained cyclically $\bmod 24$.

4. PARTIALLY NEIGHBOR BALANCED DESIGNS FOR ODD v

In this section, for odd v , partially neighbor -balanced designs are constructed for different configurations, where lack of balance is $[200/(v-1)]\%$.

4.1 PNBD for $v = 2m + 1$ and $k = m - 1$

Let $v = 2m + 1$ and $k = m - 1$ then consider a series:

$$1, 2, \dots, (m-2) \quad (4.1)$$

Let s be sum of series (4.1) mod v . If $s \notin \{m-1, m, m+1, m+2\}$, replace one or more numbers of series (4.1) by their complements so that the s' (sum of the new series mod v) $\in \{m-1, m, m+1, m+2\}$, where $(v - a_i)$ is the complement of a_i . If the elements of new series are a_1, a_2, \dots, a_{m-2} , then the initial block of design will be $(0, a_1, (a_1 + a_2), \dots, (a_1 + a_2 + \dots + a_{m-2})) \bmod v$. The remaining $(v-1)$ blocks are obtained cyclically mod v . The property of binary block can be achieved by rearranging the elements a_1, a_2, \dots, a_{m-2} in such a way that the sum of any two, three, \dots , $(m-2)$ successive elements mod v is not zero. If c is common divisor of k and $v(v-1)/2$, then these designs save $[100(v-1-2c)/(v-1)]$ % experimental. A catalogue of these designs for $v \leq 49$ is presented in table 4.1.

Example 4.1: Partially neighbor balanced design for $v=11$ and $k=4$ in 11 blocks. The selected numbers are 1, 2, 3. Sum of selected numbers is equal to $m+1$, hence the initial block of the required design is $(0,1,3,6)$. The remaining 10 blocks are obtained cyclically mod 11.

4.2 PNBD for $v = 2m + 1$ and $k = (m - 1)/2$ in $2v$ circular blocks.

Let $v = 2m + 1$ and $k = (m - 1)/2$ then consider a series: $1, 2, \dots, m$. Select two sets of values from this series, each of $k-1$ values, in such a way that (i) the selected values along with their complements and (ii) sum of each set along with their complements, all should be distinct. If a_1, a_2, \dots, a_{k-1} are the selected elements of one set while b_1, b_2, \dots, b_{k-1} are of second set then the initial blocks of the design are $(0, a_1, (a_1 + a_2), \dots, (a_1 + a_2 + \dots + a_{m-2})) \bmod v$ and $(0, b_1, (b_1 + b_2), \dots, (b_1 + b_2 + \dots + b_{m-2})) \bmod v$. The remaining $(v-1)$ blocks are obtained cyclically mod v from each of initial block. If c is common divisor of k and $v(v-1)/2$, then these designs save $[100(v-1-4c)/(v-1)]$ % experimental material. A catalogue of these designs for $v \leq 99$ is presented in table 4.2.

Example 4.2: Partially neighbor balanced design for $v=19$ and $k=4$ in 38 blocks. The two sets of selected numbers are $(1,2,3), (5,7,15)$, the initial blocks of the required design are $(0,1,3,6), (0,5,12,8)$. The remaining 18 blocks are obtained cyclically mod 19 from each of initial block.

4.3 PNBD for $v = 2m + 1$ and $k = (m - 1)/3$ in $3v$ circular blocks.

Let $v = 2m + 1$ and $k = (m - 1)/3$ then consider a series: $1, 2, \dots, m$. Select three sets of values from this series, each of $k-1$ values, in such a way that (i) the selected values along with their complements and (ii) sum of each set along with their complements, all should be distinct. If c is common divisor of k and $v(v-1)/2$, then these designs save $[100(v-1-6c)/(v-1)]$ % experimental material. A catalogue of these designs for $v \leq 99$ is presented in table 4.3.

Example 4.3: Partially neighbor -balanced design for $v=27$ and $k=4$ in 81 blocks. The three sets of selected numbers are $(1,2,3), (4,5,7), (9,12,19)$, the initial blocks of the required design are $(0,1,3,6), (0,4,9,16), (0,9,21,13)$. The remaining 26 blocks are obtained cyclically mod 27 from each of initial block.

4.4 PNBD for $v = 2m + 1$ and $k = (m - 1)/4$ in $4v$ circular blocks.

Let $v = 2m + 1$ and $k = (m - 1)/4$ then consider a series: $1, 2, \dots, m$. Select four sets of values from this series, each of $k - 1$ values, in such a way that (i) the selected values along with their complements and (ii) sum of each set along with their complements, all should be distinct. If c is common divisor of k and $v(v - 1)/2$, then these designs save $[100(v - 1 - 8c)/(v - 1)]$ % experimental material. A catalogue of these designs for $v \leq 99$ is presented in table 4.4.

Example 4.4: Partially neighbor -balanced design for $v = 35$ and $k = 4$ in 140 blocks. The four sets of selected numbers are $(1, 2, 3), (4, 5, 7), (8, 15, 25), (11, 12, 26)$, the initial blocks of the required design are $(0, 1, 3, 6), (0, 4, 9, 16), (0, 8, 23, 13), (0, 11, 23, 14)$. The remaining 34 blocks are obtained cyclically mod 35 from each of initial block.

4.5 PNBD for $v = 2m + 1$ and $k = (m - 1)/5$ in $5v$ circular blocks.

Let $v = 2m + 1$ and $k = (m - 1)/5$ then consider a series: $1, 2, \dots, m$. Select five sets of values from this series, each of $k - 1$ values, in such a way that (i) the selected values along with their complements and (ii) sum of each set along with their complements, all should be distinct. If c is common divisor of k and $v(v - 1)/2$, then these designs save $[100(v - 1 - 10c)/(v - 1)]$ % experimental material. A catalogue of these designs for $v \leq 93$ is presented in table 4.5.

Example 4.5: Partially neighbor -balanced design for $v = 43$ and $k = 4$ in 215 blocks. The five sets of selected numbers are $(1, 2, 3), (4, 5, 7), (8, 9, 11), (12, 17, 33), (14, 20, 22)$, the initial blocks of the required design are $(0, 1, 3, 6), (0, 4, 9, 16), (0, 8, 17, 28), (0, 12, 29, 19), (0, 14, 34, 13)$. The remaining 42 blocks are obtained cyclically mod 43 from each of initial block.

4.6 Partially neighbor -balanced designs for $v = 2m + 1$ and $k = (m - 1)/6$ in $6v$ circular blocks.

Let $v = 2m + 1$ and $k = (m - 1)/6$ then consider a series: $1, 2, \dots, m$. Select six sets of values from this series, each of $k - 1$ values, in such a way that (i) the selected values along with their complements and (ii) sum of each set along with their complements, all should be distinct. If c is common divisor of k and $v(v - 1)/2$, then these designs save $[100(v - 1 - 12c)/(v - 1)]$ % experimental material. A catalogue of these designs for $v \leq 99$ is presented in table 4.6.

Example 4.6: Partially neighbor -balanced design for $v = 51$ and $k = 4$ in 306 blocks. The six sets of selected numbers are $(1, 2, 3), (4, 5, 7), (8, 9, 10), (11, 12, 13), (17, 18, 37), (22, 23, 25)$, the initial blocks of the required design are $(0, 1, 3, 6), (0, 4, 9, 16), (0, 8, 17, 27), (11, 23, 36), (0, 17, 35, 21), (0, 22, 45, 19)$. The remaining 50 blocks are obtained cyclically mod 50 from each of initial block.

5. PARTIALLY NEIGHBOR-BALANCED DESIGNS FOR EVEN v

In this section, partially neighbor -balanced designs are constructed through two or more initial blocks. Partially neighbor-balanced designs generated through two initial blocks for $v = 4k + 2$; $k = 4 + s$; s is a non-negative even numbers in $2v$ circular blocks are presented in Table 5.1. Table 5.2 shows partially neighbor balanced designs generated through m initial blocks for $v = 2mk + 2$; $k = 4$; $3 \leq m \leq 12$ in mv circular blocks.

Table 2.1

ν	k	Initial Blocks
18	8	(0,1,3,6,10,15,5,11)
26	12	(0,11,21,24,25,1,5,10,16,23,6,14)
34	16	(0,1,3,6,10,15,21,28,2,11,22,32,12,24,5,18)
42	20	(0,18,20,23,27,32,38,3,11,21,30,41,12,24,39,13,31,8,22)
50	24	(0,22,36,9,10,12,15,19,24,30,37,45,4,14,25,38,5,21,33,48,17,35,6,26)
58	28	(0,26,53,54,56,1,5,10,16,23,31,40,50,3,15,28,42,57,17,34,55,13,33,52,18,41,8,30)
66	32	(0,30,58,59,61,64,2,7,13,20,28,37,47,60,6,17,31,46,62,15,33,50,4,25,49,5,32,55,14,40,3,34)
74	36	(0,32,65,66,68,71,1,6,12,19,27,36,46,57,69,8,22,37,53,70,14,33,54,4,24,47,73,21,48,2,31,56,13,43,3,38)

Table 3.1

ν	k	Initial Blocks
32	15	(0,19,1,2,4,7,11,16,22,29,5,14,24,3,15)
40	19	(0,1,3,6,10,15,21,28,36,5,16,26,38,11,25,9,24,2,19)
48	23	(0,1,3,6,10,15,21,28,36,45,7,18,30,43,9,24,40,13,33,2,20,42,23)
56	27	(0,1,3,6,10,15,21,28,36,45,55,12,24,35,49,9,26,41,5,23,42,7,30,54,32,2,27)
64	31	(0,1,3,6,10,15,21,28,36,45,55,2,14,27,41,56,8,25,43,62,18,39,61,20,44,19,47,9,38,4,31)
72	35	(0,1,3,6,10,15,21,28,36,45,55,66,7,19,33,48,64,9,27,46,67,17,37,60,12,38,63,18,47,5,49,8,40,2,35)

Table 4.1

ν	k	Initial Block	Save %	Balance %
13	5	(0,1,4,8)	83.33	83.33
15	6	(0,1,3,6,2,7)	57.14	85.71
17	7	(0,1,3,6,10,15,9)	87.50	87.50
19	8	(0,1,3,6,10,15,2,9)	88.89	88.89
21	9	(0,1,20,2,6,12,17,3,11)	70.0	90.00
23	10	(0,1,3,6,11,15,9,16,2,10)	90.91	90.91
25	11	(0,1,3,6,10,15,21,4,11,2,12)	91.67	91.67
27	12	(0,1,4,6,10,15,22,3,9,18,2,12)	76.92	92.31
29	13	(0,1,3,7,13,10,15,22,4,12,21,2,14)	92.86	92.86
31	14	(0,1,3,6,10,16,21,14,22,2,11,23,5,15)	93.33	93.33
33	15	(0,2,5,6,12,16,23,28,3,13,22,10,21,1,15)	81.25	93.75
35	16	(0,20,19,21,24,28,33,4,12,22,29,3,14,26,5,18)	94.12	94.12
37	17	(0,1,3,6,10,15,21,28,36,8,18,29,4,17,31,9,30)	94.44	94.44
39	18	(0,16,8,9,11,14,18,23,29,36,6,19,31,2,13,28,3,20)	84.21	94.74
41	19	(0,27,28,30,33,37,1,7,14,22,31,2,12,23,36,10,26,3,20)	95.00	95.00
43	20	(0,24,25,27,30,34,39,2,9,17,26,36,4,16,29,1,15,31,5,23)	95.23	95.24
45	21	(0,1,3,6,2,8,13,20,28,37,4,15,29,39,7,23,38,12,32,5,22)	86.36	95.45
47	22	(0,1,36,38,41,46,3,9,16,24,33,43,7,20,34,2,18,35,6,25,45,19)	95.65	95.65
49	23	(0,3,5,9,10,15,21,28,36,45,6,17,29,42,8,22,38,7,26,46,18,40,23)	95.83	95.83

Table 4.2

v	k	Initial Blocks	Save %	Balance %
23	5	(0,1,3,6,10),(0,5,11,4,12)	81.82	90.91
27	6	(0,1,3,6,10,15),(0,6,14,21,3,13)	53.85	92.31
31	7	(0,1,3,6,10,15,21),(0,8,17,28,9,22,15)	86.67	93.33
35	8	(0,1,3,6,10,15,30,11),(0,6,14,23,34,11, 24,17)	88.24	94.12
39	9	(0,1,3,6,11,15,24,36,10), (0,6,13,21,32,7,22,38,18)	68.42	94.74
43	10	(0,1,3,6,10,15,21,28,36,13), (0,9,19,30,1,16,32,7,33,21)	90.48	95.24
47	11	(0,1,3,6,11,15,21,28,36,45,10), (0,11,24,38,6,22,39,10,29,2,23)	91.30	95.65
51	12	(0,1,3,6,10,16,21,28,36,45,4,15),(0,13, 29,43,9,27,46,15,36,8,37,25)	76.00	96.00
55	13	(0,1,3,6,10,15,21,28,36,45,2,13,23), (0,14,29,42,4,22,41,6,28,49,18,43,27)	92.59	96.30
59	14	(0,1,3,6,10,15,21,28,36,45,55,7,19,32), (0,14,29,45,3,21,40,1,22,44,8,32,57,26)	93.10	96.55
63	15	(0,1,4,6,10,17,22,28,36,45,55,3,15,29, 42),(0,15,31,48,3,22,2,24,47,8,33,59, 25,53,17)	80.65	96.77
67	16	(0,1,3,6,10,15,21,28,36,45,55,66,11,24,54,18), (0,14,29,45,64,17,38,60,16,40,65,24, 51,12,50, 33)	93.94	96.97
71	17	(0,1,3,6,10,15,21,28,36,45,55,66,7,20,34,63,22), (0,15,31,48,66,14,34,55,7,32,56,11,38,10,41,2, 35)	94.29	97.14
75	18	(0,1,3,6,10,15,21,28,36,45,55,66,4,16,30,46,61,17), (0,33,51,70,50,71,18,41,65,15,43,69, 21,53,8,37,2,36)	83.78	92.31
79	19	(0,1,3,6,10,15,21,28,36,45,55,66,78,12,26,41,57,74,18), (0,60,1,22,44,68,14,40,67,16,45,75,27,59,13,47,3,39,76)	94.87	97.44
83	20	(0,1,3,6,10,15,21,28,36,45,55,66,78,8,22,37,53,70,5,24), (0,39,19,40,62,2,27,53,80,25,54,1,32, 64,14,48, 13,49,3,41)	95.12	97.56
87	21	(0,20,21,23,26,30,35,41,48,56,65,75,86,11,24,38,53,69,1,19,36), (0,41,62,84,20,44,19,45,72,13,42,73,16,48,81,28,63,14,51,3,43)	86.05	97.67
91	22	(0,21,41,42,44,47,51,56,62,69,77,86,5,16,28,43,57,70,87,12,30,49), (0,50,2,24,47,71,5,31,58,86,25,54,85,26,59,4,39, 73,19,57,6,45)	95.56	97.78
95	23	(0,1,3,6,10,15,21,28,36,45,55,66,78,91,11,25,41,58,76,2,22,44,63), (0,72,1,26,52,79,12,41,71,7,40,74,14,50,87,30, 69,15,55,2,45,90,46)	95.74	97.87
99	24	(0,1,3,6,10,15,21,28,36,45,55,66,78,91,7,23,37,54,72,92,12,33,80,29), (0,77,1,25,50,76,4,32,62,93,26,59,94,29,65,3,41,80,21,63,5,61,6,51)	87.76	97.96

Table 4.3

ν	k	Initial Blocks	Save %	Balance %
33	5	(0,1,3,6,10),(0,5,11,25,7),(0,8,17,28,16)	81.25	93.75
39	6	(0,1,3,6,10,15),(0,6,13,21,37,12),(0,30,1,29,3,20)	52.63	94.74
45	7	(1,3,6,10,15,21),(0,7,15,24,34,1,14),(0,29,10,21,36,8,26)	86.36	95.45
51	8	(0,1,3,6,10,15,21,28),(0,8,17,27,38,50,12,26),(0,15,31,48,16,34,3,24)	67.86	96.00
57	9	(0,1,3,6,10,15,21,28,36),(0,26,35,45,56,11,24,49,19), (0,14,56,15,32,50,30,52,18)	89.29	96.43
63	10	(0,1,3,6,10,15,21,28,36,45),(0,10,21,33,46,60,12,28,57,24), (0,17,36,56,35,57,19,42,5,32)	90.32	96.77
69	11	(0,1,3,6,10,15,21,28,36,45,55),(0,11,23,36,51,67,15,33,52,3,24), (0,47,1,26,52,10,51,11,41,3,35)	92.31	96.06
75	12	(0,1,3,6,10,15,21,28,36,45,55,16),(0,11,23,36,50,65,7,25,44,64,10,32), (0,23,74,24,50,2,30,59,14,45,3,37)	75.68	97.30
81	13	(0,1,3,6,10,15,21,28,36,45,55,66,24),(0,12,25,39,54,70,6,24,43,63,3, 26,48),(0,56,30,57,4,33,63,13,45,79,43,78,41)	92.50	97.50
87	14	(0,1,3,6,10,15,21,28,36,45,55,66,78,13),(0,41,55,70,86,16,34,53,73,7,30, 54,79,32),(0,61,1,29,58,2,32,65,31,66,15,52,3,42)	93.02	97.67
93	15	(0,1,3,6,10,15,21,28,36,45,55,66,78,91,14),(0,15,32,50,69,89,17,39,62, 86,18,44,71,6,35),(0,63,32,64,4,38,74,37,75,21,61,9,51,1,45)	80.43	97.83
99	16	(0,14,15,17,20,24,29,35,42,50,59,69,80,92,6,21),(0,16,33,51,70,90,13,36, 60,85,12,39,67,96,27,58),(0,32,98,33,68,5,42,80,20,79,22,65,10,55,2,49)	93.88	97.96

Table 4.4

ν	k	Initial Blocks	Save %	Balance %
43	5	(0,1,3,6,10),(0,5,11,18,26), (0,9,20,39,16),(0,12,25,39,21)	80.95	95.24
51	6	(0,1,3,6,10,15),(0,6,13,21,30,40), (0,12,25,39,4,21),(0,33,1,32,3,26)	52.00	96.00
59	7	(0,1,3,6,10,15,21),(0,7,15,24,34,45,14), (0,12,25,40,56,14,32),(0,19,39,17,40,5,30)	86.21	96.55
67	8	(0,1,3,6,10,15,21,28),(0,8,17,27,38,50,63,20), (0,14,29,45,62,13,61,25),(0,46,24,47,6,33,62,32)	87.88	96.97
75	9	(0,1,3,6,10,15,21,28,36),(0,9,19,30,42,55,69,10,25), (0,17,35,54,74,20,42,66,26),(0,23,50,3,32,62,18,51,10)	67.57	97.30
83	10	(0,1,3,6,10,15,21,28,36,45),(0,10,21,33,46,60,75,8,25,43), (0,19,39,60,82,22,46,71,14,41),(0,28,57,4,35,67,17,51,3,39)	90.24	97.56
91	11	(0,1,3,6,10,15,21,28,36,45,55),(0,11,23,36,50,65,81,7,25,44,64), (0,21,43,66,90,24,50,1,42,85,34),(0,68,39,69,9,41,74,20,76,38,77)	91.11	97.78
99	12	(0,1,3,6,10,15,21,28,36,45,55,66),(0,12,25,39,54,70,87,6,26,45,92,41), (0,21,43,66,90,16,42,69,97,44,88,34),(0,29,59,90,58,93,30,67,6,45,85,43)	75.51	97.96

Table 4.5

v	k	Initial Blocks	Save %	Balance %
53	5	(0,1,3,7,17),(0,5,11,18,29),(0,18,27,50,22),(0,13,27,48,15),(0,3,15,34,26)	83.87	96.15
63	6	(0,1,3,6,10,15),(0,6,13,21,30,40),(0,11,23,36,50,17), (0,16,34,53,10,39),(0,21,59,33,60,28)	51.61	96.77
73	7	(1,3,6,10,15,21),(0,7,15,24,34,45,57),(0,13,27,42,59,4,39), (0,54,1,23,46,72,32),(0,24,49,22,50,6,36)	86.11	97.22
83	8	(0,1,3,6,10,15,21,28),(0,8,17,27,38,50,63,39),(0,14,29,46,64,1,20,41), (0,22,45,20,47,73,6,46),(0,54,1,53,2,52,3,38)	87.80	97.56
93	9	(0,1,3,6,10,15,21,28,36),(0,9,19,30,42,55,69,84,21),(0,16,33,51,70,90, 19,42,66),(0,25,51,79,15,46,78,18,52),(0,35,91,36,75,22,63,13,64)	67.39	97.83

Table 4.6

v	k	Initial Blocks	Save %	Balance %
63	5	(0,1,3,6,30),(0,5,11,18,26),(0,9,20,32,45),(0,49,1,17,34),(0,19,39,60,22), (0,10,33,60,32)	80.65	96.77
75	6	(0,1,3,6,10,15),(0,6,13,21,30,40),(0,11,23,36,53,14),(0,16,34,53,73,32), (0,25,47,70,19,49),(0,54,6,34,5,38)	51.35	97.30
87	7	(1,3,6,10,15,21),(0,7,15,24,34,45,57),(0,13,27,42,58,75,29), (0,18,37,57,79,15,39),(0,25,51,85,35,73,28),(0,27,58,26,59,7,43)	86.05	97.67
99	8	(0,1,3,6,10,15,21,28),(0,8,17,27,38,50,63,77),(0,15,31,48,66,85,6,27), (0,23,47,72,98,45,92,41),(0,29,59,90,23,56,2,36),(0,64,27,65,5,47,7,50)	87.76	97.96

REFERENCES

1. Azais, J.M., Bailey, R.A. and Monod, H. (1993). Catalogue of Efficient Neighbour-Designs with Border Plots. *Biometrics*, 49, 4, 1252-61.
2. Chan, B.S.P. and Eccleston, J.A. (1998). On the construction of complete and partial nearest neighbor balanced designs. *Australasian Journal of Combinatorics*, 18, 39-50.
3. Chaure, N.K., and Misra, B.L. (1996). On construction of generalized neighbor design. *Sankhya* B58, 245-253.
4. Kedia, R.G. and Misra, B.L. (2008). On construction of generalized neighbor design of use in serology. *Statist. Probab. Lett.* 18, 254-256.
5. Mishra, N.S. (2007). Families of proper generalized neighbor designs. *J. Statist. Plann. Inference* 137, 1681-1686.
6. Misra, B.L., Bhagwandas and Nutan (1991). Families of neighbor designs and their analysis. *Comm. Statist. Simulation Comput.* 20 (2 & 3), 427-436.
7. Rees, D.H. (1967). Some designs of use in serology. *Biometrics* 23, 779-791.
8. Wilkinson, G.N., Eckert, S.R., Hancock, T.W. and Mayo, O. (1983). Nearest neighbour (Nn) analysis of field experiments (with Discussion). *J. R. Statist. Soc. Ser. B* 45, 151- 211.

A STUDY OF THE EFFECTS OF INTERNET USAGE ON TEENAGERS

Hina Rana and Itrat Batool Naqvi
Department of Statistics
Kinnaird College for Women, Lahore

ABSTRACT

This paper elucidates the effects of internet usage on teenagers. In particular, we explore whether or not home internet usage influences the academic performance, the impact of internet on the personality of a teenager, and the influence of internet usage on the relationships with family and others. The analysis of the collected data indicates that there is a noticeable impact of internet on college-going girls.

1. INTRODUCTION

The Internet or the World Wide Web is indeed a wonderful and amazing addition in our lives. Internet has been perhaps the most outstanding innovation in the field of communication in the history of mankind. The Internet can be known as a kind of global meeting place where people from all parts of the world can come together. It is a service available on the computer, through which everything under the sun is now at the fingertips of anyone who has access to the Internet [5].

As with every single innovation, internet has its own advantages and disadvantages, especially children and teenagers are more influenced by internet's advantages and disadvantages. But usually, greater extent of advantages outweighs its disadvantages.

Home is the primary place where children use internet. By 2004, 74% of American young people ages 8 to 18 had access to an internet connection at home [1]. The limited evidence available also indicates that home computer use is linked to slightly better academic performance. The universal presence of a computer and the internet raises many questions among which the current study focus on, how internet use influences family relationship, studies of teenagers. There is growing body of literature on the impact of internet on family relationships.

From this study concerned that inappropriate Internet content may jeopardize the personality of girls. This study is designed to provide insights exposure of teenagers to negative Internet content. The present study examines the effect of family context factors, and especially how the academic activities of the teenagers affected family cohesion, shared Web activities, parents' Internet skill, and parents' perceived control, on children's exposure to negative Internet content.

2. LITERATURE REVIEW

Sook-Jung Lee & Young-Gil Chae (2007), conducted a research on the topic of "Internet Use Involves Both Pros and Cons For Children and Adolescents", According To Special Issue Of Developmental Psychology which mainly focused on fact that Some

youth benefit from Internet use while for others it can exacerbate self-destructive behaviors after the research it was concluded that Between 75 and 90 percent of teenagers in the United States use the Internet to email, instant message (IM), visit chat rooms and explore other sites on the World Wide Web. In fact, the Internet was even a relatively more important source for out-of-school than for in-school youth, a finding with important social implications. Youths said the Internet provided interesting material that helped them solve a problem or answer a question. The most common topics searched on the Internet for in-school youth were sexually transmitted diseases, diet/nutrition and fitness and exercise. For the out-of-school youth, sexually transmitted diseases, sexual activities and sexual abuse were the topics of choice. Littleton Colorado (1999), has conducted a research on, "The Social Impact of the Internet on Our Society", this research concluded that that the Internet is a whole new world emerging at the conclusion of the 20th century. Everyday, the Internet expands by the social, political, and economic activities of people all over the world, and its impact growth exponentially. Some of this growth in impact has been described here. In this new world there is no geographical separation and there are no borders, and all people are encouraged to participate and contribute drawing on their experiences and resources. In cyberspace actions and reactions are essentially instantaneous, and this is why the Internet is so gratifying and attractive. This is why it has impacted our society in almost all areas of human endeavor. In this report we touched on the positive aspects of the influence of the Internet on our society. As in any other field in life there are the negative aspects too. In the field of education children can gain access to areas that are not suitable and dangerous.

3. OBJECTIVES

The overall objective of the study is to explore the impact of internet on teenagers. Specifically, we were interested in determining:

- whether the internet usage affects the academic activities of teenagers.
- whether the internet usage influences the family relationships of the teenagers.

4. METHODOLOGY

The data has been collected from Kinnaird College for women, a well known institution of Pakistan. The sample of 73 teenagers has been selected by using simple random sampling technique. A semi- structured questionnaire has been established, consisting of 31 questions in order to collect information regarding the said objectives.

5. DATA ANALYSIS & RESULTS

5.1 Background Information

The findings of the basic information of the respondents are as follow:

- 56% of the students are of 17 years of age, 36% are of 16 years of age and 7% are of 18 years of age
- There are 5% of the respondents whose father's monthly income below Rs.15,000, 41% of the respondents whose father's monthly income lying between Rs.15,000-Rs.45000, while 53% of the respondents whose father's monthly income are above Rs. 45,000

- The knowledge of respondents' parents about using internet , most of the girls (30%) responded that their parents had knowledge of using internet to some extent.

5.2 Basic information regarding computer/internet

- The availability of computer to the respondents was asked that whether they have computer at home or not, as 94 % of the girls responded that they have computer available at home, while 5% replied that they had no computer available to them.
- The location of computer in respondent's home as it effects the activities of the net users as most of the girls had computers are located in their bedroom (35.6%).
- 93% respondents have Internet connection access at their home.
- Type of Internet connection they have as most of the response turned out to be the access of Internet through the cable Internet connection as its cheap and 24 hours available.
- The total time spend on the Internet as 67% of the girls responded that they spend 1-2 hrs on using internet daily.
- 54% teenager girls were obtained regarding usage of computer form college computer labs.

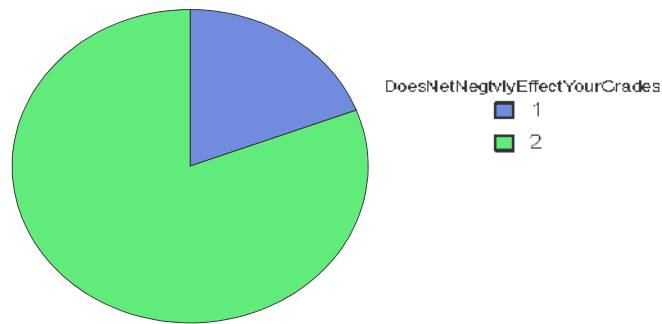
5.3: impact of internet usage on family relationships of teenagers:

- Most of the girls said that (63%) they spend more time with their family rather than spending time on internet or with friends.
- 57% of the girls have responded in agreement to the fact that many parents are unable to control and monitor Internet usage of their children as they do know much about it.
- 75% teenagers said that yes there is influence on relationships due to internet usage.
- whether parents ever keep check on their daughter while they use internet , the response turned out to be that them while there is no check they kept on surf internet.
- Chatting is one of the main attraction for teenagers during their internet activity ,most of the girls said (39%) that they share with their parents the chatting experiences.

5.4: Impact of internet usage on academic activities of teenagers:

- The respondents spend on studying as time spend by the most of the respondents (52%) was observed to be 1-2 hrs.
- 42% of the girls responded that they use half of the time for the academic purposes while rest of the time is sued for the other purposes.
- Most of the girls replied that they use internet for academic purposes (57%), while other use it for fun.
- that they obtained before they started using internet, 54% of the girls replied that they had been achieving A grade.
- 52% of the girls mentioned that there had been a positive impact on their studies after they had started using Internet.
- Before the use of internet the results obtained from data reveals that 55% of the girls were obtaining grades high such as A and 37% were getting B grades.

- After the internet usage the results obtained from data reveals that 56% of the girls which used to obtain grades high such as A are now obtaining B grades.
- 80% of the respondents said they there had been no negative affect on academic grades.



The interest in whether the grades of the students affected negatively after using the internet or not .The finding suggests that majority are disagreed with this fact. We cannot say that it means that academic grades of the students have been improved.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	14	19.2	19.2	19.2
Valid 2	59	80.8	80.8	100.0
Total	73	100.0	100.0	

While in order to check particularly the effect of internet usage on student's grades, paired t-test statistics has been applied. The variables of interest were:

- Before using internet your academic grades
- After using internet your academic grades

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	YourGradesBefore UseNet Your grades after using the internet	-.479	.766	.090	-.658	-.301	-5.350	72	.000

The highly significant results suggest that internet usage does not have a negative impact on students' grades. Although we cannot suggest that students' grades have improved because of internet usage but we are safe to say that internet is not negatively affects the academic activities of the students.

LOGISTIC REGRESSION

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a) Using Purpose	.136	.372	.135	1	.714	1.146
Your Grades Before Use Net	-1.285	.665	3.739	1	.053	.277
Does Net Negatively Effect Your Grades	-2.750	.896	9.419	1	.002	.064
If Negative Effect Than What Are Your Grades Now	.992	.511	3.773	1	.052	2.697
How Study Effect	-1.161	.507	5.248	1	.022	.313
Constant	5.594	2.341	5.712	1	.017	268.847

a Variable(s) entered on step 1: Using Purpose, Your Grades Before Use Net, Does Net Negatively Effect Your Grades, If Negative Effect Than What Are Your Grades Now, How Study Effect.

INTERPRETATION:

Table suggests that the two of the regressing variables, does internet negatively affects your grads and how your academic activities affected by using internet, are observed highly significant and informative variables for the response variable y.

Therefore the prediction equation for the probability of grade not affected (the probability that $y=1$) could be

$$Y^{\wedge} = \frac{\exp(5.594-1.161X_1+0.992X_2-2.750X_3-1.285X_4+0.136X_5)}{1+\exp(5.594-1.161X_1+0.992X_2-2.750X_3-1.285X_4+0.136X_5)}$$

CONCLUSION / DISCUSSION

Our findings suggest that 80% of the teenagers study has not negatively affected due to the internet usage. While, we can conclude from the above discussion that 25% of the teenagers whose family relationships has been negatively influenced by internet usage.

As, it is unexpected regarding to my perceptions, may be one of the reason is that Kinnaird College for Women is one of the re-known academic institution in Pakistan and almost 90% of the students/teenagers are serious in their studies. So, might be this is one of the reason of such positive findings.

REFERENCES

1. Sook-Jung Lee, Young-Gil Chae (2007). *Cyber Psychology & Behaviour*, 10(5), 640-644. doi:10.1089/cpb.2007.9975.
2. Chang-Hoan Cho and Hongsik John Cheon (2005).. Children's Exposure to Negative Internet Content. *Effects of Family Context*, 49(4) 488-509.
3. Kaveri Subrahmanyam, Robert E. Kraut, Patricia M. Greenfield, and Elisheva F. Gross (2000). Children and Computer Technology, 10(2).
4. Carmella Kedem (1999). The Social Impact of the Internet on Our Society.
5. Jayashree Pakhare (2007). Advantage. and Disadvantages of Internet.

A STATISTICAL STUDY ON THE CELLULAR MOBILE INDUSTRY OF PAKISTAN

Mehreen Ashraf¹ and Waqas Samiullah Mahmood²

¹ Statistics Department, Kinnaird College for Women, Lahore

² College of Statistical & Actuarial Sciences, University of the Punjab, Lahore

ABSTRACT

Telecommunications services play a vital role in the growth of an economy because they promote efficiency and growth across a wide range of user industries in any country. In addition to improving the performance in response to the growing demand, firms may innovate more in order to compete with others. This paper evaluates and studies customer preferences regarding cellular services. Moreover, an attempt has been made to find the usage preferences of males and females, the factors that play an important role in enhancing customer awareness and attitudes towards a particular brand.

INTRODUCTION

Telecommunication is the assisted transmission of signals over a distance for the purpose of communication. Telecommunication is an important part of the world economy and the telecommunication industry's revenue is placed at as high as approximately 3 percent of the gross world product. More and more people are using cellular phones and the world is increasingly becoming unwired. In 2006, estimates placed the telecommunication industry's revenue at \$1.2 trillion or just under 3% of the gross world product (official exchange rate).

Cellular technology has been available since 1980's in Asian countries. Telecommunication is an important part of modern society. Pakistan is also in line with rest of the world. Mobile services in Pakistan began in late nineties. Licenses for operating cellular mobile services in Pakistan were awarded to M/s Pakcom Pvt. Ltd. (Instaphone) and Paktel simultaneously in 1990. Pakistan's telecommunication market is one of the hottest in the emerging economies. As the number of mobile subscribers climb up to 76 million, so does the competition and that makes it hard to tell which companies do well in future. Presently, there are six companies which provide mobile telephone services in Pakistan named as Instaphone, ZONG (formerly Paktel), Mobilink, Ufone, Telenor, Warid.

LITERATURE REVIEW

Amendola et al (1995) considered some technological and industrial aspects of cellular telephony and stressed the technological continuity among different generations of mobile systems. Kumar et al (2002) observed that handheld mobile communications have led to closer partnerships between a company and its customers and suppliers all over the world. Lommerud et al (2003) investigated the prospects for entry into an existing network in the telecommunication industry, and how public policy may promote a more competitive outcome. Banerjee et al (2004) used cluster analysis and related statistical techniques on a panel of 61 countries representing different regions and levels

of socio-economic development, and concluded that technological substitution in some countries, and economic substitution in others, may explain the observed patterns of development in global fixed and mobile telephony. Saleem (2005) considered the evolution of cost efficiency in the cellular mobile industry of Pakistan over the period 1994-2001. Ahn et al (2006) investigated determinants of customer churn in the Korean mobile telecommunication service market. Anita Seth et al (2007) developed a model of service quality and a set of dimensions for comparative evaluation which could provide useful directions to regulators and service providers.

OBJECTIVES AND METHODOLOGY

The primary objectives of this study are:

- ❖ To ascertain the usage preferences of males and females.
- ❖ Advertising plays an important role in changing customer awareness and attitudes towards a particular brand.

A semi-structured questionnaire consisting of 23 questions was devised and was administered on 153 students of Government College University Lahore.

LIMITATIONS

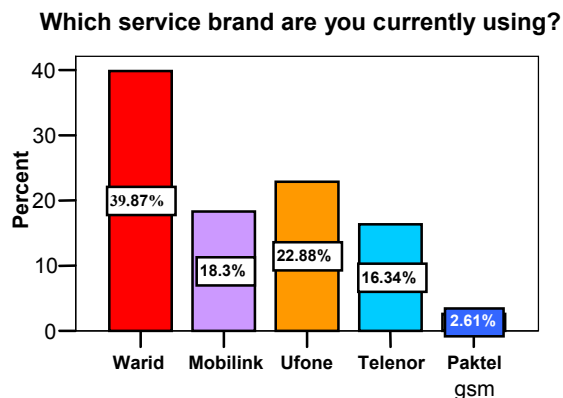
There is a risk of this research being biased because the data I am relying on does not cover larger part of the city. In this research I am mostly incorporating the views of people so there is a probability of being biased towards them.

DATA ANALYSIS

The data was analyzed using SPSS 15.0. Frequencies, percentages and the graphs are given for qualitative variables, Pearson chi-square and Fisher Exact Test were applied to observe associations. A p-value of less than < 0.05 was considered statistically significant.

RESULTS

96.1% respondent fall in the first age-group (18-25 years) and 3.9% fall in second age-group (26-32 years) where females are 89 (58%) and males are 64 (42%) out of 153. All the respondents are college going students where 19.6% are intermediate students, 30.1% are undergraduate students, 48.4% are graduate students and 2% are M. Phil students. 12.4% of respondents have their monthly household income less than Rs.10,000, 23.4% have their month household income between Rs.11,000-Rs.20,000, 27.6% have between Rs.21,000-Rs.30,000 and 36.6% respondents have their monthly household income greater than Rs.30,000. 18.3% of respondents use postpaid connections, 74.5% use prepaid connections and a very small number of respondents i.e 7.2% use both the connections postpaid and prepaid. 62.1% respondents own one mobile connection, 28.8% respondents own two mobile connections, 3.9% owns three mobile connections where as 5.2% respondents own more than three connections. 68.4% respondents said that media does play an important role in their purchase decision and 66.4% of respondents consider that television is the form of media that creates the greatest impact. 38% respondents found Mobilink's advertisements the most attractive followed by 22.3% respondents for Telenor. 43.4% respondents consider Mobilink that has the best image because of its best connectivity and better services.



Gender * Service brand currently being used:

		Which service brand are you currently using?					Total
		Warid	Mobilink	Ufone	Telenor	Paktel gsm	
Gender	Male	18	15	13	16	2	64
	Female	43	13	22	9	2	89
Total		61	28	35	25	4	153

Fisher's exact test = 10.903

P-value = 0.022

Significant association was observed between Gender and Service brand currently being used ($p < 0.022$) showing that from the total of 153, 61 respondents are using Warid connections out of which 43 are females and 18 are males. 28 respondents are using Mobilink out of which 15 are males and 13 are females. 35 respondents are using Ufone connections out of which 13 are males and 22 are females. 25 respondents are using Telenor out of which 16 respondents are males and 9 are females. 4 respondents are using Paktel gsm out of which 2 are males and 2 are females.

Gender * Main Influence In Deciding A New Connection:

Significant association was observed between gender and main influence in deciding a new connection ($p < 0.027$) which shows that from the total of 153, 34 females and 13 males are mainly influenced by family/relatives. 37 females and 26 males are influenced by their friends in deciding a new connection while 17 females and 12 males are influenced by media in deciding a new connection.

Gender * Major purpose for using cellular services:

Significant association was observed between gender and major purpose for using cellular services ($p < 0.038$) showing that 90 respondents are using cellular services for dialing/receiving calls out of which 52 are females and 38 are males. 46 respondents are using cellular services for SMS purpose out of which 32 are females and 14 are males. Equal number of respondent, 4 males and 4 females are using cellular services for MMS purpose, 4 males and 1 female use for GPRS and only 3 males are using cellular services for Power tools.

Gender *major attribute while deciding a new connection (Brand name):

Significant association was observed between gender and major attribute while deciding a new connection (Brand name), $p < 0.002$. Showing that the ratio of females is more than males as 26 females consider Brand name a very important attribute while deciding a new connection where as 11 males consider it very important.

Gender * major attribute while deciding a new connection (price):

Significant association was observed between gender and major attribute while deciding a new connection (Price), $p < 0.012$ which shows that from the total of 153, again the ratio of females is more than males as 32 females consider Price a very important attribute while deciding a new connection where as 25 males consider it very important.

Gender * awareness regarding special service feature (Missed Call Alert):

Significant association was observed between gender and awareness regarding special service feature (Missed Call Alert), $p < 0.039$ which shows that awareness of Missed call alert is more in females than in males as 54 females are fully aware of this service feature where as only 36 males are fully aware of it.

Gender * awareness regarding special service feature (GPRS):

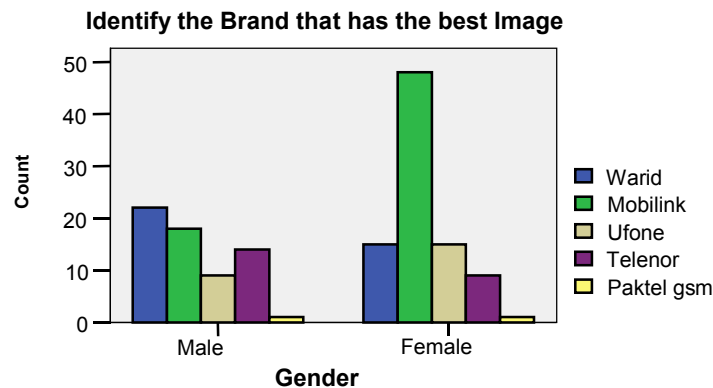
Significant association was observed between gender and awareness regarding special service feature (GPRS), $p < 0.007$ which shows that from the total of 58, 43 females and 15 males are not aware of this service feature. 24 male and 25 females out of 49 are somewhat aware while from the total of 46, 25 males and 21 females are fully aware of GPRS service.

Gender * Average amount spent per month on cellular services:

Significant association was observed between gender and average amount spent per month on cellular services, $p < 0.000$. Showing that 53 females and 15 males spent less than Rs.500 on cellular services. 22 males and 12 females spent between Rs.500-Rs.1000. 17 males and 14 females spent between Rs.1001-Rs.2000 where as equal number of respondent, 10 females and 10 males spent more than Rs.2000 on their cellular services.

Gender * Brand that has the best image:

Significant association was observed between gender and the Brand that has the best image (Fisher's Exact Test = 0.004) showing that 22 males out of 64 consider Warid has the best image where as 48 females out of 88 consider Mobilink has the best image.



Gender * why the above brand has the best image:

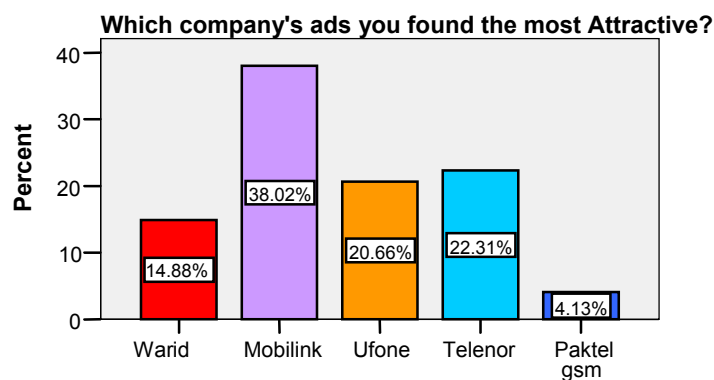
Significant association was observed between gender and why the above brands have the best image ($p < 0.016$) showing that from the total of 64, 22 males consider Warid has the best image because of its wider coverage where as 48 females out of 88 consider Mobilink has the best image because of its best connectivity and services.

Do media play an effective role in your purchase decision * Form of media that creates greatest impact?

Significant association was observed between these two variables ($p < 0.000$) showing that from the total of 122, 104 respondents said that the media do play an important role in their purchase decision and the form of media that creates greatest impact is Television.

Do media play an effective role in your purchase decision * which company's ads you found the most attractive?

Significant association was observed between these two variables ($p < 0.003$) which shows that from the total of 122, 104 respondents said that the media do play an important role in their purchase decision and the company's ad they found the most attractive is of Mobilink.

**CONCLUSIONS**

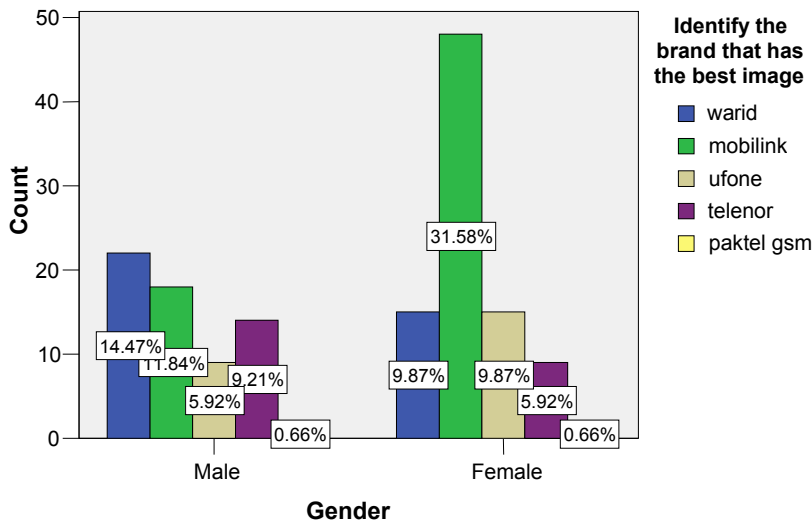
Its an on going research and these are the initial findings of it so as the results have clearly indicated the usage preferences of males and females regarding cellular services. We have the evidence to conclude that the usage preferences of females are more as compared to males. Warid is the brand that is being mostly used by both females and males because of its lowest call rates and other facilities. The ratio of females is much more then males in dialing/receiving calls and SMS, major attributes while deciding a new connection (brand name and price), females are more inspired by their friends in deciding a new connection and advertisement does play an important role in changing customer awareness and attitude towards a particular brand. Males consider Warid the best brand because of its best connectivity and services and females are more towards Mobilink because of its wider coverage.

Paktel gsm has been neglected almost by every one as a very less ratio of females n males are using it. Here are some of the recommendations/suggestions for it:

- Perceptions need to be changed
- Revise their pricing strategy.
- Change their marketing strategy
- Franchises should be up to the mark.
- New technology should be introduced.

REFERENCES:

1. Ahn, Jae-Hyeon, Sang-Pil Han and Yung-Seop Lee (2006). Customer churn analysis: Churn determinants and mediation effects of partial defection in the Korean mobile telecommunications service industry. *Telecommunications Policy*, 30(10-11), 552-568.
2. Amendola, G. and A. Ferraiuolo (1995). Regulating mobile communications. *Telecommunications Policy*, 19(1) 29-42.
3. Kumar, S. and C. Zahn (2002). Mobile communications: evolution and impact on business operations. *Technovation*, 23(6), 515-520.
4. Lommerud, K.E. and L. Sorgard, (2003). Entry in telecommunication: customer loyalty, price sensitivity and access prices, *Information Economics and Policy*, 15(1), 55-72.
5. Mohammad, Saleem (2005). *Cost Efficiency of Cellular Mobile Firms in Pakistan*. Ph.D. Thesis, Bahauddin Zakariya University, Multan.
6. Seth, A., Gupta, H.M. and Momaya, K. (2007). Quality of service parameters in cellular mobile communication. *International Journal of Mobile Communications (IJMC)*, 5(1). 68-93.



REVIEW OF APPLICATIONS OF INTELLIGENT METHODS IN PHYSICS

Adeel Akram¹, Rana Usman Ali¹, Muhayyuddin Gillani¹, Khalil Ahmed¹,
M. Saleem Khan² and Wajahat M. Qazi^{2*}

¹ School of Computer Sciences, NCBA&E, Lahore Pakistan

² Physics Department, GC University, Lahore, Pakistan

*Corresponding Author: wmqazi@yahoo.com

ABSTRACT

Intelligent methods, especially with reference to machine learning have gained significant importance in theoretical, experimental and computational physics. This paper intends to describe the strength of these intelligent methods by reviewing their important application in physics.

INTRODUCTION

Indeed traditional methods have played an important role to solve significant problems in the domain of sciences, particularly in physics but have certain limitations. One of the major limitations is that, the theoretical rationale behind the underlying physical phenomena should be known before developing a working model.

In past few years intelligent methods have played an important role in this regard. They try to learn/discover an empirical model(s) from the data where theory is not available.

This study reviews the application of intelligent methods with reference to machine learning in physics.

APPLICATION OF INTELLIGENT METHODS IN PHYSICS

In nuclear physics, neural networks have been applied to solve slab-geometry neutron diffusion problem (Brantley, 2000). Concentration level of radioactive radiation in the environment was also predicted by neural network (Lynch, et al. 2001). The neutron noise data reduction, analysis and interpretation were performed by these models (Korsah, et al. 1992). In nuclear power stations, expert systems have been used to control the station (Beck, 1992).

In high energy physics, the study of proton-proton collision was also reported in literature (El-Bakry and El-Metwally, 2003). Application of neural networks in pattern recognition (Kolanoski, 1996) and particle reconstruction has also been reported (Muresan, 1997).

Studies have also reported the use of fuzzy logic in data analysis of nonlinear functions for approximation and classification (Marcello, 1996 and Falchieri, 2002).

In astrophysics and cosmology, Bayesian model and its variations have played an important role (Ford and Gregory, 2007; John, 2005 and Trotta, 2008). They were used

for parameter estimation and experimental designs to compute the marginal posterior probability in the context of Radial velocity (RV) planet search (Ford, and Gregory, 2007). They were also applied to predict deceleration time of the universe, by analyzing the astronomical data (John, 2005).

Studies in biophysics have extensively reported the use of hidden markov models (HMM) to solve complex problems (Feron and Djafari, 2004). HMM is the proposed tool in experimental physics (Kanter, 2005). HMM have also been used to study low dimensional electronics system, which reveal time dependent resistance noise (Kanter, 2005).

In quantum mechanic genetic algorithm have been applied to study quantum dot (Sahin, 2006). Schrödinger wave equation was also solved using genetic algorithms (Saha and Bhattacharyya, 2004).

Most importantly fuzzy logic was used to model chaos for nonlinear dynamic systems (Li, 2003).

DISCUSSION

Cited literature in this study suggested that intelligent methods are usually used when solution of problem cannot be found by traditional techniques.

One of limitation in traditional models is that they depend on the number of occurrence of an event (Trotta, 2008). Therefore they do not take into account events with low frequencies (Trotta, 2008). Such problems are solved by using Bayesian models as they compute the degree of belief of a proposition (Trotta, 2008).

Furthermore traditions methods have limitations to solve systems with multiple peaks or discontinuous surface (Kemp, 2006). In such cases it is very hard to identify the right solution peak using traditional methods (Kemp, 2006). As being calculus based techniques they apply derivative test to calculate peaks of the surface (maxima) and may find a solution which is local maxima; while skipping the global maxima (which may be the solution) (Kemp, 2006).

Intelligent method provides optimization techniques which uses a population of solutions, over the whole surface to find the exact solution (maxima) without keeping in view whether it is local or global maxima (Kemp, 2006).

The above review proposed that to solve complex problem in physics and to deal with technical limitations, intelligent methods are playing significant roles. These methods for example, HMM are expected to become standard experimental techniques in physics (Kanter, et al. 2005).

REFERENCES

1. Beck, C.E., Behera, A.K. and Reed, M.L. (1992). Expert system applications in nuclear plants: discussion of the keyissues. *IEEE* 1363-1368.
2. Brantley, P.S. (2000). *Artificial neural network Solutions of Slab-geometry Neutron Diffusion problems*. American Nuclear Society ANS/ENS 2000 International Winter Meeting & Embedded Topical Meetings, Washington, DC.

3. Falchieri, D., Gabrielli, A. and Gandolfi, E. (2002). Very fast rate 2-input fuzzy processor for high energy physics, *Fuzzy Sets and Systems*, 261-272.
4. El-Bakry, M.Y. and El-Metwally, KA. (2003). Neural network model for proton-proton collision at high energy. *Chaos, Solitons and Fractals*, 16, 279-285.
5. Feron, O. and Djafari M.A. (2004). A Hidden Markov model for Bayesian data fusion of multivariate signals. *Fifth Int. Triennial Calcutta Symposium on Probability and Statistics*, Calcutta, India.
6. Ford, B.E. and Gregory, C.P. (2007). Bayesian model Selection and Extrasolar Planet Detection. *ASP Conference Series* Vol. 2007 1-1.
7. John, V.M. (2005). Cosmography, Decelerating Past, and Cosmological Model: Learning the Bayesian Way. *Astrophysics Journal*, 630: 667-674.
8. Kanter, I., Frydman, A. and Ater, A. (2005). Utilizing hidden Markov processes as a tool for experimental physics, *Europhys. Lett.*, 69, 798-804.
9. Kemp, R. (2006). An Introduction to Genetic Algorithms for Neural Networks, University of Cambridge. http://www.msm.cam.ac.uk/phase-trans/2006/ga_html_files/ga.html
10. Kolanoski, H. (1996). Application of Artificial Neural Networks in Particle Physics, *Proc. of the 1996 International Conference on Artificial Neural Networks*, 1-14.
11. Korsah, K., Damiano, B. and Wood, R.T.(1992). Representation of neutron noise data using neural networks. *Presented at the 8th Power Plant Dynamics, Control and Testing Symposium*, Knoxville, TN.
12. Li, Z. (2003). Fuzzy chaos generators for nonlinear dynamical systems, *Physics and Control*, 2003. *Proceedings. 2003 International Conference*, 429-433.
13. Lynch, M., Patel, H., Abrahamse, A., Rajendran, R.A. and Medsker L. (2001). Neural Network Application in Physics, *IEEE* 2054-2058.
14. Marcello, C., Francesco, Masulli. and Massimo, P. (1996). Fuzzy systems in high-energy physics, *Proc. SPIE* Vol. 2761, 163-171.
15. Saha, R. and Bhattacharyya, P.S. (2004). On Solving Schrodinger equation for the ground state of a two-electron Atom Using Genetic Algorithm, *Current Science*, 960-963.
16. Sahin, M., Atav U. and Tomoak, M. (2006). Application of Genetic Algorithm to Quantum Mechanical Systems, *Turk J Phys.* 253-275.
17. Muresan, R. (1997). Data analysis in relativistic nuclear physics using neural network. *Czechoslovak Journal of Physics*, 47, 945-949.
18. Trotta, R. (2008). Bayes in the Sky: Bayesian Inference and Model Selection in Cosmology, *Contemporary Physics*, 1-41.

**A CONCEPTUAL FRAMEWORK FOR WOMEN POVERTY ALLEVIATION
USING DECISION SUPPORT STRATEGIES**

Tooba Batool and Khalil Ahmed

School of Computer Sciences, National College of Business Administration
and Economics, Lahore, Lahore. Email: tooba_b@hotmail.com

ABSTRACT

It is a universally recognized phenomenon that sustainable patterns of socioeconomic development cannot be attained without mainstreaming women as equal contributors for the development process. Therefore it is essential to increase the female empowerment by their training, awareness and utilizing the recourses of rural area for economic stability. This paper presents a conceptual framework for developing practicable business patterns to facilitate all phases of local women's decision-making process for sustainable income generating activity. It provides complete support and awareness so that the talents and skills of female sector can be brought into practice through various partnerships and e-technologies.

1. INTRODUCTION

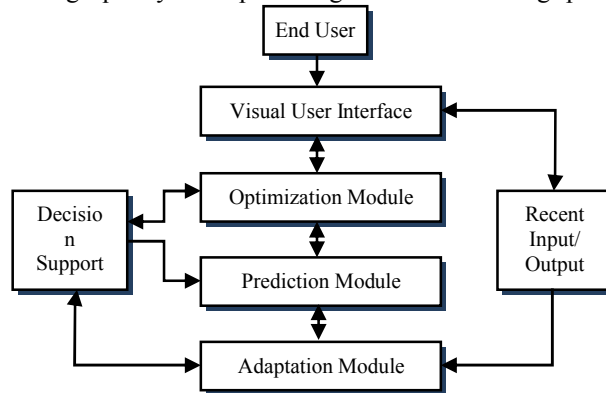
An analysis of poverty in Pakistan from gender lens reveals that the brunt of poverty in Pakistan is borne by women and is reflected in the poor human development indicators [12]. Women are restricted to the "inside" space of home and household, embodied in the tradition of prohibition. This restricts women's access to education, employment, training opportunities and social services. Another important aspect is the social disapproval of women working outside the home translates into the invisibility of women in the labor force. Although they participate actively in the family and farm affairs, their unpaid work is perceived as a social duty rather than an economic contribution.

Therefore it is important to focus on the survival skills of the beneficiaries and their major thrust is on poverty alleviation. The proposed framework will improve the socio-economic status of women in both urban and rural areas by creating opportunities for their development through enhanced economic participation [3]. Many organizations, Government agencies and NGOs launch numbers of projects to support the rural area female but they are unaware about these projects and if they know their long procedure of filling forms, choice of grant and contacting them is cause of hesitation for them. In the propose framework the user will enter her complete profile and system will suggest which technical or professional course is suitable, available technical institute in that area with complete information of course duration, and admission procedure etc, after completion how to utilize it for starting business and from where get economic support for that business. Poverty reduction strategy emphasize on the importance to women mainstreaming in economy through market, skills and credit and engendered governance. This framework combines prediction, optimization, and adaptation techniques with the proper utilization of community resources to improve the quality of life by;

- advisory and consultancy services for investment
- identification of agricultural and industrial projects for potential women
- training in technical and managerial skills
- market development for the products of women entrepreneurs
- promoting clients' products in national and international
- provide financial aids and loans on easy terms

2. POVERTY ALLEVIATION FRAMEWORK

This framework classifies the complete user decision-making process as a process encompassing identification, intelligence, design, choice, implementation, and control stages. Main tasks in each of the six stages respectively are identifying and specifying user requirements, designing feasible decision plans for individual, evaluating and selecting the optimal or the most satisfactory decision plan, implementing the chosen decision plan, as well as controlling quality and providing feedbacks during plan execution [5]. The system detects data trends in a dynamic environment, incorporates optimization module to recommend a near-optimum decision, and includes Adaptation modules to improve future recommendations [6]. As figure 1 shows, flow from data acquisition to recommended action, including adaptation module.



- The Visual User Interface:** The visual user interface allow users to generate and submit requests for information and decisions, to browse the contents of retrieved information and the computational results of decision modules, to revise inputs of decision procedures and activate what if analysis, to give feedbacks with respect to system outcomes and performances, to select and execute applications and functions, to login and logout the system. The VUI goal is to reduce the amount of extraneous thinking users must do to successfully move between parts of application and use its features. Therefore VUI provides wizard to navigate through a series of screens. A user performing a task might click on a link to a secondary task that moves away from the sequence of screens that make up the primary task. Use of icons with the different options makes the user more comfortable and familiar with the screen. The VUI multilingual quality facilitates different type of users to enter their data with ease.
- Optimization Module:** The optimization module performs two main jobs by providing user or organization data for input and to recommend the best possible solution because this recommendation is based on prediction. Optimization Module arrange user and organization profile for information management and then pass it to prediction module as input, after processing on it the recommended best business plans are given back to optimization Module for resulting output to evaluate the

solution. There are three basic levels of optimization from which one is implemented according to predicted output.

- i) **NONE:** No optimization is done, except for what is necessary in order to translate the plan.
- ii) **BASIC:** Some basic optimization is done, it add few new features to make the plan more compatible with the requirements of the user.
- iii) **FULL:** All optimization techniques are applied to select the best-predicted plan for the local user.

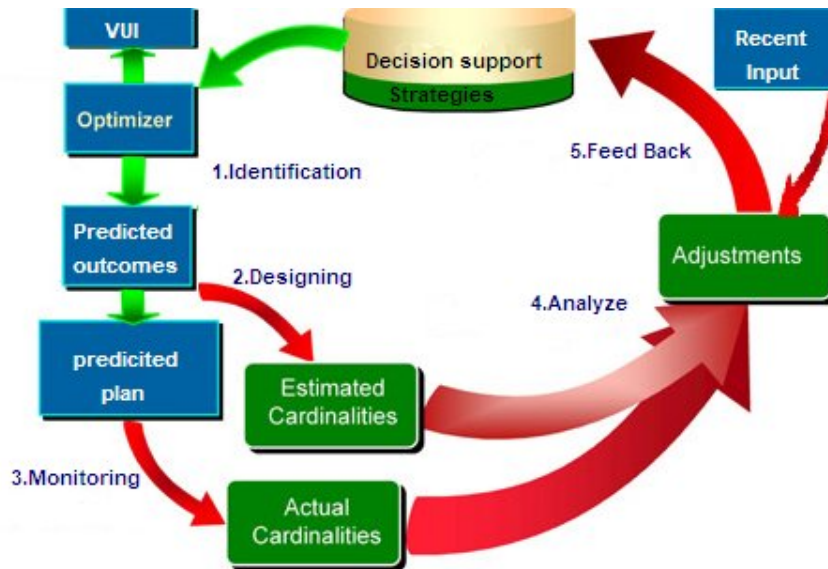
A variety of evolutionary algorithms (EAs), such as genetic algorithms and genetic programming have been successfully applied to numerous problems both at the level of structural and parametric optimization [8].

- c. **Prediction Module:** The Prediction module's are designed to analyze and calculate component, best plans and plan failure rates, in accordance with the appropriate standard and provided profiles. After the analysis is completed it recommend the best, and these recommendations are based on user specifications and requirements provided by Optimization Module. Prediction module aim at predicting outcomes on the basis of a given set of variables: they estimate what should be the outcome of a given situation with a certain condition defined by the values of the given set of variables. The steps that have to be performed during development of such plans are:
 - i) Selection of the outcome attribute;
 - ii) Selection of predictor (input) variables;
 - iii) Data collection;
 - iv) Assembly of the plan;
 - v) Validation of the plan; and
 - vi) Updates and modifications of the plan

Rule Induction can be used to predict effective business procedure for a local user. Rule induction is a machine learning technique that induces decision rules from data [9]. These rules are simple, logic rules that are often highly predictive.

- d. **Adaptation module:** An intelligent software system require a prediction module and optimizer, by themselves they're insufficient for today's rapidly changing environment. Adaptation can accomplish by slightly altering the learned relationship between input and output as needed. An ideal adaptive solution can decide the update frequency for itself by continuously measuring its own prediction errors and adjusting its parameters accordingly. Theory-based Bayesian models of induction can be successfully used for adaptation module .It focuses on three important questions: what is the content of probabilistic theories, how are they used to support rapid learning, and how can they themselves be learned [10]. The learner observes data about the world and must predict other unobserved data. The learner's intuitive theory generates hypotheses that can explain the observed data and that support the desired predictions.
- e. **Decision Support Strategies:** Decision Support System integrates the management of strategies, resources, activities and information about plan, with a view to improving effectiveness, efficiency and accountability, and achieving results. It

applied in identifying, planning, analyzing, monitoring, evaluating and controlling the plan with management initiative for the final business proposal[11].



Decision Support system Strategies helps to

- Provide user complete profile requirements and determining their causes and effects;
- Provide full supportive data for Designing strategies and activities that will lead to the plan.
- Balancing expected results with the resources available;
- Monitoring progress regularly and adjusting the activities as needed to ensure that the desired results are achieved;
- Evaluating, documenting and incorporating lessons learned into decision making for the next planning phase

Decision support strategies will contribute towards achieving the overall results defined for the proposed business plan

3. CONCLUSIONS

This paper presents a conceptual framework for poverty alleviation, and discusses how this approach can be applied to support personalized decision making. All phases of the user decision-making process can be supported, in which local women will find an intelligent assistance for business within its available practices. This framework ensures decision support services with the help of its unique multi-dimensional data and knowledge repositories which are essential to make multi-option decisions. The proposed framework will improve the living conditions of people through close collaborating with all tiers of the government: federal, provincial and district with civil society organizations, private sector and the beneficiary communities.

REFERENCES

1. Alexandre Gachet and Pius Haettenschwile (2003). *Developing Intelligent Decision Support Systems: A Bipartite Approach*. Springer Berlin / Heidelberg.
2. Babka, O. (1998). Decision support system learning from history cases. In the *Proceedings of the IASTED International Conference Intelligent Systems and Control (ISC '98)*, Halifax, Nova Scotia, Canada, June 1-3.
3. UNDP and Planning Commission of Pakistan (2008). *Center of Poverty Reduction and Social Policy Development Project Document*.
4. Chien-Chih Yu (2004). *National ChengChi University, A Web-Based Consumer-Oriented Intelligent Decision Support System for Personalized E-Services*. ACM.
5. Grzymala-Busse, J.W. (2002). Discretization of numerical attributes. In W. Klösgen, & J.
6. <http://www.nationalliteracytrust.org.uk/Research/boysresearch.html>
7. <http://www.pakistan.gov.pk/ministries/index.jsp?MinID=17&cPath=182>
8. Joshua B. Tenenbaum, Thomas L. Griffiths and Charles Kemp (2006). Theory-based Bayesian models of inductive learning and reasoning. *Trends Cogn. Sci.* 10(7), 309-18.
9. Khoshgoftaar, T.M. and Seliya, N. (2002). Tree-based software quality models for fault prediction. In the Proceedings of *Eight International Software Metrics Symposium*, Ottawa, Canada, 203-214. Los Alamitos, CA: IEEE Computer Society.
10. Marek Reformat, Petr Musilek, and Efe Igbide (2007). *Intelligent Analysis of Software Maintenance Data*. University of Alberta, Canada, Idea Group Inc.
11. Martin Schmidt, Matthew Michalewicz, and Constantin Chiriac (2005). *An Intelligent Decision-Support System*. IEEE Computer Society.
12. Economic Affairs Division. *MGD-Driven Poverty Policy Package, Project document 2007-2010*. Government of Pakistan, Islamabad.
13. W. Klossgen and J. Zytlow (2002). *Handbook of Data Mining and Knowledge Discovery*. Oxford University Press, 218-225.

GENERATION OF EMOTIONS IN NEURAL NETWORKS BASED ON EXPERIENCE

Atifa Athar and Khalil Ahmed

National College of Business Administration and Economics, Lahore
Email: atifaathar@yahoo.com

ABSTRACT

Human mind has a complex system and an emotion can be considered as a unit of it. The human mind has the capability to respond to the real time situations while continually reviewing the past emotional experience. By the implementation of this ability of mind, this paper presents a conceptual model for neural networks to cater the process of regeneration of emotions by simulating the brain processing phenomenon for emotion regeneration in transitory and evolutionary patterns based on experience.

1. INTRODUCTION

An emotion is not an observation of physical states, nor is it just a cognitive evaluation of one's overall situation. Rather, an emotion is a process of neural activity in the system (mind) including inputs from physical states and external senses and producing some output actions. All human beings experience and distinguish a wide variety of emotions. The English language has hundreds of words for different emotions, ranging from the commonplace "happy" and "sad" to the more esoteric and extreme "euphoric" and "dejected" (Wordnet, 2005). Some emotions, such as happiness, sadness, surprise, fear, anger and disgust, seem to be universal across human cultures (Ekman, 2003), while others may vary with different languages and cultures [1].

The human emotions are realized by mind when it sense, an external stimulus. After the realization, these emotions go to the working memory. The working memory acts as a moderator for the short-term preservation of these emotions. At birth, our minds have only one level; a "conscious" level [2]. In overall mind formation the conscious is a high level structure because the representation of emotions resides in conscious, based on past experiences. When neural representations of already experienced emotions achieve high activation due to numerous reoccurrences, as an element of working memory these are transferred to the conscious. The emotions in conscious are bi-directionally connected with all other parts of the mind structure.

The subconscious is another level of mind which develops by the time. The subconscious operates below the level of conscious. Our experienced emotions are retained by the subconscious, implicitly and regenerated again in the conscious automatically when received some distinctive retrieval cue. The subconscious acts as an in-charge of human emotions.

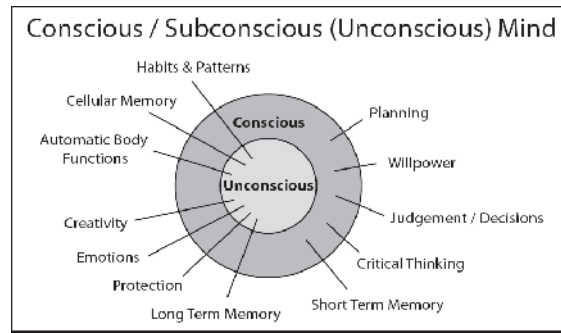


Fig. 1: Hypnosis [3]

The backward generation of an emotion from conscious to working memory depends upon assessment of emotional consciousness. This assessment can be performed on the basis of partial recognition of an emotion's parameters to address the transitory aspects. In Neural networks, to address this scenario the candidate is a neural conceptual model which receives inputs from environment and checks presence of related emotion patterns in conscious and decides about their generation in working memory. This model introduces a neural repository for the emotion storage after realization. This repository is distributed into three levels: The first level corresponds to the working memory where an emotion can be stored, which is experienced once. The intensity evaluation of that emotion specifies its transfer to the second level.

The second level of repository corresponds to the conscious where emotion patterns can be stored. In this model the characteristics of an experienced emotion plays an important role in the selection of that specific emotion to be regenerated from second level to the first level in the neural repository. The level of excitation of any specific emotion depends on its intensity. The intensity of that emotion in turns depends upon the environment sensing ability of the system.

The third level of neural repository corresponds to the subconscious where all emotions whether experienced once or already mutated are stored automatically in parallel to the second level. Whenever the system comes across a certain situation and gets some distinctive cue, the related emotions become excited to the second level.

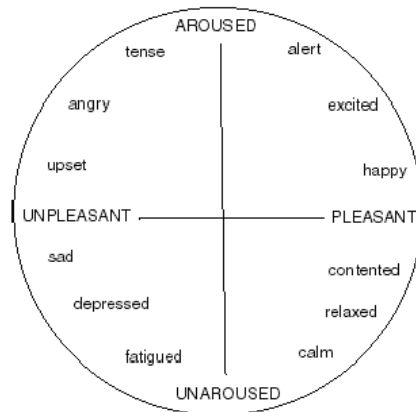


Fig. 2: Thagard (2005)

2. CHARACTERISTICS OF EMOTIONS

- a) **Valence of Emotions:** According to Russell (2003), valence of emotion is the positivity/negativity of some specific emotion.
- b) **Intensity of Emotions:** The intensity of an emotional experience is its degree of arousal, which varies among different emotions. For example exuberance and elation involve much more arousal than plain happiness or even less intense contentment. Similarly, terror is more aroused than fear or anxiety[4].
The most natural explanation of difference in intensity between emotional states with the same valence, for example being happy and being elated is in terms of firing rates in the relevant neural populations. For extreme happiness, we would expect more rapid firing of more neurons in regions associated with positive valence such as the dopamine areas and the left prefrontal cortex than would occur with moderate happiness [4]. The emotions can be located along these two dimensions, as shown in figure.
- c) **Change in emotions:** An emotion is not a constant thing. Emotional change includes shifts from one emotion to another due to the change in environment and dispersing some emotions. The time period of an emotion can be comparatively short rather than moods, which can last for hours or days. For example surprise lasts for only seconds.
- d) **Combinations of emotions:** The emotions are combined or integrated in the conscious mechanism of the human mind. The basic emotions provide the grounds for the existence of other more complex emotions. Different emotions can be affected by each other. These connections will also allow for the learning of complex emotions.
- e) **Segregation of emotions:** All emotions involve positive or negative valence and different degrees of intensity, but these two dimensions are not sufficient to differentiate consciousness of a full range of emotions.[4]. In the example of student's emotion mentioned above there are two emotions happy and relieved. Both of these are positive emotions having intensity from core to intense level. But these two emotions cannot be confused even these are similar up to some extent in the specific situation.

3. EMOTIONAL EXPERIENCE

Emotional experience starts logically with new external incentives such as an unexpected visit from an old friend. But usually an external incentive does not cause a new emotion generation. So the term "emotional experience" makes logic to generate an emotion from the neural repository in formulaic situations.

4. STATES OF EMOTIONS AS AN ENTITY

To explain the phenomena of emotional consciousness we need to know the following states of emotions.

- a) **Dependent:** Emotions do not crop up in isolated contexts, but are experienced, expressed, synchronized and responded in the course of interaction with environment. The attributes of an emotion are interdependent like environment sensing ability and its evaluation, quality of an emotion, emotional content, emotion-related signals and signs, and context.
- Irrecoverable loss for sadness [9].
 - Passing exam with flying colors for happiness.

- b) **Relational:** Emotions are affected by each other. They have elements of relations and their survival depends on the degree of relations. So we can stabilize the related emotions according to the specific situation. The relations could be observed for both the positive and negative emotions such as genuine joy, appear significantly less on the face of shocked patients as compared with the healthy women. The primary emotions are related to each other to form a full scale emotional experience just like we can make new colors from existing primary colors.
- c) **Mutative:** After defining the degree of relationships between emotions the next step is to decide that which emotions are powerful or weak. We need to decide that which emotions are required to be approached or avoided on the basis of their level of cooperation to perform some action or remain intact to the existing state or return to the initial state. The example of mutated emotions is just like a rainbow having different colors overlapping each other but maintaining their individual level of intensity.
- d) **Evolved:** The emotions do not have rigid nature rather these are floppy. An emotion is evolved through a process of frequent encounters with identical situations that can cause an evident change in its intensity level. A specific emotion can be evolved to another emotion if it is highly excited or de-excited along the intensity axis.
- e) **Transitive:** The emotions are required to be captured to perform certain actions in the range of a specific context. So after mutating certain emotion if its intensity goes beyond the trigger point then some specific reaction would be generated as the final output.

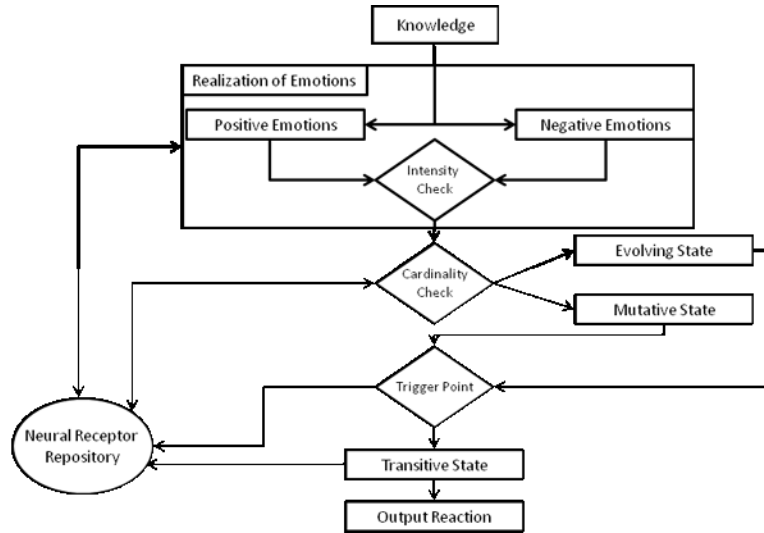
5. PROPOSED MODEL

By simulating the ability of mind, this paper presents a conceptual model to regenerate an emotion which has already been experienced in formulaic situations from the repository which consists of very short term memory, short term memory and long term memory. The activation of an emotion starts from some environmental cue and during the process of its realization; the values for its attributes are assessed and recorded in the neural receptor repository along with the emotional patterns. Neural receptor repository categorized in two levels of storage i.e. transitive storage and permanent storage. The transitive storage further divides into the primary transitive storage and secondary transitive storage. As discussed above, the key to understanding the onset and cessation of emotions is working memory (Fuster, 2003), it plays a vital role in the process of emotion generation, and same conception is being adopted in this proposed model. The Primary Transitive Storage in main neural receptor repository depicts the process of working memory in human mind. The primary transitive storage consists of neural population of emotions which is active in terms of neural firing. In neural terms, this part of storage consists of particular neurons and respective neural interconnections, while activity means the scale of neural firing.

The secondary transitive storage depicts the process of emotion generation in conscious of human mind. The emotional patterns are stored at this level with the specific values of their attributes and the current state of emotions. The different possible states of an emotion are evolving, mutative and transitive states. The process of regeneration of an emotion from secondary transitive level of repository to the primary level requires an input cue from the environment. By implementing the encoding process that incoming cue is interpreted and then combined with the information already stored at secondary level in the form of emotional experience. During encoding process the input cue and the

status of an emotion which is already residing at the secondary level would be evaluated along with its current state. This evaluation would provide the decision that whether that required emotion can be generated from secondary level to the primary level or not.

MODEL TO GENERATE AN EMOTION IN NEURAL NETWORKS



The permanent storage level depicts the role of subconscious in human mind. The data related to emotions is permanently stored in this part, implicitly in parallel to the transitive storage. During the retention process this permanent storage keeps the custody of encoded emotions. The proposed model portrays three distinctive states of an emotion i.e. Evolving, Mutative and Transitive; each state contains its exclusive properties as discussed above. An emotion can move in these states in accordance with its respective attributes. The further processing in this model is dependent upon emotion attributes; various conditional checks are defined to evaluate the neural process flow. All emotion's attributes are computable and provides the basis for conditional checks. The realization process requires an environmental input as knowledge to invoke the associated emotion. During this process the valence and intensity checks are applied to the emotion attributes and the values of these attributes are stored in the form of entries in the repository.

The state selection process for an emotion performs the decision making by applying a cardinality check on the attributes of it. At this stage there are two possible upcoming states for an emotion transformation i.e. mutative and evolving. If the cardinality of an emotion is less than 1, it would reside in the repository with its current state and properties otherwise there are two possibilities that an emotion could be transformed to the evolving state if the cardinality is 1 and could be transformed to the mutative state if the cardinality is more than 1. During mutation, the valence of emotions can be altered e.g. positive emotions can be changed in negative emotions and intensity level could be increased or decreased as well. Whereas during evolvement, the valence cannot be changed but intensity level could be increased or decreased along the intensity axis. The emotions in mutated or evolved state can change to the transitive state by applying trigger

point intensity check. If the intensity of emotions does not reach to the trigger point then these would be stored in neural receptor repository, otherwise these emotions would be transformed to the transitive state and perform some mandatory action as final output. The emotions in transitive state would be saved in neural receptor repository with all attributes and current state. The emotions stored in the neural repository forms the emotional experience. From this experience an emotion can be generated again due to some distinctive cue from the formulaic situations. The specific state of an emotion after regeneration depends upon the assessment of its attributes.

6. CONCLUSION

This paper attempts to identify the properties of emotions as an entity, the foundation for emotional experience and states of emotions.

Our proposed model provides the mechanism to generate an emotion from the emotional experience stored in neural receptor repository. It also includes different possible states of emotions and checks on its attributes which form the basis of emotion's transition in different states.

As an extension to this model we can further work on inflection of input cue and output action and a decision making criteria can be incorporated for the retrieval of an emotion from the permanent storage of the repository.

As a future work this model can be further implemented in neural networks using different neural operations to produce complex emotions from the exiting primary emotions in machines.

7. REFERENCES

1. Wierzbicka, A. (1999). *Emotions across languages and cultures: Diversity and universals*. Cambridge: Cambridge University Press.
2. *The Conscious, Subconscious, Unconscious: A New Look at an Old Metaphor*. www.theemergencesite.com/Theory/Consciousness-Subconsciousness-2.htm.
3. <http://www.ont-hypnosis-centre.com/ohc/ebook.pdf>
4. Thagard, P. and Aubie, B. (2007). Emotional consciousness: *A neural model of how cognitive appraisal and somatic perception interact to produce qualitative experience*. *Consciousness and Cognition*.
5. Cowie, R, Douglas-Cowie, E. and Cox, C. (2005). Beyond emotion archetypes: Databases for emotion modeling using neural networks. *Neural Networks*. 18(4), 371-388.
6. Schröder, M. and Cowie, R. (2006). *Developing a consistent view on emotion-oriented computing*. In Renals, S. & Bengio, S. (Ed.), *Machine Learning for Multimodal Interaction: LNCS 3869*, Springer, 194-205.
7. Russell, J.A. (2003). *Core affect and the psychological construction of emotion*. *Psychological Review*, Vol. 110 145-72.
8. Thagard, P. (2005). *Mind: Introduction to cognitive science*. Second Edition. Cambridge, MA: MIT Press.
9. www.wikipedia.com
10. [http://encarta.msn.com/encyclopedia_761578303_3/Memory_\(psychology\).html](http://encarta.msn.com/encyclopedia_761578303_3/Memory_(psychology).html)

A NEW CONCEPTUAL MODEL OF MACHINE TRANSLATION

Muhammad Anwar Saeed and Khalil Ahmed

School of Computer Sciences

National College of Business Administration and Economics, Lahore

Email: m_a_saeed@yahoo.com

ABSTRACT

With the advancement and implementation of technology in every field throughout the world, machine translation has become an essential requirement, especially for online information exchange. Computer programs are available for multi-lingual translation of technical manuals, scientific documents, commercial prospectuses, administrative memoranda, and medical reports but it still needs improvement. In this paper a conceptual model for automatic machine translation environment is proposed for an evolving multi-lingual translation mechanism.

INTRODUCTION

A computerized system used for translations is termed as machine translation (MT) which may or may not need human assistance. Computer based translation tools like online dictionaries, remote terminology databanks, transmission and reception of texts etc are excluded from this term. We can not draw a certain boundary between machine aided human translation (MAHT) and human aided machine translation (HAMT). The automation of the full translation process is the central core of MT. The ultimate goal of MT may be to produce high quality translation, but in practice the output is usually revised like most of the human translator. However, the types of errors produced by both types are different. MT output may be used as a rough draft for human translator (Hutchins, 1995).

Systems are designed either for two particular languages called bilingual systems or for more than a single pair of languages called multilingual systems. Bilingual systems may be designed to operate either in only one direction or in both directions. Multilingual systems are usually intended to be bidirectional; most bilingual systems are unidirectional (Hutchins, 1995).

Hutchins suggested in his work that the translation quality of MT systems may be improved either by developing more sophisticated methods or by imposing certain restrictions on the input. Firstly, the system may be designed to deal with texts limited to the sublanguage of a particular subject field and/or document type. Secondly, input texts may be written in a controlled language by restricting the range of vocabulary, and avoiding complex sentence structures. A third option is to require input texts to be marked (pre-edited) with indicators of prefixes, suffixes, word divisions, phrase and clause boundaries, or of different grammatical categories. Finally, the system itself may refer problems of ambiguity and selection to human operators for resolution during the processes of translation itself, in an interactive mode (Hutchins, 1995).

Hutchins described three different types of translation approaches. The first type is generally referred to as the direct translation approach. In this approach the MT system is designed in all details specifically for one particular pair of languages. Translation is direct from the source language (SL) text to the target language (TL) text by the assumption that the vocabulary and syntax of SL texts need not be analyzed any more than strictly necessary for the resolution of ambiguities, the correct identification of TL expressions and the specification of TL word order. Such direct translation systems are necessarily bilingual and unidirectional (Hutchins, 1995).

The second basic design strategy described by Hutchins is the inter-lingua approach, which assumes that it is possible to convert SL texts into representations common to more than one language. From such inter-lingual representations texts are generated into other languages. Translation is thus in two stages: from SL to the inter-lingua (IL) and from the IL to the TL. Procedures for SL analysis are intended to be SL-specific and not oriented to any particular TL; likewise programs for TL synthesis are TL specific and not designed for input from particular SLs. A common argument for the inter-lingua approach is economy of effort in a multilingual environment. Translation from and into n languages requires $n(n-1)$ bilingual direct translation systems; but with translation via an inter-lingua just $2n$ inter-lingual programs are needed. With more than three languages the inter-lingua approach is claimed to be more economic. On the other hand, the complexity of the inter-lingua itself is greatly increased. Interlinguas may be based on an artificial language, an auxiliary language, a set of semantic primitives presumed common to many or all languages, or a universal language independent vocabulary (Hutchins, 1995).

The third basic strategy is the less ambitious transfer approach. Rather than operating in two stages through a single inter-lingual representation, there are three stages involving underlying representations for both SL and TL texts. The first stage converts SL texts into abstract SL oriented representations; the second stage converts these into equivalent TL oriented representations; and the third generates the final TL texts. Whereas the inter-lingua approach necessarily requires complete resolution of all ambiguities in the SL text so that translation into any other language is possible, in the transfer approach only those ambiguities inherent in the language in question are tackled; problems of lexical differences between languages are dealt with in the second stage. Transfer systems consist typically of three types of dictionaries and various grammars (Hutchins, 1995).

The direct translation approach was typical of the first generation of MT systems. The indirect approach of inter-lingua and transfer based systems is often seen to characterize the second generation of MT system types. Both are based essentially on the specification of rules. Most recently, corpus-based methods have changed the traditional picture. During the last five years, there is beginning to emerge a third generation of hybrid systems combining the rule-based approaches of the earlier types and the more recent corpus-based methods. The differences between direct and indirect, transfer and inter-lingua, rule-based, knowledge-based and corpus-based are becoming less useful for the categorization of systems. Transfer systems incorporate inter-lingual features. Inter-lingua systems include transfer components. Rule-based systems make increasing use of

probabilistic data and stochastic methods. Statistics and example based systems include traditional rule-based grammatical categories and features (Hutchins, 1995).

The research on machine translation has a long tradition and a somehow disputed reputation. Like for many other disciplines of computational linguistics the overjoyed mood of the first days gave place to a pessimistic period of stagnation. The interest in machine translation systems faded away after they could not fulfill the unrealistic promises of the first hype. However, within the last few years this situation has changed considerably. In particular in Japan there have been extensive efforts regarding the automatic translation from Japanese into English and vice versa. One of the most prominent research directions in Japan has been example based machine translation, which relies on massive bilingual corpora to build a knowledge base of translation examples. New sentences are then translated by finding the most similar example. Unfortunately, this promising approach can only be successfully applied to language pairs for which enough bilingual data is available (Winiwarter, 2001).

Another popular approach, often incorporated in commercial products, is transfer-based machine translation. Transfer-based systems divide the translation problem into three parts: analysis, transfer, and generation. The analysis part parses the source sentence by means of a source grammar to create a structured representation. The transfer part applies a comparative grammar to map every source representation onto a target representation. Finally, the generation part produces the target sentence by using a target grammar. Most of the existing machine translation systems suffer from two severe weaknesses:

The transfer rules are static, i.e. they cannot be altered by the user.

The translation is realized as stand-alone program, which is not integrated into the accustomed workflow of the user (Winiwarter, 2001).

In this paper W. Winiwarter focuses on the important role of human language technology as one of the key technologies for the universal access to worldwide digital libraries. In particular, linguistic barriers caused by the multilingual nature of the global information pool require solutions from cross-language information retrieval and machine translation. In this research W. Winiwarter developed a machine translation environment for the automatic translation of Japanese documents into German. An important point regarding the implementation of the translation environment is that it is completely embedded in the widely used text processing program Word to ensure its easy use by any potential end user (Winiwarter, 2000).

In the earliest years, efforts were concentrated either on developing immediately useful systems or on fundamental research for high quality translation systems. After the ALPAC report in 1966, which virtually ended MT research in the US for more than a decade, research focused on the development of systems requiring human assistance for producing translations of technical documentation, on translation tools for direct use by translators themselves, and, in recent years, on systems for translating email, Web pages and other Internet documentation, where poor quality is acceptable in the interest of rapid results (Hutchins, 2001).

Mostly techniques used for text retrieval are based on the statistical analysis of a term either as a word or a phrase. Through the statistical analysis of a term frequency, it is only possible to capture the importance of the term within a document. In order to achieve a more accurate analysis the underlying representation should indicate terms that capture the semantics of text. In this case, the representation can capture terms that present the concepts of the sentence, which leads to discover the topic of the document. Based on this concept authors have proposed new concept-based representation, called Conceptual Ontological Graph (COG), where a concept can be either a word or a phrase and totally dependent on the sentence semantics, is introduced. The aim of the proposed representation is to extract the most important terms in a sentence and a document with respect to the meaning of the text. The COG representation analyzes each term at both the sentence and the document levels. This is different from the classical approach of analyzing terms at the document level. First, the proposed representation denotes the terms which contribute to the sentence semantics. Then, each term is chosen based on its position within the COG representation. Lastly, the selected terms are associated to their documents as features for the purpose of indexing before text retrieval. The COG representation can effectively discriminate between non-important terms with respect to sentence semantics and terms which hold the key concepts that represent the sentence meaning (S. Shehata, F Karray, and M Kamel, 2007).

DISCUSSION

For MT during analysis and synthesis, many systems exhibit clearly separated components involving different levels of linguistic description. From the observation analysis may be divided into morphological analysis, syntactic analysis, and semantic analysis. Synthesis may consist of semantic, syntactic, and morphological synthesis. In transfer systems, the transfer component may also have separate programs dealing with lexical transfer and with structural transfer. In some earlier forms of transfer systems analysis did not involve a semantic stage transfer was restricted to the conversion of syntactic structures, i.e. syntactic transfer alone (Hutchins, 1995).

In many older systems separation between transfer and synthesis were not clear. Even in some systems there were mixed data and processing rules and routines. Later systems were of modular nature with the capability of adaption of any change in system components, data and programs without effecting or damaging system efficiency as a whole. A further stage in some recent systems is the reversibility of analysis and synthesis components, i.e. the data and transformations used in the analysis of a particular language are applied in reverse when generating texts in that language. Recent developments underline what has always been true, namely that MT research and MT systems adopt a variety of methodologies in order to tackle the full range of language phenomena, complexities of terminology and structure, misspellings, ungrammatical sentences, neologisms, etc. The development of an operational MT system is necessarily a long-term engineering task applying techniques which are well known, reliable and well tested (Hutchins, 1995).

This research by Winiwarter was aimed to challenge the shortcomings by designing and implementing an environment for Embedded Adaptive Translation (EAT) for the automatic translation of Japanese documents into German, but due to the lack of available

bilingual corpora research could not follow the example-based translation paradigm. Instead researchers have adapted the transfer based approach to develop an efficient machine translation environment (Winiwarter, 2001).

This paper has presented a system, which aims at facilitating the global access to Japanese documents. It provides an adaptive machine translation environment, which can be fully embedded in the common spreadsheet program Excel, and EAT applies transfer-based machine translation to produce high quality automatic translations from Japanese into German. The adaptive behavior still has the capacity to be improved, so the system is able to run reverse translation leading to automatic update of the transfer rule base (Winiwarter, 2001).

An important point to be handled is the adaptation of the linguistic knowledge by the user. Although at the current state it is possible for the user to freely adapt the transformation rules for the individual steps of the translation process, but still there is a need to make the front-end for this adaptation more user-friendly. Also the system requires such a mechanism that the user can simply correct or improve the target sentence, which causes the system to run a reverse translation leading to an automatic update of the linguistic rule base (Winiwarter, 2000).

Many MT vendors have been providing network-based translation services for on-demand translation, sometimes with human revision as optional extra. In some cases these are client-server arrangements for regular users. The growing influence of the Internet has been reflected in the appearance MT software products specifically for translating Web pages. Japanese companies led the way, and they were followed quickly elsewhere. At the same time, companies began to offer translation services on the Internet, usually through MT portals. Equally significant has been the use of MT for electronic mail and for chat rooms. Although translation quality is often poor, given the colloquial nature of the source texts, it seems to be widely acceptable. It is now clear that different types of MT systems are required to meet widely differing translation needs (Hutchins, 2001).

In this work authors have tried to narrow down the gap between natural language processing and information retrieval disciplines. COG is proposed to enhance the text retrieval quality substantially. By exploiting the semantic structure of the sentences in documents, a better text retrieval quality is achieved. This representation captures the structure of the sentence semantics represented in the COG hierarchical levels. Such a representation allows choosing concepts that actually contribute to the meaning of the sentence. This leads to perform concept matching and weighting calculations in each document in a very robust and accurate way. The quality of the ranking results achieved by this representation significantly surpasses that of traditional ranking approaches. It is assumed that on the basis of this work it is possible to link the presented work to web document retrieval. Also, this concept can be applied to text classification (S. Shehata, F Karray, and M Kamel, 2007).

PROPOSED CONCEPTUAL MODEL

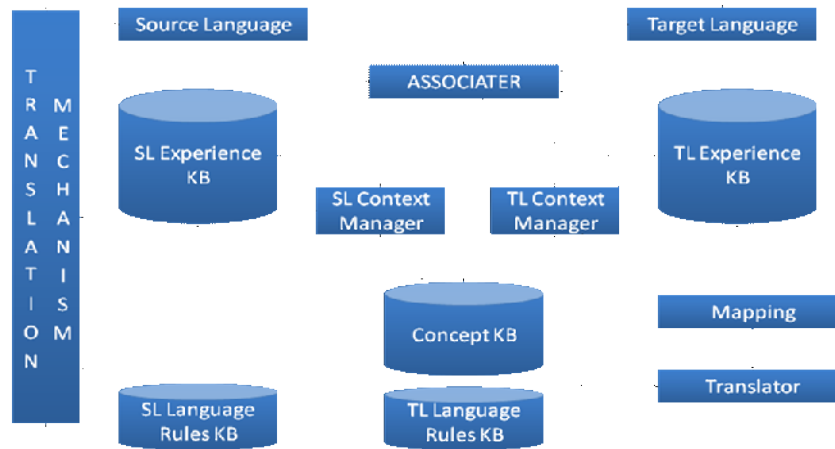
The proposed conceptual model for MT is based on the self organizing colonies of different languages. Agents have associations with other respective agents in same colony

and other colonies. The frequency of a word does not reflect the importance of a word in a language. There may be some words though not frequent but have a significant role in translation. This problem is handled by tagging a concept with each word or phrase. These concepts can be shared and used to develop new concepts both for source and target language because of layered approach. Best possible translation can be produced using these concepts. Due to its evolving nature mistakes will not be repeated and eventually an almost perfect translation environment will be achieved. Model consists of three layers. First layer contains the concepts and their inner-associations. In second layer agents have associations with other language agents of first and second layer. This layer agent can generate request for concept across the colony. Layer above these layers is responsible for language manipulation.

In order to develop some basic concepts, the method defined by S. Shehata, F Karray, and M Kamel in their work can be used. For a given input to a specific colony, the input is analyzed and parsed into different conceptual grammatical parts of a language. For each grammatical part there is a unique agent, which is responsible to map the given input to the target output. All the concepts learned are stored in a knowledge base (KB), and if there is no concept available in the KB then a new concept will be developed. New concepts are developed from the basic concepts. In a situation where basic concepts are not enough to develop a new concept, concepts in the target language associated with the second layers will be used. All these concepts will be used to develop a different map. If more maps of same level of acceptance are available then the concept used most of the time will be used and will be prompted for feedback about the correctness and quality of translation. Based on the feedback, suitability of a concept for a certain environment will be decided.

There are three different parts in a colony having its own KB. First part is responsible to analyze the input and parse it into grammatical part. In the second part agents map the parsed input into the target language grammar. If there is no concept in the KB then a request is generated at second layer to other colonies/ target language to have a proper map. On the bases of returned concepts translation of source grammatical part to the target grammatical part is performed and new concept is stored in KB. In the third part translation of given input to the target language is generated by mapping the grammatical parts of the target language using concept in the KB of third part to produce the best possible quality translation. Agents within a colony for different grammatical portion have association with each other, which represents the proper concept of a certain word or a phrase.

This mechanism will help to resolve the problem of reverse translation and automatic update of the linguistic rule base. Also this model can fulfill the MT requirement over Web. This model is independent of front-end application and provide a facility to develop a user friendly front-end in any language/tool. Associations can be classified as Local Association for Agent's own language and Global Association for the association of other colonies. Each colony (language) will have a local Lexical and Syntactic analyzer. This proposed model can work with any front-end user interface.



CONCLUSION

Proposed conceptual model has the capability to cope the problems faced in the translation in previous work. Due to its evolving nature mistakes in translation will be reduced, human dependency is also reduced. Model is also suitable for any environment and is capable of producing multi-lingual translation. During its evolution this model is capable to achieve a stage where it can translate any language using its own KB. Model can perform effectively for web based applications and solves the user friendly front-end problem.

REFERENCES

1. Hutchins, W.J. (1995). Machine Translation: A Brief History. *Concise history of the language sciences: from the Sumerians to the cognitivists*. Edited by E. F. K. Koerner and R. E. Asher, Oxford: Pergamon Press, 431-445.
2. Werner Winiwarter (2001). Embedded Adaptive Machine Translation Environments. *ÖGAI Journal*, 20(1), 15-21.
3. Werner Winiwarter (2000). Human Language Technology in Digital Libraries. *Research and Practice, 2000 Kyoto, International Conference*, 418-425.
4. Hutchins W.J. (2001). Machine translation over fifty years. *Histoire, Epistemologie, Language, Tome XXII*, fasc. 1, 7-31.
5. Shady Shehata, Fakhri Karray and Mohamed Kamel (2007). Enhancing Search Engine Quality Using Concept-based Text Retrieval. *2007 IEEE/WIC/ACM International Conference on Web Intelligence*, DOI 10.1109/WI.2007.132, 26-32

**WILD BOOTSTRAP TECHNIQUE FOR FINDING CONFIDENCE INTERVAL
OF TRUNCATED NEGATIVE BINOMIAL PARAMETER 'p'**

Muhammad Ibrahim Shamsi¹ and Ghulam Hussain²

¹ Department of Humanities & Science, NUCES-FAST,
Karachi. Email: ibrahim.shamsi@nu.edu.pk

² Department of Statistics, University of Karachi.
Email: ghussain1212004@yahoo.com

ABSTRACT

In formula based inferential statistics, many problems deal with the estimation of unknown parameters. This paper considers interval estimation. The bootstrap confidence intervals for the parameter 'p' of an unknown population are discussed. It is obtained by the two-stage wild bootstrap method. The results are illustrated with an example in which the investigated variable has the Truncated Negative Binomial distribution. We do not have to know the population distribution for determining the bootstrap confidence intervals for the parameters. This is the great advantage of bootstrap methods. The authors have developed a computer program that computes confidence limits using the procedure in this paper.

KEYWORDS

Wild Bootstrap, Confidence Interval, Truncated Negative Binomial Distribution.

I. INTRODUCTION

Bootstrapping is a procedure where repeated samples are drawn from the sample, discriminant analysis is conducted on the samples drawn, and an error rate is computed. The overall error rate and its sampling distribution are obtained from the error rates of the repeated samples that are drawn. Bootstrapping techniques require a considerable amount of computer time. However, with the advent of fast and cheaper computing, they are gaining popularity as a viable procedure for obtaining sampling distribution of statistics whose theoretical sampling distributions are not known.

In the section 2 we briefly review the method of wild bootstrap and its application for finite populations. Most of bootstrap literature is concerned with bootstrap implementations of tests, confidence intervals and application for estimation problems. It has been argued that for these problems bootstrap can be better understood if it is described as a plug-in method.

II. THE WILD BOOTSTRAP TECHNIQUE

Bradly Efron (1979) has developed a new and major subpart of resampling procedure name as 'Bootstrap'. It has swept the field of statistics to an extra ordinary extent. Let us consider a finite population that can view as a realization of a certain super population model.

$$Y_i = \beta X_i + \varepsilon_i \quad ; \quad i = 1, 2, 3, \dots, N, \quad (1)$$

where, Y_i 's are the measurement taken observations, β represents the regression parameter, X_i 's are assumed to be auxiliary quantities or past experiences. Also $\beta X_i = \mu_i$ are the true values of interest. The measurement errors ε_i 's are the identical and independent (i.i.d.) random variable such that

- $E(\varepsilon_i) = 0$ and
- The variation is independent of μ , i.e. $E(\varepsilon_i^2) = \sigma^2$

It cannot generally be assumed that the error distribution follows Normal with mean zero and variance σ^2 . To perform statistical test and to calculate confidence intervals the distribution of error ε_i has to be known. So the great challenge is how to gain information on the error distribution. Our motivation is to introduce the technique of Bootstrapping that aids us to extract the information about the residuals and to find the characteristics of the unknown population.

Wild bootstrap

It is basically a two stage resampling scheme, that was first suggested by Wu (1986), modified by Liu (1988) and finally proposed and given its name by Hardle and Mammen (1993). It is a variant of residual method but in this procedure i.i.d. observations are drawn from an external random variable with first moment zero and second and third moments both being one. The wild bootstrap residuals are constructed through multiplying these i.i.d. observations by the residuals in place. This method has more freedom for the assumption of heteroscedasticity.

Chen and Sitter (1993) have proposed a two stage resampling scheme; first simple random sampling without replacement in each stratum and then show that the resulting bootstrap sample is second order efficient.

In our study we follow the same technique of two-stage wild bootstrapping. That is given a sample $S = \{i_1, i_2, \dots, i_n\}$ from a population u and any estimator $\hat{\beta}$ as define on model (1). Estimate the residuals $\hat{\varepsilon}_i = Y_i - \hat{\beta}X_i$; $i \in S$, then generate n independent wild bootstrap components $\{Z_1, \dots, Z_n\}$ of a random variable Z with $E(Z)=0$ and $E(Z^2)=1$ and set

$$Y_i^* = \hat{\beta}X_i + \varepsilon_i^* \quad \text{with} \quad \varepsilon_i^* = \hat{\varepsilon}_i Z_i \quad ; \quad i \in S \quad (2)$$

Technically speaking, each wild bootstrap observation is drawn from a distribution that mimics its corresponding sampling distribution through matching up the first three moments.

III. THE TRUNCATED NEGATIVE BINOMIAL DISTRIBUTION

The Negative binomial distribution is a two parameter discrete distribution. It is use extensively for the description of data that are too heterogeneous to be fitted by the Poisson distribution. It can be defined in terms of the expansion of the negative binomial

expansion $(Q-P)^k$, where $Q = 1 + P$, $P > 0$, and k is positive real; the $(x + 1)^{\text{th}}$ term in the expansion yields $\Pr[X = x]$.

Thus the negative binomial distribution with parameters k , P , is the distribution of the random variable X for which

$$\Pr[X = x] = \binom{k+x-1}{k-1} \left(\frac{P}{Q}\right)^x \left(1 - \frac{P}{Q}\right)^k ; \quad x = 0, 1, 2, \dots \quad (3)$$

where $Q = 1 + P$, $P > 0$ and $k > 0$.

The mean and variance are

$$\mu = kP \quad \text{and} \quad \mu_2 = kP(1 + P). \quad (4)$$

This parameterization (but with the symbol p instead of P) is the one introduced by Fisher (1941). You may relate Q and P as; $Q = 1 / p$ and $P = q / p$ (i.e., $p = 1 / Q$ and $q = P / Q$).

Our aim is to apply the technique of bootstrapping on truncated negative binomial distributions, to estimate the parameter p and to construct the 95% confidence band. Then compare these results with the classical approach like maximum likelihood method, normal approximation.

In most common form of truncation, the zeroes are not recorded, thus the equation (3) becomes,

$$\Pr[X = x] = (1 - Q^{-k})^{-1} \binom{k+x-1}{k-1} \left(\frac{P}{Q}\right)^x \left(1 - \frac{P}{Q}\right)^k ; \quad x = 1, 2, \dots, \quad (5)$$

With mean

$$\mu = E(X) = kP(1 - Q^{-k})^{-1} \quad (6)$$

and variance

$$\mu_2 = \frac{(kPQ + k^2 P^2)}{(1 - Q^{-k})} - \frac{k^2 P^2}{(1 - Q^{-k})^2} \quad (7)$$

Since the parameters of Negative binomial distribution is not easy to estimate. Its calculation is often lengthy and time consuming. Different statisticians proposed some iterative procedures to overcome this problem. David and Johnson (1952) proposed an explicit estimator based on the first three sample moments. Sampford (1955) developed a reasonably rapid iterative technique for solving the two moment estimating equations but ultimately concluded that resulting estimates might only be suitable for use as first approximation in an iterative solution of Maximum likelihood estimating equations.

IV. AN ILLUSTRATIVE EXAMPLE

To illustrate estimation in the truncated negative binomial distribution using bootstrap method and other classical method, we considered a sample of chromosome breakage that was originally given by Sampford (1955). Where, the observed samples may be

truncated, in the sense that the number of individuals falling into the zero class cannot be determined. For example, if chromosome breaks in irradiated tissue can occur only in those cells which are at a particular stage of the mitotic cycle at the time of irradiation, a cell can be demonstrated to have been at that stage only if breaks actually occur. Thus in the distribution of breaks per cell, cells not susceptible to breakage are indistinguishable from susceptible cells in which no breaks occur. The sample data are as follows:

X	1	2	3	4	5	6	7	8	9	10	11	12	13
Obs	11	6	4	5	0	1	0	2	1	0	1	0	1

The sample mean = 3.438, and sample variance = 9.931. The moment estimates of k and P are 0.632842 and 3.26216 respectively.

These results are obtained by the program coded on Mathematica.

```
d=FindRoot[{m==kp(1-(1+p)^(-k))^(-1),m2==(kp(1+p)+k^2 p^2)/
(1-(1+p)^(-k))-(k^2 p^2)/(1-(1+p)^(-k))^2},{k,4},{p,3}]
{k=0.632842,p=3.26216}
```

Since $p = 1 / Q$ and $Q = 1 + P$, therefore

$$\hat{p} = 0.23462282 \quad (8)$$

Estimation of confidence interval

Brass Estimate

For this example Cohen (1965) calculated the estimate for p as

$$\hat{p}^b = 0.2345 \quad (9)$$

and

$$V(\hat{p}^b) = 0.0098628$$

And the 95% confidence interval for \hat{p}^b is:

$$0.2345 \pm (1.96)(0.09931163) = (0.039849, 0.429151) \quad (10)$$

Maximum Likelihood Estimate

The maximum likelihood estimate for this example, calculated by Sampford (1955) as,

$$\hat{p}^b = 0.2113 \quad (11)$$

and

$$V(\hat{p}^b) = 0.0097231$$

And the 95% confidence interval for \hat{p}^b is:

$$0.2113 \pm (1.96)(0.09860578) = (0.018033, 0.404567) \quad (12)$$

V. RESULTS & CONCLUSION

The purpose of this paper is to apply wild bootstrapping method for constructing confidence intervals for the parameter p of Truncated Negative Binomial Distribution. Various methods, classical as well as bootstrap, have been described with example illustrating Sampford (1955) the application of each procedure. The algorithm for bootstrapping is designed on C++. For sample one program code for wild bootstrap confidence interval is given on appendix. Others are with author and can be shown on demand. In order to assist the reader in assessing the options of the methods for construction of confidence intervals, the results of the example considered in the article are summarized below:

Methods of Estimate		95% Confidence Interval for true parameter 'p'		Length of Confidence Interval
		LL	UL	
Classical	Brass Estimate	0.039849	0.429151	0.389302
	Maximum Likelihood	0.018033	0.404567	0.386534
Bootstrap	Standard Bootstrap	0.100502	0.423390	0.322888
	Wild Bootstrap	0.122231	0.356407	0.234176

where, LL = Lower limit and UL = Upper Limit

By Comparing the classical method with bootstrap, it is vivid that wild bootstrap provides the confidence bound approximately as precise as the classical method, whereas standard bootstrap method has a little bit wide confidence interval. And overall we can conclude that the bootstrapping provides more easy and sufficient method for finding the confidence intervals.

VI. REFERENCES

1. Chen, J. and Sitter, R.R. (1993). Edge worth expansion and the Bootstrap for the stratified without replacement from a finite population. *Canadian Journal of Statistics*, 21, 347-357.
2. Chien-Feng, C. (1998). *Bootstrapping the order selection test*. Dissertation, National Chengchi University, Taipei, Taiwan.
3. Cohen, A.C. (1965). *Estimation in the Negative Binomial Distribution*. T.R.14, Department of Statistics, University of Georgia, Athens.
4. Efron, B. (1979). Bootstrap Methods: Another Look at the Jackknife. *Ann. of Statist.* 7, 1-26.
5. Fisher, R.A. (1941). *The Negative Binomial Distribution*. *Annals of Eugenics*, London, 111, 182-187.
6. Hardle, W. and Mammen, E. (1993). Comparing Nonparametric Versus Parametric Regression Fits. *Ann. of Statist.* 21, 1926-1947.
7. Helmers, R., and Wegkamp M. (1998). Wild Bootstrapping in finite populations. *Scandinavian Journal of Statistics*, USA, 25, 383-399
8. Ibrahim M. (2004). *Recent trends in Bootstrapping Technique–Wild Bootstrap*. Report submitted in partial fulfillment of M.Sc., Department of Statistics University of Karachi, Pakistan.
9. Khurshid A., Ageel M.I. and Raheeq A. (2005). On confidence intervals for the negative binomial distribution. *Investigaciones Operacionales*, 26, 59-70.

10. Liu, R.Y. (1988). Bootstrap Procedures under some non i.i.d. models, *Ann. of Statist.* 16, 1696-1708.
11. Sampford, M.R. (1955). The truncated Negative Binomial Distribution, *Biometrika*, 42, 58-69.
12. Wu, C.F.J. (1986). Jackknife, Bootstrap and other resampling methods in regression analysis. *Ann. of Statist.* 14, 1261-1343.

VII. APPENDIX

The algorithm for bootstrapping is designed on C++. For sample one program code for wild bootstrap confidence interval is given below. Others are with authors and can be shown on demand.

```
#include<iostream>
#include<fstream>
using namespace std;
float B = -0.6263;
int power(int num , int pow)
{ return (pow == 0) ? 1 : num * power(num,pow-1);}
void Select_Sort(float arr[],int length)
{
    int min = 0;
    for (int i = 0 ; i < length ; i++)
    {
        min = i;
        for (int j = i ; j < length ; j++)
            min = (arr[min] >= arr[j]) ? j : min;
        if (min != i)
        {
            float temp = arr[min];
            arr[min] = arr[i];
            arr[i] = temp;
        }
    }
}
int main(int argno, char **argv)
{
    srand(time(NULL));
    if (argno == 4)
    {
        int n = 13 , t = 0;
        cout << "Enter number of Bootstrap Samples : ";
        cin >> t;
        int *xi,*yi,*yci,*ei;
        float *mean,*variance,*p;
        float **esi;
        float **ysi;
        float **zi;
        xi = new int [n];
        yi = new int [n];
        yci = new int [n];
        ei = new int [n];
        mean = new float [t];
        variance = new float [t];
        p = new float [t];
        ifstream infile(argv[1]);
        int num = 0;
        char temp = 'a';
        while (temp != '\n')
            infile.get(temp);
        infile.get();
        for (int i = 0 ; i < n ; i++)
        {
            infile >> num;
        }
    }
}
```

```

infile.get();
infile >> num;
xi[i] = num;
infile.get();
infile >> num;
yi[i] = num;
infile.get();
infile >> num;
yci[i] = num;
infile.get();
infile >> num;
ei[i] = num;
infile.get();
}
esi = new float * [t];
ysi = new float * [t];
zi = new float * [t];
for (int i = 0 ; i < t ; i++)
{
    *(esi + i) = new float [n];
    *(ysi + i) = new float [n];
    *(zi + i) = new float [n];
}

float arr[2] = {-0.6180,1.6180};

int count = 0, cp = 0;
float **xf = new float * [t] , **xsqf = new float * [t];
for (int i = 0 ; i < t ; i++)
{
    *(xf+i) = new float [n];
    *(xsqf+i) = new float [n];
}
float *sumx,*sf,*sxf,*sxsqf,*syi,*sysi,*sei,*sesi,*szi;
sumx = new float [t];
sf = new float [t];
sxf = new float [t];
sxsqf = new float [t];
syi = new float [t];
sysi = new float [t];
sei = new float [t];
sesi = new float [t];
szi = new float [t];
float s1,s2,s3,s4,s5,s6,s7,s8,s9;
int psc = 0;
for ( ; cp < t ; )
{
    s1 = s2 = s3 = s4 = s5 = s6 = s7 = s8 = s9 = 0;
    for (int j = 0 ; j < n ; j++)
    {
        zi[cp][j] = arr[rand() % 2];
        esi[cp][j] = zi[cp][j] * ei[j];
        ysi[cp][j] = (xi[j] * B) + esi[cp][j];
        xf[cp][j] = xi[j] * ysi[cp][j];
        int pow = power(xi[j],2);
        xsqf[cp][j] = ysi[cp][j] * pow;
        s1 += xi[j];
        s2 += ysi[cp][j];
        s3 += xf[cp][j];
    }
}

```

```

        s4 += xsqf[cp][j];
        s5 += yci[j];
        s6 += ysi[cp][j];
        s7 += ei[j];
        s8 += esi[cp][j];
        s9 += zi[cp][j];
    }
    sumx[cp] = s1;
    sf[cp] = s2;
    sxf[cp] = s3;
    sxsqf[cp] = s4;
    syi[cp] = s5;
    sysi[cp] = s6;
    sei[cp] = s7;
    sesi[cp] = s8;
    szi[cp] = s9;
    mean[cp] = sxf[cp]/sf[cp];
    variance[cp] = ((s4/s2) - (mean[cp] * mean[cp]));
    float check = 0;
    if (variance[cp] > 0)
    {
        check = (variance[cp]/mean[cp]);
        check -= 1;
    }
    else
    check = -9999;

    if (check < 0)
    count++;
    else
    {
        p[psc++] = check;
        cp++;
    }
}
infile.close();
ofstream out(argv[2]);
ofstream out2(argv[3]);
out2 << "p's," << "Q = 1+p," << "p = 1/Q" << endl;
for (int i = 0 ; i < t ; i++)
{
    out << "Reading Number : " << (i+1) << endl << endl;
    out << "S.No.," << "Xi (x)," << "Yi," << "Yi* (f)," << "Ei," <<
    "Ei*," << "Xf," << "X2f," << "Zi" << endl;
    for (int j = 0 ; j < n ; j++)
        out << (j+1) << "," << xi[j] << "," << yci[j] << "," <<
    ysi[i][j] << "," << ei[j] << "," << esi[i][j] << "," << xf[i][j] << "," <<
    xsqf[i][j] << "," << zi[i][j] << endl;
    out << "Total: ," << sumx[i] << "," << syi[i] << "," << sf[i] <<
    "," << sei[i] << "," << sesi[i] << "," << sxf[i] << "," << sxsqf[i] << ","
    << szi[i] << endl << endl;
    out << "Mean : ," << mean[i] << endl;
    out << "Variance : ," << variance[i] << endl;
    out << "p : ," << p[i];
    out << endl << endl << endl;
}

float sump = 0;
Select_Sort(p,t);

```

```

for (int i = 1 ; i < t ; i++)
{
    (p[i] >= 0) ? sump += p[i] : p[i];
    out2 << p[i] << "," << (1+p[i]) << "," << (1/(1+p[i])) << endl;
}

out2 << endl << "Sum : " << sump << endl << endl;
out2 << "Average : ," << (sump/t) << endl << endl;
out2 << endl << "There Were " << (count+cp) << " P's But " << count
<< " P's Were Dropped As They Were Negative" << endl;
out2 << "P [25th] :," << (1/(1 + p[974]))/2.8 << endl;
out2 << "P [975th] :," << (1/(1 + p[24]))/2.8 << endl;
out2.close();
out.close();

for (int i = 0 ; i < t ; i++)
{
    delete[] *(xf+i);
    delete[] *(xsqf+i);
    delete[] *(ysi+i);
    delete[] *(esi+i);
}
delete[] xf;
delete[] xsqf;
delete[] ysi;
delete[] esi;
delete[] xi;
delete[] yi;
delete[] yci;
delete[] ei;
delete[] mean;
delete[] variance;
delete[] p;
cout << "Output Is Generated In : " << argv[2] << endl;
cout << "And The List Of P's Are Generated In : " << argv[3] <<
endl;
}
else
{
    cout << "Usage Error ..... !" << endl;
    cout << "Use It As : ";
    cout << "Program.exe InputFile.csv OutputFile.csv Pfile.csv" <<
endl;
}
system("pause");
return 0;
}

```

AUGMENTED BOX-BEHNKEN THIRD ORDER RESPONSE SURFACE DESIGNS

Hafiz Muhammad Arshad¹ and Munir Akhtar²

¹ Department of Statistics, The Islamia University of Bahawalpur.
Email: hmarshadphd@yahoo.com

² Department of Mathematics, COMSATS Institute of Information
Technology Lahore. Email: drmunirakhtar@ciitlahore.edu.pk

ABSTRACT

Box-Behnken Designs are very popular with the experimenters, wishing to estimate a second order model. It is due to their three levels, simplicity and high efficiency. However, in case of serious lack of fit in the analysis it becomes necessary to augment these designs up to third order. We have augmented the Box-Behnken Designs and developed catalogues for three to twelve factors. These designs can be used to estimate the parameters of a third order response surface model.

KEYWORDS

Second Order Designs; Box-Behnken Designs; Third Order Designs; Lack of Fit; G-Optimality.

1. INTRODUCTION

Box and Behnken (1960) introduced three level incomplete factorial designs. By definition, a three level incomplete factorial design is a subset of factorial combinations from 3^k factorial design. These designs are formed by combining two-level factorial designs with Balanced Incomplete Block Designs (BIBD) in a particular manner. Since every BBD is associated with a BIBD or partially BIBD, and hence have k = the number of design variables/factors, b = the number of blocks in the BIBD, r = the number of blocks in which a factor is appeared, and t = the number of factors per block.

These designs have been very popular with the experimenters due to their simplicity and high efficiency and are used to estimate the second order model. However, there are situations when second order model representations may be inadequate and unrealistic due to lack of fit caused by higher-order terms in the true mean response model. In this case a third order model is needed. Box-Behnken designs with equally spaced three levels (+1, 0, -1) have no ability to detect pure cubic terms because these are fully aliased with linear effects as $x_i^3 = x_i$. The situation is, however, better for third order terms involving interactions. Mee (2006) has referred one example of six factors Box-Behnken design from Srinivas et al (1995) suffering from high lack of fit. He has concluded that these designs cannot estimate third order model and hence augmenting them is necessary. In this study efforts have been made to achieve this goal.

2. AUGMENTING THE BOX-BEHNKEN DESIGNS

Das and Narasimham (1962) have obtained some second order designs by using the properties of BIB designs. By extending the method they have obtained third order rotatable designs, both sequential and non-sequential, up to 15 factors with the help of doubly balanced incomplete block designs and complementary balanced incomplete block designs. This idea has been extended to augment the BBD's for estimation of third order model. These designs are much smaller in size as compared to Das and Narasimham (D&N) designs.

As we know that each point in a design is always a combination of different levels (l) of different factors (k). Suppose we denote these l levels by a, b, c etc., then all possible combinations of l levels with k factors will be l^k , where $l \leq k$. Let us call this group of l^k combinations as Design-I and denote its m^{th} point with k entries by x_j^m , $m = 1, \dots, l^k, j = 1, \dots, k$. Any two entries of this point may be equal or unequal. Now suppose we have a two levels factorial design with k factors having values +1 and -1. Let us call it Design-II and denote its entries by $y_{ij}, i = 1, 2, \dots, 2^k, j = 1, 2, \dots, k$. Now we select any one point/ combination (of levels) from Design-I to be called selected combination (say m^{th} combination), and multiply its j^{th} entry with j^{th} entry of each point of Design-II. Then the resulted design with 2^k points will be as below.

$x_1^m * y_{11}$... $x_j^m * y_{1j}$...	$x_k^m * y_{1k}$
$x_1^m * y_{21}$... $x_j^m * y_{2j}$...	$x_k^m * y_{2k}$
\vdots	\vdots	\vdots
$x_1^m * y_{i1}$... $x_j^m * y_{ij}$...	$x_k^m * y_{ik}$
\vdots	\vdots	\vdots
$x_1^m * y_{2^k 1}$... $x_j^m * y_{2^k j}$...	$x_k^m * y_{2^k k}$

This can be denoted by $(x_1^m, x_2^m, \dots, x_k^m)$. It is a combination of 'factorial points' with levels say a, b, etc. Let us have another combination of $2k$ axial points $(\pm\alpha, 0, 0, \dots, 0), (0, \pm\alpha, 0, \dots, 0), \dots, (0, 0, \dots, 0, \pm\alpha)$, to be denoted by $(\alpha, 0, 0, \dots, 0)$. If we add 2^k factorial points defined above along with $2k$ axial points of level α , to the k factor Box-Behnken Design (BBD), then we shall achieve a third order design which may be called as Augmented Box-Behnken Third Order Design (ABBD). It is important to note that factorial points and α cannot take value equal to ± 1 at the same time, because in this situation total number of levels in the augmented design will be three, whereas we need at least four levels for a third order design.

First of all we try to select a point from Design-I consisting of only one level say a, and obtain 2^k factorial points by multiplying with respective entries of each point of Design-II. However, as the number of factors increases from five (i.e. $k > 5$), we have to face the problem of singularity of information matrix XX' due to which some of the

parameters of third order model cannot be estimated, and thus the design breaks down. To overcome this deficiency, we select a point from the Design-I which includes two levels. If the singularity problem still exists, then we select a point consisting of three levels, and so on. It is mentioned here that all of the points of Design-I do not serve the purpose, and we have to explore some appropriate points. The measure in this regard to be kept in mind is the “non-singularity of the information matrix XX' ”.

The procedure can be illustrated by taking an example of six factors i.e. $k=6$. Selected combination's levels like a, b, etc. can take any values within our experimental region. When we consider more than one levels in our Design-I, we obtain thousands of designs making it difficult to study. Let us put a constraint on the levels to take different values, that is, they can take only values from 0.25, 0.5, 0.75, 1.25, 1.50, 1.75, 2.0, 2.25, 2.5, 2.75, 3.0, as per requirements of the experimental region. Using these values we have constructed catalogues of Augmented Box-Behnken Third Order Designs for $k=3$ to 12 factors, with the efforts to add minimum possible number of levels to the original BBD's. Interested readers can obtain these catalogues, on request, through e-mail.

However, these designs for six or more factors have the following discrepancies:

- i. Experimental region becomes larger in more cases. For example in the case of $k=6$, we can achieve our desired design with non-singular information matrix when at least one level of factorial points with the value greater than or equal to 2 is added, i.e. our experimental region becomes larger to ± 2
- ii. Variances of the parameter estimates of response surface model become so high.
- iii. Design size becomes large for higher number of factors i.e. $k>6$.

These discrepancies can be removed by using one more combination of design points which is obtained from the complement of the original Box-Behnken Design. Consider the case for $k=6$ factors, the BBD has the following six blocks (in the sense of Incomplete Block Designs).

1	2	3	1	2	1
2	3	4	4	5	3
4	5	6	5	6	6

According to the notation introduced in section 2, it has $k=6$, no of factors, $b=6$, no of blocks, and $t=3$, no of design variables per block. Now its complement has $b'=6$ blocks with $t'=k-t=6-3=3$ design variables per block given as:

3	1	1	2	1	2
5	4	2	3	3	4
6	6	5	6	4	5

When we add this design (complement of original BBD) of $b' \times 2^{t'} = 6 \times 2^3 = 48$ points along with $2^k = 64$ factorial points of level a, and $2k=12$ axial points, we achieve the required third order design for six factors.

However, for $k>6$, there is no need to add factorial part to the original BBD. Rather, we have to add only the combination of complementary and axial parts. For example, if $k=7$, complement of the original BBD has the following blocks:

3	1	1	1	2	1	2
5	4	2	2	3	3	4
6	6	5	3	4	4	5
7	7	7	6	7	5	6

It has $b' = 7$ blocks with $t' = k - t = 7 - 3 = 4$ design variables per block. Thus we have to add $b' \times 2^{t'} = 7 \times 2^4 = 112$ complementary design points, along with $2k = 14$ axial points for obtaining the third order ABB design for seven factors.

Similar is the case with $k = 10$ and 12 factors. For $k = 10$, BBD has $b = 10$, $t = 4$, and $t' = k - t = 10 - 4 = 6$, thus we add $2k = 20$ axial points and $b \times 2^{t'} = 10 \times 2^6 = 640$ ($b' = b$) complementary points for the purpose. For $k = 12$, it has $b = 12$, $t = 4$, and $t' = k - t = 12 - 4 = 8$, thus we add $2k = 24$ axial points and $b \times 2^{t'} = 12 \times 2^8 = 3072$ ($b' = b$) complementary points, and obtain third order Augmented Box-Behnken Design for twelve factors. It is indicated here that when we add only the axial points and complementary points then axial points cannot take value of ± 1 .

Sometimes this goal can be achieved by adding complement of some blocks rather than adding a full complement of the original BBD. For example in the case of $k = 8$ factors, BBD has $b = 24$, and $t = 3$ with following blocks.

1	3	5	1	1	2	2	4	1	3	1	3	1	2	4	2	1	1	3	5	1	3	2	2
3	5	7	2	6	3	4	6	5	7	2	4	4	3	5	6	7	2	4	6	4	6	5	4
4	6	8	7	8	8	5	7	6	8	5	7	8	6	8	7	8	3	5	7	6	8	8	7

Then third order design can be generated by adding merely the complement of first eight blocks along with $2k = 16$ axial points. Thus total number of complementary design points for this design will be $b' \times 2^{t'} = 8 \times 2^{k-t} = 8 \times 2^{8-3} = 256$. Similarly in case of $k = 9$ factors, we have to add complement of first eleven blocks along with $2k$ axial points. Number of design points in the complement of eleven blocks will be $b' \times 2^{t'} = 11 \times 2^{k-t} = 11 \times 2^{9-3} = 704$.

As regards the case of $k = 11$ factors, Box and Behnken (1960) have used one half fraction of 2^5 factorial design in each block. While in the third order designs we cannot use any fraction with the resolution less than seven. So we have to add $b \times 2^t = 11 \times 2^t = 11 \times 2^4 = 176$ points of the other one half fraction of 2^5 factorial design to avoid aliasing of the factors. After adding this we add $b' \times 2^{t'} = 11 \times 2^{k-t} = 11 \times 2^{11-5} = 11 \times 2^6 = 704$ points of the complement of all the blocks along with $2k = 22$ axial points, and thus achieve the requisite third order design for eleven factors.

The catalogue of Augmented Box-Behnken Third Order Designs for $k = 3$ to 12 factors is given in the Table 3.1.

3. G-OPTIMAL AUGMENTED BOX-BEHNKEN DESIGNS

G-Optimality and corresponding G-Efficiency use the Scaled Prediction Variance $v(x) = n \cdot \text{var}[\hat{y}(x)] / \sigma^2 = n \cdot x^{(m)'} (X'X)^{-1} x^{(m)}$, where $x^{(m)}$ is a function of the location in the design variables at which one predicts, $X'X$ is the information matrix, n is the number of the design points and $\hat{y}(x)$ is the predicted response. A design is called G-Optimal if it minimizes the maximum $v(x)$ in the design region. The corresponding G-Efficiency can easily be determined as $G_{eff} = 100 \cdot p / \text{Max} v(x)$, where p is the number of parameters in the model.

Consider the case of seven factors Augmented Box-Behnken Design. We have three parts in this design, namely original Box-Behnken part, axial part, and complement part. Only the axial part is in the variable form. Let us find the G-Efficiency for various values of alpha, which are shown in the Figure 3.1. This Graph along with data table indicates that the design with $\alpha = 2$ is G-Efficient. Similarly, G-Efficiency and levels for G-Efficient ABB designs for each factor are also shown in last two columns of Table 3.1.

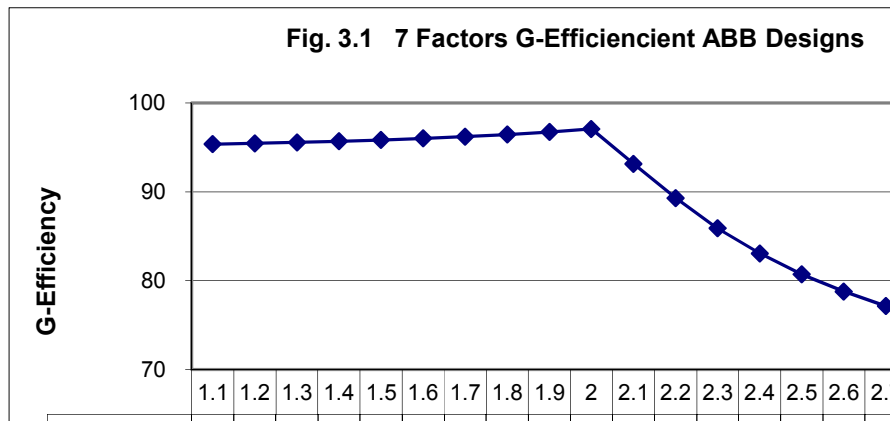


Table 3.1

Augmented Box-Behnken Third Order Designs (ABBD) for $k=3$ to 12 factors

Number of factors k	Original BBD + Added Points	Number of design points	Levels for G-Efficient ABB design	G-Efficiency
3	Original BBD (a, a, a) (α , 0, 0).	12 8 6 Total=26+ n_c	a=0.79 α =1.40	99.1266
4	Original BBD (a, a, a, a) (α , 0, 0, 0)	24 16 8 Total=48+ n_c	a=0.70 α =1.40	99.4832

Number of factors k	Original BBD + Added Points	Number of design points	Levels for G-Efficient ABB design	G-Efficiency
5	Original BBD (a, a, a, a, a) (α , 0, 0, 0, 0)	40 32 10 Total=82+ n_c	a=0.70 α =0.70	98.4125
6	Original BBD (a, a, a, a, a, a) Complement of BBD (α , 0, 0, 0, 0, 0)	48 64 48 12 Total=172+ n_c	a=0.90 α =0.38	89.2795
7	Original BBD (α , 0, 0, 0, 0, 0, 0) Complement of BBD	56 14 112 Total=182+ n_c	α =2	97.0525
8	Original BBD (α , 0, 0, 0, 0, 0, 0) Complement of 8 blocks of BBD	192 16 256 Total=464+ n_c	α =0.65	67.9396
9	Original BBD (α , 0, 0, 0, 0, 0, 0, 0) Complement of 11 blocks of BBD	120 18 704 Total=842+ n_c	$0.1 < \alpha < 3.0$	$G_{\text{eff}} \cong 26.13$
10	Original BBD (α , 0, 0, 0, 0, 0, 0, 0, 0) Complement of BBD	160 20 640 Total=820+ n_c	$0.1 < \alpha < 0.98$ α =0.60	$G_{\text{eff}} \cong 66$ 66.1809
11	Original BBD Second half fraction of BBD (α , 0, 0, 0, 0, 0, 0, 0, 0) Complement of BBD	176 176 22 704 Total=1078+ n_c	$0.1 < \alpha < 3.0$	$G_{\text{eff}} \cong 63.25$
12	Original BBD (α , 0, 0, 0, 0, 0, 0, 0, 0, 0) Complement of BBD	192 24 3072 Total=3288+ n_c	$0.1 < \alpha < 2.40$	$G_{\text{eff}} \cong 26$

4. DISCUSSION

Third order designs proposed here have some special characteristics. For example in case of $3 \leq k \leq 5$ factors, we have added two parts namely factorial and axial parts. If we assume that factorial part can take only +1 and -1 values, and axial part can take values

different from them, then augmented part becomes the Central Composite Design (CCD). Thus armed with this property, these designs provide an opportunity to the experimenters who use the CCD's and also face lack of fit, in the manner that they can use them for estimation of third order terms in addition to second order terms in the model. Similar is the case with $k=6$ factors, except the complement of original BBD which has been used in addition to factorial and axial parts. Another property of these designs comparative to those of proposed by Das and Narasimham (1962) is the run size efficiency except in the case of $k=12$ factors, although, we have to sacrifice some rotatability in return. However, sometimes run size efficiency is more desirable for an experimenter instead of rotatability, specially in situations where the experimental material is costly. Table 4.1 provides us evidence of run size efficiency.

Table 4.1
Number of runs required for ABB Designs and D&N Designs

Factors	k	3	4	5	6	7	8	9	10	11	12
Number of runs	ABBD	26	48	82	172	182	464	842	820	1078	3288
	D&N Designs	40	72	192	260	238	480	1256	1372	2228	3224

Still another good property of these designs is that they use less number of levels as compared to third order designs developed by other statisticians like Das and Narasimham (1962). The number of levels used by ABB designs and D&N designs are compared in the Table 4.2.

Table 4.2
Number of levels of ABB designs and D&N designs

Factors	k	3	4	5	6	7	8	9	10	11	12
Number of Levels	ABB Designs	7	7	7	7	5	5	5	5	5	5
	D&N Designs	11	9	15	11	5	11	15	9	11	11

REFERENCES

1. Bose, R.C. and Draper N.R. (1959). Second Order Rotatable Designs in Three Dimensions. *The Ann. of Statist.* 31(1), 23-33.
2. Box, G.E.P. and Behnken, D.W. (1960). Some New Three Level Designs for the Study of Quantitative Variables. *Technometrics*, 2, 455-475.
3. Box, G.E.P. and Wilson, K.B. (1951). On the Experimental Attainment of Optimum Conditions. *J. Roy. Statist. Soc.* 13, 1-45.
4. Box, G.E.P. and Hunter, J.S. (1961). The 2^{k-p} fractional factorial designs. *Technometrics*, 3, 311-351.
5. Das M.N. and Narasimham V.L. (1962). Construction of Rotatable Designs Through Balanced Incomplete Block Designs. *The Ann. of Statist.* 33(4), 1421-1439.
6. Draper, N.R. and Lin, D.J.K. (1990). Small Response Surface Designs. *Technometrics*, 32, 187-194.
7. Draper, N.R. (1960). Third order rotatable designs in three dimensions. *Ann. Math. Stat.* 31, 865-874.

8. Gardiner D.A., Grandage H.E. and Hader R.J. (1959). Third order rotatable designs for exploring response surfaces. *Ann. Math. Stat.* 30, 1082-1096.
9. Mee, R.W. (2006). *Optimal Three-Level Designs for Response Surfaces in Spherical Experimental Regions*. University of Tennessee, Department of Statistics.
10. Morris, M.D. (2000). A Class of Three-level Experimental Designs for Response Surface Modeling. *Technometrics*, 42, 111-121.
11. Mukerjee R. and Wu C.F.J. (2001). Minimum aberration designs for mixed factorials in terms of their complementary sets. *Statistica Sinica*, 11, 225-239.
12. Myers R.H. and Montgomery, D.C. (2002). *Response Surface Methodology*, 2/ed. Wiley Series.

**ON A CLASS OF POWERED NON-CENTRAL WEIBULL
RANDOM VARIABLES**

Abdur-Razaq and Ahmed Zogo Memon

National College of Business Administration & Economics, Lahore
Email: razaqfb18@yahoo.com

ABSTRACT

Razaq and Memon (2007) develop a powered function of non-central Weibull random variable that produces a symmetrical distribution for practical purposes. The powered function generates a large class of symmetrical distributions involving Weibull shape and non-centrality parameters. This paper evaluates the coefficient of kurtosis of these distributions. It is discovered that each member of this class of distributions has a platykurtic behaviour.

1. INTRODUCTION

Weibull distribution has a wide range of applications in industry and other fields. It was introduced by Weibull in 1951 under the following class of distributions

$$F(x) = 1 - \exp(-\alpha x^\beta) \quad x > 0, \text{ with } \alpha > 0, \beta > 0$$

where α and β are its scale and shape parameters.

Hirai (1978) finds the moments of the order statistics using a random sample from Weibull distribution for $\beta = 2$. Memon and Daghel (1987) investigate the sampling distribution of a linear combination of powered order statistics. Memon (2006) makes a number of remarks on power transformation of Weibull order statistics.

Islam (2003) introduces a Non-Central Weibull Distribution with β and λ as its shape and non centrality parameters. Razaq and Memon (2007) investigate the characteristics of X^c where X has a Non-Central Weibull distribution, and $c > 0$. They determine the relationship between c/β and λ for which the powered random variable X^c follows a symmetric distribution.

This paper studies the kurtosis behaviour of these distributions. It is discovered that each member of this class of distributions has a platykurtic property.

2. REMARKS ON THE NON-CENTRAL WEIBULL DISTRIBUTION

The pdf of this distribution in Islam (2003) is

$$f(x) = \beta \sum_{r=0}^{\infty} \frac{e^{-\lambda/2} (\lambda/2)^r}{r!} \frac{\theta^{r+1} e^{-\theta x \beta} x^{\beta \left(\frac{1}{\beta} + r + 1 \right)}}{|r+1|} \quad 0 < x < \infty, \theta > 0, \beta > 0 \quad (2.1)$$

where $\lambda > 0$ is the non-centrality parameter. Assume that $\theta = 1$.

For $Z = X^c$ the pdf of Z simplifies to

$$f(z) = \beta \sum_{r=0}^{\infty} \frac{e^{-\lambda/2} (\lambda/2)^r}{r!} \frac{e^{-z^{\beta/c}} z^{\frac{\beta}{c}(r+1)-1}}{|r+1|} \quad 0 < z < \infty \quad (2.2)$$

3. KURTOSIS OF THE DISTRIBUTION OF Z

We give below the coefficient of kurtosis ($\gamma_2 = u_4 / u_2^2$) of Z for $\lambda = 0, 0.05, \dots, 3$; $c/\beta = 0.10, .20, \dots, 2.00$.

(γ_2 Values)

C/β	λ=0	λ=0.05	λ=0.1	λ=0.5	λ=1.0	λ=1.5	λ=2.0	λ=2.5	λ=3.0
0.100	3.57	3.57	3.57	3.58	3.66	3.79	3.94	4.11	4.27
0.200	2.88	2.88	2.88	2.89	2.94	3.01	3.11	3.22	3.33
0.250	2.75	2.75	2.75	2.75	2.76	2.80	2.87	2.95	3.03
0.280	2.72	2.71	2.71	2.70	2.70	2.73	2.78	2.85	2.92
0.285	2.71	2.71	2.71	2.70	2.69	2.72	2.77	2.83	2.90
0.290	2.71	2.71	2.71	2.69	2.69	2.71	2.76	2.82	2.88
0.295	2.71	2.71	2.71	2.71	2.71	2.71	2.75	2.81	2.87
0.300	2.71	2.71	2.71	2.69	2.68	2.70	2.74	2.79	2.86
0.305	2.71	2.71	2.71	2.71	2.71	2.71	2.73	2.78	2.84
0.310	2.71	2.71	2.71	2.69	2.67	2.69	2.72	2.77	2.83
0.315	2.71	2.71	2.71	2.71	2.71	2.71	2.72	2.76	2.82

We have given below the graph for the coefficient of kurtosis over a larger range of c/β values for $\lambda \leq 3$.

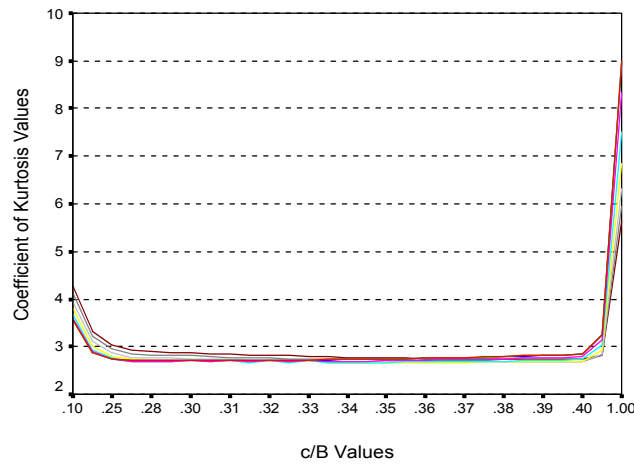


Fig. 1: (γ_2 Graph for distributions of Z)

For $\lambda \leq 3$, all distributions are platykurtic for values of c/β in the interval $\{0.28 \text{ to } 0.40\}$. For values more than 0.40 the distribution of Z has a tendency to assume a narrower peak rapidly.

4. THE CLASS OF C* DISTRIBUTIONS

Razaq and Memon (2007) show that the distribution of Z for which c/β is related to λ as

$$c/\beta = 0.270 + 0.039 \lambda \tag{4.1}$$

is nearly symmetrical. That is, for given β and $\lambda \leq 3$ the random variable Z under (4.1) is symmetrically distributed. Let C^* denote a class of such symmetrical distributions obtained from the non-central random variable X. We give below the coefficient of kurtosis for some of these distributions.

γ_2 Values for C* Distributions

λ	c/β	γ_2	λ	c/β	γ_2
0.01	0.2697572807	2.72	1.10	0.3124190936	2.69
0.05	0.2713228518	2.71	1.50	0.3280748047	2.70
0.10	0.2732798157	2.72	2.00	0.3476444436	2.70
0.20	0.2771937435	2.71	2.10	0.3515583714	2.72
0.30	0.2811076713	2.71	2.20	0.3554722992	2.68
0.40	0.2850215990	2.70	2.30	0.3593862270	2.70
0.50	0.2889355268	2.69	2.40	0.3633001548	2.70
0.60	0.2928494546	2.69	2.50	0.3672140826	2.71
0.70	0.2967633824	2.68	2.60	0.3711280104	2.72
0.80	0.3006773102	2.68	2.0	0.3750419382	2.71
0.90	0.3045912380	2.68	2.80	0.3789558659	2.72
1.00	0.3085051658	2.69	2.90	0.3828697937	2.72

Remark:

It follows that all C^* distributions are platykurtic with β_2 falling in the range 2.68 to 2.73, mostly clustering around 2.71.

5. REFERENCES

1. Hirai, A.S. (1978). Moments of order statistics from the Raleigh distributions. *J. Statist. Res.* 12(1&2), University of Dacca, Bangladesh.
2. Hogg, R.V and Craig, A.T. (1978). *Introduction to Mathematical Statistics*. Macmillan Publishing Company, Inc. New York.
3. Islam, Munirul (2003). Family of non-central transformed chi-square distributions. *Pak. J. Statist.* 19(3), 325-330.
4. Memon, A.Z. and Daghel M.H. (1987). Some studies of order statistics from a Weibull distribution. *Pak. J. Statist.* 3(1)A, 23-30.
5. Memon A.Z. (2008). Some Remarks on Weibull Order Statistics. *Pak. J. Statist.* 24(1), 11-20.
6. Razaq A. and Memon A.Z. (2007). Symmetric Transformation of A Non-Central Weibull Random Variable, *Proceedings Second International Conference (2007)* Institute of Statistics, University of the Punjab, Lahore.
7. Weibull, W. (1951). A Statistical Distribution Function of Wide Applicability. *J. App. Mech.* 18, 293-297.

**DISTRIBUTION OF THE NUMBER OF RECTANGLES
ARISING IN BINOMIAL TRIALS**

Zafar Iqbal and Ahmed Zogo Memon

National College of Business Administration & Economics, Lahore
Email: zafariqbal75@hotmail.com

ABSTRACT

The paper finds factorial moments of the number of rectangles that arise when independent binomial trials occur simultaneously at n^2 adjacent locations appearing in rows and columns. It is assumed that each trial results in some event E with the same probability. For $n = 2, 3$ we determine the exact distributions. We also find the asymptotic distribution of the number of rectangles.

1. INTRODUCTION

Single binominal trials often find their application in scientific inquiries specially where a trial results in some specified event with a constant probability and for any reason a researcher concentrates on the number of such events that happen randomly when the trial is independently repeated. Suppose that we have a set of locations arranged in m rows and n columns, and that binomial trials occur simultaneously at all these locations. If each trial results in a specified event E with some probability, various configurations are likely to emerge. One could possibly be concerned about the probability of a particular configuration of these events.

Moran (1948) shows that the distribution of the number of joins in the above situation tends to be normal for large m and n . Fuchs and David (1965) prove that the counts of certain patterns of the events yield asymptotic correlated Poisson distribution. Memon and David (1968) find the number of horizontal and vertical joins in an $m \times n$ lattice approximating a Poisson distribution for large m and n . Memon (2006) proposes a general theorem for obtaining moments of the number of configurations as a result of binomial trials.

We investigate here the nature of distribution by using theorem Memon (1968) that relates the factorial moments of a random variable to probabilities of particular events in such a situation.

2. MODELLING THE RECTANGLE

Let φ_{ij} denote j^{th} link in i^{th} row with a value:

$$\begin{aligned} &= 1 \text{ (if the event } E \text{ occurs at locations } j \text{ and } j + 1 \text{ in } i\text{th row)} \\ &= 0 \text{ Otherwise} \end{aligned}$$

So that $\varphi_{ij} = \varphi_{i+1j} = 1$ for a rectangle with the event E occurring at the locations (i, j) , $(i, j + 1)$, $(i + 1, j)$, $(i + 1, j + 1)$.

3. FACTORIAL MOMENT THEOREM MEMON AND DAVID (1968)

Memon and David theorem on factorial moments facilitate a relationship between factorial moments and probabilities of specified events. They consider n possibly dependent events each of whose materialization is determined by a single binomial trial. Then the r^{th} factorial moment of the number of materializing events is

$$\mu_{[r]} = r! \sum_{{}^n C_r} P(w)$$

where $P(w)$ denotes the probability of materialization of all events in a set of size r and the summation extends over all ${}^n C_r$ sets of size r .

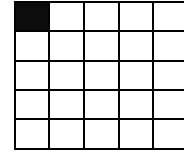
4. FACTORIAL MOMENTS OF THE RANDOM VARIABLE X

Let X be the random variable denoting the number of rectangles. We find below the first three factorial moments in this section.

4.1 The First Factorial Moment

A particular rectangle forms by the model.

$$\begin{aligned} \varphi_{ij} = \varphi_{i+1j} = 1 \quad \text{where } i = 1, 2, 3, \dots, n-1 \\ j = 1, 2, 3, \dots, n-1 \end{aligned}$$



For $r = 1$ in the above theorem the first factorial moment is given by

$$\begin{aligned} \mu_{[1]} &= \sum_k p_k ; p_k \text{ is the probability of particular rectangle that is,} \\ &= (n - 1)^2 p^4 \end{aligned}$$

4.2 The Second Factorial Moment

For the second factorial moment

$$\begin{aligned} \mu_{[2]} &= 2! \sum_{{}^n C_2} P \text{ (Two particular rectangles appear in } n \times n \text{ locations)} \\ &= a_{2,6} p^6 + a_{2,7} p^7 + a_{2,8} p^8 \end{aligned}$$

We find the terms with Probability p^6 , p^7 and p^8

The Model for Two rectangles with a common side

a) $\varphi_{ij} = \varphi_{i+1j} = \varphi_{ij+1} = \varphi_{i+1j+1} = 1$

where $i = 1, 2, 3, \dots, n-1$
 $j = 1, 2, 3, \dots, n-2$

The number of configurations is:

$$n_1 = (n-1)(n-2)$$



$$\text{b) } \varphi_{ij} = \varphi_{i+1j} = \varphi_{i+2j} = 1$$

$$\text{where } \begin{aligned} i &= 1, 2, 3, \dots, n-2 \\ j &= 1, 2, 3, \dots, n-1 \end{aligned}$$

The number of configurations is:

$$n_2 = (n-1)(n-2)$$

Each pair occurs with probability p^6



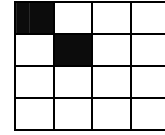
The Model for the Two rectangles with a common corner

$$\text{c) } \varphi_{ij} = \varphi_{i+1j} = \varphi_{i+1j+1} = \varphi_{i+2j+1} = 1$$

$$\text{where } \begin{aligned} i &= 1, 2, 3, \dots, n-2 \\ j &= 1, 2, 3, \dots, n-2 \end{aligned}$$

The number of configurations is:

$$n_3 = (n-2)^2$$



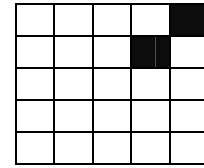
$$\text{d) } \varphi_{ij-1} = \varphi_{i+1j-1} = \varphi_{i+1j-2} = \varphi_{i+2j-2} = 1$$

$$\text{where } \begin{aligned} i &= 1, 2, 3, \dots, n-2 \\ j &= 3, 4, 5, \dots, n \end{aligned}$$

The number of configurations is:

$$n_4 = (n-2)^2$$

Each pair occurs with probability p^7



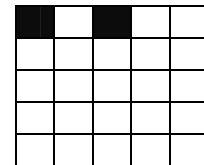
The Model with Probability p^8

$$\text{e) } \varphi_{ij} = \varphi_{i+1j} = \varphi_{im} = \varphi_{i+1m} = 1$$

$$\text{where } \begin{aligned} i &= 1, 2, 3, \dots, n-1 \\ j &= 1, 2, 3, \dots, n-3 \\ m &= 3, 4, 5, \dots, n-1 \\ m-j &\geq 2 \end{aligned}$$

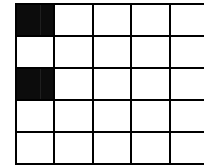
The number of configurations is:

$$n_5 = \frac{(n-1)(n-2)(n-3)}{2}$$



$$\text{f) } \varphi_{ij} = \varphi_{i+1j} = \varphi_{kj} = \varphi_{k+1j} = 1$$

$$\text{where } \begin{aligned} i &= 1, 2, 3, \dots, n-3 \\ j &= 1, 2, 3, \dots, n-1 \\ k &= 3, 4, 5, \dots, n-1, \\ k-i &\geq 2 \end{aligned}$$

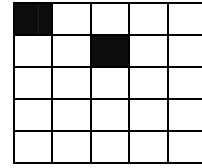


The number of configurations is:

$$n_6 = \frac{(n-1)(n-2)(n-3)}{2}$$

g) $\varphi_{ij} = \varphi_{i+1j} = \varphi_{i+1k} = \varphi_{i+2k} = 1$

where $i = 1, 2, 3, \dots, n-2$
 $j = 1, 2, 3, \dots, n-3$
 $k = 3, 4, 5, \dots, n-1,$
 $k-j \geq 2$



The number of configurations is :

$$n_7 = \frac{(n-2)^2(n-3)}{2}$$

Similarly

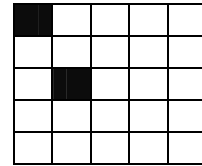
$$n_8 = \frac{(n-2)^2(n-3)}{2}$$

h) $\varphi_{ij} = \varphi_{i+1j} = \varphi_{km} = \varphi_{k+1m} = 1$

where $k \geq i+2$ $m \geq j+1$

The number of configurations is:

$$n_8 = \frac{(n-1)(n-2)^2(n-3)}{2}$$



and so the terms with Probability p^6 , p^7 and p^8 are:

$$a_{2,6} = 4(n-1)(n-2)$$

$$a_{2,7} = 4(n-2)^2$$

$$a_{2,8} = 2(n-1)(n-2)(n-3) + 2(n-2)^2(n-3) + (n-1)(n-2)^2(n-3)$$

4.3 The Third Factorial Moments

For the third factorial moment

$$\begin{aligned} \mu_{[3]} &= 3! \sum_{n C_r} P \quad (\text{Three particular rectangles appear in } n \times n \text{ locations}) \\ &= a_{3,8} p^8 + a_{3,9} p^9 + a_{3,10} p^{10} + a_{3,11} p^{11} + a_{3,12} p^{12} \end{aligned}$$

We find the terms with Probability p^8 , p^9 , p^{10} , p^{11} and p^{12} , we given below the final results

where

$$a_{3,8} = 3n^4 - 12n^3 - 9n^2 + 78n - 72 + 12(n-1)(n-3) + 24(n-2)^2$$

$$a_{3,9} = 48(n-2)(n-3)$$

$$a_{3,10} = 6(12n^3 - 96n^2 - 246n - 198)$$

$$a_{3,11} = 6(2n^4 - 16n^3 + 34n^2 + 40n - 48)$$

$$a_{3,12} = n^6 - 6n^5 + 40n^3 + 17n^2 - 490n + 480$$

4.4 A Remark on Asymptotic Factorial Moments of X

Assuming that $n^2 p^4 \rightarrow \lambda$ as $n \rightarrow \infty$, and p is small, it is easy to see that the first, second, third factorial moments of X are simplified to $\lambda, \lambda^2, \lambda^3$ respectively, indicating that X is asymptotically distributed as a Poisson random variable with λ as its parameter.

5. APPENDIX: Corollary due to Memon (2006)

Let B_1, B_2, \dots, B_n be the single binomial trials so that each trial results in the event ξ with Probability P_1, P_2, \dots, P_n . Let X denotes the number of events ξ that occur when these n trials are conducted. The first four moments of the random variable X are:

$$E(X) = \sum_i p_i$$

$$E(X^2) = \sum_i p_i + 2 \sum_{i < j} p_{ij}$$

$$E(X^3) = \sum_i p_i + 6 \sum_{i < j} p_{ij} + 6 \sum_{i < j < k} p_{ijk}$$

$$E(X^4) = \sum_i p_i + 14 \sum_{i < j} p_{ij} + 36 \sum_{i < j < k} p_{ijk} + 24 \sum_{i < j < k < l} p_{ijkl}$$

6. MOMENTS OF THE RANDOM VARIABLE X

Let X be the random variable denoting the number of rectangles. We find below the first three moments.

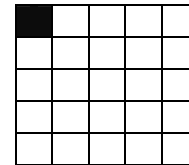
6.1 The First Moment

$$\phi_{ij} = \phi_{i+1j} = 1$$

where $i = 1, 2, 3, \dots, n-1$
 $j = 1, 2, 3, \dots, n-1$

$$E(X) = \sum_k p_k \text{ (} p_k \text{ is the probability of particular rectangle)}$$

$$= (n-1)^2 p^4 \text{ ----- (1)}$$



6.2 The Second Moment

For the second moment by the Corollary

$$E(X^2) = \sum_i p_i + 2 \sum_{i < j} p_{ij}$$

To obtain it we need $\sum p_{ij}$ which involves the probability of two particular rectangles and the final result is

$$E(X^2) = (n-1)^2 p^4 + 4(n-1)(n-2)p^6 + 4(n-2)^2 p^7 \\ + \left[2(n-1)(n-3)(n-4) + 2(n-2)^2(n-3) + (n-1)(n-2)^2(n-3) \right] p^8$$

6.3 The Third Moment

$$E(X^3) = \sum_i p_i + 6 \sum_{i < j} p_{ij} + 6 \sum_{i < j < k} p_{ijk}$$

To obtain it we need $\sum_{i < j < k} p_{ijk}$ which involves the probability of three particular rectangles. A large number of possibilities are modeled as a requirement of the Corollary in the Appendix.. We give below the final result.

$$E(X^3) = (n-1)^2 p^4 + 6 \left[2(n-1)(n-2)p^6 + 2(n-2)^2 p^7 + \left(\frac{(n-1)(n-2)(n-3) + (n-2)^2(n-3)}{2} \right) p^8 \right] \\ + 6 \left[\left(2(n-1)(n-3) + 4(n-2)^2 \right) p^8 + 8(n-2)(n-3)p^9 + \left(\frac{2(n-3)^2 + 2(n-1)(n-3)(n-4)}{+ 4(n-2)(n-3)(n-4)} \right. \right. \\ \left. \left. + 4(n-2)(n-3)^2 + 2(n-2)^2(n-3) \right) p^{10} \right] \\ \left(2n^4 - 16n^3 + 34n^2 + 40n - 48 \right) p^{11} + \frac{1}{6} \left(n^6 - 6n^5 + 40n^3 + 71n^2 - 490n + 480 \right) p^{12}$$

6.4. A REMARK ON ASYMPTOTIC MOMENTS OF X

Assuming that $n^2 p^4 \rightarrow \lambda$ as $n \rightarrow \infty$, and p is small, it is easy to see that the first, second, third moments of X are simplified to λ , $\lambda + \lambda^2$, $\lambda + 3\lambda^2 + \lambda^3$ respectively, indicating that X is asymptotically distributed as a Poisson random variable with λ as its parameter.

7. REFERENCES

1. Fuchs, C.E. and David H.T. (1965). Poisson Limits of Multivariate Run Distributions. *Ann. Math. Stat.*, 36: 215-225.
2. Memon A.Z. and David H.T. (1968). The Distribution of Lattice Join Counts. *Bulletin of the Institute of Statistical Research and Training*, 2(2), Reprint Series No. 252, Statistical Laboratory, Iowa State University, USA.
3. Memon A.Z. (2006). Unpublished Manuscript. Moments of Random Variables based on Binomial Trials. National College of Business Administration and Economics, Lahore.
4. Moran P.A.P. (1948). Interpretation of Statistical Maps. *J.R. Statist. Soc.*, 10, 243-251.

**SOME REMARKS ON DAVID & JOHNSON METHOD FOR FINDING
 MOMENTS OF ORDER STATISTICS BASED ON UNIFORM AND
 EXPONENTIAL DISTRIBUTIONS**

Hafiz M. Salman and Ahmed Zogo Memon

National College of Business Administration & Economics, Lahore
 Email: hafizsalman85@yahoo.com

ABSTRACT

F.N. David and N.L. Johnson (1954) provide a method of finding moments of order statistics when the sample size is not small. Little information is available about its precision, application or usefulness. This paper investigates the performance of their method for the first, second and third quartiles of random samples from uniform and exponential distributions.

1. INTRODUCTION

The use of order statistics is often made in life testing of industrial products. The derivation of their expected values and cumulants generally becomes tedious. F.N. David and N.L. Johnson (1954) propose a method of finding moments of order statistics when the sample size is large. Saw (1958) defines a general class of integrals for the moments of normal order statistics and applies David and Johnson method in obtaining approximations for these integrals. This paper investigates the performance of their method for the first, second and third sample quartiles based on rectangular and exponential distributions.

1.1 David & Jhonson Moments of Order Statistics (1954)

Let X be a continuous random variable with cdf $F(x)$. For a random sample of n observations from this distribution we denote the order statistics by X_1, X_2, \dots, X_n . Furthermore, let x_1, x_2, \dots, x_n be defined by the equations

$$F(x_m) = \frac{m}{n+1} \quad m = 1, 2, 3, \dots, n \quad (1.1.1)$$

then the expansion of X_m about x_m by inverse Taylor Series is

$$X_m = x_m + x_m^{(1)} h(X_m) + \frac{1}{2} x_m^{(2)} [h(X_m)]^2 + \dots \quad (1.1.2)$$

where $h(X_m) = F(X_m) - F(x_m) = F(X_m) - m / (n+1)$ (1.1.3)

and $x_m^{(i)} = \left. \frac{d^{(i)} x_m}{d F} \right|_{x=x_m}$; $i = 1, 2, 3, \dots$ (1.1.4)

David & Johnson (1954) find the expected value and cumulants of X_m as given in Appendix-A.

2. DAVID & JOHNSON CUMULANTS OF SAMPLE QUANTILES

We use appendix-A to find the cumulants of sample quantiles based on uniform and exponential distributions

2.1 Uniform Distribution

$$f(x) = \begin{cases} 1 & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases} \quad (2.1.1)$$

To determine $x_m^{(i)}$ we use $F(x_m) = x_m$

Here,

$$x_m^{(1)} = 1, \quad x_m^{(i)} = 0 \quad ; \quad i = 2, 3, 4, \dots \quad (2.1.2)$$

2.1.1 Lower Sample Quartile

Substituting (2.1.2) in equations given in appendix-A with

$$l = \frac{n+1}{4}; \quad p_l = 1/4 \quad \text{and} \quad q_l = 3/4 \quad \text{we get} \quad (2.1.1.1)$$

$$E(X_l) = \frac{1}{4}$$

$$K(X_l^2) = \frac{3}{16(n+2)}$$

$$K(X_l^3) = \frac{3}{16n^2} - \frac{15}{16n^3} + \frac{54}{16n^4} + \dots$$

$$K(X_l^4) = \frac{9}{128n^3} - \frac{54}{128n^4} + \dots$$

2.1.2 Sample Median

For the sample median, taking

$$m = \frac{n+1}{2}, \quad p_m = 1/2 \quad \text{and} \quad q_m = 1/2 \quad \text{we have} \quad (2.1.2.1)$$

$$E(X_m) = \frac{1}{2}$$

$$K(X_m^2) = \frac{1}{4(n+2)}$$

$$K(X_m^3) = 0$$

$$K(X_m^4) = -\left(\frac{3}{8n^3} - \frac{18}{8n^4} + \dots \right)$$

2.1.3 Upper Sample Quartile

$$u = \frac{3(n+1)}{4}, \quad p_u = 3/4 \quad \text{and} \quad q_u = 1/4$$

$$E(X_u) = \frac{3}{4} \tag{2.1.3.1}$$

$$K(X_u^2) = \frac{3}{19(n+2)}$$

$$K(X_u^3) = -\left(\frac{3}{16n^2} - \frac{15}{16n^3} + \frac{54}{16n^4} + \dots\right)$$

$$K(X_u^4) = \frac{9}{128n^3} - \frac{54}{128n^4} + \dots$$

2.1.4 Exact Cumulants of Sample Quantiles:

2.1.5 Rectangular Order Statistics

The r^{th} moment of m^{th} uniform order statistic is

$$= \frac{n! \overline{m+r}}{(m-1)! \overline{n+r+1}}$$

from where it follows that

$$E(X_l) = \frac{1}{4} \tag{2.1.5.1}$$

$$K(X_l^2) = \frac{3}{16(n+2)}$$

$$K(X_l^3) = \frac{3}{16n^2} - \frac{15}{16n^3} + \frac{57}{16n^4} + \dots$$

$$K(X_l^4) = \frac{9}{128n^3} - \frac{108}{128n^4} + \dots$$

$$E(X_m) = \frac{1}{2}$$

$$K(X_m^2) = \frac{1}{4(n+2)}$$

$$K(X_m^3) = 0$$

$$K(X_m^4) = -\frac{3}{8n^3} + \frac{24}{n^4} - \frac{132}{n^5} + \dots$$

$$E(X_u) = \frac{3}{4}$$

$$K(X_u^2) = \frac{3}{16(n+2)}$$

$$K(X_u^3) = -\frac{3}{16(n+2)(n+3)}$$

$$K(X_u^4) = \frac{9}{128n^3} - \frac{108}{128n^4}$$

Remarks :

David & Johnson method provides exact results for expected value and variance of all quartiles for each sample size. However the third and fourth cumulants separately have the same terms upto the order $1/n^3$. For large n these cumulants are nearly equal.

2.2 Exponential Distribution

$$f(x) = \frac{1}{\beta} e^{-\frac{x}{\beta}} \quad 0 < x < \infty, \beta > 0 \quad (2.2.1)$$

To find x_m and its derivatives from $F(x_m) = 1 - e^{-\frac{x_m}{\beta}}$ we have

$$x_m = [-\beta \ln(1-F)] \quad (2.2.2)$$

and its derivatives

$$x_m^{(i)} = \frac{(i-1)! \beta}{(1-F)^i}; \quad i = 1, 2, 3, \dots \quad (2.2.3)$$

2.2.1 Lower Sample Quartile

Substituting (2.2.3) in equations of appendix-A with $l = \frac{n+1}{4}$;

$$p_l = \frac{1}{4} \quad \text{and} \quad q_l = \frac{3}{4}$$

we get

$$E(X_l) = \beta \left[\ln\left(\frac{4}{3}\right) + \frac{1}{6(n+2)} + \frac{25}{108(n+2)^2} + \frac{8}{27(n+2)^3} \right] \quad (2.2.1.1)$$

$$K(X_l^2) = \beta^2 \left[\frac{1}{3(n+2)} + \frac{13}{18(n+2)^2} + \frac{217}{162(n+2)^3} \right]$$

$$K(X_l^3) = \beta^3 \left[\frac{7}{9(n+2)^2} + \frac{79}{27(n+2)^3} \right]$$

$$K(X_l^4) = \beta^4 \left[\frac{74}{27(n+2)^3} \right]$$

2.2.3 Sample Median

$$m = \frac{n+1}{2}, \quad p_m = \frac{1}{2} \quad \text{and} \quad q_m = \frac{1}{2}$$

$$E(X_m) = \beta \left[\ln 2 + \frac{1}{1(n+2)} + \frac{3}{4(n+2)^2} + \frac{1}{4(n+2)^3} \right] \quad (2.2.3.1)$$

$$K(X_m^2) = \beta^2 \left[\frac{1}{(n+2)} + \frac{5}{2(n+2)^2} + \frac{31}{6(n+2)^3} \right]$$

$$K(X_m^3) = \beta^3 \left[\frac{3}{(n+2)^2} + \frac{13}{(n+2)^3} \right]$$

$$K(X_m^4) = \beta^4 \left[\frac{14}{(n+2)^3} \right]$$

2.2.4 Upper Sample Quartile

$$u = \frac{3(n+1)}{4}, p_u = \frac{3}{4} \quad \text{and} \quad q_u = \frac{1}{4}$$

$$E(X_u) = \beta \left[\ln 4 + \frac{3}{2(n+2)} + \frac{11}{4(n+2)^2} + \frac{4}{(n+2)^3} \right] \quad (2.2.4.1)$$

$$K(X_u^2) = \beta^2 \left[\frac{3}{(n+2)} + \frac{21}{2(n+2)^2} + \frac{57}{2(n+2)^3} \right]$$

$$K(X_u^3) = \beta^3 \left[\frac{15}{(n+2)^2} + \frac{93}{(n+2)^3} \right]$$

$$K(X_u^4) = \beta^4 \left[\frac{126}{(n+2)^3} \right]$$

2.2.5 Exact Cumulants of Sample Quantiles (Exponential)

From the r^{th} moment

$$\frac{n!}{(m-1)!(n-m)!} \beta^r \frac{1}{r+1} \sum_{i=1}^m (-1)^{i-1} \binom{m-1}{i-1} \frac{1}{(n-m+i)^{r+1}}$$

of m^{th} exponential order statistic we can obtain the cumulants of quartiles by replacing m

$$\text{by } l = \frac{n+1}{4}, m = \frac{n+1}{2} \text{ and } u = \frac{3(n+1)}{4}.$$

Remark :

Since the r^{th} moment of a quartile by both methods has the same term β^r , the ratio of cumulants becomes independent of the exponential parameter β . The performance of David & Johnson relative to the exact method can therefore be evaluated without reference to β .

3. NUMERICAL STUDY

In this section we compare David & Johnson method with the exact method with respect to each quartile using the sample size $n = 3, 7, 11, 15, 19, 23$.

Lower Sample Quartile

We have computed the cumulants by both methods in the following table. The ratio of cumulant by David / Exact cumulant is also given.

n	Ratios			
	$E(X_l)$	$K(X_l^2)$	$K(X_l^3)$	$K(X_l^4)$
3	0.99794	0.95644	0.73606	0.29607
7	0.99981	0.99180	0.90258	0.52735
11	0.99996	0.99719	0.94880	0.65104
15	0.99999	0.99873	0.97050	0.72727
19	0.99999	0.99932	0.98113	0.76923
23	1.00000	0.99959	0.98621	0.81818

3.1 Sample Median

n	Ratios			
	$E(X_m)$	$K(X_m^2)$	$K(X_m^3)$	$K(X_m^4)$
3	0.99738	0.94522	0.69121	0.24940
7	0.99975	0.98918	0.88017	0.47797
11	0.99995	0.99629	0.93780	0.60551
15	0.99999	0.99840	0.96233	0.68510
19	1.00000	0.99907	0.97506	0.73659
23	1.00000	0.99932	0.98084	0.77586

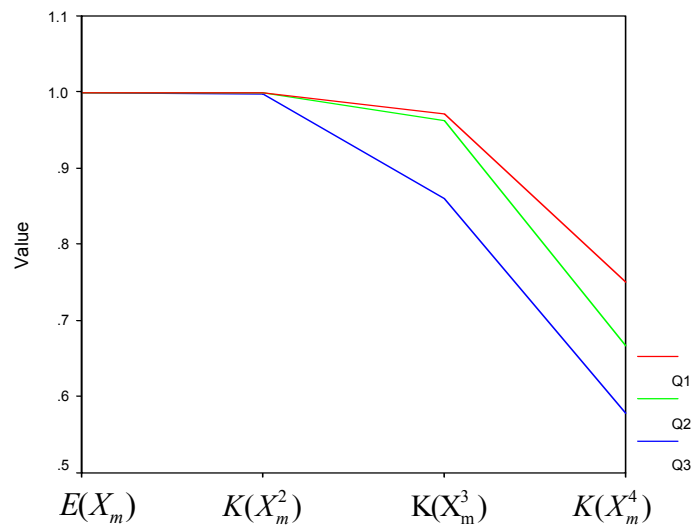
3.2 Upper Sample Quartile

n	Ratios			
	$E(X_u)$	$K(X_u^2)$	$K(X_u^3)$	$K(X_u^4)$
3	0.99725	0.91690	0.57830	0.15630
7	0.99971	0.98097	0.80940	0.35328
11	0.99993	0.99299	0.89438	0.48755
15	0.99997	0.99667	0.93345	0.57861
19	0.99999	0.99818	0.95451	0.64319
23	0.99999	0.99885	0.96675	0.69066

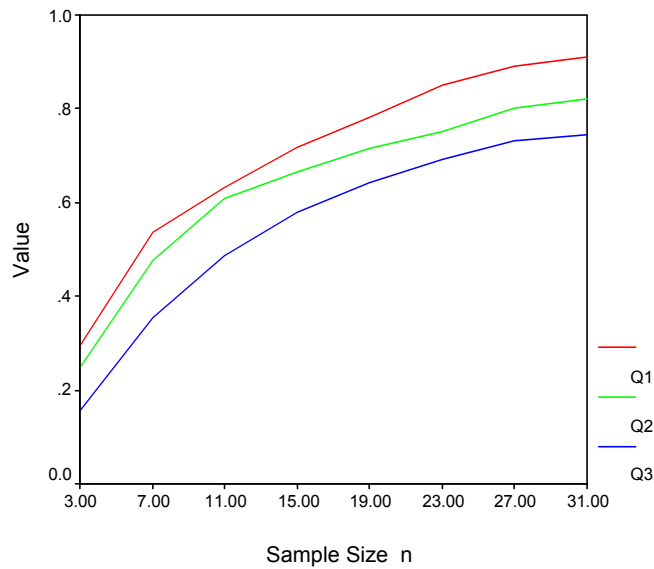
3.2 Graphical Presentation

To understand the behaviour of cumulant ratios we have a graph in the following

Cumulant Ratios for Sample Quartiles (n = 15)



Fourth Cumulant Ratios for Sample Quartiles against n



Remark

David & Johnson method provides nearly the exact expressions for the first two cumulants of all sample quartiles and for all n, but as n increases the difference between the two expressions decreases. However, the accuracy of this method deteriorates for the higher cumulants. In particular, for higher sample quartiles its performance further declines.

APPENDIX-A

$$E(X_m) = x_m + \frac{p_m q_m}{2(n+2)} x_m^{(2)} + \frac{p_m q_m}{(n+2)^2} \left[\frac{1}{3} (q_m - p_m) x_m^{(3)} + \frac{1}{8} (p_m q_m) x_m^{(4)} \right] \\ + \frac{p_m q_m}{(n+2)^3} \left[-\frac{1}{3} (q_m - p_m) x_m^{(3)} + \frac{1}{4} \{ (q_m - p_m)^2 - p_m q_m \} x_m^{(4)} + \right. \\ \left. \frac{1}{6} p_m q_m (q_m - p_m) x_m^{(5)} + \frac{1}{48} p_m^2 q_m^2 x_m^{(6)} \right]$$

and the second, third and fourth cumulants are

$$K(X_m^2) = \frac{p_m q_m}{(n+2)} (x_m^{(1)})^2 + \frac{p_m q_m}{(n+2)^2} \left[2(q_m - p_m) x_m^{(1)} x_m^{(2)} + p_m q_m (x_m^{(1)} x_m^{(3)} + \frac{1}{2} (x_m^{(2)})^2) \right] \\ + \frac{p_m q_m}{(n+2)^3} \left[-2(q_m - p_m) x_m^{(1)} x_m^{(2)} + \{ (q_m - p_m)^2 - p_m q_m \} \left(2 x_m^{(1)} x_m^{(3)} + \frac{3}{2} (x_m^{(2)})^2 \right) \right. \\ \left. + p_m q_m (q_m - p_m) \left(\frac{5}{3} x_m^{(1)} x_m^{(4)} + 3 x_m^{(2)} x_m^{(3)} \right) + \frac{1}{4} p_m^2 q_m^2 \left(x_m^{(1)} x_m^{(5)} + 2 x_m^{(2)} x_m^{(4)} + \frac{5}{3} (x_m^{(3)})^2 \right) \right]$$

$$K(X_m^3) = \frac{p_m q_m}{(n+2)^2} \left[2(q_m - p_m) (x_m^{(1)})^3 + 3 p_m q_m (x_m^{(1)})^2 x_m^{(2)} \right] \\ + \frac{p_m q_m}{(n+2)^3} \left[-2(q_m - p_m) (x_m^{(1)})^3 + 9 \{ (q_m - p_m)^2 - p_m q_m \} (x_m^{(1)})^2 x_m^{(2)} + 3 p_m q_m (q_m - p_m) \right. \\ \left. \left(3 (x_m^{(1)})^2 x_m^{(3)} + 4 x_m^{(1)} (x_m^{(2)})^2 \right) + p_m^2 q_m^2 \left(\frac{3}{2} (x_m^{(1)})^2 x_m^{(4)} + 6 x_m^{(1)} x_m^{(2)} x_m^{(3)} + (x_m^{(2)})^3 \right) \right]$$

$$K(X_m^4) = \frac{p_m q_m}{(n+2)^3} \left[6 \{ (q_m - p_m)^2 - p_m q_m \} (x_m^{(1)})^4 + 24 p_m q_m (q_m - p_m) (x_m^{(1)})^3 x_m^{(2)} \right. \\ \left. + 4 p_m^2 q_m^2 \left((x_m^{(1)})^3 x_m^{(3)} + 3 (x_m^{(1)})^2 (x_m^{(2)})^2 \right) \right]$$

4. REFERENCES

1. David, F.N. and Johnson, N.L. (1954). Statistical treatment of censored data, part I. fundamental formulae. *Biometrika*. 41, 228-240.
2. Hogg, R.V. and Craig, A.T. (1978). *Introduction to Mathematical Statistics*. Macmillan Publishing Company, Inc. New York.

**ROLE OF SMS / MOBILE MARKETING AND ITS GAINSAYS –
A NEW HORIZON FOR MICRO MARKETING.**

Muhammad Mazhar Manzoor

Department of Business Administration, Federal Urdu University of Arts
Sciences and Technology, Gulshan-e-Iqbal Campus, Karachi-75300
Email: mmazher@gmail.com

ABSTRACT

In general, there are four level of marketing segment such as mass marketing, segment marketing, niche and micro marketing. SMS marketing may equally fall by characteristics in niche and micro marketing but ideally it suited to the term micro marketing. As the mobile phone is becoming the ultimate personal communication device for users, SMS / Mobile Marketing can provide the opportunity for truly one to one interaction and relationship building with customers and the innovative use of SMS marketing can deliver real benefits to these companies. According to a survey conducted by a mobile marketing provider, approximately 89% of major brands are planning to market their products through text and multimedia mobile messaging by 2008. One-third is planning to spend about 10% of marketing budgets through mobile marketing. Also, in about 5 years over half of brands are expected to spend between 5% and 25% of their total marketing budget on their mobile marketing. Already, 40% of the firms that responded have implemented this feature for their audiences. Proponents say that if you're marketing entertainment or want to reach young people, SMS is the only way to stand out from the crowd.

In this study focus on customer behavior specifically either right messaging criteria helping them out in selection of relevant good or services or annoying them i.e. 'Prompt Customer response'. This study based on survey, conducted to most audience of today's mobile users such as youth and businesses. Meanwhile further scope of this study is to analyze those surveys, if possible establish proper correlation among different variables such as mode, taste and reaction upon receiving such SMS and Mobile marketing. Furthermore It highlight some legal and ethical issues of mobile marketing as well.

KEY WORDS

Marketing management, cellular companies and operators, market segmentation, niche marketing, micro marketing, sms marketing, consumer behavior, target marketing

INTRODUCTION

SMS is now firmly established as serious marketing weapon that a firm can benefit. The underlying idea behind mobile messaging is to empower users to communicate in an asynchronous manner, where messages are stored in the network and delivered to the recipient as soon as the recipient's mobile phone can receive it. SMS (Short Messaging Service) has grown to be the single most frequently used mobile data service. This

service is also referred to as “text messaging” or “texting”. SMS is a communication medium which enable mobile user to send and receive a message in a text form up to 160 characters and across virtually any operator network, since all mobile phones are shipped with this feature now a days which ultimately create a large addressable market for SMS – based mobile marketing.

For effective and efficient micro and niche level marketing, we can consider an new communication weapon by which a marketers can grab appropriate mass ‘s attention towards its marketing campaign if planned properly in effectuate way. Due to intense competition among service provider and a tight regulatory policy by PTA (Pakistan telecommunication Authority) average revenue per user (ARPU) also falls but as from revenue function we know that :

$$TR = \sum PQ \quad (i)$$

Total revenue may also depends on number of quantity being sold. In the light of above mention fact, facet to SMS marketing is definitely consider as new skyline for micro and niche marketing.

Table 1: Purpose of Using SMS by Respondents

Purpose of SMS	%age of respondents
people send business text messages from their mobile phone on a daily basis	65%
people receive business text messages from a member of their team/ department/office	50%
people receive business text messages from a colleague	47%
receive business text messages from a customer or client	36%
people use business texts for setting 'reminders of meetings and appointments'	71%
people used business texts for 'notifying people about new meetings and appointments'	18%
people use business text for 'chasing up suppliers or new orders'	14%
receive text messages from a customer or client	36%
people receive text messages from suppliers	11%

Source: e-marketers -2008

Scope

- This research aimed to identify that SMS marketing is getting rigorous popularity as a new domain for micro marketing.
- Investigate that how SMS marketing my influential in personal life of respondents
- Also limning the reaction upon getting such marketing messages
- Enumerates the responses of respondent upon receiving such marketing message
- Investigate how decision making process of an individual for purchase and sale of stuff, influenced by these SMS.

LITERATURE REVIEW

A survey by PTA revealed that two to three million peoples subscribe to the cellular network every month and people's relationship to the mobile phone is consistent with their general consumption styles. Ewan (2008) compile a comprehensive data for UK, accordingly 45 million mobile phones are in UK which aggressively using the text message services i.e. 1.5 billion text every month are sent. For this, contribution of peoples aged between 35-60 also 72% which shows its not only popular among youth, although mature peoples are also an integrating part of this emerging market of communication. Sally Robertson (2007) draws the attention towards SMS marketing's cost effectiveness and responsiveness, i.e. Mobile marketing is extremely responsive-5 times more than direct mail and approximately 80% cheaper than direct mail, further more it is innovative, interactive and measurable. Debbie, Ellis (2006) reached the conclusion from their survey that 38% of respondents liked to receive SMS advertisements, while 20.7% were indifferent to receiving these advertisements

Wilska (2003) draws the connection between consumption patterns and mobile phone use. The data stems from a survey of Finnish young people aged 16-20 indicating that an "addictive" use of the phone was related to "trendy" and "impulsive" consumption style usually prevalent among females. The necessity and mandatory requirement of cellular phones and SMS marketing have been recognized in a number of current researches. Their importance can be judged from the reality that they are no longer credentialed as bare technological objects but have acquired the status of social objects. Barraclough, Chris (2004) concluded the interesting benefits of SMS marketing such as it has 100% penetration, SMS targets end-customers in a very focused way via their mobile phone, It gives a higher recall and readership rate compared to the Internet or print ads, It compels the consumer to take action in order to enjoy a promotion, thus increasing the success rates of advertisers, advertising of products and services, advertising campaign and downloads of digital products can be offered to mobile phone users (consumers) via SMS at anytime and anywhere without need for an Internet connection, It lowers the barrier to enter for advertisers: any small business, around the corner restaurant can afford it. Furthermore, it is compatible with WAP and 3G mobile technology and it is already available and proven also advertising campaigns can be executed regionally or globally and it also offers a possibility of a real time assessment of results.

The progressive and dynamic growth and expansion of the global mobile phone market have made cell phones another weapon of marketing communication channel. Sending discount coupons through mobile phone text messages or short message service (m-coupons) has become the latest sales promotion trend for companies. Analysis of qualitative interviews with 30 students revealed that text messaging is the dominant mode of electronic communication amongst students and plays a central role in maintaining their social networks. The text message dialogue amongst students provides emotional and social peer support and facilitates an informal system of interdependent learning in relation to navigating unfamiliar academic and administrative systems.

O'doherty, Rao (2007), provide a unique examination of the link between perceptions of mobile content and the perceived role of the mobile phone in routine life in Australia. The mobile phone is seen as an inferior channel for entertainment and information as compared to television, magazines and the internet. It is primarily seen as a communication tool so the need of the time to develop successful revenue and profit

models in order to get around this quandary. Massoud, Gupta (2004) predict that m-commerce applications will contribute significant revenue which calls for a need to develop productive strategy in order to harness the potential.

SMS provides a medium for direct marketing. Direct marketing is described as "using a database to communicate (and sometimes distribute) directly to customers so as to attract a direct response" and database marketing is "using a database to hold and analyse customer information" (Tapp, 1998). Tapp (1998) points out that there is considerable overlap between database marketing and direct marketing.

Meaningful accumulated target market information can be used to produce a more meaningful product, thereby providing a greater incentive to buy. Thus the ability to effectively communicate a meaningful product to the target market will in turn allow for a differential competitive advantage to be established, as a product that better satisfies a need while also offering superior value will be purchased in preference to any substitute (Tapp, 1998:19). South African SMS solutions provider, Clickatell (2003), states that media used by marketers are usually rated on their reach, cost and effectiveness. The selected form of media to choose is therefore one that is rated highest in terms of the above criteria whilst also being appropriate to the target market. Clickatell (2003) and Sewsunker (2004) infer that SMS marketing is the only direct marketing technique that offers high reach, low cost and high retention. They also point out that 18-24 year olds are the most receptive age group to SMS marketing.

METHODOLOGY

This basal research study used a structured questionnaire as the instrument for data collection. It was designed to elude information on demographic and psychological aspects such as behavior, taste, trends, adoptability of the respondents. The demographic aspect included age, gender, and education level and field of study. The psychographic variable included attitude towards adaptability of SMS marketing, tolerance behavior influence, ethical and legal issues.

The sample comprised of 805 male/female professional from diverse fields, business & industrialist, university students and peoples from various social and ecological domains, age range 13 to 60 plus years, engaging in different professions and field of studies / specialization. The 805 respondents were selected on the basis of goal-directed sampling. Out of the total number of questionnaires, 28 were dropped from the analysis on counts of incomplete/ fake / selecting all dimension or choices data entry at the respondents end. Therefore the analysis presents data of 777 respondents, i.e. n=777. For the purpose of survey two main cities of Pakistan being selected i.e. Karachi and Islamabad. In addition to the primary research, secondary data was collected from articles published in latest academic journals, industry and governmental survey and reports.

DATA ANALYSIS AND DISCUSSION

1. SMS Usage Ratio

Among all respondent surveyed, a significant number of majority reported a bulky usage of SMS services as they considered it as mandatory function to perform. SMS usage ratio may be calculated by dividing the expense on SMS to total amount of balance available. A graphic depiction shows the percentage of amount respondents spending on

SMS out of their total balance. 67% of total respondents are spending 20 – 60 % of their total mobile balance on SMS sending. Most of them are using telenor and Ufone, i.e. 59%.

Table 2: Purpose of sending/ receiving SMS

Educational	12.35%
Entertainment	21.75%
Informational	22.91%
Others	16.2%
Multi Purpose	24.58%
Not answer	2.18%

Respondents also described the number of sending and receiving messages per day which is delineation as:

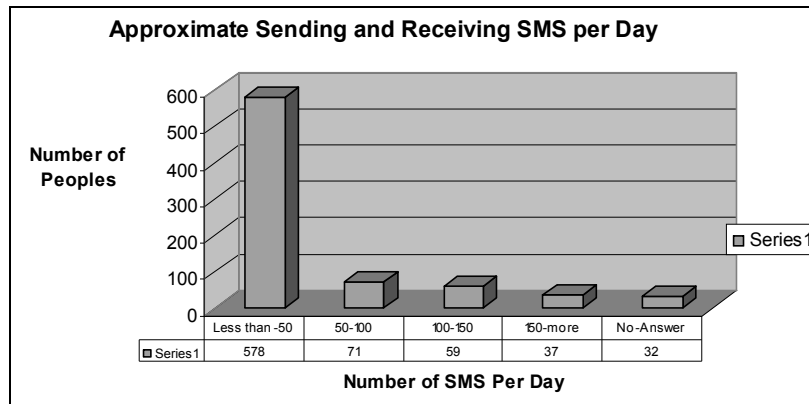


Fig. 1 : sending and receiving SMS per day

2. Knowledge and responses about SMS marketing

Respondents were asked to rank their response upon receiving marketing messages via SMS, among 777 peoples, 42% took it as good activity while 26.89 % took it more than good activity rather its creative and innovative one which help them in purchasing a right good or service at an appropriate cost, they think it saved them wandering all around for a good or service which is time effective. Thereof, 9.6% of respondent took it as bad activity which is problem some for them while rest of 16.6% thought its annoying activity which disturbed them while they are at work or office or home.

Table 3: Disturbance Due to SMS Marketing

Yes	18.15 %
NO	39.12 %
Often	9.13 %
Sometime	30.2 %
No Answer	3.35 %

75 % respondents acknowledged that SMS marketing is a avid source of information building process, due to lack of time they weren't able to watch and review other communication medium and channels, so this become blessing for them to be in touch with latest updating regarding product and services. Among 777 respondents, 90% were interested to opt this new way of marketing, i.e. SMS marketing, interesting result in this

connection is that remaining 10% did not answer this question though we may interpret them as may be or may be not category, so there is equal probability for deviation of these person towards receiving marketing SMS as well. We can infer this as more than 95 % are interested to receive marketing messages, this render the fastest penetration of SMS marketing in marketing world.

3. Ethical and Legal obligations

Due to repetitive and vague information transmission via SMS marketing, as it is remain unscheduled, unplanned and with out monitoring tool, most of the time it become panic for user to get rid of such marketing messages.

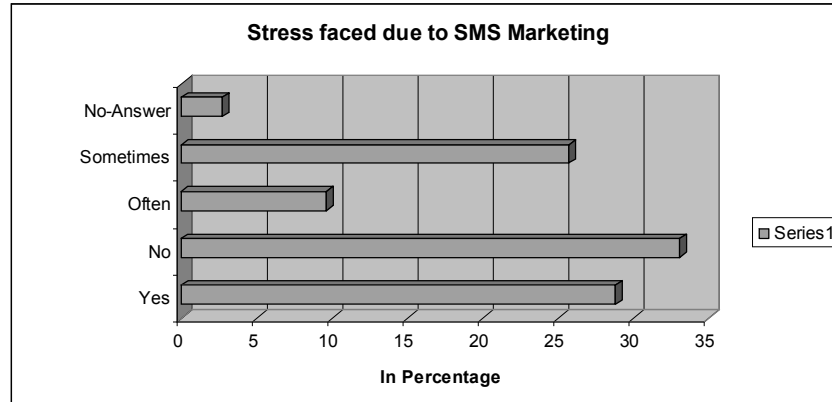


Fig 2: Stress faced due to SMS marketing

A fairly large number of respondents (86.6 %) admitted that they never complained against these stress producing messages. Another interesting result came when rest of respondents who launch their complain against these headache messages, told that mostly they never follow up for these complain (approximately 96 %) while among rest, 2.7 % said that there were no action taken by authorities for these complains. Similarly, mostly evaluate SMS marketing as legal way to advertise (70 %). 63 % of respondents were emphasized on law requirement on controlling and regulating these marketing SMS as already done in UK and USA. survey also showed that 25.6 % of respondents knows about legal frame work for communicating through SMS but surprisingly non of respondents were able to explain any dimension of existing laws relating to this issue.

4. Influencer of decision making process.

Now a days, in competitive age, time – constraint is getting significant importance, as a tool of marketing and communication, SMS marketing playing a vital role in decision making process i.e. it is helpful in both type of decisions like rational as well as intuitive too. Survey analysis reveals that a fairly large number of respondents (26 % approx.) influenced by these marketing message and it produce great impact on their decision making for purchasing, hiring or buying activity. It may be benchmark for upcoming days because this type of marketing is emerging with innovative ideas now a days, so far in future it may propel it self with more positive attitude. 38 % of respondents made purchased good or services while they come to know regarding that stuff via marketing

messages. 59 % admitted that these type of SMS enhance their knowledge about the reliability, cost, usage etc.

5. Ethical and legal responsibilities of the Marketer

User must accept responsibility for the consequences of their activities and make effort to ensure that its usage, recommendations and action function to identify, serve and satisfy all customers, organizations and society. Some set of rules which is universally govern and understood able for legal and ethical responsibilities as mentioned as follows:

- Not knowingly to do harm
- The adherence to all applicable laws and regulations
- The active support practice and promotion of the code of ethics
- Products and services offered are safe and fit for their intended uses
- Communications about offered products and services are not deceptive through SMS
- All users intend to discharge their obligation in good faith
- Appropriate internal service providers checks should be adjusted and or redress of grievances concerning
- Disclosure of all substantial risks associated with the wrong use of product or service usage
- Identify repercussion of misuse of services
- Avoidance of false misleading advertising through SMS
- Rejection of high-pressure manipulations or misleading sales tactics
- Avoidance of sales promotions that use deception or manipulation
- Not manipulating the availability of a service for purpose of exploitation
- Not using coercion in the marketing channel
- Not exerting undue influences over customer
- Prohibiting selling or fundraising under the guise of conducting research

6. Intention of receiving marketing SMS

Almost 71 % of respondents were willing or having intentions towards receiving these marketing messages.

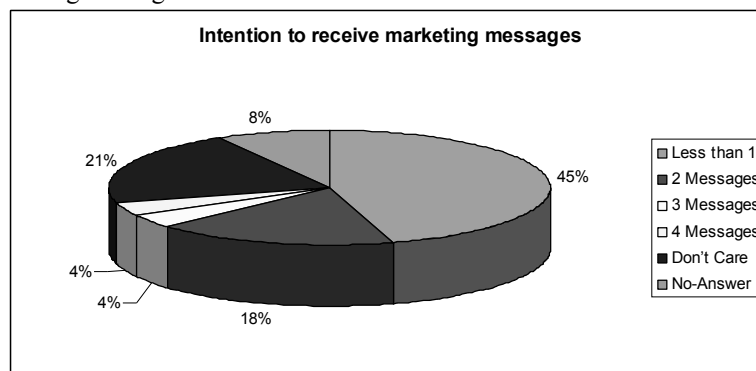


Fig. 3 : Intention to receive marketing messages

During survey it is also revealed that 49 % of respondents read the whole message.

Table 4: Extent of Message Reading

Not at all	9 %
Read about quarter of message than delete	22.5 %
Read half of message found unrelated than delete	11.7 %
Read about three quarter of message	3.2 %
Read the whole message	49.03 %
No answer	4.5 %

The result depict 47.1 % respondents read such message as whole as soon they received it.

CONCLUSION

SMS Advertising is an advertising and marketing tool which is a blend of electronic and mobile commerce methods which capitalize on the global reach of the Internet and the exponential growth of the mobile phone market. SMS advertising is a possibility to target consumer in a much focused way and is the shortest path to reach those peoples. SMS advertising is direct permission marketing that dramatically increases response rate. New concepts, based on SMS, can also be linked with other advertising media — SMS & Internet, SMS & TV, SMS & Email. “The advantages of mobile marketing are manifold - it's an intensely personalized medium, it attracts immediate response, it brings interactivity to new levels, and it tracks response by the hour for any marketing campaign,” according to Rajiv Hiranandani, CEO, Mobile2Win. Key challenges to address in wireless marketing include avoiding the mobile spam demon, creating compelling mobile content, and devising complementary channels for effective marketing. For instance, an interesting trend to watch for marketers is the growth of “mobisodes” or mobile episodes of radio and TV content. Cautionary steps have to be taken against abuse of SMS marketing or “over marketing,” however.

The premise of this paper was to study how SMS marketing is effectuate on our peoples, what are the challenges which is being faced by this novel tool of advertising and marketing. What is the acceptance ratio of such messages among common peoples. The results and data analysis of this study might be helpful and will provide a futuristic guide line based on reality that how they may promote different brands and products effectively in an efficient manner so that adaptation of this tool become easy for customer. Meanwhile, while making most of this tool, care should be taken in setting up ethical and legal lines for this marketing in context of environment in Pakistan.

REFERENCES

1. Bodnarchuk, R. (2003). The next chapter in the text-messaging saga. *Marketing Magazine*, (108)15.
2. McCorell, G. (1997). *Direct and Database Marketing*. London: Kogan Page Limited.
3. Green, Eileen and Singleton, Carrie (2007). Mobile Selves: Gender, ethnicity and mobile phones in the every day lives of young Pakistani-British women and men, Information. *Communication and Society*, 10(4), 506-526 (21), Routledge, part of the Taylor and Francis Group.

4. Harley, Dave; Winn, Sandra; Pemberton, Sarah and Wilcox, Paula (2007). Using texting to support students' transition to university. *Innovations in Education & Teaching International*, 44(3), 229-241 (13), Routledge, part of the Taylor & Francis Group.
5. Karim, Nor Shahriza Abdul; Darus, Siti Hawa; and Hussin, Ramalh (2006). Mobile phone applications in academic library services: a students' feedback survey, *Campus-Wide Information Systems*, 23(1), 35-51 (17), Emerald Group Publishing Limited.
6. L. Srivastava, (2005). Mobile phones and the evolution of social behavior. *Behavior and Information technology*, 24(2), 111-129 (19), Taylor and Francis.
7. Massoud, Samia; Gupta, Omprakash K. (2004). Consumer perception and attitude toward mobile communication. *International Journal of Mobile Communications*, 1(4), 390-408(19), Inderscience.
8. Nasar, Jack; Hecht, Peter; and Wener, Richard (2007). Call if you have trouble: Mobile Phones and Safety among College students. *International Journal of Urban and Regional Research*, 31(4), 863-873 (11).
9. Gautier, A. (2003). The Pester Factor. *NZ Marketing Magazine*. (22)6: 39.
10. JansenVan Ryssen, F. (2004). SMS Marketing: Its place in mobile commerce and opportunity in the South African market. *Acta Commercii*. (4): 48-59.
11. Ramsunder, K. 2005. A Study on Consumer Perceptions of M-Commerce technology, used in Marketing by First National Bank. Honours Dissertation.
12. Tapp, A. 1998. Principles of direct and database marketing. *Financial Times*. London: Pitman Publishing.
13. Terreblanche, M. and Durrheim, K. (1999). *Research in Practice: Applied Methods for the Social Sciences*. Cape Town: University of Cape Town Press.
14. Rogers, E. (2004). Cornetto backs love potions line with SMS push. *Marketing (UK)*, May: 4.
15. O'Doherty, Kieran; Rao, sally; and Mackay, Marisa Maio (2007). Young Australians perception of mobile phone content and information services: an analysis of the motivations behind usage, Young Consumers. *Insight and Ideas for responsible marketers*, 8(4), 257-268(12), Emerald Group Publishing Limited.
16. Wilska T.A. (2003). Mobile Phone Use as Part of Young People's Consumption Styles, *Journal of Consumer Policy*, 26(4), 441-463(23), Springer.

**A STUDY ON THE EFFECTS OF USING CELL PHONES
ON THE STUDIES OF STUDENTS**

Sonia Anjum and Nikhat Khan
Kinnaird College for Women, Lahore.
Email: sonia_4jc@yahoo.com

ABSTRACT

This paper presents a statistical study regarding the influence of using of cell phones on the studies of students. The data taken was a primary data and the responses collected were by means of a questionnaire. The responses were both qualitative and quantitative. The focus group of this study was youth and the target group as college students. The data was collected in December 2005 and January 2006, consists of 937 responses, representing a 100 percent response rate. The data was collected from the four top most colleges of Lahore. The names of the colleges are Kinnaird College, Forman Christian College, Lahore College for Women University and the Government College University. The nature of this research is extendable. The tests that were applied are, Paired sample T-test, Differences between two Proportions and Chi-square-test to test the relationship and association among the variables. The paper ends up with the no. of recommendations for the governmental authorities dealing with the implementation of common laws/ rules for colleges/universities, administration of the colleges/ universities, handset-makers and cell phone connection companies, and for the parents as well.

1. INTRODUCTION

Dr. Martin Cooper is considered the inventor of the first modern portable handset. He made the first call on a portable cell phone in April 1973. And To have a rough idea of how rapidly the use cell-phone has grown, the first commercial cell phone service was started by NTT in Japan on December 3, 1979. The commercial AMPS (Advanced Mobile Phone Service) began in the U.S.A in 1983. In Pakistan, the commencement of cell phones was with the AMPS technology which was introduced by Paktel, the cellular company. This technology does not need any sim card, as the function is implanted within the Cell Phone Set. Then later Mobilink, another cellular company was the first company to bring GSM technology in Pakistan. There are different cell phone connections and cell phone sets' companies working in Pakistan. The major connection companies in Pakistan are Paktel (now called as CM, Pak), Mobilink, Ufone, Telenor, Warid and Instaphone. And the cell phones sets' giants are, Nokia, Sony Ericsson, Motorola, Samsung, LG and Siemens. This study was undertaken to check whether there are any effects of using cell phones on the studies of students specifically on their grades and the time they are giving to their studies. The scope of this study is for the students, both male and female. For this research work Lahore's four top-most (with respect to study standards and merits), degree-awarding colleges were selected. The four colleges are: Kinnaird College for Women, Lahore College University, Forman Christian College and Government College University. The colleges selected were degree awarding

colleges and are the top most colleges of Lahore and the data was collected from the five percent of the population of these college students by means of a questionnaire.

2. LITERATURE REVIEW

Mizuko Ito and Okabe Daisuke (2000) did a research on mobile phones, Japanese youth, and the re-placement of social contact. Leysia Palen, Mailyn Salzman and Ed Youngs (2000) did a research on Going Wireless: Behavior & Practice of New Mobile Phone Users. Dariusz Leszczynski, Sakari Joenvaara, Jukka Reivinen, and Reetta Kuokka (2002) conducted a research on non-thermal of the hsp27p38MAPK stress pathway by mobile phone radiation in human endothelial cells: molecular mechanism for cancer- and blood-brain barrier-related effects. Dariusz Leszczynski (2002) researched on Effect of GSM Mobile Phone Radiation on Blood-Brain Barrier. Leif G. Salford, Arne E. Brun, Jacob L. Eberhardt, Lars Malmgren, and Bertil R. R. Persson (2003) conducted study on Nerve Cell Damage in Mammalian Brain after Exposure to Microwaves from GSM Mobile Phones. Kumiko Aoki and Edward J. Downes (2003) research with a title: Analysis of Young People's use of and toward Cell Phones. The Chartered Society of Physiotherapists (2005) warned the increase Attitudes in text messaging, especially popular with today's youngsters, may contribute to a rise in repetitive strain injury (RSI) in young thumbs. A research team of Kappa Omicron Nu Honor Society undergraduate and graduate students under the direction of Peggy S. Meszaros (2005) did a research on cell phone usage among college students. Another study was conducted by Lennart Hardell, Micheal Carlberg, Fredrick Söderqvist, Kjell Hansson, L Lloyd Morgan (2006) on long-term use of cellular phones and brain tumours: increased risk associated with use for ≥ 10 years.

3. OBJECTIVES OF THE STUDY

The objectives of the study are:

1. To check that how many of the students are actually using cell phones in colleges.
2. To compare the grades of the cell phone user students before and after using cell phones to test difference between two.
3. To compare the grades of the students working part-time, before using cell phone with that of the grades after using cell phone working part-time.
4. To compare the time spent by students on cell phones and the time they spent on studies.
5. To check the association of students who are having more than one cell phone with the time they are giving to their studies.
6. To check that the association of students having more than one cell phone with their grades which they have obtained after using cell phones.
7. To check the relationship of students having simple/ camera/ both the cell phones with the grades they are obtaining after using cell phones.
8. To test the relationship of students having a costly handset worth Rs. 10,000 and more than Rs. 10,000 with that of the time they are giving to their studies.
9. To test the relationship of students having a costly handset of worth Rs. 10,000 and more than Rs. 10,000 with that of the grades they are getting on using cell phones.

10. To check the association between the students who are having more than one cell phone connection with that of grades they are getting after using cell phones.
11. To check the association between the students who receive calls during the class with that of their sitting at the back in their lessons.
12. To check the association between the students who receive calls during their lessons call with that of the grades of the students that they are getting after using cell phones.
13. To check the association between the students who are spending credit of more than an amount of Rs.500 and their securing of grade less than or equal to 70%.

4. METHODOLOGY

Five percent of the population of these colleges was selected to run the tests on and to get the results in return. A total of nine hundred and thirty-seven questionnaires were filled out by those five percent students of the above mentioned colleges and universities. A questionnaire had three sections and for this research, only first two sections of the questionnaire were used. The first section of the questionnaire was meant for the cell phone users which had two portions. The first portion was the information regarding the handset and the second portion was the information regarding the connection. The second section was to determine whether the studies and grades of the students, were being affected by the excess use of cell phones or not. Options were provided against each of the question keeping in view the student's convenience and their precious time. SPSS, Minitab and Microsoft Excel were the computer softwares used in this research for the computations. And the tests applied for the analysis were *Chi Square test* to check the association between certain variables, *Paired Sample T-test* and the *Differences between two Proportions*.

5. DATA ANALYSIS AND RESULTS

The total no. of students who are using cell phones in the sample are seven hundred and fifty seven students (757) which makes their percentage as 80.79%. On comparing the pairs of grades which were taken before using and after using cell phones computed with the help of test Paired Sample T-test, there was no difference found. But after viewing the bar chart of the students giving grades before and after using cell phones, there was a difference observed in the number of students who secured above 80%. The number of the students securing above 80% marks decreased after using the cell phones. So to test it statistically, *Difference between two Proportions* was used by taking the proportion of grades of the students before and using cell phones. The test was applied using a computer program, *Minitab* which revealed p-value as 0.008, showing a strong significance that there got a difference in number of students securing above 80% after using cell, which left an interpretation that the number of students securing above 80% did decrease after using cell phones. After having the significant result, other differences between proportions were also checked college-wise by using the same test, *Difference between two Proportions*. First test was run on Kinnaird College, which revealed p-value as 0.140 which showed no statistical difference. On applying the test on FC College, p-value was turned to be 0.500 which also showed no statistical difference. After that, difference between two proportions was applied to Lahore College University that gave

p-value equals to 0.054 which also showed no statistical difference. Lastly the same test was applied to the GC University, which gave p-value as 0.000 signally the strong significant difference and also indicating about the reason for the overall change as well. So, for GC University, after testing statistically, it was revealed that there got a difference in the number of students securing above 80% after using cell phones.

The other hypothesis was to check whether there is any difference in the grades of students doing part time work, keeping in mind that earning could be the factor on using cell phone more than an average cell phone-user student. Because the students earning besides their studies could spend money on their cell phones more than the students who are not earning plus they can also afford latest mobiles phone sets which could lead to more interest towards this amazing gadget and hence their grades could be affected. But on testing the hypothesis by applying Chi Square test, the results revealed no association at all.

Another postulate tested to check that if there is any difference among the time spent on studies and the time spent on cell phones by the students. Chi-Square test was applied. On testing, it revealed that the students who spend more time using cell phones has no association with giving more time to their studies. Another comparison was run to check if there is any relationship between the students who are using more than one cell phone with that of the time they are giving to their studies. In this comparison, it was observed that there were fifty-one (51) students were found using more than one cell phone out of seven hundred and fifty-seven (757) students who were cell phone users. Chi-square test was applied to test the relationship. On application of the test, it showed a strong relationship between the two. So, it revealed that the students who are owner of / are using more than one cell phone has got a strong association with that of the time that they giving to their studies. The next relationship that was investigated based on the previous one. It was to check the relationship among the students who are using more than one cell phone with that of the grades they are getting after using cell phones because the previous results have proved a strong association with the time they are giving to their studies. Again Chi-Square test was applied to test the independence. Which again showed a relationship between the two factors and it supported the previous test as well which was done with the time that the students gave to their studies. So the students who are owner of/ using more than one mobile phone is associated with the grades they are getting after using Cell Phones.

The relationship of the students using Camera Cell Phones or both (Simple and Camera Cell Phones) was also compared with the time students giving time to their studies as well as with the grades they are getting after using mobile phones. To sort out both the relationships Chi-Square test was used. For the first hypothesis which was to check in respect to the time of the students that they are giving to their studies, showed no association with the usage of camera mobile phone. On the contrary, the second test in respect to the grades that students are getting after using the cell phones, showed a strong association with their usage of camera mobile phone.

Other relationships were also been tested to check whether the price of the cell phones matter against the time given to the studies by the students as well as against the grades got by the students after using cell phones. So, the price of the cell phones was divided in

such a way that illustrates the modernism and advance features of the cell phones in use. The price that played as a separator-price role was Rs. 10, 000. To test the first part, two categories were made in such a respect showing one as of worth below Rs. 10, 000 and the other was of worth Rs. 10, 000 and more against the four time categories which students used to give to their studies. And to test the second part, the two price categories were tested against the four-grade's categories. For the both the test again Chi-Square test was used. So the first result showed no relationship among the costly mobile phone of worth Rs. 10, 000 or more with that of the time, students give to their studies. But on the contrary, the second result revealed a strong association detected between the students who are owner of/ are using costly mobile phones of worth Rs. 10, 000 or more with that of the grades they are getting after using cell phones.

Another analysis was done to check the association between the students using more than one cell phone connections with that of the grades they are getting after using cell phones. Chi-square test was used for that. There was again a strong association found, showing relationship between the students having more than one cell phone connection and the grades they are having after using cell phones.

An association between the students who receive calls during their lessons with that of the grades they were having after using cell phones was also tested by using of Chi-square test. A strong association was observed between the students who receive calls during their lessons and the grades they are having after using cell phones, could be an alarm to their studies and a source of distraction for other students as well.

A relationship between the students receiving calls during their lessons with that of the grades they are having was also tested by using Chi-square test. The results revealed that no relationship of students receiving calls during their lessons with that of the grades they are getting after using cell phones. Another association was also checked between the average credit-usage of an amount more than Rs.500 by the students with that of the grades they are securing less than or equal to 70%. The results revealed an association between the students spending an average amount more than Rs.500 with that of the grades they are getting after using cell phones.

6. CONCLUSIONS AND RECOMMENDATIONS

Under the light of the study conducted, following recommendations are for the governmental authorities dealing with the implementation of common laws/ rules for colleges/universities, administration of the colleges/ universities, for the handset-makers, for the cell phone connection companies, and the parents to make note of and authorities of the colleges and universities can implement these points to get good results

- having more than one cell phone affects the time that the students are giving to their studies and moreover the grades are also being affected. On restriction of more than one cell phone would make the students to give proper time to their studies because having one cell phone can meet the student's basic communication need if there is any and eventually the good grades in studies
- having a camera cell phone affects the grades of the students, so it would be therefore suggested to curb camera cell phones in the study campus

- having cell phone of worth more than Rs.10,000 or more, with advance and contemporary features affects the grades of the students due to the distraction. Handset companies should provide the students with a proper guide booklet that they may purchase their mobile phones within the mentioned limit with a proper permit. Permission from the parents/ colleges/ universities could be requested from students to prevent the bad use/ criminology
- to avoid distraction during the lessons, cell phones should be restricted in the class rooms or if allowed then the cell phones should be on switched-off mode
- having more than one connection, with different services affects the grades of the students because of the distraction. Hence, there should be a proper channel by which cell phone connection companies should sell their connections keeping in view the record of the precious connection of the student if there is any or there should be a proper guide booklet that may help the students to choose a single connection for themselves. Permission from the parents/ colleges/ universities could be requested from students to prevent the bad use/ criminology
- parents should make sure that the students should not be using balance of more than Rs.500/month (exceptions are always there on negative and positive sides) as it could be an alarm towards the grades of the students.

REFERENCES

1. University of North Texas (2005). *Study says students dependent on cell phones.* <http://web2unt.edu/news/story.cfm?story=9143>
2. Jennifer Anderson (2005). *Cell Phone Design Given a Failing Grade for Usability.* <http://www.ergoweb.com/news/detail.cfm?id=1177>
3. Jennifer Anderson (2005). *New Study Recasts Cell Phones as Effective Teaching Tool.* <http://www.ergoweb.com/news/detail.cfm?id=1180>
4. Dan Cannon (2005). *Two Thumbs Down to Increased Texting Among Teens.* <http://www.ergoweb.com/news/detail.cfm?id=1188>
5. Virginia Polytechnic Institute and State University (2007). *Professor researches cell phone usage among college students.* <http://www.physorg.com/news91732046.html>
6. Leszczynski, D. et al. (2002). Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in the human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects. *Differentiation* 70: 120-129.
7. Leszczynski, et al. (2002). *Effect of Gsm Mobile Phone Radiation on Blood-Brain Barrier.* http://dynamics.org/Altenberg/MED/CELL_PHONES/p1043.pdf
8. Hardell et al. (2007). Long-term use of cellular phones and brain tumours: increased risk associated with use for ≥ 10 years. *Occupational and Environmental Medicine.* 64: 626-632. http://dynamics.org/Altenberg/MED/CELL_PHONES/626.pdf
9. Kumiko Aoki and Edward J. Downes (2003). An analysis of young people's use of and attitudes toward cell phones. <http://portal.acm.org/citation.cfm?id=948917>

**BAYESIAN ANALYSIS OF THE TWO COMPONENT MIXTURE
OF THE EXPONENTIAL DISTRIBUTION ASSUMING THE
UNINFORMATIVE AND INFORMATIVE PRIORS**

Mirza Naveed Shahzad¹, Muhammad Aslam² and Muhammad Saleem²

¹ Deptt. of Statistics, University of Gujrat, Gujrat. Email: naveedshahzad4@hotmail.com

² Deptt. of Statistics, Quaid-i-Azam University Islamabad. Email: aslamsdq@yahoo.com

ABSTRACT

Exponential distribution, because of its memory-less property, is used for the life-testing of the products that do not age with time. In this paper, Bayesian analysis is made of the two component mixture of the Exponential distribution assuming the uninformative and informative priors. The possible uninformative priors include Uniform and Jeffreys priors and informative include Inverted Chi-square and Inverted Gamma priors. The motivation is to explore the most appropriate prior for the mixture of Exponential, between uninformative and informative priors. A mixture data is simulated and the censored sampling is assumed to be employed. The elicitation of the hyper-parameters is made by the help of the trend of predictive interval for the future observation in terms of more favorable combinations of the hyper-parameters and by the expert's suggestions. A comparison is presented of the Bayes estimates and their variances assuming the selected uninformative and informative priors. Frequentist approach is also used for comparison of Bayesian and classical estimates.

KEYWORDS

Mixture distribution; Exponential model; Uniform; Jeffreys; Inverted Chi-square; Inverted Gamma priors; Bayes Predictive Interval; Maximum Likelihood estimator.

1. INTRODUCTION

The current century has exposed a multitude of fields of application which demonstrate features that demand the use of mixture models, measurement are available from experimental units which are known to belong to one set of classes but their individual class memberships are unavailable. Only mixture models offer systematic treatment for such mixture structure.

In this paper, we are interested to estimate the parameters of the two component mixture of Exponential distribution form a number of subpopulation mixed with an unknown proportion. Generally in survival analysis of components we have censored data due to the two restrictions one is time and other is cost. Hence life testing distribution often deals with censored sample in order to estimate the mixture proportions and the parameters of the conditional distributions.

Lifetime distributions have been extensively used in the study of data arising from times to failure of units under observation. A finite mixture of distributions arises in a

variety of applications. The estimation of the parameters of finite mixture distributions has many more different applications that are listed by Titterington et al. (1985). Sinha (1998) has obtained the 95% Predictive Intervals for various sets of values of the hyper-parameters using the sample of size from the Mendenhall and Harder (1958) mixture model. The exponential distribution, because of its memory-less property, is used for the life-testing of the products that do not age with time. Gosh and Ebrahimi (2001) have made the Bayesian analysis of the mixing function in a mixture of two exponential distributions. Saleem and Aslam (2008) presented a comparison of the Maximum Likelihood estimates with the Bayes estimates using the Uniform and Jeffreys priors for the parameters of the two component Rayleigh mixture. Saleem and Aslam (2007) mentioned a comparison of the 95% Bayes predictive intervals for the two component mixture of the Rayleigh distribution with different informative priors with a motivation to look for the better prior among the available standard informative conjugate priors.

2. THE POPULATION AND THE MODEL

Consider a population that age doesn't with time i.e., the memoryless property hold for them and suppose the population comprises two subpopulations each with a different life expectancy. So a mixture of two Exponential distributions is appropriate to model such population. A finite mixture density function with the two component densities of specified parametric form (but with unknown parameters, θ_1 & θ_2) and with unknown mixing weights, p and $1-p$. Finite mixture distribution function with two component of Exponential distribution is $F(t) = pF_1(t) + qF_2(t)$; $q = 1-p$, $0 < p < 1$, with the corresponding finite mixture density function given by with the two component densities of specified parametric (Exponential) form

$$f(x) = p\theta_1^{-1}\exp(-t/\theta_1) + (1-p)\theta_2^{-1}\exp(-t/\theta_2), \quad 0 \leq \theta_1, \theta_2 < \infty, \quad 0 \leq p \leq 1, \quad t > 0.$$

3. SAMPLING

In sampling, suppose we take n units from the above mixture model are employed to a life testing experiment with a test termination time T . Let the test be conducted and it is observed that out of $n-r$, units have the lifetime in the interval $(0, T]$. Let out of r units, r_1 units be observed from the first subpopulation, r_2 units from the second subpopulation with $r = r_1 + r_2$ and $n-r$ units are still functioning when the test termination time T is over. We define t_{ij} = the failure time of the j th unit belonging to the i th subpopulation, where; $j = 1, 2, \dots, r_i$; $i = 1, 2$; $0 < t_{1j}, t_{2j} < T$.

4. THE LIKELIHOOD FUNCTION OF MIXTURE MODEL

Consider the existence and properties of Likelihood function for the mixture distributions. Let out of n units r units have life time in the interval $(0, T]$ and $n-r$ units have life time in the interval (T, ∞) . The likelihood function for such situation is

$$L(\theta_1, \theta_2, p | t) \propto \left\{ \prod_{j=1}^{r_1} p f_1(t_{1j}) \right\} \left\{ \prod_{j=1}^{r_2} q f_2(t_{2j}) \right\} \left\{ (1 - F(T))^{n-r} \right\} \tag{4.1}$$

where $t = (t_{1j}; t_{2j}) = (t_{11}, t_{12}, \dots, t_{1r_1}; t_{21}, t_{22}, \dots, t_{2r_2})$ and $F(T) = pF_1(T) + qF_2(T)$

Substituting the values of $f_1(t_{1j}), f_2(t_{2j})$ and $F(T)$ in (4.1) and for convince, variables are transformed into new variables as $t_{1j} / T = x_{1j}$, $t_{2j} / T = x_{2j}$, $\theta_1 / T = \beta_1$, $\theta_2 / T = \beta_2$, and got the one answer of the Jacobian matrix, then the above likelihood function becomes

$$L(\theta_1, \theta_2, p | t) \propto \left. \begin{aligned} & \sum_{k=0}^{n-r} C_k^{n-r} p^{n-k-r_2} (1-p)^{r_2+k} \beta_1^{-r_1} \beta_2^{-r_2} \\ & \times \exp(-\beta_1^{-1}(r_1 \bar{x}_1 + n - r - k)) \exp(-\beta_2^{-1}(r_2 \bar{x}_2 + k)) \end{aligned} \right\}$$

where $\bar{x}_1 = \sum_{j=1}^{r_1} \frac{x_{1j}}{r_1}$ and $\bar{x}_2 = \sum_{j=1}^{r_2} \frac{x_{2j}}{r_2}$

So this is the Likelihood function of the two component mixture of Exponential distribution. Now we will proceed further with suitable priors for Bayesian estimation of parameters.

5. ASSUMING UNINFORMATIVE PRIORS

Uniform and Jeffreys priors are well known uninformative prior, these prior are assumed in this study for the estimation of parameters when we have no prior information. Uniform prior for the unknown parameter β_i can easily be calculated as $\beta_i \square U(0,1)$. We assume that $(\beta_i, p); i=1,2$ are independent a priori and we further assuming that $p \square U(0,1)$. So the joint prior distribution of β_1, β_2 and p is $g(\beta_1, \beta_2, p) \propto 1$.

With the help of Bayes theorem we made the posterior distribution as combining likelihood function and joint prior distribution we get joint posterior of β_1, β_2 and p as under

$$h(\beta_1, \beta_2, p | x) = \frac{\sum_k^{n-r} C_k^{n-r} p^{a_k} (1-p)^{b_k} \beta_1^{-r_1} \beta_2^{-r_2} \exp(-\beta_1^{-1} c_k) \exp(-\beta_2^{-1} d_k)}{\Gamma(r_1 - 1) \Gamma(r_2 - 1) \sum_{k=0}^{n-r} C_k^{n-r} B(a_k + 1, b_k + 1) c_k^{-(r_1 - 1)} d_k^{-(r_2 - 1)}} \tag{5.1}$$

$0 \leq \beta_1, \beta_2 < \infty, 0 \leq p \leq 1$

where $a_k = n - r - k + r_1$, $b_k = r_2 + k$, $c_k = r_1 \bar{x}_1 + (n - r - k)$, $d_k = r_2 \bar{x}_2 + k$

The second assumed uninformative prior is Jeffreys prior. Jeffreys prior for the unknown parameter β_i can easily be calculated as $g(\beta_i) = \beta_i^{-1}$. We assume that $(\beta_i, p); i = 1, 2$ are independent a priory and we further assuming that $p \square U(0,1)$. So the joint prior distribution of β_1, β_2 and p is $g(\beta_1, \beta_2, p) \propto (\beta_1 \beta_2)^{-1}, 0 \leq \beta_1, \beta_2 < \infty$. Combining likelihood and joint prior distribution we get joint posterior as under

$$h(\beta_1, \beta_2, p | x) = \frac{\sum_k^{n-r} C_k^{n-r} p^{a_k} (1-p)^{b_k} \beta_1^{(r_1+1)} \exp(\beta_1^{-1} c_k) \beta_2^{(r_2+1)} \exp(\beta_2^{-1} d_k)}{\Gamma(r_1) \Gamma(r_2) \sum_k^{n-r} C_k^{n-r} B(a_k + 1, b_k + 1) c_k^{-r_1} d_k^{-r_2}} \quad 0 \leq \beta_1, \beta_2 < \infty$$

where $a_k = n - r - k + r_1, b_k = r_2 + k, c_k = r_1 \bar{x}_1 + (n - r - k), d_k = r_2 \bar{x}_2 + k$.

Bayes estimates are found by the marginal distribution, those are derived from the posterior distribution. Bayes estimator of β_1, β_2 and p is

6. ASSUMING INFORMATIVE PRIORS

In the case of informative prior we assumed Inverted Gamma prior and Inverted Chi-square prior. Firstly we assumed that β_1 and β_2 are independently a priory and follow Inverted Gamma distributions with parameters m_1, l_1 and m_2, l_2 . We further assuming that $p \square U(0,1)$. So the joint prior distribution of β_1, β_2 and p is $g(\beta_1, \beta_2, p | x) \propto \beta_1^{-(l_1+1)} \beta_2^{-(l_2+1)} \exp(-m_1 / \beta_1) \exp(-m_2 / \beta_2), 0 \leq \beta_1, \beta_2 < \infty, m_1, m_2, l_1, l_2 > 0$ where m_1, m_2, l_1 and l_2 are hyper-parameters. The joint posterior distribution is very important in Bayesian statistics. It is found as that the joint Posterior distribution \propto (Prior distribution) (Likelihood function).

$$h(\beta_1, \beta_2, p | x) = \frac{\sum_{k=0}^{n-r} C_k^{n-r} p^{a_k} q^{b_k} \beta_1^{-(r_1+l_1+1)} \beta_2^{-(r_2+l_2+1)} \exp(-\beta_1^{-1} (c_k + m_1)) \exp(-\beta_2^{-1} (d_k + m_2))}{\Gamma(r_1 + l_1) \Gamma(r_2 + l_2) \sum_{k=0}^{n-r} C_k^{n-r} B(a_k + 1, b_k + 1) (c_k + m_1)^{-(r_1+l_1)} (d_k + m_2)^{-(r_2+l_2)}} \quad 0 \leq \beta_1, \beta_2 < \infty, m_1, m_2, l_1, l_2 > 0$$

where $a_k = n - r - k + r_1, b_k = r_2 + k, c_k = r_1 \bar{x}_1 + (n - r - k), d_k = r_2 \bar{x}_2 + k$

Secondly we assumed that β_1 and β_2 are independently a priory and follow Inverted Chi-square distributions with parameters w_1 and w_2 . We further assuming that $p \square U(0,1)$. So the joint prior distribution of β_1, β_2 and p is

$$g(\beta_1, \beta_2, p | x) \propto \beta_1^{(w_1/2)+1} \beta_2^{(w_2/2)+1} \exp(-1/2\beta_1) \exp(-1/2\beta_2), 0 \leq \beta_1, \beta_2 < \infty, w_1, w_2 > 0$$

Prior information is combining with experimental data to arrive at the joint posterior probability distribution as

$$h(\beta_1, \beta_2, p | x) \propto \sum_{k=0}^{n-r} C_k^{n-r} p^{a_k} q^{b_k} \beta_1^{-(r_1+(w_1/2)+1)} \beta_2^{-(r_2+(w_2/2)+1)} \exp(-\beta_1^{-1} y_k) \exp(-\beta_2^{-1} z_k)$$

$$0 \leq \beta_1, \beta_2 < \infty, 0 \leq p \leq 1, w_1, w_2 > 0$$

where $a_k = n - r - k + r_1$, $b_k = r_2 + k$, $y_k = r_1 \bar{x}_1 + (n - r - k) + 0.5$, $z_k = r_2 \bar{x}_2 + k + 0.5$

7. THE PREDICTIVE INTERVAL OF THE INFORMATIVE PRIOR

The predictive distribution of the future observation is obtained for $(1 - \alpha)100\%$ Bayesian Predictive interval (L, U) is by solving the following two equations for both informative priors

$$\int_0^L p(y|t) dy = \frac{\alpha}{2}; \quad \int_U^\infty p(y|t) dy = \frac{\alpha}{2}$$

8. ESTIMATION OF PARAMETERS BY THE ML METHOD

Method of maximum likelihood is often used for estimating the parameters in Classical Statistics. In this section we obtained the three equations by taking log and partial derivations of the likelihood function of the sample data. Those expressions contain the unknown parameters. The numerical values of unknown parameters are found for comparison proposes with Bayesian theory results. These three equations, in simplified form, are

$$\frac{r_1 \bar{x}_1}{\beta_1} + \frac{(n-r)p \cdot \exp(-\beta_1^{-1})}{\beta_1 (p \cdot \exp(-\beta_1^{-1}) + q \cdot \exp(-\beta_2^{-1}))} = r_1;$$

$$\frac{r_2 \bar{x}_2}{\beta_2} + \frac{(n-r)q \cdot \exp(-\beta_2^{-1})}{\beta_2 (p \cdot \exp(-\beta_1^{-1}) + q \cdot \exp(-\beta_2^{-1}))} = r_2$$

$$\frac{(1-p)r_2}{p} + \frac{(1-p)(n-r) (\exp(-\beta_1^{-1}) + \exp(-\beta_2^{-1}))}{\beta_2 (p \cdot \exp(-\beta_1^{-1}) + q \cdot \exp(-\beta_2^{-1}))} = r_2$$

It is not possible to solve the above system of three non-linear equations analytically. However, they can be solved by the numerical iterative procedure using the SAS package. Let $\hat{\beta} = (\hat{\beta}_1, \hat{\beta}_2, \hat{p})$ and by the properties of MLE's $\hat{\beta} \square N(\beta, I^{-1}(\beta))$ where $I(\beta) = -E \left(\frac{\partial^2 l}{\partial \beta \partial \beta'} \right)$ is the information matrix of order 3×3 , inverting it we can find the variance of MLE's on the main diagonal.

9. A NUMERICAL STUDY

Now we take a numerical example to analysis our result those are obtained from the two component mixture of Exponential distributions with Informative, Uninformative priors and ML method. We take a random sample of size $n=400$ from the mixture of two Exponential distributions censored at $T = 300$. It is randomly generated data with the proportion of mixture $p=0.375$. A uniform number u is generated 400 times and if $u < p$ the observation is taken randomly from F_1 (the Exponential distribution with parameter $\theta_1 = 76$), Otherwise from F_2 (the Exponential distribution with parameter $\theta_2 = 126$). So the estimated parameters need to equal with $\theta_1 = 76$ and $\theta_2 = 126$ and $p = 0.375$. We censored our data at time T . Actually the observations greater than T will never be observed during the real test of survival analysis and hence all the observations that are greater than T are ignored while calculating and conducted. In practically elements generated observations are easily distinguished to be a member of either subpopulation-I or subpopulation-II. Ignoring values that are greater than $T = 300$ in both the subpopulations, the above data yields $n = 400$, $r_1 = 147$, $r_2 = 228$, $r = 375$,

$$n - r = 25, \bar{t}_1 = \frac{t_{1j}}{r_1} = 69.4713, \bar{t}_2 = \frac{t_{2j}}{r_2} = 96.5028, \bar{x}_1 = \frac{\bar{t}_1}{T} = 0.2315, \bar{x}_2 = \frac{\bar{t}_2}{T} = 0.3216.$$

9.1 Estimation of Bayesian Predictive Interval Assuming Inverted Gamma Prior

The Bayesian estimation of parameters in case of informative prior necessitates the elicitation of hyper-parameter. Bayesian Predictive intervals assuming the Inverted Gamma prior are found by using equations (7.1.1) and (7.2.2) for different combinations of the hyper-parameters. We used the combinations of $m_1, m_2 = 10, 40, 70, 100, 150$ and $l_1, l_2 = 10, 40, 70, 100, 150$. The trend observed of the L and U, it is examine that the lower values of, m_1, m_2 and higher values of l_1 and l_2 make predictive intervals minimum. To make our prior information more reliable, we take some experts opinion about the hyper-parameters. Bring in mind the objective (predictive internals trends) and subjective (experts suggestions) approaches, finally select the values of the hyper-parameters as $l_1 = 40, l_2 = 20, m_1 = 10, m_2 = 10$.

9.2 Bayesian Predictive Interval Assuming the Inverted Chi-Square Prior

As inverted Chi-Square distribution has single parameter. Here two Chi-Square distributions are assuming prior distribution; therefore there are two hyper-parameters. For elicitation of hyper-parameters Bayesian Predictive intervals are found by using equations (7.2.1) and (7.2.2) for different combinations of the hyper-parameters, those are $w_1 = 10, 40, 70, 100, 150$ and $w_2 = 10, 40, 70, 100, 150$. Observing the predictive intervals, we analysis that the intervals become high as we increase the value of w_1 and the interval goes down as we increase w_2 . We also use some subjective approach to make our prior information more reliable, we take some experts judgment about the hyper-parameters. They suggested us various combinations of hyper-parameters those leads us to more efficient results. The recommended combination of hyper-parameters (w_1, w_2) are as (50,125), (40,110), (75,150), (60,135) and (55,90). After taking the experts verdict we

select minimum value of w_1 from the recommended combinations, so $Min(50,40,75,60,55)=40$ and we select maximum value of w_2 from the advised combination, so $Max(125,110,150,135,90)=150$. Using both subjective and objective approaches, finally we select values of the hyper-parameters as $w_1 = 40$ and $w_2 = 150$.

10. COMPARISONS OF THE INFORMATIVE, UNINFORMATIVE PRIORS AND CLASSICAL ESTIMATES

In this section, comparisons are made on the basis of the estimates and their standard deviation. Standard deviations are very important for comparisons purpose, because the estimator which has lesser standard deviation will more reliable and efficient. When presenting a Statistical estimate, it is usually necessary to indicate the accuracy of the estimate. The customary Bayesian measure of the accuracy of an estimate is the posterior variance/posterior standard deviation of the estimate.

By using posteriors distributions, we evaluated the Bayes estimates and their posterior standard deviations for the uninformative and informative priors, ML estimates and their standard deviations are also calculated. All these results are reported in the following tables after applying inverse transformation (as transformation has made in the section 4) to convert our parameters in basic form to interpret the survival time of the electronic components. So $\theta_1 = T\beta_1$, $\theta_2 = T\beta_2$, $\theta_3 = T\beta_3$ and $\theta_4 = T\beta_4$.

11. CONCLUSION

This study illustrates that the posterior distribution assuming the suitable informative prior is more reliable than the uninformative competitors and Classical counterparts. As the evidence Table 10.1 & 10.2, shows that Jeffreys prior is more accurate and efficient as its Bayes estimates are more close to the true parameters and its posterior standard deviation are lesser than the uniform prior and the Classical estimates. In Bayesian approach suitable informative prior is valuable over the uninformative priors. It confirms the supremacy of our informative prior distribution, that the Inverted Gamma prior is reliable prior because its Bayes estimates are more close to the true parameters and posterior standard deviations are lesser other than any estimates and Inverted Chi-square is not suitable informative prior.

REFERENCES

1. Mendenhall, W. and Hader, R.A. (1958). Estimation of Parameters of Mixed Exponentially Distributed Failure Time Distributions from Censored Life Test Data. *Biometrika*, 45(3/4).
2. Everitt, B.S. and Hand, D.J. (1981). *Finite Mixture Distributions*. Chapman and Hall, London.
3. Titterington, D.M., Smith, A.F.M. and Makov, U.E. (1985). *Statistical Analysis of Finite Mixture Distributions*. John Wiley & Sons.
4. Sinha, S.K. (1998). *Bayesian Estimation*. New Age International (P) Limited, Publishers, New Delhi.

5. Gosh, S.K. and Ebrahimi, N. (2001). *Bayesian Analysis of the Mixing Function in a Mixture of Two Exponential Distributions*. Institute of Statistics Mimeo Series No. 2531.
6. Abd-Elfattah, A.M, Amal S. Hassan and Ziedan, D.M. (2007). Efficiency of Maximum Likelihood Estimators under Different Censored Sampling Schemes for Rayleigh Distribution, *Interstat*.
7. Saleem M. and Aslam M. (2008). Bayesian Analysis of the two component mixture of the Rayleigh Distribution with uninformative priors. *J. App. Statist. Science*, 16.
8. Saleem M. and Aslam M. (2007). On prior selection for the mixture of Rayleigh distribution using predictive intervals. *Pak. J. Statist.* 24(1), 21-35.

**SOME NEW METHODS TO REDUCE THE NUMBER OF
BLOCKS REQUIRED FOR NEIGHBOR DESIGNS**

Rashid Ahmed¹ and Munir Akhtar²

¹Department of Statistics, The Islamia University of
Bahawalpur. Email: rashid701@hotmail.com

²COMSATS Institute of Information Technology, Lahore.
Email: drmunirakhtar@ciitlahore.edu.pk

ABSTRACT

Neighbor balanced designs satisfy fairly restrictive combinatorial constraints, therefore, mostly such designs require large number of blocks. In the literature, partially neighbor balanced designs and generalized neighbor designs have been suggested to avoid a large number of blocks. But in this study, some new methods are proposed to overcome this problem. The reduction in number of blocks is made by using some extra treatment/s which will not be included in the analysis. Plans for saving experimental material by using one or two extra treatments are also presented for $v \leq 50$.

KEY WORDS

Neighbor balanced designs; Partially balanced neighbor designs; Generalized neighbor designs; Neighbor designs with extra treatment.

1. INTRODUCTION

Neighbor balanced designs satisfy fairly restrictive combinatorial constraints, therefore, mostly such designs require large number of blocks. In many field experiments such as agriculture, it is impossible to have as much replication as is needed for neighbor designs. Wilkinson et al. (1983) defined a design to be partially neighbor balanced if each experimental treatment has other treatment as a neighbor, on either side, at most once. In situations where resources are limited partially neighbor balanced designs are preferred. Misra et al. (1991) constructed generalized neighbor designs for odd v (number of treatments). Chaudhary and Misra (1996) constructed generalized neighbor designs for (i) $v=4t+1$, $k=3$ in $b=t(4t+1)$ blocks where t is a natural number, (ii) GN_3 -designs (the designs where some pairs of treatments appear once, some appear twice while all others appear three times as nearest neighbor) for $v=4t$, $k=2t$ in $b=2(4t-1)$ blocks where $t > 2$, (iii) GN_2 -designs (the designs where some pairs of treatments appear once as nearest neighbor while others appear twice) for $v=4t-1$, $k=2n+1$, where 'n' is a positive integer and (iii) GN_2 -designs for $v=4t-1$, $k=2n$. Mishra (2007) constructed families of proper generalized neighbor designs. Kedia and Misra (2008) constructed some series of generalized neighbor designs which are obtained by developing the initial blocks, using the Rees' principle. They constructed a series of GN_2 -designs for (i) $v=3t+1$, $k=4$, (ii) $v=5t$, $k=4$, (iii) $v=6t+1$, $k=4$, (iv) $v=7t+1$, $k=6$. They also constructed a series of

GN_3 -designs for (i) $v=5t+1$, $k=4$ and (ii) $v=6t+1$, $k=6$. In section 2, neighbor designs for v even and $k=2$ are presented. Neighbor designs with extra treatment are discussed in section 3 and designs with two extra treatments are discussed in section 4. In section 5 and 6, plans for saving experimental material by the proposed designs are also presented for $v \leq 50$.

2. NEIGHBOR DESIGNS WITH $k=2$ FOR v EVEN

If the unused units are not wasted, using block size 2 for even v (number of treatments) is the most economical. In general, for block size 2, the minimum number of blocks required for neighbor designs is $v(v-1)/2$. For $v=2m$, $m=2,3,\dots$ the neighbor designs with $r=v-1$ and $\lambda=2$, can be generated through the $(m-1)$ initial blocks $(0,1),(0,2),\dots,(0,m-1)$ with augmented blocks $(0,m),(1,m+1), \dots,(m-1,2m-1)$. Remaining $(v-1)$ blocks are obtained cyclically mod v from each initial block.

Example 2.1:

Neighbor design for $v=10$ and $k=2$ can be generated through 4 initial blocks $(0,1),(0,2),(0,3),(0,4)$ with 5 augmented blocks $(0,5),(1,6),(2,7),(3,8),(4,9)$. Nine blocks can be generated cyclically mod 10, through each initial block.

3. NEIGHBOR DESIGNS WITH EXTRA TREATMENT

A new methodology is proposed to reduce the number of blocks, named as neighbor designs with extra treatment/s. In this methodology, a neighbor design for $v-1$ treatments is obtained through a design constructed for v treatments and then v th treatment is excluded from the analysis.

Example 3.1:

A neighbor design for $v=8$, $k=3$ required 56 blocks while a neighbor design for $v=9$, $k=3$, can be constructed in $b=12$. Considering 9th treatment (labeled as 8) as extra treatment, the required design is: $(0,2,3)$, $(1,3,4)$, $(2,4,5)$, $(3,5,6)$, $(4,6,7)$, $(5,7,0)$, $(6,0,1)$, $(7,1,2)$, $(0,4,8)$, $(1,5,8)$, $(2,6,8)$, $(3,7,8)$. Proposed design with extra treatment saves 78.57 % experimental material. For analysis, it will be a neighbor design for $v=8$ with $k_1=3$, $k_2=2$.

Theorem 3.1:

If v is an even number, $v > k$, d_1 is common divisor of $v(v-1)$ & k and d_2 is common divisor of $v(v+1)/2$ & k then neighbor designs with extra treatment will reduce the experimental material at least $[1 - d_1(v+1)/2d_2(v-1)]$ 100 percent if: (i) $v > (2d_2 + d_1)/(2d_2 - d_1)$ & (ii) $2d_2 > d_1$.

Proof:

If v is an even number, $v > k$, d_1 is common divisor of $v(v-1)$ & k and d_2 is common divisor of $v(v+1)/2$ & k then neighbor design requires at least $b = v(v-1)/d_1$ and our proposed design requires $b = v(v+1)/2d_2$. So our proposed design reduces at

least $\lceil v(v-1)/d_1 - v(v+1)/2d_2 \rceil$ blocks which saves at least $\lceil [1 - d_1(v+1)/2d_2(v-1)] \rceil$ 100 percent material. \square

Corollary I:

If v is even and k is relatively prime to $v(v-1)$ & $v(v+1)/2$ then neighbor designs with extra treatment will reduce the experimental material at least 35.7 %.

Proof:

If v is even and k is relatively prime to $v(v-1)$ & $v(v+1)/2$, neighbor design requires at least $v(v-1)$ blocks and our proposed design requires at least $v(v+1)/2$ blocks.

$$\text{Saved material} = v(v-1) - v(v+1)/2 = [100\{v(v-1) - v(v+1)/2\}/v(v-1)]\% = 50(1 - 2/(v-1))\%.$$

The smallest v which satisfied the above conditions is 8. For $v=8$, neighbor designs with extra treatment will reduce the experimental material 35.7 % . \square

Corollary II:

If v is even and k is relatively prime to $v(v-1)$, d is common divisor of k and $v(v+1)$, where $d > 1$, neighbor designs with extra treatment will reduce experimental material at least 50%.

Proof:

If v is even ($v > 2$) and k is relatively prime to $v(v-1)/2$ then neighbor design required at least $v(v-1)$ blocks. If d is common divisor of k and $v(v+1)$ then $v(v+1)/2$ blocks are required for $v+1$.

$$\text{Saved material} = v(v-1) - v(v+1)/2d = [100\{v(v-1) - v(v+1)/2d\}/v(v-1)]\%.$$

$$\text{For the smallest value of } d \text{ which is } 2, \text{ minimum saved material} = [25(3v-5)/(v-1)]\%.$$

Since $[(3v-5)/(v-1)] > 2$, for $v > 3$, hence proved that neighbor designs with extra treatment will reduce experimental material at least 50%. \square

Theorem 3.2:

If v is an odd number, $v > k$, d_1 is common divisor of $v(v-1)/2$ & k and d_2 is common divisor of $v(v+1)$ & k then neighbor designs with extra treatment will reduce the experimental material at least $\lceil [1 - 2d_1(v+1)/d_2(v-1)] \rceil$ 100 percent if: (i) $v > (d_2 + 2d_1)/(d_2 - 2d_1)$ & (ii) $d_2 > 2d_1$.

Proof:

If v is an odd number, $v > k$, d_1 is common divisor of $v(v-1)/2$ & k and d_2 is common divisor of $v(v+1)$ & k then neighbor design requires at least $b = v(v-1)/2d_1$ and our proposed design requires at least $b = v(v+1)/d_2$. So our proposed design reduces at least $\lceil [v(v-1)/2d_1 - v(v+1)/d_2] \rceil$ blocks which saves at least $\lceil [1 - 2d_1(v+1)/d_2(v-1)] \rceil$ 100 percent material. \square

Theorem 3.3:

For complete block neighbor designs when v is even & $v > 3$ then our proposed neighbor design with extra treatment will reduce $\lceil [50(v-3)/(v-1)] \rceil$ % experimental material.

Proof:

We have always a complete block neighbor design for odd v in $(v-1)/2$ blocks. For even v at least $(v-1)$ blocks are required for complete block neighbor design, it means for v even, neighbor design with extra treatment will require $b = v/2$ blocks.

$$\text{Saved material} = [100 \{v(v-1) - v(v+1)/2\} / v(v-1)]\% = [50 (v-3) / (v-1)]\% , \text{ for } v > 3. \square$$

4. NEIGHBOR DESIGN WITH TWO EXTRA TREATMENTS

Here, a neighbor design for $v-2$ treatments is obtained through a design constructed for v treatments and then v th and $(v-1)$ th treatments are excluded from the analysis.

Example 4.1:

A neighbor design for $v=23, k=3$, can be constructed in $b=253$, while such design for $v=25, k=3$, can be constructed in 100 blocks. Our proposed design saves 60.5% experimental material by considering 24th and 25th treatments as extra treatments. For analysis, it will be a neighbor design for $v=23, k_1=3, k_2=2$.

Theorem 4.4:

If v is even and k is relatively prime to $v(v-1)$ & $v(v+1)/2$ but not to $(v+2)(v+1)$ then neighbor designs with two extra treatments will reduce $[1 - (v+2)(v+1) / dv(v-1)]100$ percent experimental material.

Proof:

If v is even and k is relatively prime to $v(v-1)$ & $v(v+1)/2$ then at least $v(v-1)$ blocks are required for neighbor designs. Let d ($d > 2$) be common divisor of k and $(v+2)(v+1)$ then $(v+2)(v+1)/d$ blocks are required. So our proposed design with two extra treatments will reduce $[v(v-1) - (v+2)(v+1)/d]$ blocks. \square

Corollary III:

If $v=4t; k=m+1; m=2t+1$ where $t > 1$ then a neighbor design can always be constructed through our proposed design with two extra treatments, which saves $[1 - 2(v+1) / v(v-1)]$ 100% material.

Proof:

If $v=4t; k=m+1; m=2t+1$ where $s > 1$ then $v+2 = 2k$. In this situation neighbor design for v treatments will require $v(v-1)$ blocks while for $v+2$, it will take $2(v+1)$ blocks. \square

5. PLANS WITH EXTRA TREATMENT

Here, plans using extra treatment which saves at least 70% experimental material required for neighbor designs are presented for $8 \leq v \leq 50$ and $3 \leq k \leq 20$

Original designs				Designs with extra treatment					
v	k	b	Units	v	k	b	Units	Saved Units	Reduction %
8	3	56	168	9	3	12	36	132	78.6
14	3	182	546	15	3	35	105	441	80.8
20	3	380	1140	21	3	70	210	930	81.6
26	3	650	1950	27	3	117	351	1599	82.0

Original designs

v	k	b	Units
32	3	992	2976
38	3	1406	4218
44	3	1892	5676
14	5	182	910
24	5	552	2760
34	5	1122	5610
44	5	1892	9460
8	6	28	168
20	6	190	1140
32	6	496	2976
38	6	703	4248
44	6	946	5676
20	7	380	2660
34	7	1122	7854
41	7	820	5740
48	7	2256	15792
15	8	105	840
23	8	253	2024
47	8	1081	8648
14	9	182	1638
17	9	136	1224
20	9	380	3420
26	9	650	5850
32	9	992	8928
35	9	595	5355
38	9	1406	12654
44	9	1892	17028
50	9	2450	22050
14	10	91	910
19	10	171	1710
24	10	276	2760
34	10	561	5610
39	10	741	7410
44	10	946	9460
21	11	210	2310
32	11	992	10912
43	11	903	9933
23	12	253	3036
29	12	203	2436
35	12	595	7140
47	12	1081	12972
25	13	300	3900
38	13	1406	18278
51	13	1275	16575
20	14	190	2660
27	14	351	4914

Designs with extra treatment

v	k	b	Units	Saved Units	Reduction %
33	3	176	528	2448	82.3
39	3	247	741	3477	82.4
45	3	330	990	4686	82.6
15	5	21	105	805	88.46
25	5	60	300	2460	89.1
35	5	119	595	5015	89.4
45	5	198	990	8470	89.5
9	6	6	36	132	78.6
21	6	35	210	930	81.6
33	6	88	528	2448	82.3
39	6	147	882	3366	79.2
45	6	165	990	4686	82.6
21	7	30	210	2450	92.1
35	7	85	595	7259	92.4
42	7	246	1722	4018	70.0
49	7	168	1176	14616	92.6
16	8	30	240	600	71.4
24	8	69	552	1472	72.7
48	8	282	2256	6392	73.9
15	9	35	315	1328	80.8
18	9	34	306	918	75.0
21	9	70	630	2790	81.6
27	9	39	351	5499	94.0
33	9	176	1584	7344	82.3
36	9	140	1260	4095	76.5
39	9	247	2223	10431	82.4
45	9	110	990	16038	94.2
51	9	425	3825	18225	82.7
15	10	21	210	700	76.9
20	10	38	380	1330	77.8
25	10	30	300	2460	89.1
35	10	119	1190	4420	78.8
40	10	156	1560	5850	78.9
45	10	99	990	8470	89.5
22	11	42	462	1848	80.0
33	11	48	528	10384	95.16
44	11	172	1892	8041	81.0
24	12	46	552	2484	81.8
30	12	145	1740	696	82.6
36	12	105	1260	5880	82.4
48	12	188	2256	10716	82.6
26	13	50	650	3250	83.3
39	13	57	741	17537	95.9
52	13	204	2652	13923	84.0
21	14	15	210	2450	92.1
28	14	54	756	4158	84.6

Original designs				Designs with extra treatment					
v	k	b	Units	v	k	b	Units	Saved Units	Reduction %
34	14	561	7854	35	14	85	1190	6664	84.8
44	14	946	13244	45	14	495	6930	6314	91.1
48	14	1128	15792	49	14	84	1008	14784	93.6
20	15	75	1140	21	15	14	210	930	81.6
24	15	184	2760	25	15	20	300	2460	89.1
29	15	406	6090	30	15	58	870	5220	85.7
32	15	992	14880	33	15	176	2640	12240	82.3
38	15	1406	21090	39	15	247	3705	17385	82.4
44	15	1892	28380	45	15	66	990	27390	96.5
23	16	253	4048	24	16	69	1104	2944	72.7
31	16	465	7440	32	16	62	992	6448	86.7
39	16	741	11856	40	16	195	3120	8736	73.7
47	16	1081	17296	48	16	141	2256	15040	87.0
33	17	528	8976	34	17	66	1122	7854	87.5
50	17	2450	41650	51	17	75	1275	40375	96.9
26	18	325	5850	27	18	39	702	5148	88.0
32	18	496	8928	33	18	88	1584	7344	82.3
35	18	595	10710	36	18	70	1260	9450	88.2
44	18	946	17028	45	18	55	990	16038	94.2
37	19	666	12654	38	19	74	1406	11248	88.9
24	20	138	2760	25	20	15	300	2460	89.1
34	20	561	11220	35	20	119	2380	8840	78.8
39	20	741	14820	40	20	78	1560	13260	89.5
44	20	473	9460	45	20	99	1980	7480	79.1

6. PLANS WITH TWO EXTRA TREATMENTS:

Here, plans using two extra treatments which saves at least 70% experimental material required for neighbor designs are presented for $15 \leq v \leq 50$ and $4 \leq k \leq 20$

Original designs				Designs with extra treatment					
v	k	b	Units	V	k	b	Units	Saved Units	Reduction %
15	4	105	420	17	4	34	136	316	75.2
23	4	253	1012	25	4	75	300	712	70.4
31	4	465	1860	33	4	132	528	1332	71.6
39	4	741	2964	41	4	205	820	2144	72.3
47	4	1081	4324	49	4	294	1176	3148	72.8
13	5	78	390	15	5	21	105	285	73.1
18	5	306	1530	20	5	76	380	1150	75.2
19	5	171	855	21	5	42	210	645	75.4
23	5	253	1265	25	5	60	300	965	76.3
28	5	756	3780	30	5	174	870	2910	77.0
33	5	528	2640	35	5	119	595	2045	77.5
38	5	1406	7030	40	5	312	1560	5470	77.8
39	5	741	3705	41	5	164	820	2885	77.9
43	5	903	4515	45	5	198	990	3625	78.1
48	5	2256	11280	50	5	490	2450	8830	78.3

Original designs

v	k	b	Units
49	5	1176	5880
11	6	55	330
23	6	253	1518
35	6	595	3570
47	6	1081	6486
12	7	132	924
13	7	78	546
19	7	171	1197
26	7	650	4550
27	7	351	2457
40	7	1560	10920
41	7	820	5740
47	7	1081	7567
15	8	105	840
22	8	231	1848
31	8	465	3720
38	8	703	5624
46	8	1035	8280
47	8	1081	8648
17	9	136	1224
23	9	506	4554
29	9	812	7308
35	9	595	5355
18	10	153	1530
19	10	171	1710
23	10	253	2530
28	10	378	3780
38	10	703	7030
39	10	741	7410
43	10	903	9030
48	10	1128	11280
20	11	380	4180
21	11	210	2310
31	11	465	5115
42	11	1722	18942
43	11	903	9933
14	12	91	1092
23	12	253	3036
26	12	325	3900
38	12	703	8436
47	12	1081	12972
24	13	552	7176
25	13	300	3900
37	13	666	8658
50	13	2450	31850
19	14	171	2394

Designs with extra treatment

V	k	b	Units	Saved Units	Reduction %
51	5	255	1275	4605	78.3
13	6	13	78	252	76.4
25	6	50	300	1218	80.2
37	6	111	666	2904	81.3
49	6	196	1176	5310	81.9
14	7	26	182	742	80.3
15	7	15	105	441	80.8
21	7	30	210	987	82.5
28	7	108	756	3794	83.4
29	7	58	406	2051	83.5
42	7	246	1722	9198	84.2
43	7	129	903	4837	84.3
49	7	168	1176	6391	84.5
17	8	17	136	704	83.8
24	8	69	552	1296	70.1
33	8	66	528	3192	85.8
40	8	195	1560	4064	72.3
48	8	282	2256	6024	72.8
49	8	147	1176	7472	86.4
19	9	19	171	1053	86.0
25	9	100	900	3654	80.2
31	9	155	1395	5913	80.9
37	9	74	666	4689	87.6
20	10	38	380	1150	75.2
21	10	21	210	1500	87.7
25	10	30	300	2230	88.1
30	10	87	870	2910	77.0
40	10	156	1560	5470	77.8
41	10	82	820	6590	88.9
45	10	99	990	8040	89.0
50	10	245	2450	8830	78.3
22	11	42	462	3718	88.9
23	11	23	253	2057	89.0
33	11	48	528	4587	89.7
44	11	172	1892	17050	90.0
45	11	90	990	8943	90.0
16	12	20	240	852	78.0
25	12	25	300	2736	90.1
28	12	63	756	3144	80.6
40	12	130	1560	6876	81.5
49	12	98	1176	11796	90.9
26	13	50	650	6526	90.9
27	13	27	351	3549	91.0
39	13	57	741	7917	91.4
52	13	204	2652	29198	91.7
21	14	15	210	2184	91.2

Original designs				Designs with extra treatment					
v	k	b	Units	V	k	b	Units	Saved Units	Reduction %
26	14	325	4550	28	14	54	756	3794	83.4
27	14	351	4914	29	14	29	406	4508	91.7
47	14	1081	15134	49	14	84	1008	14126	93.3
19	15	57	855	21	15	14	210	645	75.4
23	15	506	7590	25	15	20	300	7290	96.0
28	15	252	3780	30	15	58	870	2910	77.0
29	15	406	6090	31	15	31	465	5625	92.4
38	15	1406	21090	40	15	104	1560	19530	92.6
43	15	301	4515	45	15	66	990	3525	78.1
22	16	231	3696	24	16	69	1104	2592	70.1
30	16	435	6960	32	16	62	992	5968	85.7
31	16	465	7440	33	16	33	528	6912	92.9
38	16	703	11248	40	16	195	3120	8128	72.3
46	16	1035	16560	48	16	141	2256	14304	86.4
32	17	992	16864	34	17	66	1122	15742	93.3
33	17	528	8976	35	17	35	595	8381	93.4
49	17	1176	19992	51	17	75	1275	18717	93.6
23	18	253	4554	25	18	50	900	3654	80.2
35	18	595	10710	37	18	37	666	10044	93.8
43	18	301	5418	45	18	55	990	4428	81.7
47	18	1081	19458	49	18	196	3528	15930	81.9
36	19	1260	23940	38	19	74	1406	22534	94.1
37	19	666	12654	39	19	39	741	11913	94.1
23	20	253	5060	25	20	15	300	4760	94.1
34	20	561	11220	36	20	63	1260	9960	88.8
39	20	741	14820	41	20	41	820	14000	94.5
43	20	903	18060	45	20	99	1980	16080	89.0
47	20	1081	21620	49	20	294	5880	15740	72.8

REFERENCES

1. Chaure, N.K. and Misra, B.L. (1996). On construction of generalized neighbor design. *Sankhya B* 58, 245-253.
2. Kedia, R.G. and Misra, B.L. (2008). On construction of generalized neighbor design of use in serology. *Statist. Probab. Lett.* 18, 254-256.
3. Mishra, N.S. (2007). Families of proper generalized neighbor designs. *J. Statist. Plann. Inference* 137, 1681-1686.
4. Misra, B.L., Bhagwandas and Nutan (1991). Families of neighbor designs and their analysis. *Comm. Statist. Simulation Comput.* 20 (2 & 3), 427-436.
5. Wilkinson, G.N., Eckert, S.R., Hancock, T.W. and Mayo, O. (1983). Nearest Neighbour (Nn) Analysis of Field Experiments (with Discussion). *J.R. Statist. Soc. Ser. B* 45, 151-211.

EMERGING TRENDS IN TEMPORAL DATABASES WITH ILLUSTRATIONS

S.M. Aqil Burney¹ and Nadeem Mahmood²

Department of Computer Science, University of Karachi, Karachi.

Email: ¹burney@uok.edu.pk; ²nmahmood@uok.edu.pk

ABSTRACT

Research is being conducted concerning Temporal Databases for more than two decades. Traditional relational database model does not support structure and mechanisms for effective management of temporal data. Although, several temporal data models were proposed, but very few are fully transformed into implemented systems. Most of the temporal models proposed are the extension of the relational model. This paper explains the key concepts attached to temporal databases and discusses few of the temporal data models proposed with examples. This paper offers a brief introduction to temporal database research and new research areas in this field.

KEY WORDS

Temporal data, temporal database, temporal data model, relational database

1. INTRODUCTION

Time is the one of the most difficult aspect to handle in real world applications such as database systems. Relational database management systems proposed by Codd [Cod70] & [Cod90] offer very little built-in query language support for temporal data management [CJT99]. The model itself incorporates neither the concept of time nor any theory of temporal semantics [CW83]. Relational database without a temporal dimension, record single state of real world phenomena usually called as snapshot database. Many temporal extensions of the relational model have been proposed some of them are also implemented [NA93] & [Cho94]. This paper offers a brief introduction to temporal database research.

The relational model is based on the mathematical notion of a relation [Bat07]. Codd and others have extended the notion to apply to database design. Thus they were able to take advantage of the power of mathematical abstraction and the expressiveness of mathematical notation to develop a simple but powerful structure for databases. The relational data model only support functionality to access a single state (most recent one) of the real world, called as snapshot [Dat00], and to transition from one database state to another (updates) thereby giving up the old state. There exist, however, many application domains which need to have access not only to the most recent state, but also to past and even future states, and the notion of data consistency must be extended to cover all of these database states.

Many applications in the real world requires management of time varying data [DDL03] such as financial applications, inventory systems, insurance applications,

reservation systems, stock market applications [BJ08], medical information management systems and decision support systems. Efforts to incorporate the temporal domain into database management system have been ongoing for more than two decades and dozens of temporal models have been proposed [Skj97] & [Gar03].

In the first section we will discuss the important notions of time [Mck86] and the basic concepts important to understand and evaluate any temporal database model [DDL03]. Second section presents a survey of temporal database models and proposed extensions to the relational algebra [MS91], with a classification of the different approaches presented in the literature. Finally we conclude by identifying some key areas of research, moreover all the illustrations are given for employee database.

2. IMPORTANT CONCEPTS

2.1 Valid Time(VT)

The time a fact is true with respect to the given mini-world. It captures the time-varying states of the given mini world. Two attributes StartVT and EndVT are used to represent a time interval which is closed at its lower bound and open at its upper bound. Remember valid time [Sno85] & [Jea93] is always independent of the recording time of the fact in the database. For e.g., Ali has been hired promoted to manager on July 7, 2003. Fig. 1 represents a valid time instance.

2.2 Transaction Time (TT)

It is the time period during which a fact is recorded in the database. e.g., the fact Hasan was hired on June 1, 2003 was stored in the database on June 2, 2003 Transaction time [Sno85] & [Jea93] has a duration: from insertion to deletion, with multiple insertions and deletions being possible for the same fact over a period of time. Transaction time is more often represented with two attributes i.e StartTT and End TT. Fig. 1 represents a transaction time instance.

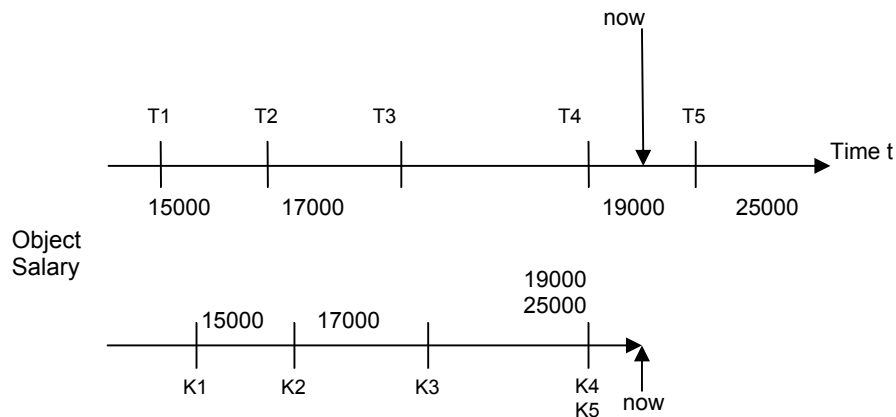


Fig 1: Transaction time and valid time instance

2.3 Time-Varying Attribute

A time varying attribute [Jea93] is an attribute whose value is not constrained to be constant over time. In other words it may or may not change over time.

2.4 Time Domain

A time domain is a ordered pair $(T ; \leq)$ where T is a non-empty set of time instants and " \leq " is total order on T . A time domain is dense [DDL03] & [Jea93] if it is an infinite set and for all $t, t' \in T$ with $t < t'$, there exists $t'' \in T$ such that $t < t'' < t'$. A time domain is discrete [DDL03] & [Jea93] if every element except the last element (if any) has an immediate successor, and every element except the first (if any) has an immediate predecessor.

2.5 Time Granularity

Partitioning of the time-line into a finite set of smaller segments called granules. Each non-empty subset $G(i)$ is called a granule of the granularity G [Cea98] & [BJW00]. For e.g. birthdates are typically measured at granularity of days, business appointments to granularity of hours and train schedules to granularity of minutes. Mixing of granularities create problems in handling temporal data.

A granularity is a mapping G from the integers (the index set) to subsets of the time domain such that:

- 1) If $i < j$ and $G(i)$ and $G(j)$ are non-empty, then each element of $G(i)$ is less than all elements of $G(j)$
- 2) If $i < k < j$ and $G(i)$ and $G(j)$ are non-empty, then $G(k)$ is non-empty.

2.6 Temporal Dependency

Let X and Y be sets of explicit attribute of a temporal relation schema, R . a temporal functional dependency [Jea93], denoted $X \xrightarrow{T} Y$, exists on R if, for all instances r of R , all snapshots of r satisfy the functional dependency $X \rightarrow Y$.

2.7 Lifespan

The lifespan [Jea93] of a database object is the time over which it is defined. The valid time lifespan of a database object refers to the time when the corresponding object exists in the modeled reality, whereas the transaction time lifespan refers to the time when the database object is current in the database.

2.8 Temporally Homogeneous

A temporal tuple is temporally homogeneous [Gad88] if the lifespan of all attribute values within it are identical. A temporal relation is said to be temporally homogeneous if its tuples are temporally homogeneous. Homogeneity is also specific to some time dimension as in temporally homogeneous in the valid time dimension or temporally homogeneous in the transaction time dimension.

2.9 Chronon

Discrete and indivisible (smallest) unit of time with a positive duration that can be represented is called as chronon [Cea98] & [BJW00].

2.10 Tuple Time-Stamping

In tuple time stamping [Sno87], [CW83], [Ari86] & [Ben82], each tuple is augmented by one or two additional attributes for the recording of timestamps. One additional attribute can be used to record either the time point at which the tuple becomes valid or the time at which the data is valid. Two additional attributes are used to record the start and stop time points of the corresponding time interval of validity of the corresponding

data. Tuple time stamping is usually applied where relations support first normal form assumption (FNF)[Sar90].

2.11 Attribute Time-Stamping

In attribute time stamping [Tan86], [Gad92] the time is associated with every attribute which is time-varying. It is not necessary for every attribute to be time-varying in an attribute time stamping approach. Consequently, a history is formed for each time-varying attribute within each tuple. Attribute time stamping overcomes the disadvantage of data redundancy introduced when applying tuple time stamping. In attribute time stamping values in a tuple which are not affected by a modification do not have to be repeated. Therefore, the history of values is stored separately for each attribute. Relations of this type are known as Non-1NF (N1NF) [TG89] relations.

3. TEMPORAL DATA MODELS

3.1 Clifford's Model

Clifford introduced Historical Database Model-HDBM [Cli82]. He also developed a formal theory of database semantics with time and calculus-based query language [CW83]. The tuples of relations are time stamped with the help of a special attribute named STATE. Moreover a Boolean-valued attribute, EXISTS, is introduced to indicate which entities exist or not at any given state. The two new attributes are not ordinary attributes, but are built-in parts of the model. Fig. 2a and 2b represents instances of relations employee representing state 1 and state 2 respectively.

This model is further explored in 1985 [CT85] but this time from the operational point of view using a relational algebra. The temporal dimension is incorporated into the model at the attribute level. Relations are in N1NF since attributes that are time-varying have complex domains. However, key attributes in a relation must be constant.

State	Emp	Exists?	Mgr	Dept	Sal
S1	Ali	1	Babar	Finance	10K
S1	Babar	1	Babar	Finance	12K
S1	Sadiq	1	Sadiq	Audit	15K
S1	Salman	1	Sadiq	Accounts	13K
S1	Naeem	0	⊥	⊥	⊥

Fig. 2a: Employee Relation 1

State	Emp	Exists?	Mgr	Dept	Sal
S2	Naeem	1	Naeem	Finance	13K
S2	Babar	1	Babar	Finance	12K
S2	Sadiq	1	Sadiq	Audit	15K
S2	Salman	1	Sadiq	Audit	11K
S2	Ali	0	⊥	⊥	⊥

Fig. 2b: Employee Relation 2

3.2 Ariav Model

The temporally oriented data model was proposed by Ariav [Ari86]. It is based on the concept of data cube, comprising of the three dimensions, attributes, tuples and time,

supports an explicit and inherent order of the tuples contained in it. This cube preserves the identity and of the tuples and the temporal context of the data. The ordering of objects over time and interpolation are necessary to know how long a state prevailed or what the state was at any time. Ariav's model is a bi-temporal relational model [CI94] where timestamps are based on time points. Fig 3 represents Ariav's model.

Name	Department	Position	Valid time	Transaction time
Ali	Finance	Assistant	Jan2001	Jan2001
Ali	Audit	Junior auditor	March2003	Feb2003
Babar	Finanace	Manager	June2002	July2002
Babar	Accounts	Manager	Dec2005	Dec2005
...

Fig 3: A bi-temporal employee relation by Ariav's model

3.3 Gadia's Model

Homogeneous relational model (HRM) was proposed by Gadia [Gad88]. HRM is based on interval time stamping and supports the valid time dimension. The new concept that Gadia proposed in HRM is the homogeneity assumption in a database. A temporally homogeneous [Gad88] database is a database which is restricted to having temporal relations in which the lifespan of all attribute values. In other words the time over which they are defined in every tuple are identical. The idea was to prevent objects containing null values, i.e., all attributes have to be defined during the lifetime of an object. He introduced the concept of temporal element which is a finite union of time intervals. Temporal version of relational algebra using snapshot semantics was also introduced. Fig. 4 represents a temporal employee relation.

Name	Salary	Department
[9,52)	Ali	[9,41) Finance [41,52) Audit
[0,18)∪[18,46)	Sadiq	[0,18) 12K Accounts [18,46) 15K Computer
[61, now]	Saleem	[61, now] 15K Finance
[27,now]	Babar	[27,now] 16K Audit

Fig. 4: The Temporal Employee Relation

3.4 Gadia and Yeung's Model

Gadia and Yeung's model [GY88] is also called the heterogeneous model. In this model [GY88], temporal elements may be multi-dimensional to model different aspects of time. It is based on attribute time stamping. Attribute values are still functions from temporal elements onto attribute value domains, but attribute values need not be functions on the same temporal element. As a result of the lack of temporal homogeneity, some time slices may produce nulls. Relations are assumed to have key attributes, with the restriction that such attributes be single-valued over their interval of validity. Also, no two tuples may match on the ranges of the functions assigned to the key attributes. In [GY91], a NINF tuple calculus is introduced, called TCAL, based on Gadia's NINF homogeneous temporal model.

3.5 Ben-Zvi's Model

Ben-Zvi's model [Ben82] is a interval tuple based time stamping model. This model introduced different times i.e effective time, registration time and deletion time which are analogous to the notion of valid time and transaction time respectively (see fig. 5). A relation schema R has the form:

$$R(A_1, \dots, A_n, T_{es}, T_{rs}, T_{ee}, T_{re}, T_d),$$

where

T_{es} effective start & T_{ee} effective end

T_{rs} registration start & T_{re} registration end

T_d (deletion) indicates the time when the information in the tuple was logically deleted

Emp	Dept	T_{rs}	T_{es}	T_{ee}	T_{re}	T_d
Sadiq	Finance	feb2001	Feb2001	Oct2002	Mar2001	'-'
Saleem	Finance	Mar2001	Apr2001	Dec2001	May2001	Jan2002
Saleem	Audit	Jun2001	Dec2001	'-'	'-'	'-'
Babar	Audit	Apr2002	Jul2002	Jan2003	July2002	'-'

Fig: 5: A bi-temporal department relation by Ben-Zvi's model

3.6 Jensen's Model

Jensen's model [Jen90] is an interval based event model. The Op attribute denotes tuples as deletion and insertion requests indicated by 'D' and 'I', respectively. Modifications of an object is handled by a pair of deletion and insertion requests in the following manner; First a deletion request is represented by a new tuple with the same attribute values and valid-time as its previous insertion request of this object, but the Op value equals 'D' ; Second, the deletion request is followed by an insertion request with a transaction-time identical that of the deletion request it is paired with, but in this case the Op value is equal to 'I'.

3.7 Tansel's Model

Tansel's model [Tan86] supports the concept of historical relations adds both valid-time and different structure types on attributes, such as atomic, set-valued, triplets, and set-triplet-valued attributes. The first contains atomic values only. The second is a set of atomic values. The last two are attributes with timestamps. That is, each triplet is an attribute value with valid start- and end-times. Atomic attributes contain values such as integers, reals and character strings. Triplet-valued attributes consists of valid-time interval $[l \leftrightarrow u)$, closed at the lower and open at the upper bound, together with an atomic value, $< [l \leftrightarrow u)$, value $>$. The temporal data model presented in [CT85] & [Tan86] supports historical relations (see fig. 6). Tansel's model is based on attribute value time stamping and relations are in non first normal form. Fig. 6 representing a employee-salary relation based on Tansel's model.

Empid	Name	Salary	Dept
100	Asim	{<[jan2001-feb2004], 15K>, <[feb2004-now], 17K>}	<[jan2001-now], audit>
101	Ali	{<[jan2002-june2003], 10K>, <[june2003-now], 12K>}	<[jan2002-now], finance>
102	babar	{<[jan2000-now], 7K>}	<[jan2000-now], computer>
...
105	Sadiq	{<[jan2001-june2002], 7.5K>}	<[jan2001-june2002], accounts>}
105	Sadiq	{<[jan2003-now], 9K>}	{<[jan2003-now], accounts>}
...

Fig 6: employee salary relation

3.8 McKenzie's Model

McKenzie's model [Mck88] & [MS91] is a attribute value time stamped data model based on non first normal form relations. This model is represented as a sequence of valid-time states indexed by transaction time. The timestamps associated with each attribute value are sets of valid-time chronons. McKenzie extends the relational algebra to support both temporal dimensions (valid time and transaction time). McKenzie proposed a historical algebra supporting valid time by extending the snapshot algebra.

In McKenzie's model a temporal database, D_{db} , is a finite sequence, $D_{db_0}, \dots, D_{db_n}$, where each element, D_{db_i} , of the sequence is a database "state" relative to a particular transaction time (see fig. 7). The main disadvantage of his model is the redundancy caused by the value parts of attributes not being set-valued. Another problem is caused by the representation of time as a set of chronons.

T_t	R
0	ϕ
Jan2001	{(12000, {dec2000,, dec2001})}
Jun2003	{(12000, {dec2000,, dec2001}), (15000, {jan2002,, mar2004})}
May2005	{(12000, {dec2000,, dec2001}), (15000, {jan2002,, mar2004}), (20000, {jan2005,, α)}

Fig 7: Object salary by McKenzie's model

3.9 Lorentzos's Model

Lorentzos proposed a formal extension of the relational model to support generic intervals [lor88]. He studied different properties of the intervals and gave the concept of "Duality Principle" which says that every one-dimensional point is isomorphic to an elementary interval. He also defines all possible relative positions between two 1-dimensional intervals [LJ88a] and then, extends his definitions to n-dimensional intervals.

His proposed model can be used directly as a temporal model where time is treated as generic data type and not as a "stamp" for the related data values. Lorentzos's also proposed a Temporal Relational Algebra (TRA), [LJ87], [LJ88a] & [LJ88b]. The model is a minimal extension of the Conventional Relational Model. In this model 1NF is maintained and it supports valid time dimension with both time points and intervals. There are certain drawbacks in this model such as data regarding the same entity is not

included in the same tuple, in this way the history of the object split to many tuples instead of one.

3.10 Snodgrass Model

Snodgrass [Sno87] proposed a temporal query language [Cho94], TQuel [Sno93]. He classified temporal databases into three categories, rollback database, historical database, and temporal database, based on what kinds of time a database employed. TQuel is a query language for the temporal database employing the valid and transaction times. He claimed that error corrections and retroactive updates could be modeled by the two times.

A tuple is tuple-time-stamped with four time-stamps so that a valid time period and a transaction time period are attached to a tuple. The valid time period represents a valid period of a tuple, whereas the transaction time period is a period during which a tuple can be accessed (see Fig. 8).

Emp	Department	Position	Valid time	Trans time
Salman	IT	Support Eng	Jan2000 oct2000	Feb2000 uc
Salman	IT	Support Eng	Dec2000 nov2001	Nov2000 oct2001
Asif	Audit	Assistant	Feb2001 mar2002	Mar2001 feb2002
Asif	Audit	Assistant	Apr2002 jun2003	Apr2002 uc
Danish	Finanace	Manager	Apr2002 jul2003	Jun2002 uc
...

Fig 8: Bitemporal employee relation

3.11 Snodgrass BCDM Model

Snodgrass [Sno95b] proposed the Bi-temporal Conceptual Data Model (BCDM). BCDM is the basis for the definition of the temporal query language TSQL2 [Sno95b]. TSQL2 is a temporal extension to SQL-92 and specifically designed to query and manipulate time-varying data.

TSQL2 supports user defined time, valid time and transaction time. Data is time stamped either with sets of time instants or temporal elements. A relation in BCDM consists of a set of ordinary tuples, consisting of explicit and implicit attributes. User-defined time is recorded as an explicit attribute. Valid time and transaction time are recorded as implicit attribute values of a tuple, specifying when the data represented by the tuple is true in the real world and stored in the database, respectively. The implicit valid-time attribute has either a valid-time instant set or a valid-time element as its value. Transaction-time attributes are recorded as temporal elements. Tuples in bi-temporal relations are time stamped with implicit attributes containing bi-temporal elements (see fig. 9) or bi-temporal instant sets (fig 9a). In fig. 9 employee Ahmed's history with respect to the time period of his first employment was described. The shaded area covers time instants this specific fact about employee tome was valid and stored in the database.

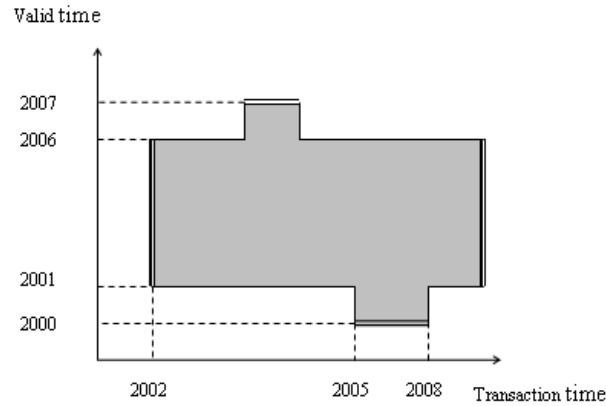


Fig. 9: Bi-temporal element in BCDM

$$\{(2001,2002), \dots, (2006,2002), \{(2001,2003), \dots, (2006,2003), \\ (2001,2004), \dots, (2006,2004), \{(2000,2005), \dots, (2006,2005), \\ (2000,2006), \dots, (2006,2006), \dots\}$$

Fig 9a. The timestamp of the bi-temporal element in fig is the following set of pairs (valid time, transaction time) of bi-temporal chronons, assuming a chronon to have the granularity of a year:

3.12 Navathe and Ahmed's Model

Navathe and Ahmed [NA89] proposed temporal relational model and a associated query language based on the model [NA88]. Important highlights of the paper are the notion of time normalization and a language construct.

According to him the time normalization is based on the classification of time-varying attributes into synchronous and asynchronous ones. Synchronous attributes in a relation change their values always at the same time, whereas asynchronous time varying attributes change their values independently from the other attributes in the relation.

For example, if an employee gets a raise in salary if and only if he/she gets a promotion, then salary and position form a set of synchronous attributes. An asynchronous attribute, on the other hand, is a time varying attribute which does not belong to any set of synchronous attributes.

4. CONCLUSION

This paper has surveyed various temporal data models. All these models are different in representation and capture the mini world in a different way. Different assumption and considerations were made and some of them are also physically implemented. Majority of the temporal models proposed were extensions of the conventional relational model that attempted to capture the time- varying nature of both the enterprise (mini world) being modeled and the database. These models support user defined time, valid time and transaction time. They attempted to retain the simplicity of the relational model. There is

a tradeoff between using the tuple time stamping and attribute time stamping approaches for the development of temporal model. For implementation point of view attribute time stamping is a better approach.

Bi-temporal conceptual data model proposed in this paper is a more appropriate basis for expressing time varying semantics in a database. Many other models have their own weaknesses and strengths. Many temporal query languages were proposed based on the data models and some of them are also implemented such as TQuel, ATSQL2, TSQL2 etc. The TSQL2 query language has consolidated many years of research results into a single, comprehensive language. Constructs from TSQL2 are being incorporated into SQL3. Despite the fact that lot of work has been done in the field of temporal databases, many issues still has to be resolved and there are many new avenues for research in the area of temporal databases such as temporal data mining, development of generic temporal data models, handling of uncertainty, data vacuuming etc. In future we will extend our work in temporal database to the area of fuzzy timeseries forecasting [BJ08] & [JBC07] and neuro fuzzy systems.

5. REFERENCES

1. [Ari86] Ariav G.A (1986). Temporal Oriented Data Model. *ACM Transaction on Database Systems*, 11(4), 499-527.
2. [Ben82] Ben-Zvi J. (1982). *The Time Relational Model*. Ph.D. Dissertation, University of California, Los Angeles.
3. [BJ08] Aqil Burney S.M. and Jilani T.A. (2008). A Refined Fuzzy Time Series Model for Stock Market Forecasting. *PHYSICA A* 387(2008) 2857-2862: Statistical Mechanics with Applications (Econophysics and Models), Elsevier Publishers available online at www.sciencedirect.com.
4. [BJW00] Bettini C., Jajodia S. and Wang S. (2000). *Time Granularities in Databases, Data Mining, and Temporal Reasoning*. Berlin: Springer-Verlag.
5. [CC87] Clifford J. and Croker A. (1987). The Historical Relational Data Model (HRDM) and Algebra Based on Lifespans. *IEEE 3rd International Conference on Data Engineering*, Los Angeles, California, 528-537.
6. [Cea98] Claudio Bettini, Curtis E. Dyreson, William S. Evans, Richard T. Snodgrass, Xiaoyang Sean Wang (1997). A Glossary of Time Granularity Concepts. *Temporal Databases - Research and Practice LNCS*. 1399, 406-413.
7. [Cli82] Clifford J. (1982). A Model for Historical Databases. *Proceedings of Logical Bases for Data Bases*, Toulouse, France.
8. [Cod70] Codd EF (1970). A relational model of data for large shared data banks. *Communications of the ACM* 13: 377-387.
9. [Cod90] Codd EF (1990). *The Relational model for database management: version 2*. Addison-Wesley, Reading, Mass.
10. [CT85] Clifford J. and Tansel A.U. (1985). On an Algebra For Historical Relational Databases: Two Views. *Proceedings of the 3rd International Workshop on Statistical and Scientific Databases*, Austin, Texas, 247-265.
11. [CW83] Clifford J. and Warren D.S. (1983). Formal Semantics for Time in Databases. *ACM Transactions on Database Systems*, 8(2), 214- 254 .
12. [CJT99] Christian S. Jensen and Richard T. Snodgrass (1999). Temporal Data Management. *IEEE Transactions on Knowledge and Data Engineering* 11(1):36-44.

13. [Cho94] J. Chomicki (1994). Temporal Query Languages: A Survey. In D.M. Gabbay and H.J. Ohlbach, editors, *Proceedings of the First International Conference on Temporal Logic*, 506-534.
14. [CI94] James Clifford and Tomas Isakowitz (1994). On the Semantics of (Bi)Temporal Variable Databases. In *Proceedings of the International Conference on Extending Database Technology*, Vol. 779 of Lecture Notes in Computer Science, 215-230. Springer-Verlag.
15. [Dat00] Date C.J. (2000). *An Introduction to Database Systems* (7th edition). Addison-Wesley Publishing Company.
16. [Dat07] Date C.J. (2007). *Logic & Databases: The roots of Relational Theory* (1st edition), Trafford Publishing Company.
17. [DDL03] Date C.J., Darwen H. and Lorentzos N.A. (2003). *Temporal Data and the Relational Model*. Morgan Kaufmann Publishers.
18. [Gad88] Gadia S.K. (1988). A Homogeneous Relational Model and Query Languages for Temporal Databases. *ACM Transactions on Database Systems*, 13(4), 418-448.
19. [Gad92] Gadia S.K. (1992). A Seamless Generic Extension of SQL for Querying Temporal Data. Technical Report TR-92-02, Comp. Sc. Department, Iowa State University.
20. [Gar03] Georgia Garani (2003). *A temporal database model using nested relations*. Ph.D. Thesis, School of Computer Science & Information systems, Birbeck College, University of London, Oct 2003.
21. [GY88] Gadia S.K. and Yeung C.S. (1988). A Generalised Model for a Relational Temporal Database. *Proceedings of the ACM SIGMOD International Conference on Management of Data*, Chicago, Illinois, 251-259.
22. [GY91] Gadia S.K. and Yeung C.S. (1991). Inadequacy of Interval Timestamps in Temporal Databases. *Information Sciences*, 54, 1-22.
23. [JBC07] T.A. Jillani, Aqil Burney S.M. and Cemal Ardil (2007). Fuzzy Metric Approach for fuzzy timeseries forecasting based on frequency density based partitioning. *IJCI* 4(2), ISSN 1304-2386.
24. [Jen90] C.S. Jensen. (1990). *Towards the Realization of Transaction Time Database Systems*. Ph.D. thesis, Aalborg University, Department of Mathematics and Computer Science, Aalborg, Denmark.
25. [Jea93] C. Jensen and et al. (1993). *A Consensus Glossary of Temporal Database Concepts*. Technical Report R 93-2035, Aalborg University.
26. [LJ87] Lorentzos N.A. and Johnson R. TRA (1987). A Model for a Temporal Relational Algebra. *Proceedings of the Conference on Temporal Aspects in Information Systems*, Sophia-Antipolis, France, 95-108.
27. [LJ88a] Lorentzos N.A. and Johnson R.(1988). An Extension of the Relational Model to Support Generic Intervals. *Proceedings of the International Conference on Extending Database Technology (EDBT' 88)*, Venice, Italy, 528-542.
28. [LJ88b] Lorentzos N.A. and Johnson R. (1988). Extending Relational Algebra to Manipulate Temporal Data. *Information Systems*, 13(3), 289-296.
29. [Lor88] Lorentzos N.A. (1988). *A Formal Extension of the Relational Model for the Representation and Manipulation of Generic Intervals*. Ph.D. Thesis, Department of Computer Science, Birkbeck College, University of London.

30. [Mck86] McKenzie E. (1986). Bibliography: Temporal Databases. *SIGMOD Record*, 15(4), 40-52.
31. [Mck88] McKenzie J.E. (1988). *An Algebraic Language for Query and Update Temporal Databases*. Ph.D. Thesis, The University of North Carolina at Chapel Hill.
32. [MS91] McKenzie J.E. and Snodgrass R.T. (1991). Evaluation of Relational Algebras Incorporating the Time Dimension in Databases. *ACM Computing Surveys*, 23(4), 501-543.
33. [NA88] S.B. Navathe and R. Ahmed. TSQL (1988). A Language Interface for History Databases. In M. Leonard C. Rolland, F. Bodart, editor, *Proceedings of the Conference on Temporal Aspects in Information Systems*, 113-128.
34. [NA89] S.B. Navathe and R. Ahmed. (1989). A Temporal Relational Model and Query Language. *Information Sciences*, 49(2), 147-175.
35. [NA93] S. Navathe and R. Ahmed. Temporal Extensions to the Relational Model and SQL. In A. Tansel, J. Clifford, S. Gadia, S. Jajodia, A. Segev, and R. Snodgrass (1993). *Temporal Databases: Theory, Design, and Implementation*, Benjamin/Cummings Publishing Company, 92-109.
36. [Sar90] Sarda N.L. Algebra and Query Language for a Historical Data Model. *The Computer Journal*, 33(1), 11-18.
37. [Skj97] Bjorn Skjellaug (1997). Temporal data: time and relational databases Research Report, Department of Informatics, University of Oslo.
38. [Sno85] R.T. Snodgrass and I. Ahn (1986). Temporal databases, *Computer*. 19(9), 3542.
39. [Sno87] R. Snodgrass (1987). The Temporal Query Language TQuel. *ACM Transactions on Database Systems*, 12(2), 247-298.
40. [Sno93] R. Snodgrass. (1993). An Overview of TQuel. In A. Tansel, J. Clifford, S. Gadia, S. Jajodia, A. Segev, and R. Snodgrass, editors, *Temporal Databases: Theory, Design, and Implementation*, Benjamin/Cummings Publishing Company, 141-182.
41. [Sno95a] R. Snodgrass (1995). Temporal Object-Oriented Databases: A Critical Comparison. In W. Kim, editor, *Modern Database Systems*, ACM Press, Chapter 19, 386-408.
42. [Sno95b] R. Snodgrass (1995). *The TSQL2 Temporal Query Language*. Kluwer Academic Publishers, 101 Philip Drive, Assinippi Park, Norwell, Massachusetts 02061, USA.
43. [Tan86] Tansel A.U. (1986). Adding Time Dimension to Relational Model and Extending Relational Algebra. *Information Systems*, 11(4), 343-355.
44. [TG89] Tansel A.U. and Garnett L. (1989). Nested Historical Relations. *Proceedings of the ACM SIGMOD International Conference on Management of Data*, Portland, Oregon, 284-293.

LOSSLESS PROGRESSIVE CODING FOR GREYSCALE IMAGES USING JBIG STANDARD

Ahmed M. Abushaala

Faculty of Information Technology, 7th October University, Misurata-Libya.

Email: Am_rata@yahoo.co.uk

ABSTRACT

The Adaptive Binary Arithmetic Coding (*ABAC*) is one of the lossless data compression and decompression techniques. It has used by the *JBIG* standard (Joint Bi-level Image Experts Group) to encode an input data string, which is mapped into a real number x between “0” and “1”. The *JBIG* defines a compression method for bi-level images (images consisting of a single bit-plane). In this work, the *ABAC* is implemented using progressive method for static greyscale images. Therefore, the input image is divided into bit-planes, each divides into D resolution layers.

Four sub-blocks of the *JBIG* standard namely: Model Template, Typical Prediction, Adaptive Arithmetic Encoder and Resolution Reduction implemented to encode the lowest resolution layer of each bit-plane of an input greyscale image.

The 10th order of Markov model with template of three lines is used for each pixel that is being encoded to compute an integer value (context). In addition, the *JBIG* standard uses a Typical Prediction algorithm to speed the implementation. The obtained results presented a high compression ratio.

KEY WORDS

JBIG Standard, Arithmetic Coding, Greyscale Coding, Progressive Coding, Lossless Compression.

1. INTRODUCTION

The *ABAC* technique is used by *JBIG* standard for a progressive coding of 2-tone images (each pixel taking on just one of two possible level colours). It is one of the lossless compression techniques, that is; the output image is identical to the input image. One application of this compression is facsimile [1]. The objective of compression algorithm is the reduction of transmission time and/or storage space. *ABAC* technique utilizes the statistics change on a bit-to-bit basis. It is different from other techniques, which use prefix codes, such as Huffman.

The coding process can be split into two stages: *modelling*, which estimates the relative probability (some indications) for each input pixel, and *coding*, which converts an input data string into a coded string [2]. According to the probabilities that the pixels will occur, the *ABAC* technique maps an input string into a real number x (code point) between “0” and “1”.

The 10th order Markov model is used by *JBIG* standard, where the three-line template is chosen. The integer output (context) of Markov model is sent to lossless *ABAC* encoder. The model is applied for each bit being encoded [3].

The input greyscale image is divided into bit-planes before it is encoded. Each of which is divided into D resolution layers [4], and the lowest resolution layer is sent to the lossless *ABAC* encoder. The encoding process is done recursively until all the input string is encoded, and the code is generated.

This paper presents the greyscale image reduction algorithm for bit-planes and resolution layers. It also shows the typical prediction process, lossless *ABAC* algorithm of *JBIG* standard and its model template of three-line data string. A software implementation of such process gave an excellent compression results for five greyscale images.

2. THE RESOLUTION REDUCTION

2.1 The Image Format

Five greyscale images are used as an input data to the *ABAC* algorithm to test its compression efficiency. Each pixel of the image has levels between “0” and “256”, that is; eight bits per pixel. The sequential mode utilized by *JBIG* standard is used for reading the input image. The scan process is done in “*Raster Mode*”, pixel by pixel from left to right side and from top to bottom.

The format of a greyscale image is Portable GreyMap (*PGM*). It consists of 4 lines header followed by data stored in the unsigned char type. This format is defined as follows:

- First line contains a “magic number”, for identifying the file as *PGM*, two characters “P5”.
- Second line is a comment line, some times has one or more lines, starting with a “#” character.
- Third line has a “width” and a “height” of the image, in *ASCII* format characters in decimal, and separated by “whitespace”.
- Fourth line specifies maximum grey level contained in the image.
- Finally, the data of the image (in binary format), width * height grey values between “0” and “255”, starting at the top-left corner of the greymap, proceeding in normal English reading order.



Fig. (2.1): Format Structure of *PGM* Image (Binary).

Figure (2.1) shows an example of small grey map in *PGM* format in binary.

2.2. The Resolution Reduction Algorithm

Before the coding process is applied, the greyscale image is divided into bit-planes. The bits of a grey representation of intensity define the bit-planes [5]; each of which represents one bit, that is; the number of bit-planes is dependent on the number of bits per pixel. Each bit-plane is divided into D resolution layers, as shown in figure (2.2).

The resolution reduction algorithm accepts a high resolution image (high resolution layer) and creates a low resolution image, half as many rows and half as many columns as the original. The *JBIG* standard provides a deterministic table to the algorithm to determine a low resolution colour [4].

The *ABAC* encoder accepts the lowest resolution layer (d_0), and encodes it independently as if it was by itself a bi-level image. In the inverse process (decompression), the Adaptive Binary Arithmetic Decoding (*ABAD*) algorithm must build up the greyscale image from the bit-planes, each particular bit in the pixel is recovered.

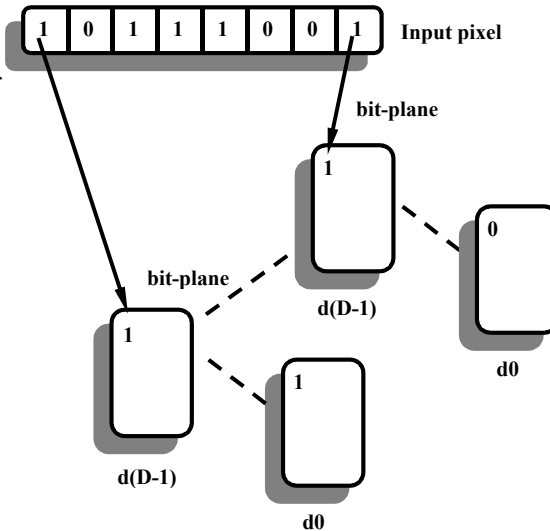


Fig. (2.2): Division of The Bit-planes and Reduction Resolution Layers.

3. THE MODEL

The *JBIG* standard presents two types of model templates (Markov models) [4]. One of them is three-line model template. It uses the 10 bits preceding the current bit being encoded; bits from the same line and two upper lines immediately above it, see figure (3.1).

Where,

X: Bit of the template.

? : Bit being encoded, it is not used as a part of the template.

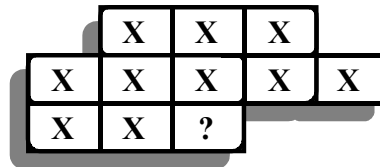


Fig (3.1): Three-line Model Template.

For each bit of the binary input data to be encoded, the model determines an integer value namely context, and sends it to the *ABAC* encoder. The *ABAC* algorithm uses the context to capture the adaptive probability estimation of the bit being encoded. Using a lookup table provided by *JBIG* standard [6], The probability can be indexed by the help of the particular context. The process of the *ABAD* algorithm uses the same context to recover the original greyscale image.

4. THE TYPICAL PREDICTION

Its function provides some coding gain [4]. When a pixel being encoded located in region of solid colour (uniform area), no process will neither do in the Model nor do in the *ABAC* encoder, that is; a given pixel is not encoded. Then, a signal will send with the code string indicated that no process is done in the encoder. The decoder can recover all pixels located in the uniform area.

5. THE *ABAC* ENCODER

The resolution reduction unit sends the **d0** layer, as an input image to the encoder. The *ABAC* encoder is receiving the sequence of binary pixels (bits) and its context (some indication of their relative probability) [7], and encodes the **d0** layer at full resolution, line by line, from left to right and top to bottom, without reference to any other resolution. That way, the output of the *ABAC* encoder is a code string, which obtained at the last division produced from the encoding process, see figure (5.1). The code string is a fractional value on the real number line between “0” and “1”.

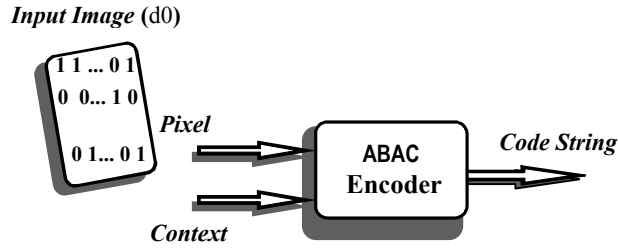


Fig. (5.1): Block Diagram of The Encoder Unit.

The *ABAC* is an entropy encoder; it maps a string of input bits into a real number x on the unit interval. The binary expansion of x is transmitted or stored instead of the original sequence. For each input binary bit (“0” or “1”), the unit interval is divided into two subintervals with sizes proportional to the relative probability [6]; they are: less probable symbol (**LPS**) and more probable symbol (**MPS**) subintervals, separated by a code point (cumulative probability), see figure (5.2).

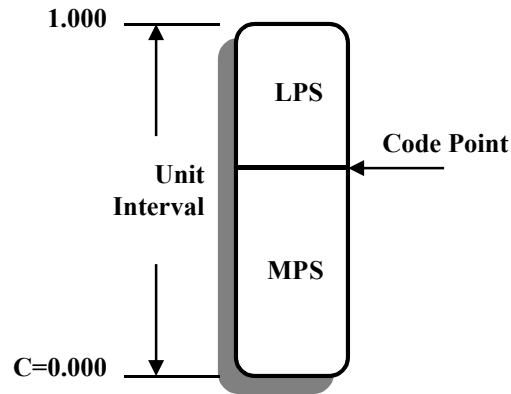


Fig (5.2): Subdivision of The Unit Interval.

The code point is the sum of the relative probabilities of the previous bits, which limits the interval partitions, as magnitudes [8]. The **LPS** is above the **MPS**, and its size is always smaller than the size of **MPS**.

For each input bit, the *ABAC* algorithm divides the interval recursively during the encoding process, that is; the subinterval relative to the value of the bit being encoded will be used for the next iteration [9]. The *ABAC* algorithm uses the context to determine the probability estimation (P_C) [10], and computes the subinterval relative to **LPS**, which is interpreted to the adaptive probability estimation, by using the following equations:

$$A = A' * P_C$$

and, $A \cong P_C = \text{LPS}$

where, A' : New current coding interval size, it maintains $\cong 1$.

To compute the subintervals, the *ABAC* algorithm needs to assign the letter **A** to the size of the current coding interval, and letter **C** to the starting point of the interval (base).

If the bit **MPS** is encoded:

$$\mathbf{A} = \mathbf{A} - \mathbf{LPS},$$

and, $\mathbf{C} = \mathbf{C}$ (unchanged).

If the bit **LPS** is encoded:

$$\mathbf{A} = \mathbf{LPS},$$

and, $\mathbf{C} = \mathbf{C} + \mathbf{MPS}$.

The *ABAD* algorithm follows a reversal procedure of *ABAC*. The magnitude comparison operation is done to construct the input greyscale image. Any interval that had been added to the code string by the encoder is subtracted. The *ABAD* uses the same context as the *ABAC* algorithm to determine the probability estimation.

6. CONCLUSION

The *JBIG* standard describes an algorithm of *ABAC* technique, which can be parameterized for sequential coding. The *ABAC* algorithm builds the code string during the encoding process. The statistics of a binary sequence (0's and 1's) is changed on bit-to-bit basis. The *ABAC* does not need the input data blocking, as in some of other entropy encoding techniques, so time and memory saving is possible.

The *JBIG* standard has superior compression over G_3 and G_4 coding, and found to achieve excellent results for text, line art and dithered greyscale [8]. It yields compression sometimes better than the *JPEG* standard in its lossless mode. The *JBIG* standard is considered as an acceptable standard for many applications such as, hardcopy facsimile, photographic images, scanned images of printed characters, computer-generated images of printed character.

The method of resolution reduction of greyscale images can be efficiently applied to applications that do not need high quality recovered image.

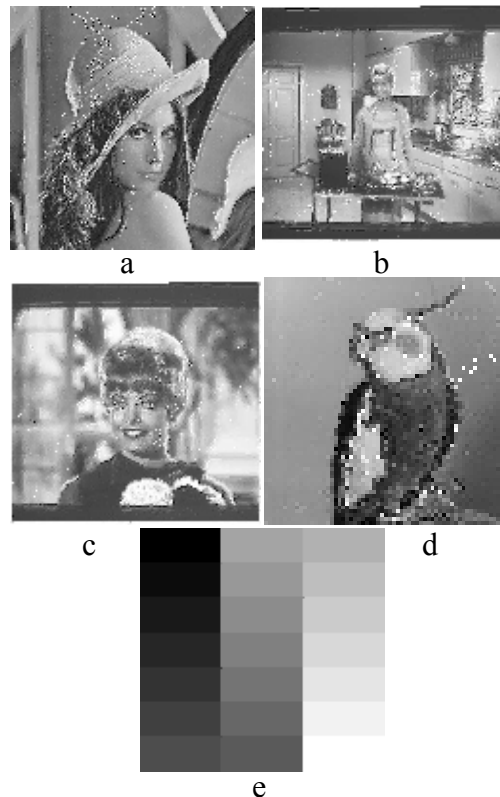


Fig. (6.1): The Recovered Images:
 (a) Lena 512X512. (b) Kitchen 512X512.
 (c) Bird 256X256. (d) Zelda 512X512.
 (e) Bars 512X512.

The *ABAC* algorithm is implemented in computer software with its model for the greyscale images. The five output images of the *ABAD* algorithm are shown in figure (6.1).

The results showed that, the compression ratio for the image that has uniform area is better than the other that has more details. Table (6.1) illustrates the results of the *ABAC ALGORITHM*.

Original image	Original size (KB)	Compressed size (KB)	% Compression
Lena.pgm	257	13	94.94
Kitchen.pgm	257	12	95.33
Bird.pgm	65	3	95.38
Zelda.pgm	257	11	95.72
Bars.pgm	257	1	99.61

7. ACKNOWLEDGEMENT

The author is grateful to the: Centro de Pesquisa e Desenvolvimento da Telebrás – CPqD/Telebrás, Conselho Nacional de Desenvolvimento Científico e Tecnológico-CNPq, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior-CAPES, Fundação de Amparo a Pesquisa do Estado de São Paulo - FAPESP, FAP/UNICAMP - Fundo de Apoio à Pesquisa da UNICAMP, the Education Ministry of Libya, and the 7th October University, Misurata-Libya.

REFERENCES

1. Hunter, R. and Robinson, A.H. (1980). International Digital Facsimile Coding Standard. *Proc. IEEE*, Vol. 68, 854-867.
2. Kuang, S.; Jou, J. and Chen, Y. (1998). The Design of an Adaptive On-Line Binary Arithmetic-Coding Chip, *IEEE Trans. on Circuits and Systems-I: Fundamental Theory and Applications*, 45(7), 693-706.
3. Ahmed M. Abushaala and Yuzo Iano (1998). Relevant Aspects of Data Compression for Two-Tone Image Based on JBIG Standard, In: IASTED International Conference, Signal Processing and Communications, Canary Islands-Spain. *Fundamental of Image Processing*, 147-150.
4. ISO/IEC Committee Draft 11544 (1991). Coded Representation of Picture and Audio Information - Progressive Bi-level Image Compression, Revision 4.1.
5. Hamming, R.W. (1980). *Coding and information theory*. Englewood Cliffs, NJ: Prentice-Hall, 96-98.
6. Ahmed M. Abushaala, ISO/JBIG (1996). *Codificação Aritmética de Imagens em 2-tone*. Campinas: FEEC, UNICAMP, 1996 Thesis (Master Degree), Faculty of Electrical Engineering and Computation, State University of Campinas.
7. Glen G. Langdon, Jr., (1984). An Introduction to Arithmetic Coding, *IBM J. Res. Develop.* 28(2).
8. Ian H. Witten, Radford M. Neal and John G. Cleary (1987). Arithmetic Coding for Data Compression, *Commun. ACM* 30(6), 520-540.
9. Langdon, Glen G., and Rissanen, J. (1981). Compression of Black-White Images With Arithmetic Coding. *IEEE Trans. Commun. COM-29*, 858-867.
10. Hampel H. et al. (1992). Technical Features of The JBIG Standard for Progressive Bi-level Image Compression. *Signal Processing: Image Communication* 4, 4(2).

THE ROBUSTNESS OF MIXED RENEWAL MODALS TO MISSPECIFICATION

Najeeb Haider

Department of Statistics, Govt. Postgraduate College

D.G. Khan

Email: haiderdr@yahoo.co.uk

ABSTRACT

Mixed models for longitudinal data analysis are known to be sensitive to the precise specification adopted for the mixed distribution. This paper provide new evidence that this sensitivity can be due to misspecification of other feature of the models. This evidence is based on a range of mixed renewal models fitted to data on multiple spell of unemployment.

KEYWORDS

Renewal models; Weibull; Logistic; Random effects; Misspecification; Nonparametric; Mixture.

1. INTRODUCTION

Statistical modelling seeks to represent the systematic relationship of interest in data and to characterized the random, unexplained variations. The Robustness of models to misspecification is an important issue in social science empirical research because we rarely have sound *a priori* justification for assuming any particular functional form for either the systematic or random relationships of interest. Proportional hazard models different with different parametric and non parametric specifications of unobserved heterogeneity have been used extensively for the analysis of duration data (e.g. Lancaster, 1979; Lancaster and Nickell, 1980; Flinn and Heckman, 1982; Heckman and Singer, 1982; Kiefer, 1988; Honore, 1990; Davies, 1993; Narendranathen and Stewart, 1993) in what are variously referred to as 'mixed', 'random effect', and 'frailty' models. However, parameter estimate tend not to be Robust to alternative parametric specification of the residual heterogeneity distribution (Heckman and singer, 1982, 1984). Other studies (Newman and McCulloch, 1984; Rider, 1986; Han and Hausman, 1990) suggest that parameter estimate are typically more sensitive to the arbitrary choice of hazards function than that of random effect. These problem are avoided or less evident in conventional homogeneous models and this has led some authors to question the wisdom of random effects models; Trussel and Richards, (1985 p273) warn that '...the investigator who wishes to avoid models misspecification by correcting for unobserved heterogeneity is treading on dangerous ground'.

2. DATA

The analyses in this paper are based on two data sets. They contained detailed longitudinal information on the time and duration of 755 and 411 spell of unemployment for sample of 353 women and 198 men, respectively. The spells in progress at the end of survey are treated as censored. There are 160 censored spells in the female data set and 87 censored spells in the male data set.

3. METHODOLOGY

3.1 The Hazard Function

The shape of the hazards function remains an essentially empirical question in modeling most social science duration data. Within econometrics, there is a well developed tradition of deriving models from theoretical considerations and there is an extensive literature on job search models for the conditional probability of leaving unemployment. See, for example, Mortenson, 1970, 1986; Lipman and McCall, 1979; Heckman and Singer, 1985.

The models are based on two main equations, one giving the wage offer distribution and the other accounting for the reservation wage. A reduced form equation may be derived from these structural relationships giving, in principle, a theoretically based hazard function specification for the rate of obtaining employment. In practice, however, a variety of structural formulations have been proposed leading to a very broad class of reduced form models which are consistent with utility maximizing behavior (e.g. Nickell, 1979; Flinn and Heckman, 1982; Lancaster, 1985; Narendranathan and Nickell, 1985; Mortenson, 1986; Bloeman, 1990); even for unemployment duration, there is therefore no unequivocal theoretical guidance on the shape of the hazard.

The reported work has used two different hazard functions: the widely used Weibull distribution which has a monotonic hazard; and the log logistic distribution which has either a monotonically decreasing or a 'sickle'-shaped hazard.

3.2 Unobserved Heterogeneity

It is well known that using conventional duration models, and thereby ignoring unobserved heterogeneity, can give misleading results. The hazard function is progressively under-estimated with duration and effects of explanatory variables are attenuated (Lancaster and Nickell, 1979; Heckman and Singer, 1982). Conversely, random effect models which explicitly allow for unobserved heterogeneity in longitudinal data analysis provide some control for unmeasured variables, improving in principle the insight possible from observational data (Davies, 1994).

Following Heckman and Singer (1984) and others, we adopt an integrated likelihood approach for eliminating the random effect from the likelihood function. Specifically the likelihood contribution for individual i is given by

$$Li = \int g(S_i | X_i, \theta, \varepsilon) f(\varepsilon) d\varepsilon \quad (3.1)$$

where X_i is a matrix of values for the explanatory variables, θ is a vector of parameters, $g(S_i)$ is the conditional probability density of the observed sequence of unemployment durations S_i and $f(\varepsilon)$ is the probability density of random effect ε . The random effect is assumed to be additive in the linear predictor with a conventional log-linear link function. As a random effect may be conceptualized in this formulation as weighted sum of the variables omitted from the linear predictor, the Central Limit Theorem could be adduced to support a conventional Normal error distribution assumption for $f(\varepsilon)$. However, there is mounting empirical evidence that the Normal distribution has over-light tails to represent the relatively high proportion of low probability 'movers' in social science application; there may even be a tendency towards polarization rather than uni-modality. Two methods are therefore compared for operationalising equation 3.1: one assumes that $f(\varepsilon)$ is Normal and quadrature methods are used to evaluate the integral; the other uses the mass point approach (Heckman and Singer, 1984; Davies, 1993, 1987) to provide a non parametric characterization of $f(\varepsilon)$, obviating the need for any assumption about the functional form of this distribution.

4. THE MODELS

The Weibull-Normal mixture model

Assuming a Weibull duration distribution and a Normal random effect gives

$$Li = \sum_{k=1}^m \left\{ \prod_{u=1}^{T_i} \left[\alpha t_{iu}^{\alpha-1} \lambda \exp(-t_{iu}^\alpha \lambda) \right]^{\delta_{iu}} \exp(-t_{iu}^\alpha \lambda)^{1-\delta_{iu}} \right\} p_k \quad (4.1)$$

where $\lambda = \exp(\beta_0 + \beta' X_{iu} + \delta Z_k)$ and δ is a censoring indicator taking value 1 if spell is completed and 0 otherwise. Z_k and P_k are quadrature point locations and probabilities respectively, and T_i is the number of unemployment spells for individual i . The mean of the distribution is absorbed into the constant term and the scale parameter σ is estimated with the other parameters of interest.

Weibull-Nonparametric models

The nonparametric characterization of the random effect distribution gives

$$Li = \sum_{k=1}^m \left\{ \prod_{u=1}^{T_i} \left[\alpha t_{iu}^{\alpha-1} \lambda \exp(-t_{iu}^\alpha \lambda) \right]^{\delta_{iu}} \exp(-t_{iu}^\alpha \lambda)^{1-\delta_{iu}} \right\} p_k \quad (4.2)$$

where $\lambda = \exp(\beta' X_{iu} + \delta Z_k)$. This is similar to equation 4.1 but Z_k and P_k are mass point locations and probabilities respectively, to be estimated simultaneously with other parameter. To achieve a full non parametric characterization, the number of points is increased until no further improvement can be obtained in the likelihood. The empirical evidence shows that the required number of mass point tends to be small.

Log-Logistic Normal mixture model

A log logistic duration distribution with normal random effect gives

$$Li = \sum^m \left[\prod^{T_i} \left\{ \alpha \lambda t^{\alpha-1} (1 + \lambda t^\alpha)^{-2} \right\}^{\delta_{iu}} \left\{ (1 + \lambda t^\alpha)^{-1} \right\}^{1-\delta} \right] pk \quad (4.3)$$

where $\lambda = \exp(\beta_0 + \beta' X_{iu} + \delta Z_k)$

Log-Logistic non parametric model

The non parametric random effect specification with a log logistic hazard gives

$$Li = \sum^m \left[\prod^{T_i} \left\{ \alpha \lambda t^{\alpha-1} (1 + \lambda t^\alpha)^{-2} \right\}^{\delta_{iu}} \left\{ (1 + \lambda t^\alpha)^{-1} \right\}^{1-\delta} \right] pk \quad (4.4)$$

where $\lambda = \exp(\beta' X_{iu} + \delta Z_k)$

Probability of Dropping out of the Labour Force

Distinguishing the two states 'unemployed' and out of labour force is a matter of empirical and theoretical importance. Search theory attempts to differentiate these two states on the basis of time consumed in search for a job. The unemployed individual who do not devote any time to search for employment are generally presumed to be out of the labour force. But this is not a concept which is readily measured and in reality the classification 'unemployed' will usually include a number of individuals who have actually withdrawn from the labour force. We assume that dropping out of the labour force take place at the beginning of the unemployment spell with probability

$$q_{iu} = \exp(\omega_0 + \omega X_{iu} + \eta) / [1 + \exp(\omega_0 + \omega X_{iu} + \eta)]$$

where the $\{\omega\}$ are parameters to be estimated and η is a random effect. There is no return to the labour force in this formulation once an individual has dropped out; there is insufficient information in the data for any analysis of temporary withdrawal from the labour force. In effect, the $\{q\}$ probabilities provide a readily interpretable correction to the model if the right-censored unemployment durations tend to be longer than expected in comparison to the completed durations. It is straight forward in principle to extend the models 4.1 to 4.4 above to include this logistics regression sub-model. For example, the integrated likelihood for the mixed Log-logistic model is given by

$$Li = \int_0^{T_i} \prod_{u=1}^u \left[q_{iu} \alpha \lambda_{iu} t_{iu}^{\alpha-1} (1 + \lambda_{iu} t_{iu}^\alpha)^{-2} \right]^{\delta_{iu}} \left[q_{iu} (1 + \lambda_{iu} t_{iu}^\alpha)^{-1} + (1 - q_{iu}) \right]^{1-\delta_{iu}} dF(\varepsilon, \eta) \quad (4.5)$$

$[1 + \exp(\omega_0 + \omega X_{iu} + \eta)]$ Then main complication is that the inclusion of a random effect in the sub-model requires a bivariate specification for unobserved heterogeneity. Following the Heckman and Singer (1982) approach, we adopt the pragmatic expedient of writing $\eta = \psi\varepsilon$ where ψ is a parameter to be estimated, and thereby reducing the equation 4.5 to a univariate integral.

5. RESULTS

5.1 Weibull models

The signs of the parameter estimates are generally consistent with expectations. The higher ‘hazard’ for women with children may appear counter-intuitive but the comparison is with women who have no children and are not working. There is ample evidence that childless women are less likely to leave paid work than women with children; the implication here is that those who do leave tend to be slower in returning to employment. Other parameter estimates tend to confirm that the rate at which women return to employment declines with age, is lower for married women, has increased over the years (with growing female participation in the labour market), and is at a minimum for women with no educational qualifications.

The higher log-likelihoods of the mixture models indicate substantial heterogeneity. As noted in 3.2 ignoring heterogeneity will attenuate the effects of explanatory variables. With few exceptions most of the parameter estimates have larger absolute values for the mixture models. The Average change in values of parameter estimates from Weibull-Normal mixture model to Weibull Nonparametric mixture model has been observed to be 43% and 28% for females and males respectively. Moreover, ignoring heterogeneity tends to reduce the slope of the hazard. This is also the observed pattern: The conventional, homogenous model suggests a pronounced decline in the hazard with duration (shape parameter estimate = 0.73) while the mixed models each indicate a decidedly more modest decline (shape parameter estimates = 0.90). The results for male data set have shown the same pattern. The table of results have been omitted for brevity.

However, the results have two disquieting features. First, there are some substantial discrepancies between the parameter estimates for the Normal and nonparametric mixture models. The log-likelihoods for the two models indicate that the heterogeneity is not fully represented by a Normal distribution and the parameter estimates tend to confirm suspicions that results are not robust to infringements of an assumed parametric form for the random effects distribution. The second disquieting feature is that the parameter estimates for the explanatory variable PRUNE (proportion of time spent unemployed

since leaving school) have larger negative values in the mixture models than in the conventional model. This is Markov-type variable summarizing previous outcomes of the process of interest. Allowing for residual heterogeneity should, theoretically, **reduce** the impact of such a variable (see Massy et al chapter 3).

5.2 Log-logistic Models

The first three columns of Table 7.1 show the results of fitting log-logistic conventional and mixture models to the same female dataset. Each of these models provides a better fit than the corresponding Weibull model. The shape parameters indicate that the hazard has a 'sickle' shape rather than monotonically declining. Comparing the parameter estimates for the two mixture models reveals that estimates are still sensitive to the distributional assumptions about residual heterogeneity but the discrepancies are all smaller than those for Weibull mixtures. The average change in the values of parameter estimates from Loglogistic-Normal mixture model to Loglogistic-nonparametric mixture model has been observed to be just 19% and 17% for females and males respectively. Another important change in comparison to the Weibull results is that the absolute value of the PRUNE parameter estimate is now reduced by a mixture specification, albeit marginally for the nonparametric model.

The final four columns of Table 7.1 show the results of extending the log-logistic mixture models to include a sub-model for dropping out of the labour force. It has shown significant improvements in goodness-of-fit. For example, a likelihood ratio test between the log-logistic nonparametric mixture model with and without the sub-model has a test statistic $\chi^2 = 2.05$ with 4 degrees of freedom (P-value < 0.001). The sub-model also has two notable consequences for the parameter estimates. First they are now remarkably stable across different mixing distribution specifications. Second, the estimated effect of the Markov-type variable PRUNE is greatly reduced and is now unequivocally nonsignificant. The disquieting features of the Weibull analyses have been completely ameliorated by these better-fitting specification. The average change in the values of parameter estimates for two specifications of unobserved heterogeneity has now dropped jus to 2% and 3% for females and males respectively.

6. CONCLUSIONS

The empirical analyses reported in this paper provide a remarkably consistent pattern of results across two separate datasets. Parameter estimates become more robust to mixture distribution assumptions and more plausible as the hazard specification and other features of the models are improved. Firms conclusions must await more extensive investigation but there is clear and replicated *prima facie* evidence that misspecification to be expected of simpler models can have complex and misleading consequences in longitudinal data analysis. More specifically, the results suggest that misspecification may be responsible for the often noted sensitivity of parameter estimates to alternative distributional assumptions about residual heterogeneity. Misspecification may also cause misleading inference about the effects of endogenous variables even with a mixture formulation to control for residual heterogeneity.

There are two important corollaries. First, sensitivity to alternative distributional assumption about residual heterogeneity could be used as an indicator of model misspecification. The cautious analyst would fit a model with a number of different random effect distributions and investigate revised formulations if the parameter estimates show substantial variation. Second, the misspecification problems are not avoided by ignoring residual heterogeneity and using conventional models. These models appear to be more robust to models misspecification but, for endogenous variables at least, this could arise because they could be consistently wrong.

7. TABLES OF RESULTS

Table 7.1
Log-logistic parameter estimates (standard errors) for female

	Log-Logistic Mixture			Log-Logistic Mixture + Submodel			
	Conventional	Normal	Non-parametric	Conventional	Normal	Non-parametric	Bivariate
SHAPE	1.10(0.04)	1.28(0.06)	1.30(0.06)	1.18(0.04)	1.41(0.07)	1.41(0.07)	1.42(0.08)
INT	-2.63(0.34)	-3.28(0.42)	-----	-2.62(0.37)	-3.19(0.46)	-----	-3.19(0.53)
AGE	-0.43(0.10)	-0.49(0.13)	-0.52(0.12)	-0.40(0.11)	-0.60(0.11)	-0.61(0.15)	-0.63(0.14)
MAR	-0.91(0.16)	-1.12(0.19)	-1.26(0.21)	-1.35(0.18)	-1.52(0.21)	-1.54(0.23)	-1.54(0.24)
TIME	0.09(0.07)	0.13(0.08)	0.07(0.09)	0.11(0.07)	0.18(0.09)	0.17(0.09)	0.19(0.10)
PRUNE	-1.20(0.36)	-0.76(0.42)	-1.15(0.45)	-1.13(0.37)	-0.29(0.57)	-0.30(0.58)	-0.14(0.59)
CHILD (1)	0.66(0.19)	0.46(0.21)	0.52(0.22)	0.73(0.19)	0.42(0.21)	0.43(0.23)	0.38(0.23)
CHILD (2)	1.48(0.23)	1.40(0.27)	1.50(0.28)	1.56(0.24)	1.43(0.29)	1.46(0.29)	1.39(0.30)
QUAL (1)	0.62(0.16)	0.79(0.21)	0.77(0.21)	0.54(0.17)	0.67(0.21)	0.63(0.22)	0.67(0.22)
QUAL (2)	0.88(0.24)	1.15(0.31)	1.11(0.31)	0.76(0.23)	1.01(0.32)	1.00(0.35)	1.04(0.32)
QUAL (3)	0.61(0.30)	0.80(0.39)	0.73(0.38)	0.58(0.32)	0.74(0.42)	0.76(0.42)	0.79(0.43)
SCALE	-----	1.03(0.16)	-----	-----	1.08(0.18)	-----	1.14(0.18)
COEFF	-----	-----	-----	-----	-----	-----	-0.66(0.95)
LOGLIKE	-2768.76	-2759.98	-2756.45	-2758.63	-2747.20	-2746.20	-2745.76

8. REFERENCES

1. Bloemen. H.G. (1992). Job Search Theory, Labor Supply and Unemployment Duration. *Center Discussion Paper* No. 9250.
2. Davies, R.B. (1987). Mass point methods for dealing with nuisance parameters in longitudinal studies. In R. Crouchley (Ed.) *Longitudinal Data Analyses*. 88-109.
3. Davies, R.B. (1993). Non parametric control for residual heterogeneity in modeling recurrent behavior. *Computational Statistics and Data analysis*. 16, 143-160.
4. Davies, R.B. (1994). From Cross Sectional to Longitudinal Analysis. Chapter No. 2 in A. Dale and R.B. Davies (Ed.) *Analyzing Social and Political Change*.
5. Flinn, C. and Heckman, J. (1982). New methods for analyzing individual event histories. In Leinhardt, S. (Ed.) *Sociological Methodology*. 99-140.
6. Han, A. and Hausman, J. (1990). Flexible parametric estimation of duration and competing risk models. *Journal of Applied Econometrics*. 5, 325-353.
7. Heckman, J. and Singer, B. (1982). The identification problem in econometric models for duration data. In W. Hilderband (Ed.) *Advance in Econometrics*. Cambridge University Press.
8. Heckman, J. and Singer. B. (1984). A method for minimizing the impact distributional assumptions in econometric models for duration data. *Econometrica*. 52, 271-230.
9. Heckman, J. and Singer. B. (1985). Social Science Duration Analysis. In J.J. Heckman and Singer (Ed.), *Longitudinal Analysis of Labor Market Data*. New York, Cambridge University Press.
10. Honore, B.E. (1990). Simple Estimation of a Duration Model with Unobserved Heterogeneity. *Econometrica*. 58(2), 453-477.
11. Kiefer, N. (1988). Econometric Duration Data and Hazard Function. *Journal of Econometric Literature*. XXVI, 646-679.
12. Lancaster, T. (1979). Econometric Methods for Duration of Unemployment. *Econometrica*. 47, 939-956.
13. Lancaster, T. and Nickell, S. (1980). The Analysis of Re-employment probabilities for the unemployed. *J. Roy. Statist. Soc. A* 134, 141-165.
14. Lancaster, T. (1985). Generalized Residuals and Heterogeneous Duration Models, *Journal of Econometrics*. 28, 155-169.
15. Lancaster, T. (1990). *The Econometric Analysis of transition data*. Cambridge University Press.
16. Lipman, S. and McCall, J.J. (1976). The Economics of Job Search. Part 1. *Economic Enquiry*. 14, 155-189.
17. Massy, W.F., Montgomery, D.M. and Marrison, D.G. (1970). *Stochastic Models of Buying Behavior*. MIT Press Cambridge, Mass.
18. Mortenson, D.T. (1970). Job Search, The Duration of unemployment and the Philips curve. *American Economic Review*. 60, 847-862.
19. Mortenson, D.T. (1986). Job Search and Labor Market Analysis. In O. Ashenfelter and R. Layard (Ed.) *Handbook of Labor Economics*. Vol. II. Elsevier, Amsterdam.
20. Narendranathen, W. and Nickell, S. (1985). Modelling the Process of Job Search. *Journal of Econometrics*. 28, 29-49.

21. Narendranathen, W. and Stewart, W. (1993). Modelling the Probability of Leaving Unemployment: Competing Risks Models with Flexible Base-line Hazards. *Applied Statistics*. 44(1), 63-83.
22. Newman, J. and McCulloch. C. (1984). A Hazard Rate Approach to the Timing of Birth. *Econometrica*. 52(4), 939-961.
23. Trusel, J. and Richard T. (1985). Correcting for Unmeasured Heterogeneity in Hazard Models: An Application of The Heckman – Singer Strategy to Demographic Data. *Sociological Methodology*. 242-276.
24. Ridder, G. (1986). The Sensitivity of Duration Models to Mis-specified Un-observed Heterogeneity and duration Dependence. *Manuscript*. University of Amsterdam.

**EDUCATED ILLITERATES PRACTICING FREEDOM WITH NECESSARY
EVIL, CELLULAR PHONE ETIQUETTE AMONG COLLEGE AND
UNIVERSITY STUDENTS OF PAKISTAN**

**Khurram Aziz Fani, Faiza Muzaffar, Maryum Arif, Waqas Ilyas,
Sana Zafar and Atif Amin**

Gift Business School, Gift University, Gujranwala. Email: khurram@gift.edu.pk

ABSTRACT

Mobile phone has become a rapidly emerging technology over the last decade. Cellular phones have become essential component of m-commerce. The purpose of this study was to explore the behavior of college students. People can use such devices whenever and wherever they want which create questions of their appropriate use in social settings. A sample of 720 students was surveyed to access the students to what extend they use technology different settings and for different purposes. Specific differences were found as a function of gender, age, government college/university and private college/university. Responses were collected from students of different disciplines and from a variety of public and private colleges and universities using structured questionnaire of lickert scale rating. Appropriate SPSS techniques (principal component analysis methods for extraction using, communalities, total variance and central tendency) were used to identify appropriate and inappropriate use of cell phone in different social settings. Findings were quantitative in which Collectively, participants reported strong perception of exchanging adult jokes, pictures etc, about use of technology for cheating, wrong use of camera in college/universities, disagreeing form placing and receiving a call in class, while driving, in library, worship place and in bath room. Most of the students are in favor of announcing Mobile Phone use policy in college/university.

LITERATURE REVIEW

Industry background:

The invention of the fixed telephone in the late 19th century in the United States altered the way that people interacted and communicated. This has been paralleled in the early 21st century by the advent of the mobile phone. The mobile phone was originally created for adults for business use (Aoki & Downes, 2003). Consumers have had a number of features to choose from: ring tones, browsers, wireless cameras, instant messaging, streaming video, mobile music, push-to-talk (walkie-talkie), television clip playing, college entrance exam preparation review, over-the air music downloads and full-length novels (see 'Firm reveals', 2002; Stern, 2002; Chmielewski, 2003; Gunch, 2003; Malik, 2003; Moore, 2003; 'Music industry', 2003; Pringle, 2003a,b; Wildstrom, 2003a,b; Mossberg, 2004a,b; Fitzgerald, 2005; Kageyama, 2005).

Mobile bloggers:

The camera phone has also led to growth in the blog world as 'mobloggers,' mobile bloggers, post their pictures on the web (Baker, 2005, p. 90). Worldwide sales of camera phones are expected to post compound growth rates of 55% from 2004 through 2008 on an

annualized basis ('Camera Phone Sales', 2004). With many mobile phones now incorporating a digital camera or video, there is a danger in schools that inappropriate pictures will be taken because of the portability and discrete nature of the camera. Pictures can be taken quickly without the knowledge of the person being photographed (SBS Insight, 2005).

Profile of use and users:

There are significant differences in use of and attitudes toward the use of cell phones for both voice calls and text messaging, in various parts of the world (Henri Issac, Robert C. Nickson, Peter Tarasewich, 2005). With the Earth's population at 6.6 billion people, this means that roughly 3 out of every 10 people now have mobile devices (J. D. Lasica, 2007). The world-wide rate was 22.92 mobile subscriptions per 100 inhabitants (ITU, 2005). According to PTA (Pakistan Telecommunication Authority), there are 74.6 million subscribers and average growth rate is 105.3 in cellular mobile industry till November 2007. Currently 29.32 percent population of Pakistan has the access to telecommunication services (PTA, 2007).

Mobiles as symbol of status and being social:

Rebecca Hastings, the SHRM information centre director, sees mobile phones as being the 'cigarettes' of the current decade and advises that gadgets, like one's dress, need to be managed for success (Leland, 2005). Not only do young people own mobile phones, they have a "symbolic and affective investment" in them (Lobet-Maris, 2003, p.88). The ownership of a mobile phone indicates that one is socially connected, accessible and in demand.

Students as a heavy user group:

According to a study, over half, and potentially as many as three quarters, of traditional college-age students own a cellular phone (Marklein, 2003; Summerville, 2003). These substantial numbers illustrate the growing trend in cell phone use on college and university campuses. Text messaging appears as a most unique and frequent teen-inflected form of mobile communication, in that is lightweight, less intrusive, less subject to peripheral monitoring, inexpensive, and enables easy contact with a spatially distributed peer group (Grinter and Eldridge 2001; Kasesniemi and Rautianinen 2002; Ling and Yttri 2002).

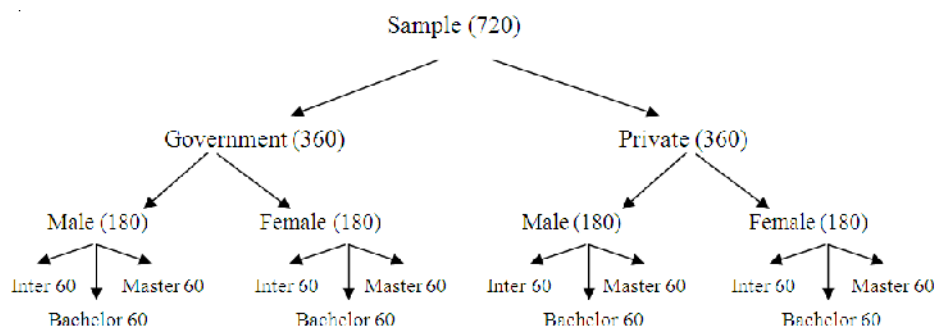
Research on social impacts of mobile phones:

According to a 2005 University of Michigan telephone survey, 42% of the 752 adult respondents 'said that there should be a law that prohibits people from talking on cell phones in public places such as museums, movies or restaurants' ('Cell phone survey', 2005). 2003). One of the main stated reasons for young people's use of the mobile phone is functionality or 'micro-coordination' of their social life. Mobile enables coordination free from the constraints of physical proximity, but also of spatial immobility; that is, the need to stay at specific places (Geser, 2004). This is surprising given the often conflicting priorities of young people, parents and teachers in relation to the device, with teachers concerned about discipline issues in the classroom and parents concerned about being able to contact their children at any time (Srivastava, 2005). People have reported the potential of the technology to support anytime, anywhere learning (Mifsud, 2003), new forms of collaboration in distance education (Milrad, 2003), distributed intelligence (Fischer & Konomi, 2005), and knowledge communities through "m-learning," the mobile evolution of Internet-based e-learning (Nyiri, 2002).

Research on mobile phone use in class room:

Wei and Leung (1999) found classrooms to be among the least acceptable places for mobile phone use. Campbell and Russo also concluded that the use of mobile phone in college classrooms is particularly horrendous and that students frequently complain about the interruption from ringing during class time (Campbell, 2003). In US, Most of the university students play video games on their mobiles phones and laptops (Gilroy, 2004 as cited in Katz, 2005). The mobile phone has the power to undermine the schools' authority and weaken their control over students (Geser, 2004). The ease of hiding the device due to its small size makes it very difficult for teachers to control. In classrooms, instructors compete with PDAs, laptops, and mobile phones for their students' attention, and are interrupted by this technology regularly (Henri Issac, Robert C. Nickson, Peter Tarasewich, 2005). Scanlon feels, however, that technology has made it easier for students to cheat there by increasing academic dishonesty. A survey of owners indicated that 57% of restaurant guests were annoyed by cell phone use, an activity that tends to slow service time (Bryant, 2002). 'In 2002, about 41 state governments were considering proposals to restrict or ban the use of cell phones while driving, up from 27 in 2000.

Research Methodology:



Govt. University and Colleges:

Post Graduate College for Women Satellite town Gujranwala, Government College for Boy's Satellite Town Gujranwala, Inter College of Commerce People Colony Gujranwala, Punjab University Campus Gujranwala, University of Agriculture Faisalabad, City College for women Gujranwala.

Private University and Colleges:

Gift University Gujranwala, Gift College Gujranwala, Punjab College of Commerce for Women Gujranwala, Punjab College of Information Technology Gujranwala, Punjab College of Commerce Gujranwala.

RESULTS

Profile of respondents:

A total of 720 students completed survey at many higher education institutions in Faisalabad and Gujranwala. Respondents were relatively evenly split in terms of gender (50% females vs. 50% males, n=720). Respondent's ages ranged from 16 to 24 and

average age is 20 years with mode 16-18 years. Respondents were from three disciplines intermediate, bachelor, and master with equal percentage in sample.

Analysis of etiquette question:

Students were asked to indicate their level of agreement or disagreement for 14 statements concerning the appropriateness of Mobile phone usage in certain specific situations using a likert-type 6-point rating scale. Situations included are class rooms, driving, library, public transport, restaurant, while eating, movie theater, music concert, public place, university/college, worship place, market, bathroom hospital. Out of 720 respondents except 68 respondents 652 respondents own mobile phone. Mostly respondents are using cell phones for 3 to 4 years. A very large number of respondents are using prepaid tariff plan and most used feature is SMS. Most of the respondents have those mobile phones which supports the features like, Voice call, SMS, MMS, Camera, Internet, A/V features. Most of the students spend Rs.200 to 500 monthly on voice calls and use their mobile phones (48.4) in the evening. Mostly students are those who send and receive text messages less than 20 in a day. Mostly students agree that students make wrong use of cameras, exchange adult jokes, picture messages through their Mobile phones and for cheating purpose during exam. Males carry their cell phones mostly in pockets and females carry their Mobile phones in bags. Most of the students keep their Mobile phone on vibration mode. In Normal settings mobile phone's own ring tone is liked by most of the respondents.

Mostly students disagree to place voice calls in class rooms, while driving, library, in worship place and in bathroom. According to mostly students perceptions it is fair to place a voice call in public transport, in restaurant, while eating, in Movie Theater, in music concert, in public place, in university, in market and in Hospital.

Large number of students strongly disagree that voice calls should be received in class rooms, while driving, in Library, in worship place, and Bathroom. A very large number of students who agree to place voice call in Public transport, in a restaurant, while eating, movie theater, music concert, in public places, in University/college, in Market and in Hospitals.

Those students are more in numbers who are strongly disagree to use text message service in class room, while driving, worship place, in Bathroom. The percentage of those students is high who agree to use text message service in Public transport, at restaurants, while eating, in Movie Theater, at music concert, in a public place, University/college, in market, in Hospital.

The percentage of those students is high who agree and strongly disagree to use text message service in Library.

Mostly students respond that they strongly disagree to use audio/Video features of cell phones in classroom, while driving, in Library, Public transport, while eating, in Movie Theater, in a public place, in university/college, Worship place, in Market, in Bathroom and in Hospital. Research shows that many students agree to use audio/Video features of cell phones at restaurant and at music concert.

More than the 50% of the students strongly disagree to use camera feature in classroom, in University/College, in Library, in a public place, in Worship place, in market and in Hospital. Most of the college students agree to use camera feature at Public ceremonies, in

Movie Theater, at music concert and at restaurant. Those students are more who prefer a policy regarding mobile phone usage, should be announced in college/university.

Table 1: shows the value of KMO and Bartlett's test

Table-1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.885
Bartlett's Test of Sphericity	Approx. Chi-Square
	28635.105
	Df
	4005
	Sig.
	.000

Table 2 shows the value of alpha in reliability statistics

Table-2: Reliability Statistics

Cronbach's Alpha	N of Items
.939	90

Table 3:

Shows the most important variables in our research out of 90 variables Factor loading

Component	
Using text message service at restaurant	.716
Receiving a voice call in class room	.738
Receiving a voice call in movie theater	.744
Using audio/video features in public transport	.704
Using camera feature in movie theater	.772
Placing a voice call in bathroom	.779
Using text message in worship place	.774
Using camera feature in university/college	.714
Placing a voice call in university/college	.709
Placing a voice call in hospital	.749
How many text messages do u send in a day	.851
Do you agree that students exchange adult jokes and pictures etc. through cell phones	.822
Age	.868
How many cell phones do u have	.625
Placing a voice call while eating	.716
Using text message service in movie theater	.533
Name of university/college of respondent	.844
How do you carry your cell phones	.808
Placing a voice call in market	.411
Normally your cell phone has which of the following ringing tones?	.716
What tariff plan you are using?	.747
Using audio/video feature at music concert	.352
Level of agreement that a university/College should announce a policy regarding mobile phone usage?	.703
Do you have mobile phone?	.737

REFERENCES

1. Baylot, A. (2004). *Post Signs: Turn the Cell Phones Off*. (Letter to the editor). Jackson [MS] Clarion-Ledger April 10: 11A.
2. Campbell, S.W. and Russo, T.C. (2003). The social construction of mobile telephony: An application of the social influence model to perceptions and uses of mobile phones within personal communication networks. *Communication Monographs*, 70, 317-334. 'http://ipumich.temppublish.com/cgi-bin/print.cgi?Releases/2005/Mar05/r031405.
3. Cohen, S. (2003). *Are you practicing good cell phone etiquette?* Monster.com [16 June 2003; Online]. [WWW document]. URL <http://technology.aol.monster.com/articles/cellphone/Index.asp>.
4. Cook, R.A., Cook, G.O. and Yale, L.J. (2005). *Guide to Business Etiquette*. Prentice Hall, Englewood Cliffs, NJ.
5. Farkas, S. and Wadsworth, D. (2002). Uncommon courtesy. *Public Perspective*. May/June: 35-37. 'Firm reveals browser for cell phones' (2002) The Advocate [Baton Rouge, LA] October 15:
6. Fitzgerald, T.J. (2005). *Music to your cell phone*. C/Net News.com [July 9; Online]. [WWW document]. URL http://news.com.com/Music+to+your+cell+phone/2100-1041_3-5778640.html.
7. Grinter, Rebecca E. and Margeryu A. Eldridge. (2001). *Y do Tngrs Luv 2 Txt Msg?* Seventh European Conference on Computer, 219-238.
8. Gilroy, M. (2004). Invasion of the classroom cell phones. *Education Digest*, 69(6), 56-61.
9. Gunch, M. (2003). *Noise 'R' us*. New Orleans October: 139.
10. Goodman, E. (2004a). *Hang up or get a room*. The [New Orleans, LA] Times-Picayune June 14: B-5.
11. James, R. (2004). *Students leery of video voyeurism*. Retrieved September 12, 2004, from <http://www.syracuse.com/search/index.ssf?/base/news-1/109463527626270.xml?Syrnepol>
12. J. D. Lasica (2007). *The Mobile Generation*. http://www.aspeninstitute.org/atf/cf/%7BDEB6F227-659B-4EC8-8F848DF23CA704F5%7D/C&S_The_Mobile_Generation.pdf
http://www.aspeninstitute.org/atf/cf/%7BDEB6F227-659B-4EC8-8F848DF23CA704F5%7D/C&S_The_Mobile_Generation.pdf
13. Kahn, R. (2005). *Women see camera mobile phones as invasion of their privacy*. The Peninsula [June 26; Online]. [WWW document]. URL <http://www.thepeninsulaqatar.com>
14. Krotz, J.L. (2003). *Cell phone etiquette: 10 dos and don'ts*. Marketing Intelligence [2 September; Online]. [WWWdocument]. URL <http://www.bcentral.com/articles/krotz/165.asp>
15. Katz, J.E. (2005). Mobile phones in educational settings. In K. Nyiri (Ed.), *A sense of place: The gobal and the local in mobile communication*, 305-317. Vienna: Passagen Verlag.
16. Kageyama, Y. (2005). *Japanese find novel use for cell phones*. The [New Orleans, LA] Times-Picayune March 19: C-1, C-5.
17. Leland, J. (2005). *In the cell-etiquette wars, the workplace is a front line*. International Herald Tribune [July 9; Online]. [WWW document]. URL <http://www.iht.com>

18. Ling, Richard and Birgitte Yttri (2002). *Hyper-coordination via mobile phones in Norway*. 139-169 in *Perpetual Contact: Mobile Communication, Private Talk, Public Performance*, edited by J.E. Katz and M. Aakhus. Cambridge: Cambridge University Press.
19. Love, S. and Kewley, J. (2003). Does personality affect peoples' attitude towards mobile phone use in public places? Paper presented at the Front Stage/Back Stage: Mobile Communication and the Renegotiation of the Social Sphere Conference, Grimstad.
20. Lyer, R. and Eastman, J.K. (2006). Academic Dishonesty: Are Business Students Different From Other College Students? *Journal of Education for Business*, Nov/Dec, 101-111.
21. Malik, O. (2003). *Terrible ideas, ill tunes, and idle terabytes*. Red Herring March: 74.
22. Marklein, M. (2003). *Colleges catch cell phone wave*. Retrieved June 7, 2004, from http://www.usatoday.com/life/2003-10-28-cellphones_x.htm
23. Morrison, D. (2003). *Cell phone etiquette*. University of Kansas website [June 16; Online]. [WWW document]. URL <http://www.people.ku.edu/~christyd/cell%20phone.html>
24. Miss Manners in the Cell/Pager Era' (2003). *Bell Mobility Solo* [August 28; Online]. [WWW document]. URL <http://www.myfw.com/sponsors/bellmanners.htm>
25. Mossberg, W.S. (2004a). Watching TV on your cellphone. *The Wall Street Journal* September 1: D7.
26. Mossberg, W.S. (2004b). Can you quiz me now? Turning a cellphone into an SAT-prep tool. *The Wall Street Journal* August 25: D1, D4.
27. Mason, K. (2006). Student Integrity. *The Business Review*, 6(1), 297-301.
28. Moore, M. (2003). *Phones call on new features*. The Advocate [Baton Rouge, LA] February 19: 4C.
29. Moore, W., Davis, E., Horak, J. and Kethley, J. (2002). *Cell Phone Ethnography*. University of Texas website [April 26; Online]. [WWW document]. URL <http://ccwf.cc.utexas.edu/~wesmoore/CellPhoneEthnography.doc>
30. Palen, L., Salzman, M. and Youngs, E. (2001). Discovery and integration of mobile communications in everyday life. *Personal and Ubiquitous Computing*, 5, 109-122.
31. Palen, L. (2002). Mobile Telephony in a Connected Life. *Communications of the ACM*, 45(3), 78-82.
32. Pakistan telecommunication Authority (2007). www.pta.gov.pk.
33. Pringle, D. (2003a). Vodafone scores with 'Live' phones. *The Wall Street Journal* May 27: B16.
34. Pringle, D. (2003b). Nokia corp. Unveils cellphone that can play television clips. *The Wall Street Journal* October 29: D4.
35. Pachter, B. and Magee, S. (2004). *The Jerk with the Cell Phone: A Survival Guide for the Rest of Us*. Marlowe & Company, New York.
36. Peppo, J. (2005). Can you hear me now? Lion's Roar [Southeastern Louisiana University] [September 7; Online]. [WWW document]. URL <http://www.selu.edu/StudentAffairs/Depts/StudentPublications/LionsRoar/>
37. Persson, A. (2001). Intimacy among strangers: on mobile telephone calls in public places. *Journal of Mundane Behavior*, 2,3, 309-316; cited in Dedeoglu, A.O. (2004). The symbolic use of mobile telephone among Turkish consumers. *Journal of Euromarketing*, 13, 2/3, 143-162; also available online at <http://www.mundanebehavior.org/index2.htm>

38. Summerville, T. (2003). Slave to a cellie? Retrieved June 7, 2004, from <http://www.collegeclub.com/servlet/channels.ChannelArticleServlet?areaid=88&articleid=3942>.
39. Stern, C. (2002). Cell phone ring tone business exploding. *Lincoln (NE) Journal Star*. December 27: 4C.
40. Summerville, T. (2003). *Slave to a cellie?* Retrieved June 7, 2004, from <http://www.collegeclub.com/servlet/channels.ChannelArticleServlet?areaid=88&articleid=3942>
41. Shihri, A. (2004). *Saudi religious edict bans camera phones*. The [Baton Rouge, LA] Advocate September 30: 8A.
42. Wei, R. and Leung, L. (1999). Blurring public and private behaviors in public space: Policy challenges in the use and improper use of the cell phone. *Telematics and Informatics*, 16, 11-26.
43. Wildstrom, S.H. (2003a). Cell phones: not just for talking anymore. *Business Week* April 14: 16.
44. Wildstrom, S.H. (2003b). Push-to-talk: Nextel is still the one to beat. *Business Week* October 13: 24.

GENERATING A FAMILY OF *SCUI* DISTRIBUTIONS

Saleha Naghmi Habibullah¹, Ahmed Zogo Memon² and Munir Ahmad²

¹Kinnaird College For Women, Lahore. Email: salehahabibullah@hotmail.com

²National College of Business Administration & Economics, Lahore.
Email: drmunir@brain.net.pk

ABSTRACT

This paper develops a differential equation that can be used for the purpose of generating families of ‘Strictly Closed Under Inversion’ probability density functions. A particular family of these density functions is derived that has the flexibility of assuming a unimodal and exponential character depending on its parameter values. The properties of this distribution are investigated in the context of exploring its possible applications.

KEYWORDS

Closure Under Inversion, Strict Closure Under Inversion, Differential Equation

1. INTRODUCTION

Inverted probability distributions have an important role in various areas such as econometrics, survey sampling, biology, engineering sciences and life testing of industrial products. Seshadri (1965) focused on the innate characteristics of a particular type of inverted distributions. Habibullah and Ahmad (2006, 2007) have presented a functional form that yields a class of distributions that are Strictly Closed Under Inversion (*SCUI*) and have derived some properties of this class.

The differential equation presented by Pearson (1895) generates the well known Pearsonian system of univariate continuous distributions. In this paper, we develop a differential equation that yields a class of *SCUI* distributions. We use the differential equation to recover the lognormal distribution and generate a class of *SCUI* density functions one of which has the flexibility of being unimodal and exponential-looking depending on what its parameter values are. The properties of this distribution are investigated from the applications’ point of view.

2. DIFFERENTIAL EQUATION FOR GENERATING *SCUI* DISTRIBUTIONS

Pearson (1895) noted that, in the limiting case, the hypergeometric distribution can be expressed in the form $\frac{df}{dx} = \frac{(x-a)f}{b_0 + b_1x + b_2x^2}$, and went on to obtain the Pearson system of continuous distribution functions. Cobb (1980) discussed a differential equation that generates three types of probability distributions under certain admissible conditions.

Ahmad (1985) focused on a special case of Cobb's differential equation, and used it to generate the Inverted Pearson System of probability distributions.

In order to develop a differential equation for generating a class of distributions that are strictly closed under inversion, we begin with a generalized version of a necessary and sufficient condition for invariance under the reciprocal transformation obtained by Seshadri (1965):

Theorem 2.1:

A necessary and sufficient condition for a continuous random variable X defined on $\left(a, \frac{1}{a}\right)$, $0 < a < 1$, to have the same distribution as its reciprocal is that the *pdf* of $Y = \ln X$ is an even function of y .

The proof of the theorem immediately follows from the transformation $Y = \ln X$ and the condition that X and its reciprocal have the same distribution.

Remark: Seshadri's result is similar to above for any $a \in (0,1)$. His assumption $0 \leq x < \infty$ seems rather erroneous.

Theorem 2.1 provides the basis for obtaining a differential equation for generating a class of *SCUI* distributions:

Theorem 2.2:

Let $g(y)$ be the *pdf* of $Y = \ln X$ where the random variable X has the *pdf* $f(x)$ defined on $\left(a, \frac{1}{a}\right)$, $0 < a < 1$. If it is possible to express $\frac{d}{dy}[\ln g(y)]$ in the form $\frac{b_2 y^2 + b_1 y^1 + b_0}{a_2 y^2 + a_1 y^1 + a_0}$, then $f(x)$ is Strictly Closed Under Inversion provided the following conditions hold:

$$\text{a) at least one of the } a_i\text{'s is nonzero} \quad (2.1)$$

$$\text{b) } a_0 b_0 = 0 \text{ and } a_0 b_2 - a_1 b_1 + a_2 b_0 = 0 \text{ and } a_2 b_2 = 0 \quad (2.2)$$

$$\text{c) the coefficient } \frac{b_i}{a_j} \text{ of } \frac{1}{y} \text{ (if it appears) is an even number.} \quad (2.3)$$

Proof:

Let $f(x)$ be the *pdf* of a random variable X such that $\left(a, \frac{1}{a}\right)$, $0 < a < 1$. Then the random variable Y given by $Y = \ln X$ will extend from $\ln a$ to $\ln a^{-1}$.

Let $g(y)$ be such that $\frac{d}{dy}[\ln g(y)]$ can be written in the form $\frac{b_2y^2 + b_1y^1 + b_0}{a_2y^2 + a_1y^1 + a_0}$

where at least one of the a_i 's is nonzero. The differential equation

$$\frac{d}{dy}[\ln g(y)] = \frac{b_2y^2 + b_1y^1 + b_0}{a_2y^2 + a_1y^1 + a_0} \quad (2.4)$$

produces a density function under the condition (2.3) for integrability.

Now, (2.4) implies that $-\frac{d}{dy}[\ln g(-y)] = \frac{b_2y^2 - b_1y + b_0}{a_2y^2 - a_1y + a_0}$

From theorem 2.1, we have

$$\frac{d}{dy}[\ln g(y)] - \frac{d}{dy}[\ln g(-y)] = 0$$

or $(b_2y^2 + b_1y^1 + b_0)(a_2y^2 - a_1y^1 + a_0) + (a_2y^2 + a_1y^1 + a_0)(b_2y^2 - b_1y^1 + b_0) = 0$ which yields the following set of conditions:

$$a_0b_0 = 0$$

and

$$a_0b_2 - a_1b_1 + a_2b_0 = 0$$

and

$$a_2b_2 = 0$$

This completes the proof.

Remark:

Whereas Pearson's (1895) differential equation is of the type 'linear divided by quadratic', Ahmad's (1985) differential equation is of the type 'quadratic divided by cubic' and Cobb's (1980) differential equation requires that the degree of the polynomial in the denominator be one higher than the degree of the polynomial in the numerator, the (2.4) is endowed with a special kind of *flexibility* which differentiates it from the differential equations given by Pearson, Ahmad and Cobb.

3. THE LOGNORMAL DISTRIBUTION

Substituting $b_2 = 0, b_1 = -1, b_0 = 0, a_2 = 0, a_1 = 0$ and $a_0 = 1$ in (2.4), we have

$\frac{d}{dy}[\ln g(y)] = -y$ implying that

$$f(x) = \frac{k}{x} e^{-\frac{(\ln x)^2}{2}}, \quad a < x < \frac{1}{a} \quad (3.1)$$

Letting $a \rightarrow 0$ and $k = \frac{1}{\sqrt{2\pi}}$ in (3.1), we have $f(x) = \frac{1}{x\sqrt{2\pi}} e^{-\frac{(\ln x)^2}{2}}$, $0 < x < \infty$

which is none other than the standard lognormal distribution, and can easily be shown to be strictly closed under inversion.

Remark:

The substitution $b_2 = -1, b_1 = 0, b_0 = 0, a_2 = 0, a_1 = 1$ and $a_0 = 0$ in the (2.4) also recovers the same distribution.

4. A NEW SCUI DENSITY:

Substituting $b_2 = b_0 = a_1 = 0$, $b_1 = 6(\theta - 1)$, $a_2 = 3(\theta - 1)$ and $a_0 = (3 - \theta)(\ln a)^2$ (where $0 \leq \theta \leq 1$ and $0 < a < 1$) in (2.4), we obtain a differential equation that leads to the density

$$f(x) = \frac{1}{x} \left[\alpha (\ln x)^2 + \beta \right], \quad a < x < \frac{1}{a} \quad (4.1)$$

where $\alpha = \frac{3(1-\theta)}{4(\ln a)^3}$, $\beta = \frac{(\theta-3)}{4(\ln a)}$, $0 < a < 1$, $0 \leq \theta \leq 1$

It is easy to see that (4.1) is strictly closed under inversion. The graph of the density is given in Figure 4.1.

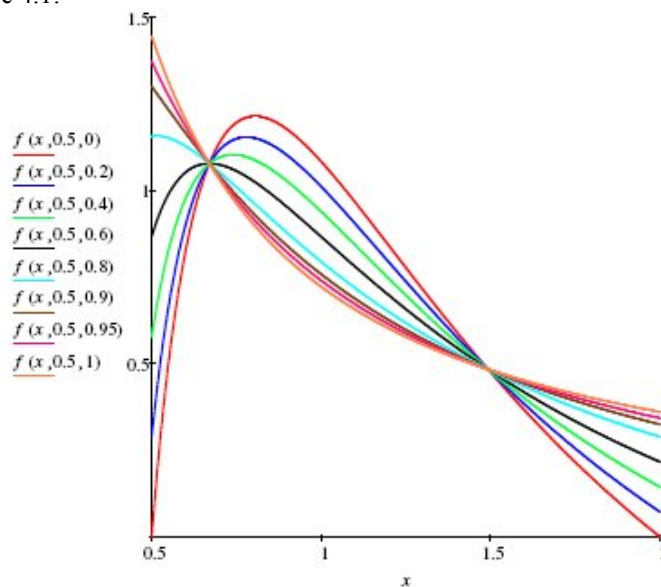


Figure 4.1

The graph of Figure 4.1 displays the very interesting feature that all density curves belonging to this family intersect at two distinct points. In this regard, we have the following result:

Property 4.1:

All frequency curves defined in (4.1) intersect when $X = a^{\pm \frac{1}{\sqrt{3}}}$.

The proof immediately follows by selecting any two probability density functions with $\beta = \beta_1$ and $\beta = \beta_2$ in (4.1) where $\beta_i = \frac{\theta_i - 3}{4 \ln a}$. On solving we have

$$\left[3(\ln x)^2 - (\ln a)^2 \right] = 0$$

and hence the result.

More importantly, the shapes of the curves in Figure 4.1 suggests that the density carries the potential of competing with unimodal and exponential families of distributions. As such, it seems pertinent to explore some more of its properties in the perspective of its possible applications:

Property 4.2:

The above random variable has the cumulative distribution function

$$\begin{aligned} F(x) &= 0, \quad x \leq a \\ &= \frac{\alpha}{3}(\ln x)^3 + \beta \ln x + \frac{1}{2}, \quad a < x < \frac{1}{a} \\ &= 1, \quad x \geq \frac{1}{a} \end{aligned} \quad (4.2)$$

Property 4.3:

The necessary condition for the density (4.1) to be unimodal is $\theta < \frac{3}{3 - \ln a}$.

Otherwise the distribution is reverse J shaped.

Proof:

For $\theta = 1$ the resulting *pdf* (4.1) assumes a reverse J shaped. For the case $\theta < 1$, the distribution has a single mode when

$$(2 - \ln x)(\ln x)\alpha - \beta = 0$$

If possible the result follows from the second derivative.

Property 4.4:

For $r \in \mathbb{Z}^+$, the r^{th} moment about the origin is given by

$$E(X^r) = c_r \alpha + d_r \beta \quad (4.3)$$

$$\text{where } c_r = \frac{r^2(1-a^{2r})(\ln a)^2 + 2r(1+a^{2r})\ln a + 2(1-a^{2r})}{r^3 a^r}, \quad d_r = \frac{1-a^{2r}}{r a^r}$$

In particular, the mean of the above random variable is

$$\mu = c_1 \alpha + d_1 \beta \quad (4.4)$$

Property 4.5:

The r^{th} negative moment about the origin is identical to the r^{th} positive moment i.e.

$$E(X^r) = E(X^{-r}) \quad (4.5)$$

The proof follows by replacing r by $-r$ in (4.3).

Property 4.6:

The harmonic mean of the density is the reciprocal of its arithmetic mean.

The result follows by substituting $r=1$ in (4.5).

Property 4.7:

The q^{th} quantile of the density (4.1) is obtained from

$$2(\ln X_q)^3 \alpha + 6(\ln X_q) \beta + 3(1-2q) = 0; \quad 0 \leq q \leq 1 \quad (4.6)$$

The proof follows from (4.2).

It also follows that the distribution's upper quartile is the reciprocal of its lower quartile.

Property 4.8:

The median of each distribution (4.1) is unity.

The result follows on substituting $q = \frac{1}{2}$ in (4.6).

Property 4.9:

The geometric mean of the above random variable is unity.

Proof:

$$\text{The GM is given by } e^{E(\ln X)}, \text{ and } E(\ln X) = \left[\alpha \frac{(\ln x)^4}{4} + \beta \frac{(\ln x)^2}{2} \right]_a^1 = 0.$$

Property 4.10:

The moment estimator of θ is $\hat{\theta} = \frac{\delta\bar{x} + \lambda}{\varphi}$

where $\delta = -2a(\ln a)^3$,

$$\lambda = 3(1+a^2)(\ln a) + 3(1-a^2)$$

and $\varphi = (1-a^2)(\ln a)^2 + 3(1+a^2)(\ln a) + 3(1-a^2)$

The result follows by replacing μ by its moment estimator in eq. (4.4).

Remarks:

- i) Properties 4.5 to 4.9 are in agreement with the properties of *SCUI* distributions presented by Habibullah and Ahmad (2006, 2007).
- ii) For any data – set that is either reverse – J – shaped or is unimodal and positively skewed, the selection of probability model (4.1) is facilitated by the above properties. An appropriate transformation of the random variable being depicted by the data can probably provide a reasonable approximation of the proposed model.

REFERENCES

1. Ahmad, M. (1985). *Theory of Inversion*. Unpublished Manuscript.
2. Cobb, L. (1980). The Multimodal Exponential Families of Statistical Catastrophe Theory. *Statistical Distributions in Scientific Work*, 4, 69-90.
3. Habibullah, S.N. and Ahmad, M. (2006). On A New Class of Univariate Continuous Distributions that are Closed under Inversion. *Pakistan Journal of Statistics and Operation Research* (University of the Punjab, Lahore, Pakistan), II(2), 151-158.
4. Habibullah, S.N. and Ahmad, M. (2007). Generalized Form and Miscellaneous Properties of a New Class of Continuous Probability Distributions that are Strictly Closed under Inversion. *Proceeding of Third National Conference on Statistical Sciences* organized by the Islamic Countries Society of Statistical Sciences (ISOSS) and held at FAST, Lahore, Pakistan.
5. Pearson, K. (1895). Contribution to the Mathematical Theory of Evolution II. Skew variation in Homogeneous Materials. *Phil. Trans. RSS*, London, Series A, 186, 343-414.
6. Seshadri, V. (1965). On Random Variables which have the Same Distribution as their Reciprocals. *Canadian Mathematical Bulletin*, 8(6), 819-824.

CELL-PHONE USAGE PREFERENCES AMONGST EDUCATED YOUTH

Khurram Aziz Fani¹, Usman Ehsan², Sumra Anwar and Nazia Saeed
GIFT Business School, GIFT University, Gujranwala, Pakistan
Email: ¹khurram@gift.edu.pk ²com2usman@gmail.com

ABSTRACT

This Research paper presents an empirically validated approach to customer preferences in cell-phone usage. Research was conducted amongst different universities of different cities in order to check their preferences. This paper will provide insight about the most and least preferred features. Discussions, Results, and suggestions will enable decision makers to attract youth as they want to be attracted.

INTRODUCTION

Booming telecom industry of Pakistan again marked high among other industries. Pakistan telecommunication Authority's latest figures compiled by the PTA suggest cellular phone connections reached 72.89-million by September 2007. Within a period of one month, September 2007, Pakistan's fast growing telecom industry managed to add 4.89 million subscribers. The overall consensus of industry analysts is that Pakistan is one of the countries with a huge untapped potential for telecom growth and an attractive investment environment. Telecommunication industry has become very competitive in rivalry of providing best possible services to their customers. It exerts an emphasis on industry to find ways to better serve the customers. Pakistan Telecommunication Authority (PTA) also emphasized the Cellular Mobile Operators companies to improve the quality of service (QoS) being provided to the consumers. PTA is more concerned about the network accessibility, service accessibility, call setup time, service retainability, etc (PTA, 2007). The objective of this empirical research paper is to identify perceived importance of various users' preferences in cell phone usage through conducting a questionnaire based survey from universities students. The paper identifies various factors from the Mobile industry's literature, which were then put to empirical verification. This exploratory study can serve as the basis of better decision making in mobile industry of Pakistan for customer satisfaction.

LITERATURE REVIEW

Theoretical Framework shows that mobile companies should provide preferred services to their users. Customers with different characteristics have different preferences (Mattern, 2003). Various factors are the key to success for any mobile business application. One opportunity to attract and retain customers, while also increasing margins, is to develop value added services. These products, which include information services, entertainment offerings, and business applications, have the potential to change the way consumers use phones while also changing the way carriers, content owners, and content aggregators make money (Bhashyam, Cohen, Dreyfus, Kim, 2006).

Technological innovations are not only the driving force behind usage of mobiles connections (Jarvenpaa, Lang, 2003). The main thing in its usage, adaptation and acceptance is the geographical location and trend in that arena (Constantiou, 2007). Mobiles are not just providing the service of voice communication, but are providing a number of other services (Damsgaard, 2007). Factors that influence adaptation rate of mobiles includes: adopter characteristics, social networks, communication process, promoters' strategies, and innovation attributes such as triability, relative advantage, compatibility, observe-ability, and complexity (Rogers, 2003).

Demographic variables have significant relationship with customer satisfaction, expectations, perceptions of performance and retention in cellular industry (Webb, 1998). The utilization of services varies significantly with the marital status, age, gender, profession, social class and location (Aliah, 1999). Due to globalization, awareness among customers has increased and challenge to provide excellent service with retention of customers in cellular industry has increased greatly (Kahaner, 1996). So, telecommunication industry has to cope with all challenges in order to provide customers desired services they want (Kassim 2006).

The world is becoming more dependent on wireless and mobile services, but the ability of wireless network infrastructures to handle the growing demand is questionable. As wireless and mobile services grow, weaknesses in network infrastructures become clearer (Snow, Varshney, Malloy, July 2000). Factors such as the increase in network coverage, increase in number of subscribers, reduction in call charges, improvement in quality of service etc are keys to have the growth in the cellular industry (Khalid 2006).

SMS now constitutes an important new set of communication practices. It is more widely used than the Internet and by a more diverse section of the population (Latham, 2007).

The mobile cellular telephony market has expanded rapidly over the past decade. In UK, at the end of the first quarter of 1999, mobile phone penetration was almost 30%-up by 5% compared to the end of 1998. This rapid growth has been mainly due to aggressive marketing and the level of competition between service providers, which led to a reduction in call charges (Norris, Khanifar, 2000). There are currently some 750 million GSM users worldwide. A Voice and SMS roaming agreements have been in place for some time, giving GSM its reputation as the international communications medium and producing consistent subscriber growth (Graham Tricky "The Big Picture", 2003).

The ability to make international roaming calls is of increasing importance to customers (Ulrich, October, 2001). General Packet Radio Service (GPRS) is the current enhancement in the GSM infrastructure, capable of handling IP traffic within the mobile context. A major deficiency of the current GPRS specification is the lack of QoS support (Priggouris, Hadjiefthymiades, Merakos, 2001).

METHODOLOGY

Research Design: A self administrated questionnaire was chosen as a communication method in this research. So the maximum data can be collected with less cost, time constraints, and maximum topic coverage and sample accessibility. Questionnaire was divided in three major portions. First part dealt with demographics, second with usage behavior and last section was with preferences developed on five point Likert scale.

Sample Design: Convenience based purposive sampling technique was used. Data was collected from seven cities (31.3% Lahore, 6.3% Sialkot, 37.9% Gujranwala, 2.8% Daska, 12.7% Gujrat and 8.9% others) and from both private and Government universities. 43.5% of Respondents were male & 56.5% were female.

Data collection: Total 500 questionnaires were distributed. 12 of them were not collected back. Out of 488, 63 were dropped due to response based errors that occurred especially in the last section of questionnaire concluding n=425.

Limitations: Research was conducted only in Lahore, Sialkot, Gujranwala, Daska, Gujrat and others. It can be conducted in other cities to have more conclusive results. Data was collected only from universities not from schools, colleges or from public places to ensure that their level of education was of bachelors and master level.

RESULTS & FINDINGS

12% respondents were between less than and equal to 18 years, 75.9% respondents were between 19-22 years, 10.9% respondents were between 23-26 years and 1.2% respondents were from 27-30 years. Respondents were from 31.3% Lahore, 6.3% Sialkot, 37.9% Gujranwala, 2.8% Daska, 12.7% Gujrat and 8.9% other cities. While in gender 43.5% were male & 56.5% were female.

Factor loading using Principle Component Method:

Factor analysis method uses covariance and correlation matrix analysis to explain the relationship between variables by using less number of factors (Ozdamar, K, 1999). It results in increased parsimony (Leech, Barrett & Morgan, 2005). Principal Components Analysis (PCA) mathematically derives a relatively small number of variables that are used to convey as much of the information in the observed/measured variables as possible. Precisely, PCA is simply directed toward enabling one to use fewer variables to provide the same information that one would obtain from a larger set of variables.

Principle Component Factor Analysis:

Variable's communality included for the factor analysis. Communality refers to the proportion of a variable's variance explained by a factor structure and may be interpreted as the reliability of the indicator. It is the squared multiple correlation for the variable as dependent using the factors as predictors. When an indicator variable has a low communality, the factor model is not working well for that indicator and possibly it should be removed from the model. Similarly, the eigenvalue for a given factor measures the variance in all the variables, which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables.

Table 1: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var.	Cumulative %	Total	% of Var.	Cumulative %	Total	% of Var.	Cumulative %
1	4.555	28.466	28.466	4.555	28.466	28.466	2.657	16.605	16.605
2	1.861	11.630	40.096	1.861	11.630	40.096	2.374	14.839	31.444
3	1.306	8.164	48.261	1.306	8.164	48.261	2.107	13.166	44.610
4	1.078	6.740	55.000	1.078	6.740	55.000	1.662	10.390	55.000
5	.972	6.077	61.077						
6	.880	5.497	66.574						
7	.768	4.802	71.376						
8	.693	4.329	75.705						
9	.676	4.227	79.931						
10	.642	4.010	83.942						
11	.574	3.586	87.527						
12	.511	3.192	90.719						
13	.483	3.022	93.741						
14	.441	2.753	96.494						
15	.413	2.584	99.078						
16	.147	.922	100.000						

Extraction Method: Principal Component Analysis.

In above table of total variance explained first or top four features comprised 55% of total variance. Call connectivity have 28.46%, GPRS services got 11.63%, Network Coverage was at 8.14% and Value added services was at 6.74% of total variance.

Table 2: Communalities

	Initial	Extraction
Importance of Call Rates	1.000	.536
Importance of Network Coverage	1.000	.701
Importance of Network Coverage During Events	1.000	.581
Importance of Friends and Relatives having Same Connection	1.000	.378
Importance of Brand Name	1.000	.239
Importance of Value Added Services	1.000	.452
Importance of SMS rates	1.000	.435
Importance of MMS rates	1.000	.632
Importance of GPRS Services	1.000	.823
Importance of GPRS Rates	1.000	.809
Importance of Helpline Services	1.000	.599
Importance of Ring back Tune Services	1.000	.497
Importance of Cal Connectivity	1.000	.571
Importance of Low Call Rates for Special Hours	1.000	.576
Importance of International Roaming Facility	1.000	.432
Importance of Friends and Family Services	1.000	.537

Extraction Method: Principal Component Analysis.

Alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous (that is, questions with two possible answers) and/or multi-point formatted questionnaires or scales (i.e., rating scale: 1 = poor, 5 = excellent) (Reynaldo & Santos, April 1999). The higher the score, the more reliable the generated scale is. Nunnally (1978) has indicated 0.7 to be an acceptable reliability coefficient but lower thresholds are sometimes used in the literature. Cronbach's alpha in that research is up to standards and value of 16 items is .805. As shown below:

Table 3: Reliability Statistics

Cronbach,s Alpha	Cronbach,s Alpha Based on Standardized Items	No. of Items
.805	.825	16

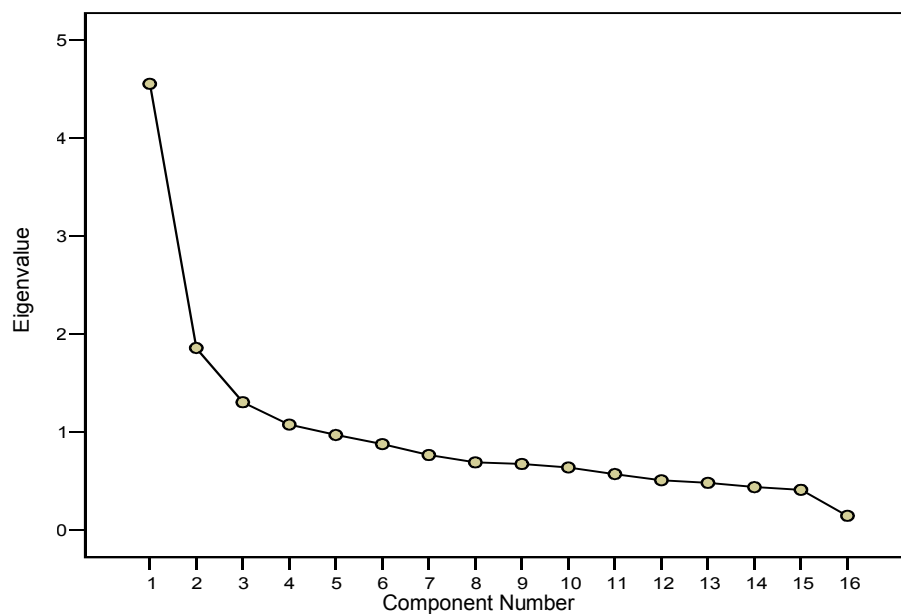


Table 3: Rotated Component Matrix (a)

	Component			
	1	2	3	4
Importance of Call Rates	.015	-.037	.697	.220
Importance of Network Coverage	.192	.177	.792	-.071
Importance of Network Coverage During Events	.424	.147	.616	-.007
Importance of Friends and Relatives having Same Connection	.143	.066	.393	.446
Importance of Brand Name	.180	.070	-.184	.410
Importance of Value Added Services	.149	.219	.063	.615
Importance of SMS rates	.013	.336	.281	.493
Importance of MMS rates	-.086	.722	-.030	.318
Importance of GPRS Services	.176	.880	.111	.071
Importance of GPRS Rates	.274	.844	.127	.074
Importance of Helpline Services	.694	.223	.232	-.121
Importance of Ring back Tune Services	.579	.257	-.162	.263
Importance of Cal Connectivity	.705	-.064	.203	.168
Importance of Low Call Rates for Special Hours	.681	-.008	.162	.292
Importance of International Roaming Facility	.609	.126	.110	.182
Importance of Friends and Family Services	.319	-.071	.390	.528

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

(a) Rotation converged in 6 iterations.

In above rotated component matrix for customer preferences in cell phone usage total of four dimensions were included. First was only of “importance of call connectivity (.705)”, second was of “Importance of MMS rates (.722), GPRS rates (.880) and services (.844)”, third concludes “Importance of network coverage in normal (.792) and especially at events (.616)” and in last “Value Added services (.615)” was marked as important factor for users.

Table 4: Kaiser –Meyer-Olkin and Bartlett’s test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.825
Bartlett's Test of Sphericity	Approx. Chi-Square	1969.600
	Df	120
	Sig.	.000

As above values shows that the value of Kaiser-Meyer-Olkin is .825, standard should be greater than .75. Similarly, Bartlett test of sphericity all features were reported significant (i.e., a significance value of less than 0.05).

CONCLUSION

Companies should offer something new except decreasing price like offers should have something for GPRS and value added services while designing the cellular package. Competition is now beyond the prices. Companies have to improve their call connectivity so that customers can think that network as a reliable connection and increase the

adoption and usage ratio. Value added services should be used as a tool to make customers more brand loyal. Telecom industry lacks number of loyal customers so to keep long term benefits and growth they have to increase them by using that tool.

Main purpose of this paper was to study how the youth population in Pakistan consumes mobile services and which one they prefer. The findings revealed that the youth segment now requires call connectivity, GPRS and value added services. While this paper focused upon Pakistan, the conclusions can be generalized for other parts of the developing world as results were the same amongst different locations (cities).

REFERENCES

1. Aliah, (1999). Measuring Service Quality for Malaysian Financial Services and Suggestion for Future Research, in *Reinvesting Asian Management for Global Challenges, Malaysia: 3rd Asian Academy of management Conference*, 75-95.
2. Baldi and Thaug (2004). *The entertaining way to m-commerce: Japan's approach to mobile*.
3. Bhashyam, Cohen, Dreyfus and Kim (2006). *Wireless Value Added Services in India*.
4. Constantiou, Damsgaard and Knutsen. *Exploring mobile device user adoption patterns and market segmentation, Four Incremental Steps. Toward Advanced Mobile Service Adoption*.
5. Denk, Wiesbauer, (2004). *M-Commerce Expert Survey: Comparison of Austrian Results 2002 and 2003 and International Comparison*. EC3 Final Report
6. Graham Tricky (2003). *MMS-The Big Picture*. Business briefing; Wireless Technology. End-to-End Features & Services Task Force, GSM Association (GSMA).
7. Jarvenpaa, Lang, Takeda, and Tuunainen, (2003). An international focus group study of users of mobile handheld devices and services. *Commun. ACM* 46, 12.
8. Snow, Varshney, Malloy. (2000). *Reliability and Survivability of Wireless and Mobile Networks*. 33(7), 49-55
9. Goldberger, Wörther, Weber, and Denk (2006). *STP-Approach Focused on Customer. Preferences for Mobile Business Applications*.
10. Barrett, Leech, Morgan (2005). *SPSS for Intermediate Statistics: Use and Interpretation*.
11. Kahaner, (1996). *Cellular Telephony in Malaysia*.
12. Kassim (2001). Determinants of Customer Satisfaction & Retention Cell Phone Market.
13. Khalid (2006). *IBA - Reasons for Growth & the Future of the Cellular Industry of Pakistan*.
14. Latham (2007). Sms, Communication, And Citizenship In China's Information Society. *Critical Asian Studies*, Vol. 39,
15. Mattern, (2003). *Ubiquitous Computing – Szenarien einer informatisierten Welt*. Springer-Verlag, Berlin, in German.
16. Norizan Kassim (2006) Telecommunication Industry in Malaysia: Demographics Effect on Customer Expectations, Performance, Satisfaction and Retention. College of Business and Economics, University of Qatar, at *Asia Pacific Business Review*. 12(4), 437-463.

17. Norris, Khanifar (2000). *Dynamic pricing in mobile communication system*. College of London
18. Priggouris, Hadjiefthymiades, Merakos (2000-01). *IP QoS frameworks in GPRS*. Department of Informatics, University of Athens, Athens 15784, Greece.
19. Rogers, E.M. (2003). *Diffusion of Innovations*. The Free Press, New York.
20. Santos (1999). *Cronbach's Alpha: A Tool for Assessing the Reliability of Scales*.
21. Daily Times (2007). *Pakistan has 72.89 m mobile phone user*. Dated: 25-10-2007.
22. Pakistan Telecommunication Mobile Industry. *Overview of industry 2006-07*.
23. Ulrich Stump (2001). Prospects for improving competition in mobile roaming. *29th TPRC 2001*.
24. Webb, (1998) Segmenting police 'customer' on the basis of their service quality expectations. *The Service Industry Journal*, 18(1), 72-110.
25. *Weekly report* published in Jang Dated: 24-03-2008.
26. Wiesbauer, (2004). *Analysis of Expert Opinions on the Situation and Future Trends of Mobile Commerce*. University of Vienna & EC3, Research Report, Vienna, in German.

ESTIMATION OF MEAN IN TWO-PHASE SAMPLING
USING ONE AUXILIARY VARIABLE

Asma Tahir

National College of Business Administration and Economics, Lahore.
Email: asmatahirstats@yahoo.com

ABSTRACT

Two new ratio-cum-regression type estimators have been developed by using one auxiliary variable. Empirical studies have also been conducted to see the performance of newly developed estimators.

1. INTRODUCTION

Use of auxiliary information in survey sampling is a common phenomenon. This information is used at the estimation stage to improve the efficiency of the estimator of population characteristics.

Consider a finite population of size N , y is the variable of interest and x is the auxiliary variable. When x is highly correlated with y and information about the population parameter(s) (say population mean \bar{X}) of the auxiliary variate x , is available, ratio and regression type estimator can be used to increase efficiency, where as in the case of unavailability of the above information, two-phase sampling technique is well known. This sampling procedure requires collection of information on x for the first-phase simple random sample (SRS) of size n_1 ($n_1 < N$) and for the second-phase SRS sample of size n_2 ($n_2 < n_1$) selected from first-phase. Sometimes, even when \bar{X} is not known, information on second auxiliary variable (say z) is available on all the units of the population and let \bar{Z} is the population mean of z . Further let \bar{x}_1 and \bar{z}_1 be the sample means of the auxiliary variable x_1 and z_1 respectively, based on the first-phase sample of size n_1 , and \bar{y}_2 , \bar{x}_2 and \bar{z}_2 be the sample means of y_2 , x_2 and z_2 respectively, based on second-phase sample of size n_2 .

Mohanty (1967), Chand (1975), Kiregyera (1980, 84), Mukerjee et al. (1987), Sahoo et al. (1993) and Roy (2003) (the famous one) proposed different competitive estimators by using both the auxiliary variables x and z (z as closely related to x). Samiuddin and Hanif (2007) introduced some improved estimators with the use of x and z auxiliary variables, assuming availability and unavailability of \bar{X} and \bar{Z} in form of different cases. Singh and Espejo (2007) proposed a ratio-product type estimator by using only one auxiliary variable x , assuming \bar{X} unknown.

For various situations of interest, following notations are introduced:

Let $S_y^2 = \frac{1}{N-1} \sum_{i=1}^N (Y_i - \bar{Y})^2$, $C_y^2 = S_y^2 / \bar{Y}^2$ with C_x^2 and C_z^2 are similarly defined, $\theta_1 = \frac{1}{n_1} - \frac{1}{N}$, $\theta_2 = \frac{1}{n_2} - \frac{1}{N}$, b_{yx} , b_{xz} are the sample regression coefficient of y on x , x on z and so on for the other ones. Also ρ_{xy} , ρ_{yz} and ρ_{xz} denote the population correlation coefficient between X and Y , Y and Z and X and Z respectively.

2. AN ARRAY OF SOME WELL KNOWN REGRESSION TYPE ESTIMATORS

I. Mohanty (1967) was the first to construct an estimator of regression type for two-phase sampling. He developed regression-cum-ratio estimator for known \bar{Z} , along with its mean square error (MSE) is as:

$$T_1 = \left[\bar{y}_2 + b_{yx} (\bar{x}_1 - \bar{x}_2) \right] \frac{\bar{Z}}{\bar{z}_2}. \quad (2.1)$$

$$MSE(T_1) \approx \bar{Y}^2 \left[\theta_2 \left\{ C_y^2 (1 - \rho_{yz}^2) + (C_z - C_y \rho_{yz})^2 \right\} + (\theta_2 - \theta_1) \left\{ C_z^2 \rho_{xz}^2 - (C_y \rho_{xy} - C_z \rho_{xz})^2 \right\} \right]. \quad (2.2)$$

Mohanty (1967) also constructed another estimator for no information about \bar{X} and \bar{Z} , along with its MSE is as:

$$T_2 = \left[\bar{y}_2 + b_{yx} (\bar{x}_1 - \bar{x}_2) \right] \frac{\bar{z}_1}{\bar{z}_2}. \quad (2.3)$$

$$MSE(T_2) \approx \bar{Y}^2 \left[\theta_2 C_y^2 + (\theta_2 - \theta_1) \left\{ C_z^2 \rho_{xz}^2 - (C_y \rho_{xy} - C_z \rho_{xz})^2 + (C_z - C_y \rho_{yz})^2 - C_y^2 \rho_{yz}^2 \right\} \right] \quad (2.4)$$

II. Kiregyera (1980) proposed a ratio in regression estimator for known \bar{Z} , along with its MSE is as:

$$T_3 = \frac{\bar{y}_2}{\bar{x}_2} \left[\bar{x}_1 + b_{xz} (\bar{Z} - \bar{z}_1) \right] \quad (2.5)$$

$$MSE(T_3) \approx \bar{Y}^2 \left[\theta_2 C_y^2 + (\theta_2 - \theta_1) \left\{ (C_x - C_y \rho_{xy})^2 - C_y^2 \rho_{xy}^2 \right\} + \theta_1 \left\{ (C_x \rho_{xz} - C_y \rho_{yz})^2 - C_y^2 \rho_{yz}^2 \right\} \right] \quad (2.6)$$

Kiregyra's (1984) also developed another regression in regression estimator for known \bar{Z} is as:

$$T_4 = \bar{y}_2 + b_{yx} \left[(\bar{x}_1 - \bar{x}_2) - b_{xz} (\bar{z}_1 - \bar{Z}) \right] \quad (2.7)$$

The MSE of T_4 is

$$MSE(T_4) \approx \bar{Y}^2 C_y^2 \left[\theta_2 - (\theta_2 - \theta_1) \rho_{xy}^2 - \theta_1 \rho_{yz}^2 + \theta_1 (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right] \quad (2.8)$$

III. Mukerjee et al. (1987) proposed the following three regression in regression estimators. These estimators for unknown \bar{X} and \bar{Z} , for known \bar{Z} and the third one also for known \bar{Z} respectively, along with their MSEs are as:

$$T_5 = \bar{y}_2 + b_{yx}(\bar{x}_1 - \bar{x}_2) + b_{yz}(\bar{z}_1 - \bar{z}_2) \quad (2.9)$$

$$MSE(T_5) \approx \bar{Y}^2 C_y^2 \left[\theta_2 - (\theta_2 - \theta_1)(\rho_{xy}^2 + \rho_{yz}^2 - 2\rho_{xy}\rho_{yz}\rho_{xz}) \right] \quad (2.10)$$

$$T_6 = \bar{y}_2 + b_{yx}(\bar{x}_1 - \bar{x}_2) + b_{yz}(\bar{Z} - \bar{z}_2) \quad (2.11)$$

$$MSE(T_6) \approx \bar{Y}^2 C_y^2 \left[\theta_2 - \theta_1 \rho_{yz}^2 - (\theta_2 - \theta_1)(\rho_{xy}^2 + \rho_{yz}^2 - 2\rho_{xy}\rho_{yz}\rho_{xz}) \right] \quad (2.12)$$

$$T_7 = \bar{y}_2 + b_{yx}(\bar{x}_1 - \bar{x}_2) + b_{yx}b_{xz}(\bar{Z} - \bar{z}_1) + b_{yz}(\bar{Z} - \bar{z}_2) \quad (2.13)$$

$$MSE(T_7) \approx \bar{Y}^2 C_y^2 \left[\theta_1(\rho_{yz} - \rho_{xy}\rho_{yz})^2 + \theta_2(1 - \rho_{xy}^2 - \rho_{yz}^2 + 2\rho_{xy}\rho_{xz}\rho_{yz}) \right] \quad (2.14)$$

IV. Sahoo et al. (1993) proposed another type of regression estimator along with its MSE is as:

$$T_8 = \bar{y}_2 + b_{yx}(\bar{x}_1 - \bar{x}_2) + b_{yz}(\bar{Z} - \bar{z}_1). \quad (2.15)$$

$$MSE(T_8) \approx \bar{Y}^2 C_y^2 \left[\theta_2(1 - \rho_{xy}^2) + \theta_1(\rho_{xy}^2 - \rho_{yz}^2) \right] \quad (2.16)$$

V. Roy (2003) proposed an unbiased regression estimator by using partial information, along with its MSE, i.e.

$$T_9 = \bar{y}_2 + k_1 \left[\{\bar{z}_1 + k_2(\bar{X} - \bar{x}_1)\} - \{\bar{z}_2 + k_3(\bar{X} - \bar{x}_2)\} \right], \quad (2.17)$$

$$\text{where } k_1 = \frac{\bar{Y}C_y \rho_{yz} - \rho_{xz}\rho_{xy}}{\bar{Z}C_z - 1 - \rho_{xz}^2}, \quad (2.18)$$

$$k_2 = \frac{\bar{Z}C_z}{\bar{X}C_x} \rho_{xz} = \frac{\sigma_z}{\sigma_x} \rho_{xz} \quad (2.19)$$

$$\text{and } k_3 = -\frac{\bar{Z}C_z(\rho_{xy} - \rho_{yz}\rho_{xz})}{\bar{X}C_x(\rho_{yz} - \rho_{xz}\rho_{yz})}. \quad (2.20)$$

$$MSE(T_9) \approx \bar{Y}^2 C_y^2 \left[\theta_2(1 - \rho_{y.xz}^2) + \theta_1(1 - \rho_{xy}^2)\rho_{yz.x}^2 \right], \quad (2.21)$$

$$\text{where } \rho_{y.xz}^2 = \frac{\rho_{yz}^2 + \rho_{xy}^2 - 2\rho_{xz}\rho_{yz}\rho_{xy}}{1 - \rho_{xz}^2} \quad (2.22)$$

$$\text{and } \rho_{yz.x}^2 = \frac{(\rho_{yz} - \rho_{xy}\rho_{xz})^2}{(1 - \rho_{xy}^2)(1 - \rho_{xz}^2)}. \quad (2.23)$$

VI. Samiuddin and Hanif (2007) considered a general linear unbiased regression estimator of when \bar{X} and \bar{Z} are known, as:

$$T_{10} = \bar{y}_2 + \alpha_1 \bar{x}_1 + \alpha_2 \bar{x}_2 + \alpha \bar{X} + \beta_1 \bar{z}_1 + \beta_2 \bar{z}_2 + \beta \bar{Z}$$

If T_{10} is unbiased for \bar{Y} for all \bar{X} and \bar{Z} , then $\alpha = -(\alpha_1 - \alpha_2)$ and $\beta = (\beta_1 + \beta_2)$

$$T_{10} = \bar{y}_2 + \alpha_1 (\bar{x}_1 - \bar{X}) + \alpha_2 (\bar{x}_2 - \bar{X}) + \beta_1 (\bar{z}_1 - \bar{Z}) + \beta_2 (\bar{z}_2 - \bar{Z}) \quad (2.25)$$

The MSE of T_{10} is

$$MSE(T_{10}) \approx \frac{\theta_2 \bar{Y}^2 C_y^2}{1 - \rho_{xz}^2} \left[1 - \rho_{xy}^2 - \rho_{xz}^2 - \rho_{yz}^2 + 2\rho_{xy}\rho_{xz}\rho_{yz} \right] \quad (2.26)$$

Samiuddin and Hanif (2007) also considered a general linear unbiased regression estimator of \bar{Y} with no information of \bar{X} and \bar{Z} , along with its MSE is as:

$$T_{11} = \bar{y}_2 + \alpha_1 \bar{x}_1 + \alpha_2 \bar{x}_2 + \beta_1 \bar{z}_1 + \beta_2 \bar{z}_2 \quad (2.27)$$

$$MSE(T_{11}) \approx \frac{\bar{Y}^2 C_y^2}{1 - \rho_{xz}^2} \left[\theta_2 \left(1 - \rho_{xy}^2 - \rho_{xz}^2 - \rho_{yz}^2 + 2\rho_{xy}\rho_{xz}\rho_{yz} \right) + \theta_1 \left(\rho_{xy}^2 + \rho_{yz}^2 - 2\rho_{xy}\rho_{xz}\rho_{yz} \right) \right] \quad (2.28)$$

VII. Singh and Espejo (2007) constructed an estimator by using one auxiliary variable as:

$$T_{12} = \bar{y}_2 \left\{ k \frac{\bar{x}_1}{\bar{x}_2} + (1-k) \frac{\bar{x}_2}{\bar{x}_1} \right\}, \quad (2.29)$$

where k is a constant to be determined to minimize the MSE. The MSE of T_{12} is

$$MSE(T_{12}) \approx \bar{Y}^2 C_y^2 \left\{ \theta_2 + (\theta_1 - \theta_2) \rho_{xy}^2 \right\} \quad (2.30)$$

3. THE PROPOSED ESTIMATORS

Two estimators have been developed using one auxiliary variable, say x , for two phase sampling. We combine regression with Singh and Espejo's (2007) estimator for \bar{X} known and for \bar{X} unknown cases.

- i) In the following estimator T_a , \bar{y}_2 of Singh and Espejo's (2007) estimator (listed as T_{12} in Section 2) is replaced by $\bar{y}_2 + b_{yx} (\bar{X} - \bar{x}_1)$. In this estimator, \bar{X} is known and information on the auxiliary variable for first and second-phase sample has been used. The estimator along with its MSE is as:

$$T_a = \left\{ \bar{y}_2 + b_{yx} (\bar{X} - \bar{x}_1) \right\} \left\{ a \frac{\bar{x}_1}{\bar{x}_2} + (1-a) \frac{\bar{x}_2}{\bar{x}_1} \right\} \quad (3.1)$$

$$MSE(T_a) = \theta_2 \bar{Y}^2 C_y^2 (1 - \rho_{xy}^2). \quad (3.2)$$

By comparing T_a with T_{12} , we get

$$MSE(T_{12}) - MSE(T_a) = \theta_1 \bar{Y}^2 C_y^2 \rho_{xy}^2 \geq 0, \quad (3.3)$$

which is positive, showing that T_a is more efficient than T_{12} .

- ii) In the following second estimator T_b , \bar{y}_2 of T_{12} is replaced by $\bar{y}_2 + b_{yx}(\bar{x}_1 - \bar{x}_2)$ and only the information on the auxiliary variable x for second-phase sample has been used. The estimator along with its MSE is as:

$$T_b = \left\{ \bar{y}_2 + b_{yx}(\bar{x}_1 - \bar{x}_2) \right\} \left\{ a \frac{\bar{x}_1}{\bar{x}_2} + (1-a) \frac{\bar{x}_2}{\bar{x}_1} \right\} \quad (3.4)$$

$$MSE(T_b) = \bar{Y}^2 C_y^2 \left\{ \theta_2 + (\theta_1 - \theta_2) \rho_{xy}^2 \right\}, \quad (3.5)$$

which is exactly equal to the $MSE(T_{12})$.

4. EMPIRICAL INVESTIGATION

In order to see the relative performance of the newly developed estimators with all the above well known estimators, we evaluate the MSE of all the estimators, relative efficiency has been made and finally, all the estimators under study have been ranked.

For this purpose, 16 natural populations, i.e Populations and Housing Statistics of Individual Rural Localities from the Punjab District Census Report (1998) have been extracted. We shall work out the comparison firstly from the population values, and then from the second-phase samples' values. So we have

N = No. of dehats/villages/settlements

y = Literacy ratio (%)

x = Population of both sexes i.e number of people

z = Educational attainment (for both sexes) Primary but below Matric.

All the calculations with their results are explained as under:

- The MSEs based on population (full information case) of all the estimators are given in Table 4.1.
- The MSEs based on information of second-phase sample (no information case) of all the estimators are given in Table 4.2.
- The relative efficiency based on T_{10} , Samiuddin and Hanif's estimator for full information, have been calculated and given in Table 4.3.
- The relative efficiency based on T_{11} , Samiuddin and Hanif's estimator for no information, has been calculated and given in Table 4.4.
- The relative efficiency for full information has been converted into ranks in Table 4.5. We found that T_{10} , Samiuddin and Hanif's estimator for full information case, stands at first place where as estimator derived by us is 7th in rank. The credit to this estimator is that it is simple and easy to use. The note able point is that we have modified Singh and Espejo's (2007) estimator which stands 9 at the ranking system.
- The relative efficiency for no information has been converted into ranks in Table 4.6. We found that T_9 , Roy's estimator, stands at first in the ranks, Samiuddin and Hanif's estimator for no information case, stands at second place and our estimator is as efficient as Singh and Espejo's (2007) estimator.

Table 4.1: MSEs for All the Estimators for Full Information Case

S#	Districts	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₂	T _a
1	Attock	75.8	66.2	49.7	4.4	4.6	4.5	4.6	4.4	3.4	3.2	4.5	4.4
2	Bahawalpur	17.7	15.5	21.7	5.4	4.4	4.2	4.4	5.2	2.7	2.2	5.4	5.4
3	Bhakkar	60.7	51.0	66.5	6.7	6.4	6.3	6.3	6.6	4.3	3.9	6.7	6.6
4	Chakwal	120.3	102.4	150.9	4.8	4.6	4.6	4.6	4.8	3.4	3.2	4.8	4.8
5	Gujrat	74.0	62.5	69.4	2.8	2.8	2.8	2.8	2.8	2.0	1.8	2.8	2.8
6	Hafizabad	68.7	59.9	49.6	4.9	5.0	4.9	5.0	4.9	3.5	3.3	5.0	5.0
7	Jhelum	236.5	198.7	236.4	9.0	8.8	8.8	8.8	9.0	6.8	6.4	9.0	9.0
8	Khushab	158.2	134.0	203.6	9.9	10.0	10.0	9.9	9.9	8.0	7.7	9.9	9.8
9	Lodhran	29.2	25.3	37.4	5.0	4.5	4.5	4.5	5.0	2.7	2.3	5.0	5.0
10	Mandi Bahauddin	88.6	75.9	91.9	4.5	4.4	4.4	4.4	4.5	3.1	2.9	4.5	4.5
11	Mianwali	126.1	99.6	99.6	7.1	7.1	6.9	7.1	7.0	5.4	4.8	7.2	7.2
12	Muzafargarh	29.4	24.7	25.9	3.6	3.3	3.3	3.3	3.5	2.4	2.2	3.5	3.5
13	Pakpattan	54.2	47.0	30.0	4.2	4.3	4.1	4.3	4.2	2.7	2.4	4.3	4.3
14	Rajanpur	17.6	15.8	10.1	3.8	3.4	3.2	3.4	3.7	2.3	2.0	3.9	3.9
15	Sahiwal	54.9	49.1	27.8	6.7	7.4	6.9	7.5	6.6	4.1	3.6	7.0	6.9
16	Toba Tek Singh	33.7	31.1	25.4	6.5	6.8	6.3	6.9	6.3	3.3	2.7	6.8	6.7

Table 4.2: MSEs for All the Estimators for No Information Case

S#	Districts	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₁	T ₁₂	T _b
1	Attock	49.5	43.2	39.6	5.7	5.7	5.6	5.7	5.7	4.2	4.2	5.8	5.8
2	Bahawalpur	11.0	9.5	12.4	2.8	1.9	1.8	1.9	2.6	1.2	1.2	2.7	2.7
3	Bhakkar	38.9	32.3	53.0	5.5	5.6	5.6	5.5	5.4	3.4	3.5	5.4	5.4
4	Chakwal	45.7	41.0	32.1	4.3	4.8	4.5	4.8	4.2	1.8	1.9	4.5	4.5
5	Gujrat	63.9	53.6	63.5	2.6	2.6	2.6	2.6	2.6	1.7	1.7	2.6	2.6
6	Hafizabad	103.8	91.4	60.4	6.4	7.1	6.9	7.2	6.3	0.6	0.7	6.6	6.6
7	Jhelum	101.4	88.8	92.9	16.5	15.9	15.5	16.0	16.3	8.4	8.5	16.7	16.7
8	Khushab	155.6	129.2	220.5	7.1	8.6	8.4	8.8	7.1	3.9	4.2	7.3	7.3
9	Lodhran	21.5	18.6	38.6	3.5	3.2	3.2	3.2	3.4	1.6	1.6	3.5	3.5
10	Mandi Bahauddin	44.7	38.2	62.0	4.2	4.2	4.2	4.2	4.2	1.7	1.7	4.2	4.2
11	Mianwali	63.5	49.2	52.2	6.2	5.8	5.7	5.7	6.1	3.3	3.3	6.1	6.1
12	Muzafargarh	24.9	21.1	31.3	4.7	4.5	4.5	4.5	4.7	3.4	3.4	4.7	4.7
13	Pakpattan	18.9	16.9	18.3	5.6	4.8	4.6	4.8	5.4	2.3	2.4	5.6	5.6
14	Rajanpur	14.4	13.7	7.7	6.1	5.4	5.0	5.5	5.9	3.4	3.5	6.3	6.3
15	Sahiwal	31.2	28.1	14.3	3.6	3.9	3.5	4.0	3.5	1.3	1.4	3.9	3.9
16	Toba Tek Singh	38.9	36.8	18.1	5.8	8.2	7.4	8.2	5.7	2.8	3.3	6.5	6.5

Table 4.3: Relative Efficiency of all the Estimators on the Base of T_{10} (Full Information Case)

S#	Districts	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{12}	T_a
1	Attock	2357.1	2059.4	1544.9	136.6	143.0	139.7	144.2	136.1	105.7	100	139.3	138.1
2	Bahawalpur	811.4	711.0	995.5	249.5	200.9	193.1	200.0	240.0	124.6	100	247.8	247.6
3	Bhakkar	1574.4	1322.8	1723.8	174.4	164.6	164.1	162.8	172.2	111.7	100	172.6	171.8
4	Chakwal	3799.8	3236.9	4769.2	151.4	146.7	146.4	146.2	150.5	107.6	100	150.8	150.7
5	Gujrat	4054.5	3422.6	3799.2	153.9	152.6	151.3	153.2	153.3	109.1	100	154.7	154.5
6	Hafizabad	2115.0	1844.6	1526.8	150.8	152.8	149.5	154.0	150.0	108.0	100	153.3	152.4
7	Jhelum	3694.7	3103.7	3693.2	140.8	138.1	137.5	138.2	140.3	106.8	100	140.9	140.9
8	Khushab	2059.7	1744.1	2650.9	128.9	129.8	129.8	129.3	128.5	104.2	100	128.5	127.8
9	Lodhran	1286.6	1116.2	1648.7	222.1	199.8	197.9	198.2	218.3	117.5	100	220.2	219.7
10	Mandi Bahauddin	3053.4	2615.2	3167.1	154.8	151.7	151.1	151.8	154.2	108.3	100	154.9	154.9
11	Mianwali	2626.0	2073.8	2074.7	147.6	147.5	144.6	148.6	146.6	111.4	100	149.4	148.9
12	Muzafargarh	1321.3	1112.8	1166.8	159.8	149.3	148.3	148.3	157.6	109.9	100	158.6	158.3
13	Pakpattan	2232.8	1936.4	1236.1	173.7	175.9	169.6	177.7	171.9	112.5	100	178.2	176.6
14	Rajanpur	896.5	808.7	515.0	194.5	174.8	165.2	175.7	189.4	115.0	100	199.1	198.0
15	Sahiwal	1544.8	1381.0	782.4	187.2	207.8	195.0	209.9	184.9	115.3	100	197.8	192.7
16	Toba Tek Singh	1262.8	1166.7	952.4	242.1	255.9	236.2	257.2	237.1	122.9	100	256.7	250.5

Table 4.4: Relative Efficiency of the Estimators on the Base of T_{11} (No Information Case)

Sr.#	Districts	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{11}	T_{12}	T_b
1	Attock	1179.9	1030.4	944.2	136.9	135.4	134.5	135.8	136.4	99.9	100	137.3	137.3
2	Bahawalpur	899.5	774.1	1011.1	224.8	158.4	149.0	157.2	212.0	99.5	100	221.4	221.4
3	Bhakkar	1108.4	921.4	1510.9	155.8	158.1	158.1	156.7	154.5	97.8	100	154.6	154.6
4	Chakwal	2431.8	2178.2	1708.0	225.8	253.1	239.2	255.9	223.5	94.5	100	237.4	237.4
5	Gujrat	3689.5	3092.7	3662.6	152.5	150.2	150.0	150.1	152.1	100.0	100	152.3	152.3
6	Hafizabad	14027.3	12359.7	8165.1	860.4	963.2	925.7	974.9	856.2	82.9	100	893.7	893.7
7	Jhelum	1195.4	1046.9	1094.6	194.1	187.4	182.1	188.8	191.6	99.4	100	197.0	197.0
8	Khushab	3708.8	3078.2	5255.0	169.8	204.3	200.9	210.6	169.4	93.8	100	172.7	172.7
9	Lodhran	1309.5	1128.7	2347.1	212.1	193.4	192.3	191.3	208.6	99.2	100	209.7	209.7
10	Mandi Bahauddin	2636.4	2254.1	3661.1	249.8	246.3	246.2	245.6	249.0	99.6	100	249.1	249.1
11	Mianwali	1921.3	1487.3	1578.1	186.4	174.8	173.8	172.6	182.9	99.2	100	183.9	183.9
12	Muzafargarh	737.4	625.6	928.2	140.4	134.6	134.3	133.6	139.0	99.6	100	139.4	139.4
13	Pakpattan	805.0	721.7	778.1	236.4	203.8	194.4	204.8	229.4	99.8	100	238.8	238.8
14	Rajanpur	411.6	392.1	220.6	173.7	155.9	144.4	156.2	168.3	98.2	100	179.7	179.7
15	Sahiwal	2245.3	2018.1	1026.9	257.8	283.2	254.9	284.5	251.1	90.8	100	279.4	279.4
16	Toba Tek Singh	1186.0	1120.2	551.4	176.2	249.7	224.7	249.8	173.7	86.4	100	198.7	198.7

Table 4.5: Ranks of All the Estimators for Full Information Case

S#	Districts	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₀	T ₁₂	T _a
1	Attock	12	11	10	4	8	7	9	3	2	1	6	5
2	Bahawalpur	11	10	12	9	5	3	4	6	2	1	7	7
3	Bhakkar	11	10	12	9	5	4	3	7	2	1	8	6
4	Chakwal	11	10	12	9	5	3	3	6	2	1	7	7
5	Gujrat	12	10	11	7	4	3	5	5	2	1	8	8
6	Hafizabad	12	11	10	5	7	3	9	4	2	1	8	6
7	Jhelum	12	10	11	7	4	3	4	6	2	1	8	8
8	Khushab	11	10	12	6	8	8	7	4	2	1	4	3
9	Lodhran	11	10	12	9	5	3	4	6	2	1	8	7
10	Mandi Bahauddin	11	10	12	7	4	3	4	6	2	1	7	7
11	Mianwali	12	10	11	6	5	3	7	4	2	1	9	8
12	Muzafargarh	12	10	11	9	5	4	3	6	2	1	7	7
13	Pakpattan	12	11	10	5	6	3	8	4	2	1	9	7
14	Rajanpur	12	11	10	7	4	3	5	6	2	1	9	8
15	Sahiwal	12	11	10	4	8	6	9	3	2	1	7	5
16	Toba Tek Singh	12	11	10	5	7	3	9	4	2	1	8	6
	Average Rank	11.6	10.4	11	6.75	5.63	3.88	5.81	5	2	1	7.5	6.6
	Rank of Avg. Rank	12	10	11	8	5	3	6	4	2	1	9	7

Table 4.6: Ranks of All the Estimators for No Information Case

S#	Districts	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	T ₁₁	T ₁₂	T _a
1	Attock	12	11	10	4	4	3	4	4	1	1	8	8
2	Bahawalpur	11	10	12	9	4	3	4	6	1	1	7	7
3	Bhakkar	11	10	12	6	9	6	6	3	1	2	3	3
4	Chakwal	12	11	10	3	8	5	8	3	1	2	5	5
5	Gujrat	12	10	11	3	3	3	3	3	1	1	3	3
6	Hafizabad	12	11	10	4	8	7	9	3	1	2	5	5
7	Jhelum	12	10	11	7	4	3	5	6	1	2	8	8
8	Khushab	11	10	12	3	8	7	9	3	1	2	5	5
9	Lodhran	11	10	12	9	4	4	3	6	1	1	6	6
10	Mandi Bahauddin	11	10	12	3	3	3	3	3	1	1	3	3
11	Mianwali	12	10	11	9	5	3	3	6	1	1	7	7
12	Muzafargarh	11	10	12	6	3	3	3	6	1	1	6	6
13	Pakpattan	12	10	11	7	4	3	4	6	1	1	8	8
14	Rajanpur	12	11	10	7	4	3	4	6	1	2	8	8
15	Sahiwal	12	11	10	5	6	3	9	3	1	2	6	6
16	Toba Tek Singh	12	11	10	4	8	7	8	3	1	2	5	5
	Average Rank	11.6	10	11	5.6	5.3	4	5	4	1	1.5	6	6
	Rank of Avg. Rank	12	10	11	7	5	3	5	4	1	2	8	8

REFERENCES

1. Chand, L. (1975). *Some ratio type estimators based on two or more auxiliary variables*. Unpublished Ph.D. thesis, Iowa State University, Ames, Iowa (USA).
2. Kiregyera, B. (1980). A chain ratio type estimator in finite population double sampling using two auxiliary variables. *Metrika*. 27, 217-223.
3. Kiregyera, B. (1984). Regression type estimators using two auxiliary variables and the model of double sampling from finite population. *Metrika*. 31, 215-226.
4. Mohanty, S. (1967). Combination of Regression and Ratio Estimate. *J. Ind. Statist. Assoc.* 5, 16-29.
5. Mukerjee, R., Rao. T.J. and Vijayan, K. (1987). Regression type estimators using multi-auxiliary information. *Austral. J. Statist.* 29, 244-254.
6. Roy, D.C. (2003). A regression type estimator in two-phase sampling using two auxiliary variables. *Pak. J. Statist.* 19(3), 281-290.
7. Sahoo, J., Sahoo, L.N. and Mohanty, S. (1993). A regression approach to estimation in two-phase sampling using two auxiliary variables. *Current Sciences*. 65(1), 73-75.
8. Samiuddin, M. and Hanif, M. (2007). Estimation of population mean in single and two phase sampling with or without additional information. *Pak. J. Statist.* 23(2), 99-118.
9. Singh, H.P. and Espejo, M.R. (2007). Double sampling ratio-product estimator of a finite population mean in sample survey. *J. Appl. Statist.* 34(1), 71-85.

EXPLORING DATA ANALYSIS USING STATISTICAL SOFTWARES

Sana Riaz, Sara Azher and Riffat Shoaib
Department of Statistics, University of Karachi

ABSTRACT

The aim of our study is to analyze the large set of data by using statistical software (SPSS & R). In this paper we give introduction and techniques of using numeric data to analyze different methods of time series by using the software SPSS and R, in very easy manners.

SPSS is a comprehensive and flexible statistical analysis and data management system. SPSS 15 can take data from almost any type of file and use them to generate tabulated reports, charts, trends, and conduct complex statistical analysis. Whereas R 2.5.0 is started in different ways depending on the platform used and the intent of usage.

There are many ways to handle time series like by using Differencing, Smoothing and by fitting different models like ARMA, ARIMA etc. In this paper we use all the above techniques by using SPSS and R by taking the monthly data set of “BRAZELIAN GDP”

This paper is basically divided into three parts:

1. Time series Analysis
2. Introduction to SPSS
3. Introduction to R

1. AN INTRODUCTION

A Time Series (TS) is a sequence of observations ordered in time. Mostly these observations are collected at equally spaced, discrete time intervals. When there is only one variable upon which observations are made then we call them a single TS or more specifically a univariate time series.

1.1 Goals of Time Series Analysis

There are two main goals of time series analysis: (a) identifying the nature of the phenomenon represented by the sequence of observations, and (b) forecasting (predicting future values of the time series variable). Both of these goals require that the pattern of observed time series data is identified and more or less formally described. . Once the pattern is established, we can interpret and integrate it with other data (i.e., use it in our theory of the investigated phenomenon, e.g., seasonal commodity prices). Regardless of the depth of our understanding and the validity of our interpretation (theory) of the phenomenon, we can extrapolate the identified pattern to predict future events.

1.2 ARMA Models

In statistics, **autoregressive moving average (ARMA) models**, sometimes called **Box-Jenkins models** after the iterative Box-Jenkins methodology usually used to estimate them, are typically applied to time series data.

Given a time series of data X_t , the ARMA model is a tool for understanding and, perhaps, predicting future values in this series. The model consists of two parts, an autoregressive (AR) part and a moving average (MA) part. The model is usually then referred to as the ARMA(p,q) model where p is the order of the autoregressive part and q is the order of the moving average part.

1.3 ARIMA Models

In statistics, an **autoregressive integrated moving average (ARIMA)** model is a generalization of an autoregressive moving average or (ARMA) model. These models are fitted to time series data either to better understand the data or to predict future points in the series. The model is generally referred to as an ARIMA(p,d,q) model where p , d , and q are integers greater than or equal to zero and refer to the order of the autoregressive, integrated, and moving average parts of the model respectively.

A generalization of ARMA models which incorporates a wide class of non stationary TS are obtained by introducing the differencing into the model. The simplest example of a non stationary process which reduces to a stationary one after differencing is Random Walk. Random Walk is a non stationary AR(1) process with the value of the parameter ϕ equal to 1, that is the model is given by

$$X_t = X_{t-1} + Z_t, \text{ where } Z_t \sim \text{WN}(0, \Omega^2).$$

Its autocovariances depend on time as well as on lag. However, the first difference

$$\nabla X_t = X_t - X_{t-1}$$

is a stationary process, as it is just the White Noise Z_t . So, ∇X_t is an ARMA (0,0) Process, or in ARIMA notation it is ARIMA (0, 1, 0) process as it is obtained after first order differencing of X_t .

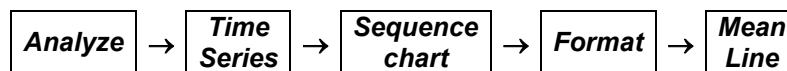
2. STATISTICAL PAKAGES

2.1 SPSS (Statistical Package for the Social Science):

SPSS stands for the “Statistical Package for the Social Sciences.” It is composed of two inter-related facets, the statistical package itself and SPSS language, a system of syntax used to execute commands and procedures. Likewise, there are two approaches to using SPSS: (a) via the Graphical User Interface (GUI), a point-and-click approach already familiar to Windows users and (b) via the use of SPSS programming syntax. Most users will find a combination of these approaches most effective in carrying out their data analyses. Here we apply only point and click approach and using the Brazilians GDP data set to show the applications of time series.

2.2 SPSS Analysis:

First we check the pattern of the data set by using the following steps for time series plot select:



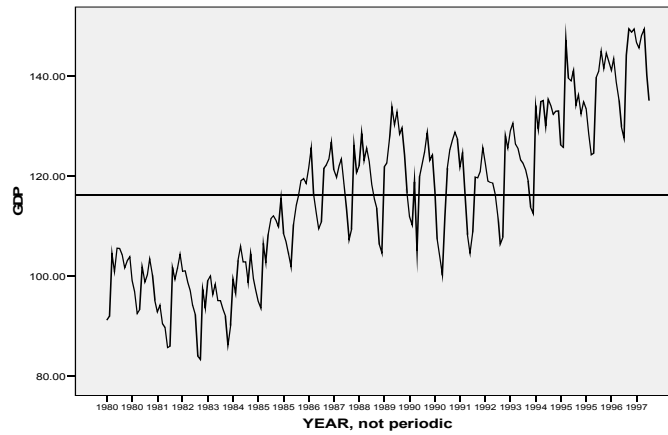


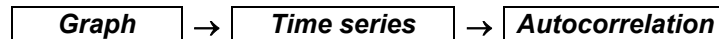
Fig. 1: TS Plot

Comments:

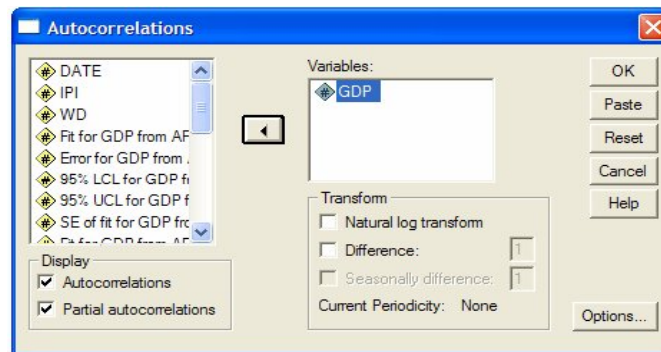
From the Time series plot of Brazilian Gross Domestic Product (GDP) we conclude that there is an increasing trend is present and data is cyclic so we apply the difference of order 1 in above TS plot. Before apply differencing we can also check the pattern of the data set by ACF and PACF plot the procedure for ACF and PACF is as follows.

2.3 Autocorrelation & Partial Autocorrelation:

For time series plot select:



A window appears:



Then select **ok** we will get the ACF and PACF graphs. After analyzing the graph we applying log transformation and differencing of order 1. by check mark on two options as given in above window.

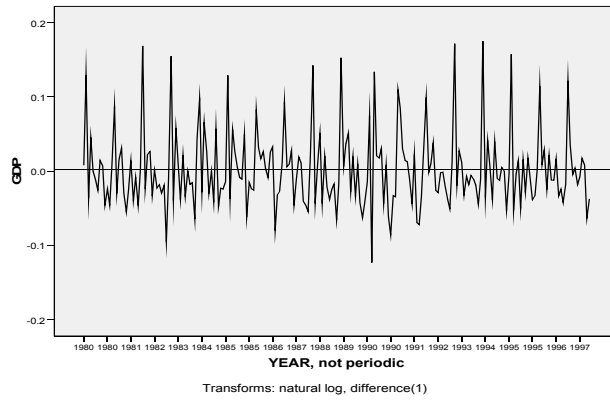


Fig. 1.2: ACF-Plot

From above TS plot we observe that series is stabilized. We can also observe this from the ACF and PACF plots (shown below)

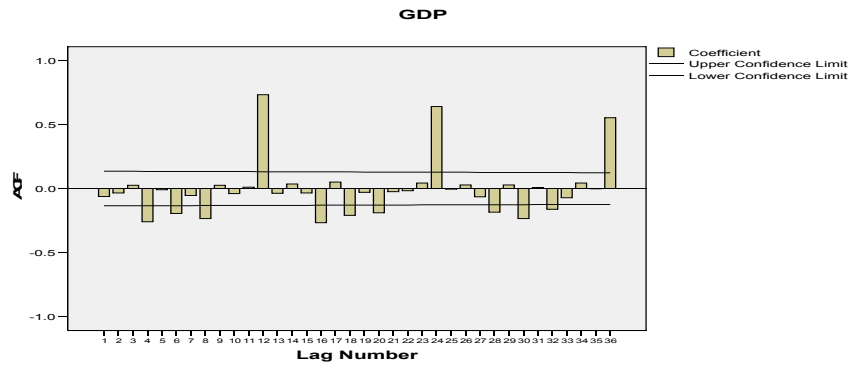


Fig. 1.4: TS Plot

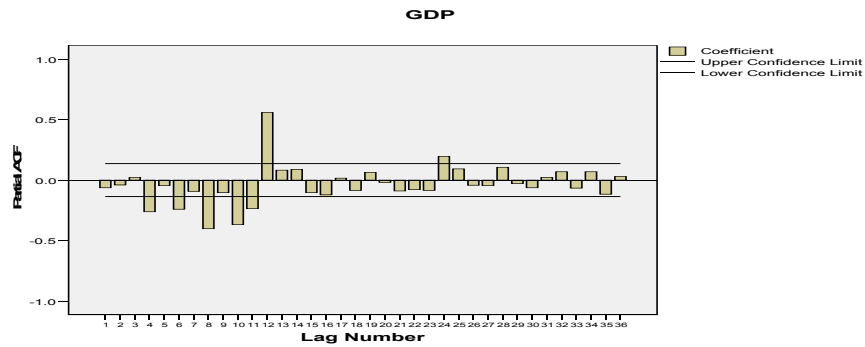
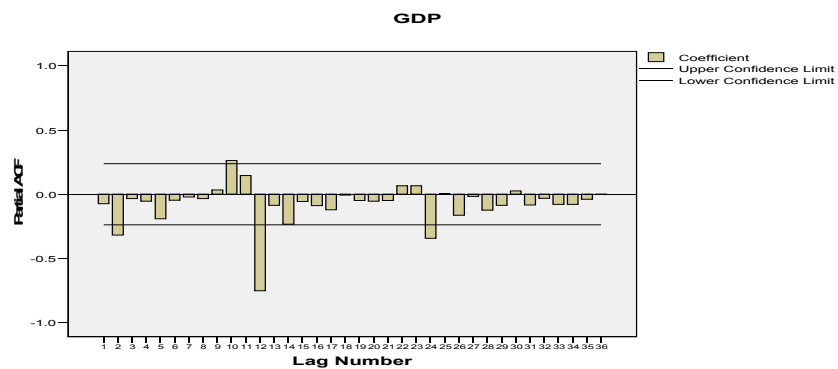
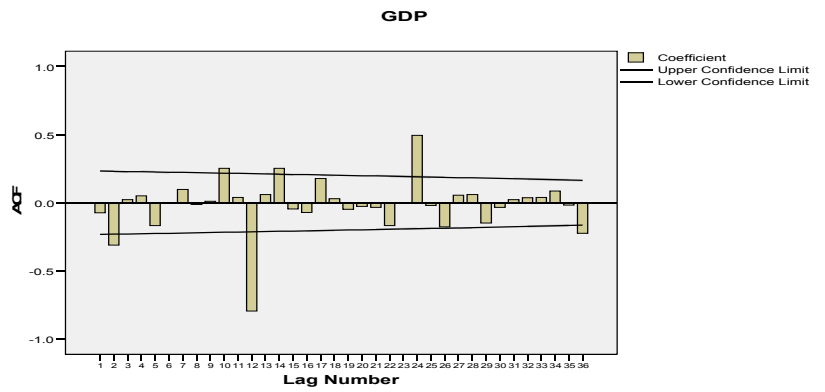


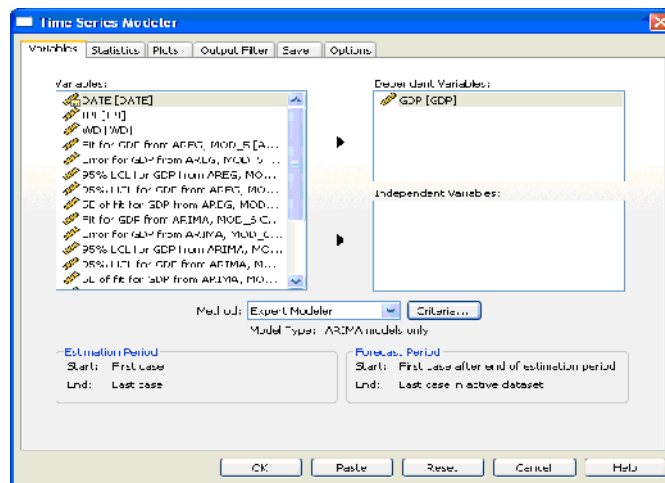
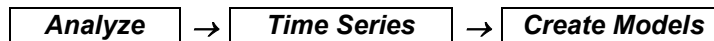
Fig 1.6: Pacf of 2ND Diff

By examine above acf and pacf we need to difference the series again by defining differencing order 12.

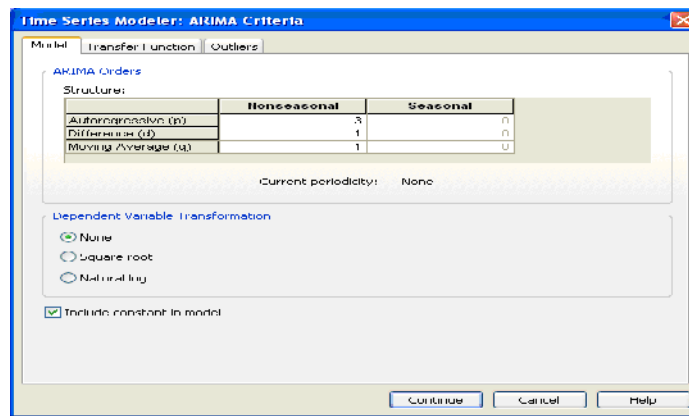


now by inspection of above acf and pacf we can say that the order of MA should be 2,4,5,7 and 12 and AR be 2.

For creating model select from Menu:



See menus below for detailed instructions.



Now Select **Criteria** in the above menu.

Select continue in above menu & then select OK. We will get the following results

Time Series Modeler Model Description

Model ID	GDP	Model 1	Model Type
			ARIMA(2,1,12)

Model Summary Model Statistics

Model	Number of Predictors	Model Fit Statistics	Ljung-Box Q(18)			Number of Outliers
			Stationary R-squared	Statistics	DF	
GDP-Model_1	1	.928	36.049	4	.000	0

ARIMA Model Parameters

			Estimate	SE	t	Sig.	
GDP-Model-1	GDP	No Transformation	Lag 1	-.014	.126	-.110	.913
			Lag 2	-.120	.124	-.964	.336
			Difference	1			
			MA Lag 1	.188	.108	1.737	.084
			Lag 2	.063	.112	.562	.575
			Lag 3	.023	.068	.334	.739
			Lag 4	.228	.064	3.530	.001
			Lag 5	.146	.062	2.342	.020
			Lag 6	.196	.063	3.112	.002
			Lag 7	.065	.063	1.031	.304
			Lag 8	.228	.063	3.623	.000
			Lag 9	-.116	.063	-1.826	.069
Lag 10	.020	.066	.300	.765			
Lag 11	-.015	.066	-.233	.816			
Lag 12	-.589	.064	-9.153	.000			

Model fit				
Fit Statistic	Mean	SE	Minimum	Maximum
	5	10	25	50
Stationary R-squared	.456	.	.456	.456
R-squared	.928	.	.928	.928
RMSE	4.404	.	4.404	4.404
MAPE	2.724	.	2.724	2.724
MaxAPE	13.574	.	13.574	13.574
MAE	3.135	.	3.135	3.135
MaxAE	14.265	.	14.265	14.265
Normalized BIC	3.340	.	3.340	3.340

2.6 For Forecasting:

To forecast the future values you just check mark on the box of forecast in the menu of model fitting.

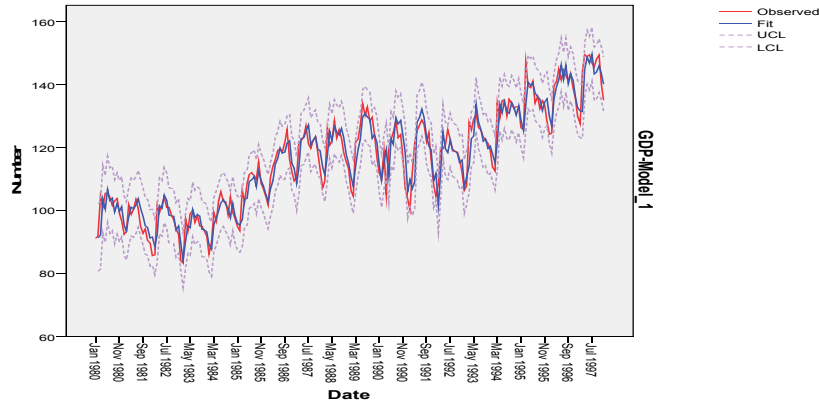
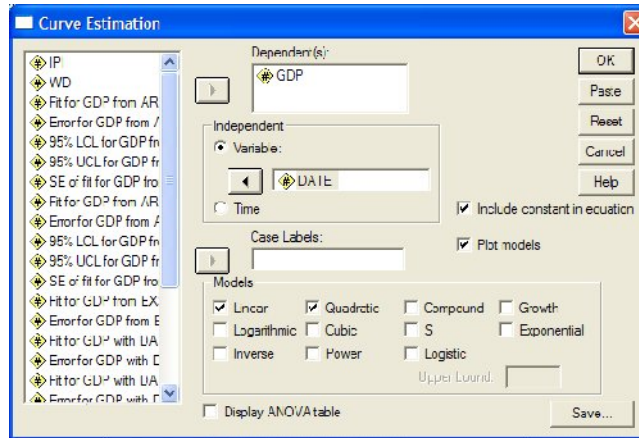


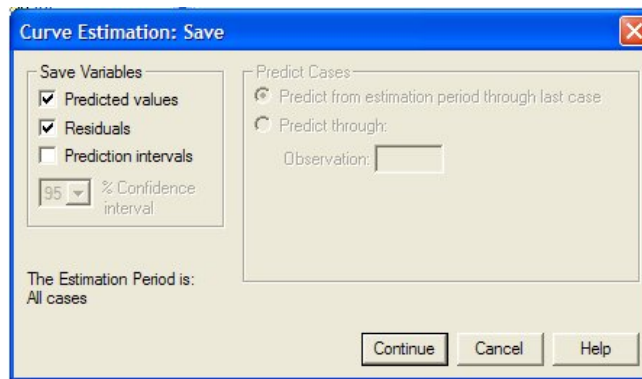
Fig. 1.7: Fitted Ts Plot

Select **save** then another window appears:

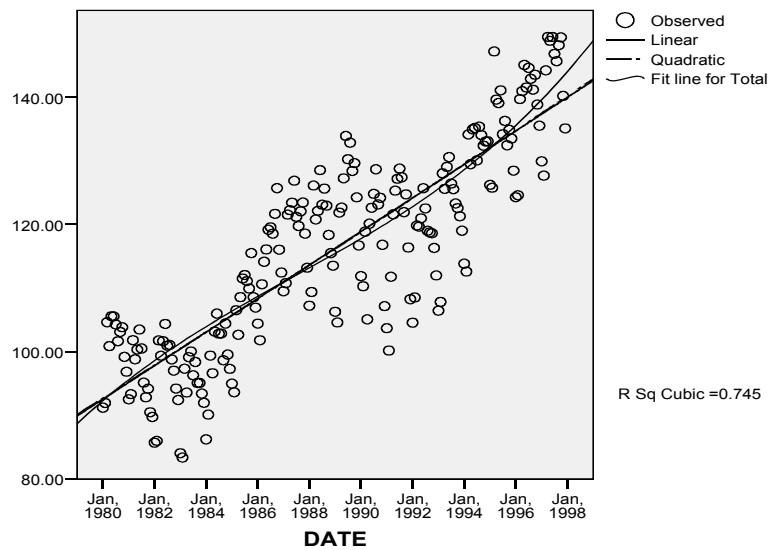
For further fitting:



Select continue in above menu & then select **OK**.



GDP



Comments:

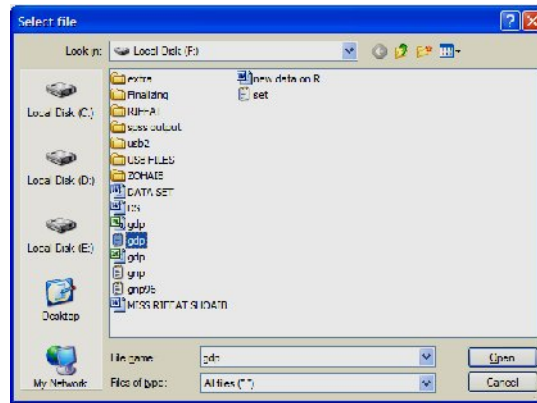
In SPSS you can also fit different *Curve Estimation* for forecasting from above plot we predict that the value of Brazilian GDP and industrial production series is rapidly increasing in coming years.

3. DATA ANALYSIS IN R:

Open data set "gdp" in **R** console for this purpose write command:

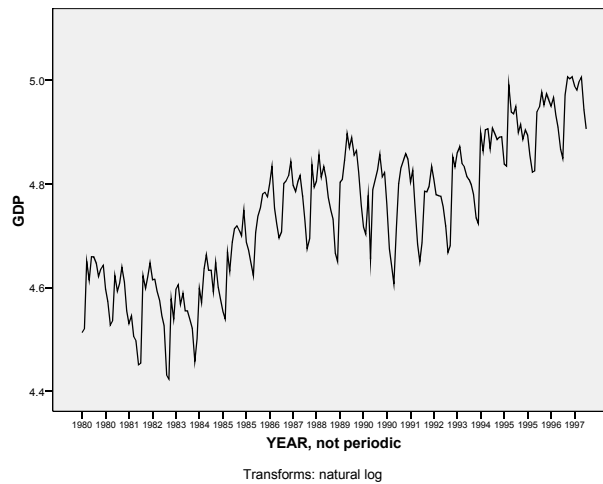
```
>read.table(file=file.choose())
```


After typing this command in R Console a window appears:



Our data set appears in R console. Now we check the Time series plot of our data set.

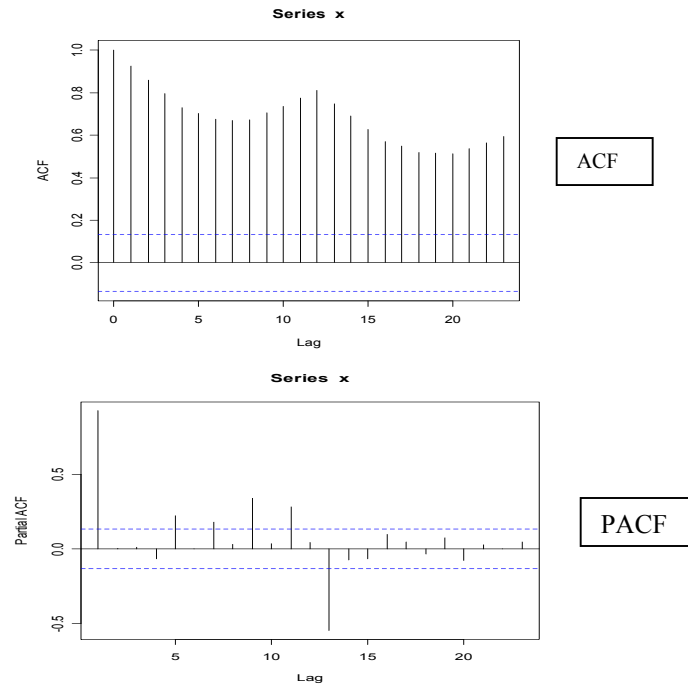
```
>plot.ts(x[2] main="GDP")
```



TS PLOT

3.1 Autocorrelation & Partial Autocorrelation:

```
>acf(x)
>pacf(x)
```

**Comments:**

As the plot of ACF and PACF is not define any particular pattern so we apply Differencing of order 1.

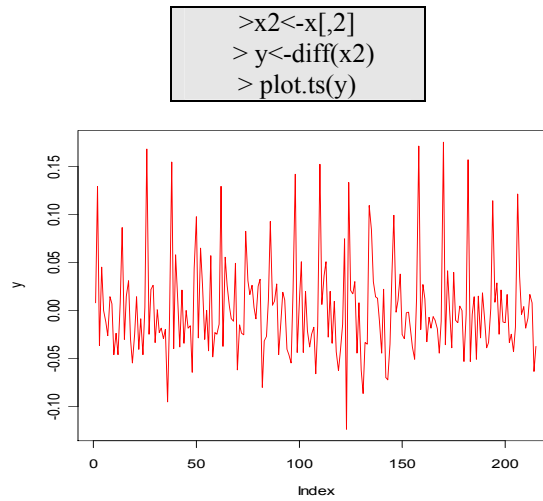
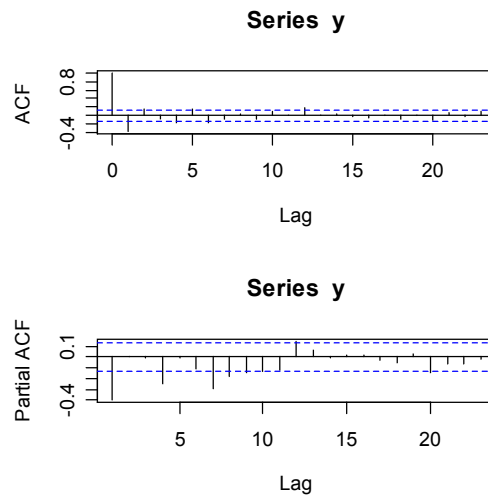
3.2 Detrending the series:

Fig 1.12 TS Plot after Diff

3.3 Autocorrelation and Partial autocorrelation of the first differences:

```
> par(mfcol=c(2,1))
> acf(y)
> pacf(y)
```

Fig 1.13: ACF & PACF OF 1ST DIFF



Comments:

After detrending the series we observe that our GDP series stabilized. The ACF plot indicates an MA(1) similarly the PACF plot indicates AR(2) so we fit an ARIMA(2,1,1) to our data of GDP.

3.4 Model Fitting:

```
> fit1 <- arima(y, order=c(2,1,1), method="ML", xreg=1:length(y))
> names(fit1)
[1] "coef" "sigma2" "var.coef" "mask" "loglik" "aic"
[7] "arma" "residuals" "call" "series" "code" "n.cond"
[13] "model"
> fit1

Call:
arima(x = y, order = c(2, 1, 1), xreg = 1:length(y), method = "ML")

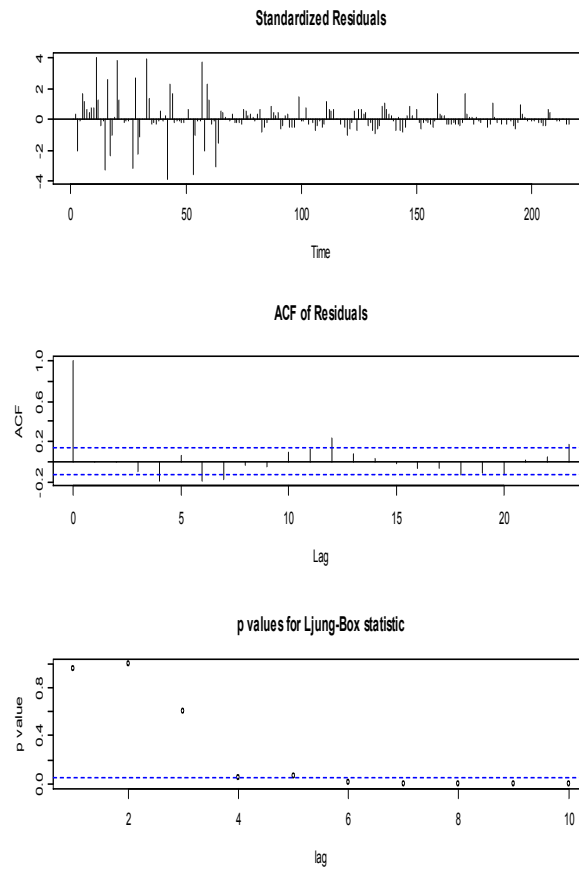
Coefficients:
ar1 ar2 ma1 1:length(y)
-0.3848 0.0118 -1.0000 0.0186
s.e. 0.0683 0.0681 0.0118 0.0422
sigma^2 estimated as 2796: log likelihood = -1161.27, aic = 2332.54
```

3.5 Model Diagnostics:

By using single command we can get the following plots and draw conclusion easily.

1. `> tsdiag(fit1)`

Fig 1.14



2. `> qqline(fit1$res)`

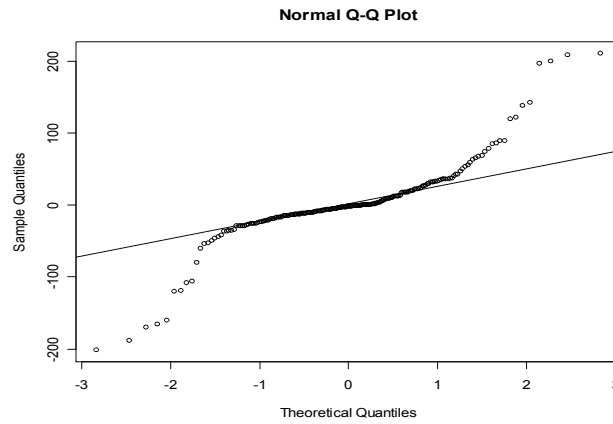


Fig 1.15

3.6 Predict Adequate Model:

To predict the future values we use the following commands.

```
> predict(arima0(lh, order = c(2,1,1)), n.ahead = 12)
$pred
Time Series:
Start = 49
End = 60
Frequency = 1
[1] 2.703744 2.590496 2.555075 2.555198 2.562933 2.568221
    2.570184 2.570390
[9] 2.570108 2.569869 2.569767 2.569747
$se
Time Series:
Start = 49
End = 60
Frequency = 1
[1] 0.4455065 0.5568145 0.5796655 0.5834539 0.5847260
    0.5860906 0.5879693
[8] 0.5902167 0.5925948 0.5949736 0.5973195 0.5996383
```

Comments:

After applying several models by changing the values of ARIMA(p,d,q) like $p=q=0,1,2$ to our data we conclude that the suitable model for our data is ARIMA(2,1,1) because it has minimum value of aic and its p-value is minimum. We conclude that a reasonable model has been selected.

CONCLUSION

The aim of our study is to analyze the large set of data by using statistical software (SPSS & R).

SPSS and R is a comprehensive and flexible statistical analysis and data management system whereas R 2.5.0 is started in different ways depending on the platform used and the intent of usage

REFERENCES

1. Chatfield, C. (1996). *The Analysis of Time Series*. 5th Edition, Chapman and Hall, New York, NY.
2. Brock well, Petter J. and Davis Richard A. (1991). *Time Series Theory and Methods*. Springer.
3. Jhon Verzani (2005). *Using R for Introductory Statistics*. Chapman and Hall, CRC
4. Chair of Statistics, University of Wurzburg (2006). *A First Course on Time Series Analysis*.
5. www.ucla/classnotes/spss
6. www.spss.com
7. <http://www.omegahat.org/RXML>
8. Tsay, R.S. (2002). *Analysis of Financial Time series*. John Wiley and sons, Inc.
9. Patterson, Kerry. *An Intraduction to applied Econometrics- A Time series approach*. Macmillanpress Ltd.

The use of statistical software in the class for time series analysis

**A CLASS OF REGRESSION CUM RATIO-PRODUCT ESTIMATORS
(USING TWO AUXILIARY VARIABLES)**

Hamad Sarwar Shaw¹ and Muhammad Hanif²

¹National College of Business Administration and Economics, Lahore.

²Lahore University of Management Sciences, Lahore. Email: hanif@lums.edu.pk

ABSTRACT

It is well known fact that efficiency and precision of the estimators of Population mean of study variable 'y' is increased if highly correlated benchmark or auxiliary variable 'x' is available. This efficiency is further increased if two auxiliary variables 'x' and 'z' are available provided that there is less correlation between two auxiliary variables otherwise more hazards can be faced especially in regression analysis.

Regression estimator is considered to be more useful than ratio and product estimators except when regression line does not pass through origin other wise these three estimators have almost same significance and analyst has to decide intuitively.

The performance of Regression, Ratio and Product estimators is improved by combining them to compose a new class of Regression cum Ratio-Product (RRP) estimator in both one and two phase sampling where information about auxiliary variables related to study variable 'Y' are available at different levels. We have considered three cases. First case when no information about the auxiliary variable is available at Two-phase sampling. Second case when partial information about any one of two auxiliary variables is used in Two-phase sampling. Third case when full information about two auxiliary variables is available in Two-phase sampling.

Biases and Mean Square Errors (MSE) of proposed class in Single and Two-phase sampling for all cases are derived. Mean square error of proposed class shows an improvement over mean per unit estimator and other well known estimators.

KEY WORDS

Mean Square Error (MSE), Efficiency, Two-Phase sampling, Auxiliary variable, Regression cum Ratio-Product estimator (RRP), Simple Random Sampling with out Replacement (srswor).

1. INTRODUCTION

In situations where auxiliary information is available at Population level and cost per unit of collecting study variable 'y' is affordable then Single-phase sampling is more appropriate. But there might be situations where no prior knowledge of auxiliary variables is available, nor is it economical to conduct a census just for this purpose, the technique of two-phase sampling is most suitable technique in such situations.

Double sampling or Two-phase sampling is commonly used for estimating a population total 'Y' when the cost per unit for getting information about auxiliary variables is less than the cost per unit of measuring the study variable 'y'.

Two phase sampling is a powerful technique which was firstly introduced by Neyman (1938) for the stratification purpose. So far, in literature of survey sampling, use of auxiliary variables is a common practice to increase the precision and efficiency of estimator of mean of main variable under study.

When information of auxiliary variable is lacking, it is cheaper to take large preliminary sample and from that, auxiliary variables are computed. Then the main sample is independently sub-sampled from that large sample.

Let S_1 be first phase sample of size n_1 from the Population of size N according to a Simple Random Sampling with out Replacement (srswor) and x_1 is observed if only one auxiliary information is available other wise z_1 is also observed. Let S_2 be second phase sample of size n_2 from first phase sample of size n_1 and y_2, x_2 & z_2 are observed.

Both x_2 and y_2 are measured and an estimate of Population mean of study variable 'Y' is obtained.

Cochran (1940) appears to be the first to use auxiliary information in Ratio estimator when there is highly positive correlation between study variable and auxiliary variables. Robson (1956) gave the idea of product estimator when there is highly negative correlation.

Regression, Ratio and Product are the well known techniques to compute the finite population mean when auxiliary information are available at different levels. A large number of estimators have been constructed in Single phase and two phase sampling using auxiliary variables related to study variable 'y' through the modification of regression, ratio and product estimators.

Keeping this in view an attempt has been made to improve the performance of these estimators by combining them to compose a new class of Regression cum Ratio-Product (RRP) estimator in both one and two phase sampling where information about auxiliary variables related to study variable 'y' are available at different levels. Motivated by the idea of Singh and Espejo, who worked only on ratio-product estimator using one auxiliary variable, a new class of estimators is constructed which will combine the three conventional estimators i.e. Regression, Ratio and Product. This class is proposed in single phase and two phase using two auxiliary variables.

2. LITERATURE REVIEW

Mohanty (1967) demonstrated that precision of study variable can be increased by using the information of another auxiliary variable. He provided an expression for the mean of study variable \bar{Y} for finite population using two auxiliary variables by combining the regression and ratio estimators. Chand (1975) developed chain ratio estimator and chain product estimator using two auxiliary variables, when population information of 2nd auxiliary variable Z was known. Kiregyera (1980) modified the ratio-type estimator by introducing regression estimate. He constructed a chain ratio to

regression type estimator by using two auxiliary variables and investigated the performance of constructed estimator to simple mean, two-phase ratio-type estimator and Chand's ratio-type estimator. Kiregyera (1984) developed two more estimators, one was ratio in regression and other was regression in regression estimator by using two auxiliary variables. Srivastava et al. (1990) developed a general family of chain ratio-type of estimators for estimating population mean by using two auxiliary variables. Sahoo et al. (1993) suggested a regression type estimator in the presence of available information on second auxiliary variable when population mean of the main auxiliary variable was unknown. Singh and Upadhyaya (1995) considered a generalized estimator for estimating the population mean in two phase sampling using two auxiliary variables. Prasad (1996) suggested some classes of chain ratio type estimators for ratio of two population means using two auxiliary variables under a simple random sampling with out replacement scheme in two phase sampling. Tracy and Singh (1999) proposed a class of chain regression estimators with asymptotic expression of bias and Mean Square Error for estimating the population mean of variable of interest in two phase sampling by using two auxiliary variables. Singh and Singh (2002) suggested a class of chain ratio-type estimators for estimating the population coefficient of variation of study variable by using two auxiliary variables in two phase sampling. Diana and Tommassi (2003) used Two-phase sampling scheme to suggest a general class of estimators for finite population mean. The proposed class depends on the sample means and variances of two auxiliary variables. Singh and Espejo (2003) considered a class of ratio-product estimators for the estimation of finite population mean. In two-phase sampling, Roy (2003) constructed a regression-type estimator of population mean of the main variable (y) in the presence of available knowledge on second auxiliary variable (z), when the population mean of the first auxiliary variable (x) is not known. Samiuddin and Hanif (2007) introduced ratio and regression estimation procedures for estimating population mean in two phase sampling for estimating different three situations depending up on the availability of information on two auxiliary variables for population. They considered three situations, first when information on both auxiliary variable was not available, second when information on one auxiliary variable was available and third, when information on both auxiliary variables were available. Singh and Espejo (2007) extended their work for Two-phase sampling for their proposed class of estimators i.e. ratio-product estimator. The asymptotic optimum estimators in that class were identified for two different cases.

3. SINGLE-PHASE PROPOSED CLASS OF ESTIMATORS

Let \bar{x} , \bar{z} be the sample means of two auxiliary variables in single phase

$Y \rightarrow$ Main variable under study

$n \rightarrow$ Size of sample in case of single phase sampling

$$\theta = \left(\frac{1}{n} - \frac{1}{N} \right) = \text{Correction Factor}$$

$$\bar{X} = \frac{\sum_{i=1}^N X_i}{N}, \quad \bar{y} = \bar{Y} + \bar{\epsilon}_y, \quad E(\bar{\epsilon}_x^2) = \theta S_x^2 = \theta \bar{X}^2 C_x^2, \quad E(\bar{\epsilon}_{x_2} \bar{\epsilon}_{y_2}) = \theta_2 \bar{X} \bar{Y} C_x C_y \rho_{xy}$$

3.1 Single phase with Two Auxiliary Variables:

Our proposed class of estimators for single phase sampling when information of two auxiliary variable 'x' and 'z' is available and after now is written as RRP (Regression cum ratio, Product) estimator is given as

$$\bar{y}_{(1)RRP} = \bar{y}_{lr} \left\{ K \frac{\bar{Z}}{\bar{z}} + (1-K) \frac{\bar{z}}{\bar{Z}} \right\} \quad (3.1.1)$$

where $\bar{y}_{lr} = \bar{y} + b_{yx}(\bar{X} - \bar{x})$

3.2 Bias:

Expressing the RRP estimator in terms of $\bar{\mathbf{E}}\mathbf{S}$, we have

$$\bar{y}_{(1)RRP} = \left\{ \bar{Y} + \bar{\mathbf{E}}_y - \beta_{yx} \bar{\mathbf{E}}_x \right\} \left\{ K \left(1 + \frac{\bar{\mathbf{E}}_z}{\bar{Z}} \right)^{-1} + (1-K) \left(1 + \frac{\bar{\mathbf{E}}_z}{\bar{Z}} \right) \right\} \quad (3.2.1)$$

By taking the assumption that $\bar{\mathbf{E}}$ is very small and expanding $\left(1 + \frac{\bar{\mathbf{E}}_z}{\bar{Z}} \right)^{-1}$ up to second degree, we obtain bias as follows

$$\begin{aligned} Bias = E(\bar{y}_{(1)RRP} - \bar{Y}) = & \left(-\theta S_{b,x} + K\theta \bar{Y} C_z^2 + \theta \bar{Y} C_y C_z \rho_{yz} \right. \\ & \left. - 2K\theta \bar{Y} C_y C_z \rho_{yz} - \beta\theta \bar{X} C_x C_z \rho_{xz} + 2K\beta\theta \bar{X} C_x C_z \rho_{xz} \right) \end{aligned} \quad (3.2.2)$$

$$Bias = E(\bar{y}_{(1)RRP} - \bar{Y}) = \theta \bar{Y} \left[KC_z^2 - C_y C_b \rho_{bx} \rho_{xy} + C_y C_z (\rho_{yz} - \rho_{xy} \rho_{xz}) (1-2K) \right] \quad (3.2.3)$$

3.3 Mean Square Error (MSE):

Squaring both sides of equation 3.2.1 we get

$$\begin{aligned} (\bar{y}_{(1)RRP} - \bar{Y})^2 = & \left(\bar{\mathbf{E}}_y - \beta_{yx} \bar{\mathbf{E}}_x + \frac{\bar{Y}}{\bar{Z}} \bar{\mathbf{E}}_z + K \frac{\bar{Y}}{\bar{Z}^2} \bar{\mathbf{E}}_z^2 - 2K \frac{\bar{Y}}{\bar{Z}} \bar{\mathbf{E}}_z \right. \\ & \left. + \frac{\bar{\mathbf{E}}_y \bar{\mathbf{E}}_z}{\bar{Z}} - 2K \frac{\bar{\mathbf{E}}_y \bar{\mathbf{E}}_z}{\bar{Z}} - \beta_{yx} \frac{\bar{\mathbf{E}}_x \bar{\mathbf{E}}_z}{\bar{Z}} + 2K \beta_{yx} \frac{\bar{\mathbf{E}}_x \bar{\mathbf{E}}_z}{\bar{Z}} \right)^2 \end{aligned} \quad (3.3.1)$$

Mean Square Error (MSE) can be obtained by taking expectation and to the 1st degree approximation

$$MSE(\bar{y}_{(1)RRP}) = \theta \bar{Y}^2 \left[C_y^2 + C_z^2 - C_y^2 \rho_{xy}^2 + 4K^2 C_z^2 - 4K C_z^2 + 2C_y C_z \rho_{yz} \right. \\ \left. - 4K C_y C_z \rho_{yz} - 2C_y C_z \rho_{xy} \rho_{xz} + 4K C_y C_z \rho_{xy} \rho_{xz} \right] \quad (3.3.2)$$

Differentiating with respect to K and equating to zero we get

$$K = \frac{1}{2} + \frac{1}{2} \frac{C_y}{C_z} \rho_{yz} - \frac{1}{2} \frac{C_y}{C_z} \rho_{xy} \rho_{xz}$$

We get Mean Square Error (MSE) as follows

$$MSE(\bar{y}_{(1)RRP}) = \theta \bar{Y}^2 C_y^2 \left[1 - \rho_{xy}^2 - (\rho_{yz} - \rho_{xy}\rho_{xz})^2 \right] \quad (3.3.3)$$

The above estimator is clearly precise than the single phase regression estimator with one auxiliary variable.

4. TWO-PHASE PROPOSED CLASS OF ESTIMATORS

Let \bar{x}_1, \bar{z}_1 be the sample means of two auxiliary variables in first phase & $\bar{y}, \bar{x}_2, \bar{z}_2$ the sample means of two auxiliary variables in second phase $n_1 \rightarrow$ Size of sample in first phase when two phase sampling design is applied $n_2 \rightarrow$ Size of sample in 2nd phase when two phase sampling design is applied

$$\begin{aligned} \theta_1 &= \left(\frac{1}{n_1} - \frac{1}{N} \right), \theta_2 = \left(\frac{1}{n_2} - \frac{1}{N} \right) \\ \bar{y}_2 &= \bar{Y} + \bar{\epsilon}_{y_2}, E(\bar{\epsilon}_{x_1}) = E(\bar{\epsilon}_{y_1}) = E(\bar{\epsilon}_{z_1}) = 0 \\ E(\bar{\epsilon}_{x_2}^2) &= \theta_2 S_x^2 = \theta_2 \bar{X}^2 C_x^2, E(\bar{\epsilon}_{x_2} \bar{\epsilon}_{y_2}) = \theta_2 \bar{X} \bar{Y} C_x C_y \rho_{xy} \end{aligned}$$

4.1 Two-phase with Two Auxiliary Variables (No Information Case):

Our proposed class of estimators for Two-phase sampling when no information of two auxiliary variables 'x', 'z' is available is given as

For two auxiliary variables our proposed RRP estimator is

$$\bar{y}_{(2)RRP} = \bar{y}_{lr} \left\{ K \frac{\bar{z}_1}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{z}_1} \right\} \quad (4.1.1)$$

where $\bar{y}_{lr} = \bar{y}_2 + \beta(\bar{x}_1 - \bar{x}_2)$

$$\bar{y}_{(2)RRP} = (\bar{y}_2 + b_{yx}(\bar{x}_1 - \bar{x}_2)) \left\{ K \frac{\bar{z}_1}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{z}_1} \right\} \quad (4.1.2)$$

4.2 Bias:

Expressing the RRP estimator in terms of $\bar{\epsilon}S$, we have

$$\begin{aligned} \bar{y}_{(2)RRP} &= \left\{ \bar{Y} + \bar{\epsilon}_{y_2} + \beta_{yx}(\bar{\epsilon}_{x_1} - \bar{\epsilon}_{x_2}) \right\} \left\{ K \left(1 + \frac{\bar{\epsilon}_{z_1}}{\bar{Z}} \right) \left(1 + \frac{\bar{\epsilon}_{z_2}}{\bar{Z}} \right)^{-1} \right. \\ &\quad \left. + (1-K) \left(1 + \frac{\bar{\epsilon}_{z_1}}{\bar{Z}} \right)^{-1} \left(1 + \frac{\bar{\epsilon}_{z_2}}{\bar{Z}} \right) \right\} \quad (4.2.1) \end{aligned}$$

By taking the assumption that $\bar{\epsilon}$ is very small and expanding $\left(1 + \frac{\bar{\epsilon}_{z_1}}{\bar{Z}} \right)^{-1}$ and $\left(1 + \frac{\bar{\epsilon}_{z_2}}{\bar{Z}} \right)^{-1}$

up to second degree, we obtain bias of above estimator as follows

$$Bias = E(\bar{y}_{(2)RRP} - \bar{Y}) = \left\{ \begin{aligned} &Cov(b_1, \bar{x}_1) - Cov(b_2, \bar{x}_2) + \frac{\bar{Y}\theta_1\bar{Z}^2C_z^2}{\bar{Z}^2} - K\frac{\bar{Y}\theta_1\bar{Z}^2C_z^2}{\bar{Z}^2} \\ &+ K\frac{\bar{Y}\theta_2\bar{Z}^2C_z^2}{\bar{Z}^2} - \frac{\bar{Y}\theta_1\bar{Z}^2C_z^2}{\bar{Z}^2} - \frac{\theta_1\bar{Y}\bar{Z}C_yC_z\rho_{yz}}{\bar{Z}} + \frac{\theta_2\bar{Y}\bar{Z}C_yC_z\rho_{yz}}{\bar{Z}} \\ &+ 2\frac{K}{\bar{Z}}\theta_1\bar{Y}\bar{Z}C_yC_z\rho_{yz} - 2\frac{K}{\bar{Z}}\theta_2\bar{Y}\bar{Z}C_yC_z\rho_{yz} - \frac{\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} \\ &+ \frac{\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} + 2\frac{K\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} - 2\frac{K\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} \\ &+ \frac{\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} - \frac{\beta\theta_2\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} - 2\frac{K}{\bar{Z}}\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz} \\ &+ 2\frac{K}{\bar{Z}}\beta\theta_2\bar{X}\bar{Z}C_xC_z\rho_{xz} \end{aligned} \right\} \quad (4.2.2)$$

$$Bias = E(\bar{y}_{(2)RRP} - \bar{Y}) = (\theta_2 - \theta_1)\bar{Y} \left\{ KC_z^2 - C_yC_b\rho_{bx}\rho_{xy} + C_yC_z(1-2K)(\rho_{yz} - \rho_{xy}\rho_{xz}) \right\} \quad (4.2.3)$$

4.3-Mean Square Error (MSE):

Mean Square Error (MSE) can be obtained by taking expectation and to the 1st degree approximation

$$MSE(\bar{y}_{(2)RRP}) = \left[\begin{aligned} &\theta_2\bar{Y}^2C_y^2 - \bar{Y}^2C_y^2\rho_{xy}^2(\theta_2 - \theta_1) + \bar{Y}^2C_z^2(\theta_2 - \theta_1) + 4K^2\bar{Y}^2C_z^2(\theta_2 - \theta_1) \\ &+ 2\bar{Y}^2C_yC_z\rho_{yz}(\theta_2 - \theta_1) - 4K\bar{Y}^2C_yC_z\rho_{yz}(\theta_2 - \theta_1) \\ &- 2\bar{Y}^2C_yC_z\rho_{xy}\rho_{xz}(\theta_2 - \theta_1) + 4K\bar{Y}^2C_yC_z\rho_{xy}\rho_{xz}(\theta_2 - \theta_1) - 4k\bar{Y}^2C_z^2(\theta_2 - \theta_1) \end{aligned} \right] \quad (4.3.1)$$

Differentiating with respect to K and equating to zero we get

$$K = \frac{1}{2} + \frac{1}{2}\frac{C_y}{C_z}\rho_{yz} - \frac{1}{2}\frac{C_y}{C_z}\rho_{xy}\rho_{xz}$$

We get Mean Square Error (MSE) as follows

$$MSE(\bar{y}_{(2_N)RRP}) = \bar{Y}^2C_y^2 \left[\theta_2 - (\theta_2 - \theta_1) \left\{ \rho_{xy}^2 + (\rho_{yz} - \rho_{xy}\rho_{xz})^2 \right\} \right] \quad (4.3.2)$$

$$MSE(\bar{y}_{(2_N)RRP}) = \bar{Y}^2C_y^2 \left[\theta_2 \left(1 - \rho_{xy}^2 - (\rho_{yz} - \rho_{xy}\rho_{xz})^2 \right) + \theta_1 \left(\rho_{xy}^2 + (\rho_{yz} - \rho_{xy}\rho_{xz})^2 \right) \right] \quad (4.3.3)$$

4.4 Two-phase with Two Auxiliary Variables (Partial Information Case) ‘X’ is known:

Our proposed class of estimators for Two-phase sampling when information of one auxiliary variable ‘x’ is available and information about ‘z’ is unknown is given as

For two auxiliary variables our proposed RRP estimator is

$$\bar{y}_{(2)RRP} = \bar{y}_r \left\{ K\frac{\bar{z}_1}{\bar{z}_2} + (1-K)\frac{\bar{z}_2}{\bar{z}_1} \right\} \quad (4.4.1)$$

where $\bar{y}_{lr} = \bar{y} + b_{yx}(\bar{X} - \bar{x}_2)$

$$\bar{y}_{(2)RRP} = \left\{ \bar{y} + b_{yx}(\bar{X} - \bar{x}_2) \right\} \left\{ K \frac{\bar{z}_1}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{z}_1} \right\} \quad (4.4.2)$$

4.5 Bias:

Expressing the RRP estimator in terms of $\bar{\mathbf{E}}_S$, we have

$$\begin{aligned} \bar{y}_{(2)RRP} = & \left\{ \bar{Y} + \bar{\mathbf{E}}_{y_2} + (\beta_{yx} + \bar{\mathbf{E}}_b)(\bar{X} - \bar{\mathbf{E}}_{x_2}) \right\} \pi \left\{ K \left(1 + \frac{\bar{\mathbf{E}}_{z_1}}{\bar{Z}} \right) \left(1 + \frac{\bar{\mathbf{E}}_{z_2}}{\bar{Z}} \right)^{-1} \right. \\ & \left. + (1-K) \left(1 + \frac{\bar{\mathbf{E}}_{z_1}}{\bar{Z}} \right)^{-1} \left(1 + \frac{\bar{\mathbf{E}}_{z_2}}{\bar{Z}} \right) \right\} \end{aligned} \quad (4.5.1)$$

By taking the assumption that $\bar{\mathbf{E}}$ is very small and expanding $\left(1 + \frac{\bar{\mathbf{E}}_{z_1}}{\bar{Z}} \right)^{-1}$ and $\left(1 + \frac{\bar{\mathbf{E}}_{z_2}}{\bar{Z}} \right)^{-1}$

up to second degree, we obtain bias of above estimator as follows

$$\begin{aligned} Bias = E(\bar{y}_{(2)RRP} - \bar{Y}) = & \left\{ \begin{aligned} & -Cov(b_2, \bar{x}_2) + \frac{\bar{Y}\theta_1\bar{Z}^2C_z^2}{\bar{Z}^2} - K \frac{\bar{Y}\theta_1\bar{Z}^2C_z^2}{\bar{Z}^2} + K \frac{\bar{Y}\theta_2\bar{Z}^2C_z^2}{\bar{Z}^2} - \frac{\bar{Y}\theta_1\bar{Z}^2C_z^2}{\bar{Z}^2} \\ & - \frac{\theta_1\bar{Y}\bar{Z}C_yC_z\rho_{yz}}{\bar{Z}} + \frac{\theta_2\bar{Y}\bar{Z}C_yC_z\rho_{yz}}{\bar{Z}} + 2\frac{K}{\bar{Z}}\theta_1\bar{Y}\bar{Z}C_yC_z\rho_{yz} - 2\frac{K}{\bar{Z}}\theta_2\bar{Y}\bar{Z}C_yC_z\rho_{yz} \\ & + \frac{\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} - \frac{\beta\theta_2\bar{X}\bar{Z}C_xC_z\rho_{xz}}{\bar{Z}} - 2\frac{K}{\bar{Z}}\beta\theta_1\bar{X}\bar{Z}C_xC_z\rho_{xz} + 2\frac{K}{\bar{Z}}\beta\theta_2\bar{X}\bar{Z}C_xC_z\rho_{xz} \end{aligned} \right\} \end{aligned} \quad (4.5.2)$$

After some simplification we get

$$\begin{aligned} Bias = E(\bar{y}_{(2)RRP} - \bar{Y}) = & -\theta_2\bar{Y}C_yC_b\rho_{bx}\rho_{xy} \\ & + (\theta_2 - \theta_1) \left\{ K\bar{Y}C_z^2 + \bar{Y}C_yC_z(\rho_{yz} - \rho_{xy}\rho_{xz}) \right\} (1-2K) \end{aligned} \quad (4.5.3)$$

4.6 Mean Square Error (MSE):

Mean Square Error (MSE) can be obtained by taking expectation and to the 1st degree approximation

$$\begin{aligned} MSE(\bar{y}_{(2)RRP}) = & \left[\begin{aligned} & \theta_2\bar{Y}^2C_y^2 - \theta_1\bar{Y}^2C_y^2\rho_{xy}^2 + \bar{Y}^2C_z^2(\theta_2 - \theta_1) + 4K^2\bar{Y}^2C_z^2(\theta_2 - \theta_1) \\ & + 2\bar{Y}^2C_yC_z\rho_{yz}(\theta_2 - \theta_1) - 4K\bar{Y}^2C_yC_z\rho_{yz}(\theta_2 - \theta_1) \\ & - 2\bar{Y}^2C_yC_z\rho_{xy}\rho_{xz}(\theta_2 - \theta_1) + 4K\bar{Y}^2C_yC_z\rho_{xy}\rho_{xz}(\theta_2 - \theta_1) - 4k\bar{Y}^2C_z^2(\theta_2 - \theta_1) \end{aligned} \right] \end{aligned} \quad (4.6.1)$$

Differentiating with respect to K and equating to zero we get

$$K = \frac{1}{2} + \frac{1}{2} \frac{C_y}{C_z} \rho_{yz} - \frac{1}{2} \frac{C_y}{C_z} \rho_{xy}\rho_{xz}$$

We get Mean Square Error (MSE) as follows

$$MSE(\bar{y}_{(2)RRP}) = \bar{Y}^2 C_y^2 \left[\theta_2 (1 - \rho_{xy}^2) - (\theta_2 - \theta_1) (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right] \quad (4.6.2)$$

$$MSE(\bar{y}_{(2p)RRP}) = \bar{Y}^2 C_y^2 \left[\theta_2 (1 - \rho_{xy}^2 - (\rho_{yz} - \rho_{xy} \rho_{xz})^2) + \theta_1 (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right] \quad (4.6.3)$$

4.7 Two-phase with Two Auxiliary Variables (Partial Information Case) 'Z' is known:

Our proposed class of estimators for Two-phase sampling when information of one auxiliary variable 'x' is unknown and information about 'z' is available is given as

For two auxiliary variables our proposed RRP estimator is

$$\bar{y}_{(2)RRP} = \bar{y}_{lr} \left\{ K \frac{\bar{Z}}{\bar{z}_1} + (1-K) \frac{\bar{z}_1}{\bar{Z}} \right\} \quad (4.7.1)$$

where $\bar{y}_{lr} = \bar{y} + b_{yx} (\bar{x}_1 - \bar{x}_2)$

$$\bar{y}_{(2)RRP} = \left\{ \bar{y} + b_{yx} (\bar{x}_1 - \bar{x}_2) \right\} \left\{ K \frac{\bar{Z}}{\bar{z}_1} + (1-K) \frac{\bar{z}_1}{\bar{Z}} \right\} \quad (4.7.2)$$

4.8 Bias:

Expressing the RRP estimator in terms of $\bar{\mathbf{E}}\mathbf{S}$, we have

$$\bar{y}_{(2)RRP} = \left\{ \bar{Y} + \bar{\mathbf{E}}_{y_2} + (b_{yx} + \bar{\mathbf{E}}_b) (\bar{\mathbf{E}}_{x_1} - \bar{\mathbf{E}}_{x_2}) \right\} \left\{ K \left(1 + \frac{\bar{\mathbf{E}}_{z_1}}{\bar{Z}} \right)^{-1} + (1-K) \left(1 + \frac{\bar{\mathbf{E}}_{z_1}}{\bar{Z}} \right) \right\} \quad (4.8.1)$$

By taking the assumption that $\bar{\mathbf{E}}$ is very small and expanding $\left(1 + \frac{\bar{\mathbf{E}}_{z_1}}{\bar{Z}} \right)^{-1}$ up to second degree, we obtain bias of above estimator as follows

$$Bias = E(\bar{y}_{(2)RRP} - \bar{Y}) = \left\{ \text{cov}(b, \bar{x}_1) - \text{cov}(b, \bar{x}_2) + K \frac{\bar{Y}}{\bar{Z}^2} \theta_1 \bar{Z}^2 C_z^2 + \frac{\theta_1 \bar{Y} \bar{Z} C_y C_z \rho_{yz}}{\bar{Z}} (1-2K) \right\} \quad (4.8.2)$$

After some simplification we get

$$Bias = E(\bar{y}_{(2)RRP} - \bar{Y}) = \bar{Y} \left\{ K \theta_1 C_z^2 + \theta_1 C_y C_z \rho_{yz} (1-2K) - C_y C_b \rho_{bx} \rho_{xy} (\theta_2 - \theta_1) \right\} \quad (4.8.3)$$

4.9 Mean Square Error (MSE):

Mean Square Error (MSE) can be obtained by taking expectation and to the 1st degree approximation

$$MSE(\bar{y}_{(2)RRP}) = \left[\theta_2 \bar{Y}^2 C_y^2 + \beta^2 \bar{X}^2 C_x^2 (\theta_2 - \theta_1) + \theta_1 \bar{Y}^2 C_z^2 (1-2K)^2 + 2\beta \bar{X} \bar{Y} C_x C_y \rho_{xy} (\theta_1 - \theta_2) + 2\theta_1 \bar{Y}^2 C_y C_z \rho_{yz} (1-2K) \right] \quad (4.9.1)$$

Differentiating with respect to K and equating to zero we get

$$K = \frac{1}{2} + \frac{1}{2} \frac{C_y}{C_z} \rho_{yz} \quad (4.9.2)$$

We get Mean Square Error (MSE) as follows

$$MSE(\bar{y}_{(2)RRP}) = \bar{Y}^2 C_y^2 \left[\theta_2 (1 - \rho_{xy}^2) - \theta_1 (\rho_{yz}^2 - \rho_{xy}^2) \right] \quad (4.9.3)$$

The above estimator will be precise in that case when 2nd auxiliary variable is more correlated than 1st auxiliary variable to study variable.

4.10 Two-phase with Two Auxiliary Variables (Full Information Case):

Our proposed class of estimators for Two-phase sampling when information of both auxiliary variables 'x' and 'z' are available is given as

For two auxiliary variables our proposed RRP estimator is

$$\bar{y}_{(1)RRP} = \bar{y}_{lr} \left\{ K \frac{\bar{Z}}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{Z}} \right\} \quad (4.10.1)$$

where $\bar{y}_{lr} = \bar{y} + b_{yx} (\bar{X} - \bar{x}_2)$

$$\bar{y}_{(1)RRP} = \left\{ \bar{y} + b_{yx} (\bar{X} - \bar{x}_2) \right\} \left\{ K \frac{\bar{Z}}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{Z}} \right\} \quad (4.10.2)$$

4.11 Bias:

Expressing the RRP estimator in terms of $\bar{\mathbf{E}}\mathbf{S}$, we have

$$\bar{y}_{(2)RRP} = \left\{ \bar{Y} + \bar{\mathbf{E}}_{y_2} + (\beta_{yx} + \bar{\mathbf{E}}_b) (\bar{X} - \bar{\mathbf{E}}_{x_2}) \right\} \left\{ K \left(1 + \frac{\bar{\mathbf{E}}_{z_2}}{\bar{Z}} \right)^{-1} + (1-K) \left(1 + \frac{\bar{\mathbf{E}}_{z_2}}{\bar{Z}} \right) \right\} \quad (4.11.1)$$

By taking the assumption that $\bar{\mathbf{E}}$ is very small and expanding $\left(1 + \frac{\bar{\mathbf{E}}_{z_2}}{\bar{Z}} \right)^{-1}$ up to second degree, we obtain bias of above estimator as follows

$$Bias = E(\bar{y}_{(2)RRP} - \bar{Y}) = \theta_2 \bar{Y} C_y \left\{ C_z (\rho_{yz} - \rho_{xy} \rho_{xz}) (1 - 2K) - C_b \rho_{bx} \rho_{xy} \right\} \quad (4.11.2)$$

4.12 Mean Square Error (MSE):

Mean Square Error (MSE) can be obtained by taking expectation and to the 1st degree approximation

$$MSE(\bar{y}_{(1)RRP}) = \bar{Y}^2 \left[\theta_2 C_y^2 + \theta_1 \left(C_z^2 - C_y^2 \rho_{xy}^2 + 4K^2 C_z^2 - 4K C_z^2 + 2C_y C_z \rho_{yz} \right. \right. \\ \left. \left. - 4K C_y C_z \rho_{yz} - 2C_y C_z \rho_{xy} \rho_{xz} + 4K C_y C_z \rho_{xy} \rho_{xz} \right) \right] \quad (4.12.1)$$

Differentiating with respect to K and equating to zero we get

$$K = \frac{1}{2} + \frac{1}{2} \frac{C_y}{C_z} \rho_{yz} - \frac{1}{2} \frac{C_y}{C_z} \rho_{xy} \rho_{xz}$$

We get Mean Square Error (MSE) as follows

$$MSE(\bar{y}_{(1)RRP}) = \theta_2 \bar{Y}^2 C_y^2 \left[(1 - \rho_{xy}^2) - (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right] \quad (4.12.2)$$

When x_2 and z_2 are taken

$$MSE(\bar{y}_{(1)RRP}) = \bar{Y}^2 C_y^2 \left[\theta_2 - \theta_1 \left\{ \rho_{xy}^2 + (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right\} \right] \quad (4.12.3)$$

When x_1 and z_1 are taken

Efficiency Comparison:

Mean Square Error for Mean per unit in two phase sampling is

$$H_0 = \bar{y}_2$$

$$MSE(H_0) = \theta_2 \bar{Y}^2 C_y^2$$

In 2007 Singh and Espejo extended their work for Two-phase sampling

$$H_1 = \bar{y}_2 \left\{ k \frac{\bar{x}_1}{\bar{x}_2} + (1-k) \frac{\bar{x}_2}{\bar{x}_1} \right\}$$

$$MSE(H_1) = \bar{Y}^2 C_y^2 \left[\theta_2 (1 - \rho_{xy}^2) + \theta_1 (\rho_{xy}^2) \right]$$

For No information case when

$$H_2 = \bar{y}_{(2)RRP} = (\bar{y}_2 + b_{yx} (\bar{x}_1 - \bar{x}_2)) \left\{ K \frac{\bar{z}_1}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{z}_1} \right\}$$

$$MSE(H_2) = \bar{Y}^2 C_y^2 \left[\theta_2 \left(1 - \rho_{xy}^2 - (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right) + \theta_1 \left(\rho_{xy}^2 + (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right) \right]$$

For Partial information case When X is Known

$$H_3 = \bar{y}_{(2)RRP} = \left\{ \bar{y} + b_{yx} (\bar{X} - \bar{x}_2) \right\} \left\{ K \frac{\bar{z}_1}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{z}_1} \right\}$$

$$MSE(H_3) = \bar{Y}^2 C_y^2 \left[\theta_2 \left(1 - \rho_{xy}^2 - (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right) + \theta_1 (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right]$$

For Full information case

$$H_4 = \bar{y}_{(1)RRP} = \left\{ \bar{y} + b_{yx} (\bar{X} - \bar{x}_2) \right\} \left\{ K \frac{\bar{Z}}{\bar{z}_2} + (1-K) \frac{\bar{z}_2}{\bar{Z}} \right\}$$

$$MSE(H_4) = \theta_2 \bar{Y}^2 C_y^2 \left[(1 - \rho_{xy}^2) - (\rho_{yz} - \rho_{xy} \rho_{xz})^2 \right]$$

Clearly

$$\begin{aligned}MSE(H_1) &\leq MSE(H_o) && \text{by } \theta_2 \rho_{xy}^2 \\MSE(H_2) &\leq MSE(H_1) && \text{by } (\theta_2 - \theta_1)(\rho_{yz} - \rho_{xy}\rho_{xz})^2 \\MSE(H_3) &\leq MSE(H_2) && \text{by } \theta_1 \rho_{xy}^2 \\MSE(H_4) &\leq MSE(H_3) && \text{by } \theta_1(\rho_{yz} - \rho_{xy}\rho_{xz})^2\end{aligned}$$

For Partial information case When Z is Known

$$\begin{aligned}H_5 = \bar{y}_{(2)RRP} &= \{\bar{y} + b_{yx}(\bar{x}_1 - \bar{x}_2)\} \left\{ K \frac{\bar{Z}}{\bar{z}_1} + (1-K) \frac{\bar{z}_1}{\bar{Z}} \right\} \\MSE(H_5) &= \bar{Y}^2 C_y^2 \left[\theta_2(1 - \rho_{xy}^2) - \theta_1(\rho_{yz}^2 - \rho_{xy}^2) \right]\end{aligned}$$

Which is equal to Mean Square Error (MSE) of Srivastava et al. estimator i.e. (1990) given below

$$T_1 = \bar{y}_2 \left(\frac{\bar{x}_1}{\bar{x}_2} \right)^{\alpha_1} \left(\frac{\bar{Z}}{\bar{z}_1} \right)^{\alpha_2}$$

and also equal to Mean Square Error of Sahoo et al. (1993) given below

$$T_2 = \bar{y}_2 + b_{yx} \left[(\bar{x}_1 - \bar{x}_2) - b_{yz}(\bar{Z} - \bar{z}_1) \right]$$

So Srivastava et al. (1990) chain ratio estimator and Sahoo et al. (1993) regression in regression estimator are special cases of proposed class of partial information case when Z is known.

For Full Information case when first phase sample information are used then

$$\begin{aligned}\bar{y}_{(1)RRP} &= \{\bar{y} + b_{yx}(\bar{X} - \bar{x}_1)\} \left\{ K \frac{\bar{Z}}{\bar{z}_1} + (1-K) \frac{\bar{z}_1}{\bar{Z}} \right\} \\MSE(\bar{y}_{(1)RRP}) &= \bar{Y}^2 C_y^2 \left[\theta_2 - \theta_1 \left\{ \rho_{xy}^2 + (\rho_{yz} - \rho_{xy}\rho_{xz})^2 \right\} \right]\end{aligned}$$

REFERENCES

1. Ahmed, M.S. (1998). A Note On Regression-Type Estimators Using Multiple Auxiliary Information. *Austral. & New Zealand J. Statist.* 40(3), 373-376.
2. Cochran, W.G. (1977). *Sampling Techniques*. 3rd Ed., New York: John Wiley.
3. Diana, G. and Tommasi, C. (2003). Optimal estimation for finite population mean in two-phase sampling. *Statistical Methods & Applications*, 12, 41-48.
4. Dobson, A.J. (1990). *An Introduction to Generalized Linear Models*. 1st Edn (New York: Chapman & Hall).

5. Kiregyera, B. (1980). A Chain Ratio-Type Estimator in Finite Population Double Sampling using two Auxiliary Variables. *Metrika*, 27, 217-223.
6. Kiregyera, B. (1984). A Regression-Type Estimator using two Auxiliary Variables and Model of Double sampling from Finite Populations. *Metrika*, 31, 215-226.
7. Mohanty, S. (1967). Combination of regression and ratio estimate. *Journal of Indian Statistical Association*, 5, 16-19.
8. Neyman, J. (1938). Contribution to the Theory of Sampling Human Populations. *J. Amer. Statist. Assoc.* 33, 101-116.
9. Samiuddin, M. and Hanif, M. (2007). Estimation of population mean in single phase and two phase sampling with or with out additional informations. *Pak. J. Statist.*, 23(2), 99-118.
10. Singh, H.P. and Singh, R. (2002). A class of chain ratio-type estimators for the coefficient of variation of finite population in two phase sampling. *Aligarh J. Statist.*, 22, 1-9.
11. Singh, H.P. and Espejo, M.R. (2003). On linear regression and ratio-product estimation of a finite population mean. *The Statistician*, 52, 59-67.
12. Singh, H.P. and Espejo, M.R. (2007). Double Sampling Ratio-product estimator of a Finite Population Mean in Sample Surveys. *Journal of Applied Statistics*, 34, 71-85.

DATA MINING ON HEART DISEASES RECORD SAMPLING

Naveed Ahsan

University of South Asia, Lahore.
Email: naveedahsan2004@hotmail.com

ABSTRACT

The aim of this research Project is the evaluation of the analytical data about cardiological diseases from the Program to observe if the domain can be a subject to data mining. The research utilizes a data warehouse to store the information and that data was extracted from four different locations of clinics and hospitals. The performances of the data mining methods were measured with the use of confusion (classification) matrices. The medical knowledge has extracted based on the indications of the majority of the methods used in date mining. The experiments were conducted in the WEKA (Data mining Analytical Tool). The data mining methods were not unanimous about finding patterns in the data. Thus the medical knowledge is not certain and requires verification from the medical experts. In the future the outcomes may constitute a good background for development of a cardiological Decision Support System.

KEY WORDS

Cardiological Decision Support System, confusion matrices, WEKA, Patterns, Warehouse.

1. INTRODUCTION

The disease can be induced by a variety of factors such as age, depression, cholesterol, blood sugar and many others. Another problem are the social and psychological side effect of the disease and possible the death in the family.

2. DATA MINING

Data mining, also known as knowledge discovery in databases (KDD) is defined as “the extraction of implicit, previously unknown, and potentially useful information from data”. Research fields such as statistics and machine learning contributed greatly to the development of various data mining and knowledge discovery algorithms

3. FINDING RULES USING INDUCTIVE ALGORITHM

cp = 4 and oldpeak = '(1.7-inf)' and thal = 7 => num = 1.

restecg = 2 and ca = '(0.5-inf)' and thal = 7 => num = 1

age = '(-inf-54.5]' and sex = 0 and thal = 3 => num = 0 exang = 1 and oldpeak = (1.7-inf)
and thal = 7=>num = 1

age = '(-inf-54.5]' and sex = 0 and exang = 0 => num = 0

restecg = 2 and oldpeak = '(1.7-inf)' and ca =(0.5-inf) => num = 1.

exang = 1 and oldpeak =(1.7-inf) and ca =(0.5-inf) =>

num = 1.

age = '(-inf-54.5]' and sex = 0 and thalach = '(147.5-inf)' => num = 0.

sex = 0 and cp = 3 and thal = 3 => num = 0

sex = 0 and restecg = 0 and slope = 1 => num = 0

sex = 0 and cp = 3 and thalach = '(147.5-inf)' => num = 0. age = '(-inf-54.5]' and cp = 2
and thal = 3 => num = 0

age = '(-inf-54.5]' and sex = 0 and slope = 1 => num = 0

sex = 0 and cp = 3 and slope = 1 => num = 0

age = '(-inf-54.5]' and sex = 0 and cp = 3 => num = 0

sex = 0 and cp = 3 and ca = '(-inf-0.5]' => num = 0

cp = 2 and restecg = 0 and thal = 3 => num = 0

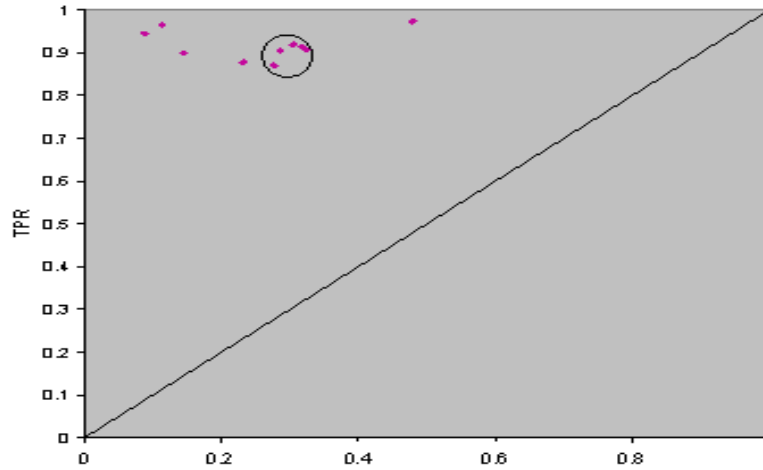
4. CLASSIFICATION

	Total # of instances	Size of Tree	No. of leaf nodes	Correctly classified Instances		Incorrectly classified Instances	
				Number	Percentage	Number	Percentage
M1	273	7	4	219	80.22	54	19.78
M2	273	41	21	254	93.04	19	6.96
M3	273	7	4	219	80.22	54	19.78
M4	273	5	3	210	76.92	63	23.08
M5	273	9	5	226	82.78	47	17.22
M6	273	53	27	254	93.04	19	6.96
M7	273	21	11	240	87.91	33	12.09
M8	273	7	4	223	81.69	50	18.31
M9	273	7	4	223	81.69	50	18.31
M10	270	7	4	219	81.11	51	19.89

We split the whole data into 10 subsets and one of the subset is use as test set and remaining 9 sets are used for building the

	TP rate	FP rate	Pre- cision	Recall	F- measure	T time
M1	0.870	0.276	0.784	0.870	0.817	0.55
M2	0.966	0.113	0.911	0.966	0.938	0.34
M3	0.906	0.323	0.771	0.906	0.833	0.28
M4	0.973	0.480	0.712	0.973	0.823	0.27
M5	0.878	0.232	0.818	0.878	0.847	0.27
M6	0.946	0.088	0.927	0.946	0.956	0.30
M7	0.899	0.145	0.882	0.899	0.890	0.28
M8	0.905	0.286	0.787	0.905	0.842	0.25
M9	0.919	0.306	0.783	0.919	0.846	0.25
M10	0.913	0.317	0.783	0.913	0.843	0.30
Mean	0.918	0.257	0.816	0.918	0.864	0.309

ROC OF TEST DATA

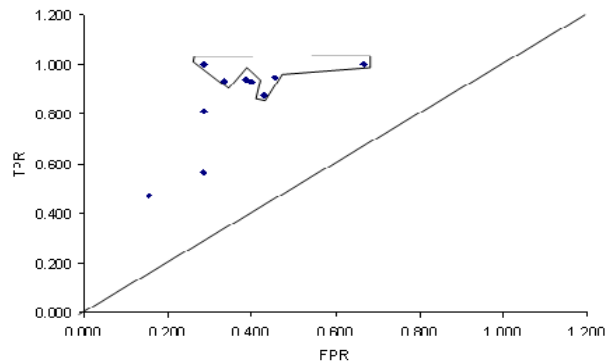


When these models are tested through their respected test sets, consequences are as follow

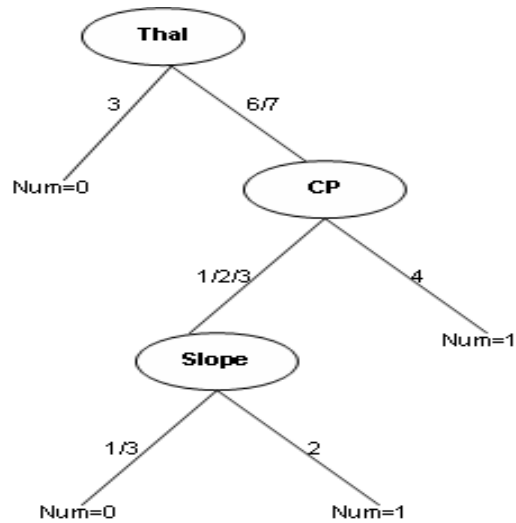
ROC OF CLASSIFIEDS DATA

	Total of instances	Correctly classified Instances		Incorrectly classified Instances	
		Number	%age	Number	%age
M1	30	24	80.0	6	20.0
M2	30	23	76.67	7	23.33
M3	30	26	86.67	4	13.33
M4	30	23	76.67	7	23.33
M5	30	24	80.00	6	20.00
M6	30	19	63.33	11	36.67
M7	30	19	63.33	11	36.67
M8	30	22	73.33	8	26.67
M9	30	22	73.33	8	26.67
M10	33	26	78.79	7	21.21

	TP rate	FP rate	Precision	Recall	F-measure	Time
M1	0.947	0.455	0.783	0.947	0.857	0.31
M2	0.813	0.286	0.765	0.813	0.788	0.28
M3	1.000	0.286	0.800	1.000	0.889	0.28
M4	0.933	0.400	0.700	0.933	0.800	0.28
M5	0.941	0.385	0.762	0.941	0.842	0.25
M6	0.471	0.154	0.8	0.471	0.593	0.28
M7	0.563	0.286	0.692	0.563	0.621	0.28
M8	1.000	0.667	0.692	1.000	0.818	0.25
M9	0.875	0.429	0.700	0.875	0.778	0.27
M10	0.933	0.333	0.700	0.933	0.800	0.28
Mean	0.848	0.368	0.739	0.848	0.779	0.276

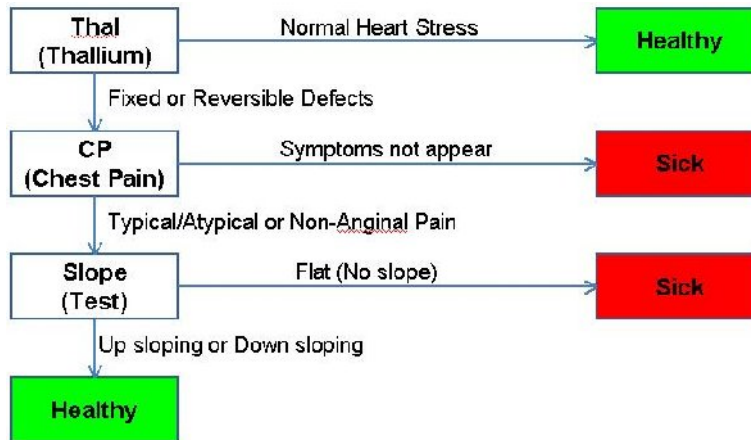


5. DECISION TREE



6. IMPORTANT FINDINGS

1. ECG resting result is most valuable for Diagnosis
2. If found abnormality in ECG and Reversible Defects of Thallium then any of the following things will confirm presence of Heart Disease
 - Not Showing Chest Pain Symptoms
 - Found Exercise induced angina
3. Females having Non-Anginal Chest Pain are out of danger if they have any of the following things
 - Normal Thallium Result.
 - Maximum Heart rate achieved
 - Age is less than 54



7. CONCLUSIONS

The main goal of the research was to first and foremost analyze the data from the surveys of four different cardiological hospital and clinics to judge whether it is suitable to be analyzed with the use of the data mining methods. The second step was to evaluate several data mining algorithm in terms of their applicability to this data. Finally, an attempt was made to deliver some tangible medical knowledge extracted by the methods. The next step of the research is to present the findings to the medical experts for verification. In the future the outcomes may constitute a good background for development of a Medical Decision Support System.

8. REFERENCES

1. <http://www.wrongdiagnosis.com>
2. <http://www.nationmaster.com>
3. http://www.mamashealth.com/Heart_stat.asp
4. National Vital Statistics Report (October 2004)

**MEASURING CUSTOMER SATISFACTION FROM
NOKIA MOBILE PHONES IN PAKISTAN**

Shoaib Nawaz and Sania Kanwal

Faculty of Business Administration and Management Sciences
Army Public College of Management Sciences, Rawaplindi.
Email: Shoaibnawaz.fl@gmail.com

Abstract

This study examines the effects of product quality and brand perception (two determinants) on customer satisfaction. This research also measured the customer's satisfaction provided by the Nokia mobile phone company in Pakistan. The findings establish a significant relationship between two determinants and customer satisfaction. The results show a positive and straight relationship among the selected determinants and customer satisfaction. Strategies addressing how to increase customer satisfaction have also been discussed in this study.

Keywords: Determinants, Customer Satisfaction, Strategies, Pakistan.

INTRODUCTION

The purpose of this research is to measure the over all customer satisfaction from Nokia mobile which occupies a good position in Pakistan. According to a survey now a day's Nokia mobile became very common and mostly people prefer to buy Nokia mobile due to its quality services. Nokia is a well known mobile phone company in Pakistan. This research shows that how much company is successful to provide the quality product to its potential and actual buyers and how much they are satisfied with its quality and brand perception. One could argue that customer satisfaction for mobile phone is likely to depend upon attribute like importance judgment related to the physical product (Goode et al. 2005).

This research identifies the relationship of customer satisfaction and its two important determinants (Brand Perception, product Quality). Customer satisfaction is a very important aspect known in marketing. The whole marketing efforts, a company does focus on the needs of customers which they want to satisfy. The most important assets of an organization are its customers. An organization's success depends on how much customers it has, how much they are satisfied. Customers that are satisfied will increase in number; buy more and more frequently (Besterfield et al.). The above lines show the importance of customer satisfaction in marketing strategies.

Brand perception is an other important determinant of customer satisfaction. The result shows the positive relationship between brand perception and customer satisfaction. According to Robbins and Sanghi (2006), people selectively interpret what they see on the basis of their interests, backgrounds, experience and attitudes. Nokia has

good brand image in the consumer mind. Nokia created a good brand perception through quality services, advertisements and desirable performance of Nokia. Nokia mobile packaging, labeling, colors and other desirable features also create good perception in the consumers mind. The customers become more satisfied when brand create good perception in the mind of users.

Product quality is another most important determinant of customer satisfaction. Result shows highly positive relationship between product quality and customer satisfaction. Quality of the product is key determinants of measuring the customer satisfaction. According to Deming (1988), costs go down and productivity goes up, as improvement quality is accomplished by better management of design, Engineering, testing and by improvement of processes. Nokia capture good market in Pakistan because it provides the better quality at lower price. Nokia products are very well known among the customer due to his quality; therefore people are mostly purchase the Nokia mobile phone in Pakistan. The quality of the Nokia products make the customer more satisfied then other. Besterfield et al. argue, customers that are satisfied will increase in number, buy more, and buy more frequently.

LITERATURE REVIEW

Customer Satisfaction:

It can be defined as, the degree of customer commitment towards the current cellular phone services provider (Sharma & Ojha, 2004). Satisfied customer are always more loyal (Verhoef & Langerak, 2002). Service provider build up and maintained relationship with customer through mutual trust, understanding and cooperation (Kiely, 2005). Interaction justice has primarily be explored in customer satisfaction studies when services failure has occurred (Severt, 2002). Improving customer satisfaction was been a key to achieving the group's business strategy of remaining competitive and achieving moderate growth (Hutchinson, Purcell & Kinnie, 2004). Severt (2002) has argued that distributive justice showed the largest total effect and highest predictive power on overall justice and was significant related to customer satisfaction. Total quality program to improve customer satisfaction (Verhoef & Langerak, 2002). The service criterion for individual customer and the access criterion for business customers should also be considered for improvement (Girigoroudis et al. 2002). The loyalty of some customers is primarily driven by satisfaction (Verhoef & Langerak, 2002). Services quality evaluation is implemented through customer satisfaction measurement (Girigoroudis et al. 2002). When customer satisfaction and retentions are strategies imperatives, manufacturers should strive to become close partners with their representatives (Brown & Chini, 2004). Service quality directly predicts customer satisfaction and indirectly predicts customer outcomes such as loyalty (Subramoney, 2004). Employees' satisfaction and experience were significant predictors of customer satisfaction (Moshavi, 2004). Voice of customer would significant impact on customer satisfaction (stank & et al. 1997). Verhoef and Langerak (2002) has argued that software will improve directly their marketing performance as well as customer satisfaction. Providing even anticipating desired services also help more customers along curve for customer satisfaction to the coveted terrain of customer loyalty (Brechtuh, 2003). Involvement with a product is significantly related to consumer satisfaction (Khouja, 2006).

Product Quality:

Quality can be defined as the degree of excellence a product or services provide (Besterfield et al. 2006). Primarily quality is defined by pretzel moisture content, color and texture (Yao et al. 2004). Nokia is by far the most popular due to quality of the product (Goode et al. 2005). Prices are seen as an indicator of product quality (Schott, 2006). When adopting new mobile phone users were under the impression that they would enjoy a upgrade in service level or quality (Jarvenapaa & Lang, 2005). Negative experience of product quality is most important contributor to dissatisfaction (Goode et al.). Service or quality performance in mobile phone communication has three distinct constituents, network based performance, retailer related process and network operator related process performance (Sharma & Ojha). The relationship of product quality and customer satisfaction is to complex (Severt, 2002). Manufactures must strive to improve features and build quality so that they can improve customers experience with mobile phone (Goode et al. 2005).

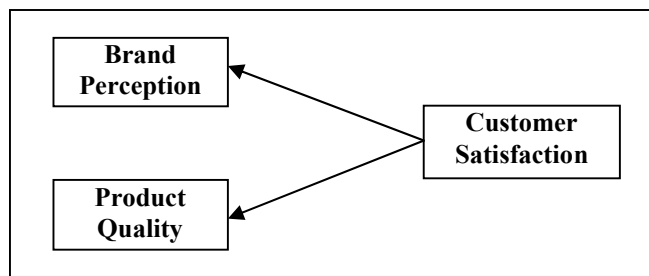
H-1: We hypothesis that the product quality has a positive and significant correlation with customer satisfaction.

Brand Perception:

Perception can be defined as, a process by which individuals organize and interpret their sensory impressions in order to give meaning to their environment (Robins and sanghi, 2006). In order to create perception to buy their brand, marketer focus not only on improving performance but also taking into account the strategies of competing brand in marketplace (Laroche et al. 2001). Perceived product value should have an impact on customer loyalty, range of products purchased, and amount spent (Leung, Lr & Au, 1998). Socialization influences on brand consciousness (Nelson & Mcleod, 2005). Brand/quality effects resulting from outsourcing to a reputable supplier reflect Consumer's perception about final products made by different firms (Xiao, Xia, and Zhang, 2007). A brand quality evaluation is implemented through customer satisfaction measurement and depends on customer judgment and perception (Grigoroudis & Siskos, 2002). Brand-conscious teens also perceived greater effects of product placement on their own purchasing behaviors as well as those behaviors of their friends and other adolescents (Nelson & Mcleod, 2005). The customer may have perception of the model's validity and this is important to their overall quality assessment (Robinson, 1998). Formal feedback appears to facilitate more favorable perceptions of performance (Stank et al. 1997). A single measure cannot effectively indicate the perceptions of customers in regards to the performance of the cellular phone service provider (Sharma & Ojha, 2004). Emotion is far more than a match between perceived and actual service on the part of consumer (Kiely, 2005). Price quality evolution of competing brands have an impact on consumer attitudes and intentions toward a focal brand ((Laroche et al. 2001). expectations and performance perceptions drive customer satisfaction/dissatisfaction in cellular phone services industry (Sharma & Ojha, 2004).

H-2: After literature review we assume that brand perception has a positive and significant relation with customer satisfaction.

THEORETICAL FRAMEWORK



The variance in the dependent variable, customer satisfaction can be explained by the two independent variables, product quality and brand perception. Above diagram showed that product quality and brand perception highly depends on customer satisfaction.

METHOD SECTION

Study Design:

In this study, data on two independent variables and the dependent variable were collected from different people included male and female in mobile phone sector. For this purpose, more than one hundred questionnaires have been used and got different responses from different people.

Population and Sample:

The population for the study comprised mobile users in the country. For this a systematic sampling procedure was first used to select different places in the city from which a sample of mobile users has drawn. Then, through a simple random sampling procedure, five different places were selected for data collection. From sample size of 150, 100 responses were received. The unit of analysis was the individual who respond to the survey. All respondents had expected satisfaction level. Their ages ranged from 18 to 56.

Demographics Data:

Mobile phones are growing rapidly in Pakistan. If we see five to ten years back, cell phones were used very rarely in Pakistan but now a day's there are millions of people use the mobile phone. The research conducted this survey with the help of the questionnaires from the following demographic data related to gender, age and qualification.

		Frequency	%
Age	16-24	85	85.9
	25-33	13	13.1
	43-above	2	2.0
Education	Metric	6	6
	Inter	21	21
	Graduate	50	50.5
	Masters	22	22.5
Gender	Male	53	53.5
	Female	46	46.5

There are total one hundred respondents in which the frequency range of male respondents 53.5% and the frequency range of female respondents are 46.5%. According to the survey results, the frequency of males was more than females because males were more frequently using the mobile phone. Questionnaires were distributed among the different age of respondents. This research mostly focused the young generation because young people mostly use the mobile phone. Therefore the frequency range was 85 between 16 years to 24 years. Mostly young people show the satisfaction from Nokia mobile phone. The percentage among 25 years to 33 years respondents was 13.1%. Then above from 43 years were only two respondents that show the neutral satisfaction with Nokia brand.

All respondents had different qualification like metric, intermediate, Graduates and Post Graduates. The frequency between metric and intermediate was relatively 6 and 21. Then the frequency range between graduates and post graduates were relatively 50 to 22. The accumulative percentage between all mobile users qualification were 100%.

Data collection method

Questionnaires were distributed among 150 mobile users in Pakistan. After two reminders, 100 completed questionnaires were received within a period of only two weeks. The high return rate of 80% can be attributed to the resource shortness and perhaps the motivation of mobile user to respond to topic close to their heart.

Data Analysis and Result:

After measuring the customer satisfaction through different sample and also obtained the overall frequency distribution for the demographics variables. Then a correlation matrix was obtained from one dependent and two independent variables.

Correlations Analysis:

	Means	St.Deviation	Customer satisfaction	Product quality	Brand perception
Customer satisfaction	2.3368	.48346	1		
Brand perception	2.4150	.850009	.479(**)	1	
Product Quality	2.2115	.64010	.261(*)	.874(**)	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The positive correlation of 0.47 ($p < .001$) between product quality and customers satisfaction showed that respondents were satisfied with Nokia product quality and quality have 47% share in the development of customer satisfaction. It also showed the highly significance ($p < .001$) between dependent and independent variable. The positive correlation of 0.26 ($P < .001$) between two variables such as Nokia brand perception and customer satisfaction showed that people were highly satisfied from Nokia brand, but it have relatively less share than quality. Our findings also showed that both variables are highly significant at $p < .001$. This significance showed that if the brand image creates good perception in the consumer mind then customer becomes satisfied but the other variable (Quality) can have high impact to develop satisfaction. Consumers mostly generate this perception from his five senses. If the brand perception in the consumer's mind is poor then customer will less attract towards the product. Yu Hong (2002) argued

that perception in the consumer mind Perception of product at-purchase performance and their expectation for future performance were significantly related to their satisfaction with the product quality.

Regression Analysis:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.580(a)	.336	.320	2.54705

Predictors: (Constant), VAR00003, VAR00002

The first table in the output list the three dependent and independent variables that are entered into the regression model and R (0.580) is show the correlation of the three independent and dependent variables After all the Interco relation among the three variables are taken into account. R square (0.336) which is explained variable is actually of the multiple R (0.580). The results shows that 32% of the variables (R-square) in intention to leave has been significant explained by three dependent and independent variables. The findings of three variable shows that if Nokia provide good quality and create a good perception in the consumer mind then customer become more satisfied. This is the key point of regression findings, got overall positive result from dependent and independent variables. There is no negative value of findings in above diagram.

Regression Table:

#	Variables	B	T	Sig.
1	Customer Satisfaction	1.003	.448	.655
2	Product Quality	7.377	5.758	.000
3	Brand Perception	5.052	3.629	.000

A Dependent Variable: VAR00001

The satisfaction items significantly correlated to each other (r was 0.87 at 0.05 level). The two Variables have positively and significantly affected satisfaction level of the customer. The standardized regressions coefficients for Nokia mobile phone customer satisfaction, product quality and brand perception were 1.003, 7.377 and 0.052 respectively, ($p < 0.001$). These points of the regression show the impact of product quality and brand perception on customer satisfaction. In the above diagram the value of Beta (B) shows the very strong impact of product quality on customer satisfaction. The positive value of brand perception also shows the very strong impact on customer satisfaction.

DISCUSSION

This research measured the overall customer satisfaction from Nokia mobile phone. Therefore the selected independent variables, product quality and brand perception, have positive and strong impact on dependent variable. This research indicates the strong relationship between dependent and independent variables. It also showed the positive correlation between customer satisfaction and product quality was 0.47, but 0.66 was the value found by Goode et al. (2005), that showed the very strong correlation between product quality and customer satisfaction. My findings do not match with base article because that research was conducted in America and almost more than 200

questionnaires were used to find the correlation between dependent and independent variables.. The value between customer satisfaction and product quality is 0.47(**), which is less than from base article because the sample size of research was less than one hundred. Goode et al. (2005) findings showed the value of Nokia brand perception was 0.10 that brand perception have low impact over the customer satisfaction but findings of this research is 0.26(*) showed bit high impact of perception on customer satisfaction. In Pakistan the people are more satisfied from Nokia mobile phones because Nokia create a strong brand image in the consumer mind. It also creates good perception in the consumer mind through Electronic media, billboards, newspapers and magazines.

IMPLICATIONS

The over all level of the customer satisfaction from mobile phone appears to be determined from two important factors like experience with product quality and brand perception. The experience with product quality is important to develop the feelings of satisfaction provided by any mobile phone. The people purchase Nokia more frequently and highly preferred the Nokia products due to its quality but they can improve product quality if they provide some added features, desirable services, durability and aesthetics. The Nokia mobile phones are well known in Pakistan due to their high product quality and strong brand perception. Perception is very important factor because it creates brand image in the consumer mind. The mobile phones are growing very rapidly in Pakistan and emerging a large number of competitors. So in future brand manager of Nokia should be improve product quality and also launch effective campaigns that create good image in the consumer mind. Brand manager should use very upcoming technology to increase the effectiveness of product. Prices of mobile phone have a deep effect on customer satisfaction. If prices will be low the people purchase the Nokia mobile phone more frequently. If the quality of the mobile is exceptional then the customer are more satisfied and they purchase the mobile phone more frequently. Brand image, product quality and effective ad create good perception in the consumer mind and that perception lead to consumer toward more satisfaction, if the perceptions in the consumer mind is doubtful then it might be lead towards dissatisfaction.

ACKNOWLEDGEMENTS

I would like to thank my beloved teacher Mr. Sajid Bashir who gave me excellent constructive advice on an earlier draft for this article, which improved my skills in Research.

REFERENCES

1. Besterfield, D., Michna, C., Besterfield, G. and Sacre, M. (2006). *Total Quality Management*. Prentice-Hall.
2. Brechbuh (2004). Best Practice for Services Organization. *Business Strategy Review*, 15(1).
3. Crozet and Rousse (2004). Trade Performances, Product Quality Perceptions, and the Estimation of Trade Price Elasticities. *Review of International Economics*, 12(1), 108-129.

4. Fox, Marsh and Cockerham (2002). How Building Design Imperatives Constrain Construction Productivity and Quality. *Engineering, Construction and Architectural Management* 9, 5/6, 378-387.
5. Goode, Fiona, Moutinho and Ahmad Jamal (2005). Customer Satisfaction from Nokia Mobile Phone. *Journal of Marketing Management*, 25, 755-778.
6. Jarvenpaa and Lang (2005). *Managing the Paradoxes of Mobile Technology*. www.ism-journal.com.
7. Joshi and Rai (2000). Impact of the Quality Information Products on Information System Users, Job Satisfaction: An Imparcial Investigation. *Info System J.*, 10, 323-345
8. Khouja (2005). The Use of Minor Setups Within Production Cycles to Improve Product Quality and Yield. *Intl. Trans.* 12, 403-416.
9. Lee and Benbasat (2004). A Framework for the Study of Customer Interface Design for Mobile Commerce. *International Journal of Electronic Commerce*, 8, 79-102.
10. Leinbach and Brunn (2001). National Innovation System, Firm Strategy and Enabling Mobile Communication: The Case of Nokia", *Tijdschrift Vero Icon mische an Sociale Geographic*, 93, 489-508.
11. Lipscomb, Totted, Cook and Lesch (2007). Cellular Phone Etiquette Among College Students. *International Journal of Consumer Studies*, 21, 46-56.
12. Morghan and Vorhies (2001). Product quality Alignment and Business Unit Performance. *The Journal of Product Innovation Management*, 18, 396-407.
13. Moshavi (2005). He Said, She Said: Gender Bias and Customer Satisfaction With Phone-Based Service Encounters. *Journal of Applied Social Psychology*, 1, 162-176.
14. Puuronen and Savolainen (1997). Mobile Information System Executive View. *Info System J.*, 7, 3-20
15. Robbins, S. and Sanghi, S. (2006). *Organizational Behavior*. Prentice-Hall.
16. Robinson (1998). Measuring Service Quality in the Process of Delivering a Simulation Study: The customer Perspective. *Int. Trans. Opl. Res.*, 5, 357-373.
17. Sharma and Ojha (2004). Measuring Service Performance Mobile Communications. *The Service Industries Journal*, 24, 109-128.
18. Stank, Daugherty, and Ellinger (1997). Voice of the Customer: The Impact on Customer Satisfaction. *International Journal of Purchasing and Materials*
19. Tibery et al. (2001). Quality, Imagery and Marketing: Producer and Percipetives on Quality Products and Services in lagging Rural Regions of the European Union. *Union Geogy. Ann.*, 83, 27-44.
20. Tsiotsou (2005). The Role of Perceived Product Quality and Overall Satisfaction on Purchase Intentions. *International Journal of Consumer Studies*, 207-217.
21. Yul and Hong (2002). Antecedents and Consequences of Consumer Satisfaction/ Dissatisfaction with the Performance of Apparel Products at Purchase and after Consumption: A Comparison. *International Journal of Consumer Studies*, 26, 117-127.

ESTIMATION METHODS OF KUMARASWAY DISTRIBUTION

M. Shuaib Khan¹, G.R. Pasha² and Ahmed Hesham Pasha³

¹ Department of Statistics, The Islamia University of
Bahawalpur. Email: skn_801@yahoo.com

² Department of Statistics, Bahauddin Zakariya University
Multan. Email: drpasha@bzu.edu.pk

³ Department of Electrical Engineering, Bahauddin Zakariya
University Multan. Email: hesham01@gmail.com

ABSTRACT

This article presents the estimation methods of Kumarasway distribution. The two parameter Kumarasway distribution was introduced by *Kumaraswamy (1980)*. We presented the Kumarasway distribution is the sum of infinite probability function. Moment estimation, inverse integer moment estimation and maximum likelihood estimation are derived for this infinite probability function.

KEY WORDS

Kumarasway distribution, Sum of infinite probability function, Moment estimation, maximum likelihood estimation.

1. INTRODUCTION

This paper presents the relationship between shape parameter and other properties such as probability function, cumulative distribution function, reliability function, hazard function, cumulative hazard function, r_{th} moment estimation, Inverse integer moment estimation are presented. Some works has already been done on Kumarasway probability distribution by *Kumaraswamy (1980)* in his article "A generalized probability density function for double-bounded random processes". Some work is done by *Fletcher and Ponnambalam (1996)* in his article "Estimation of reservoir yield and storage distribution using moment's analysis". The Kumarasway distribution approaches to the Beta distribution when $\alpha=1$. But in this paper we have derived the Kumarasway distribution is the sum of infinite probability function for different methods of estimation.

2. KUMARASWAY PROBABILITY DISTRIBUTION

The Kumarasway probability distribution has two parameters α, β . It can be used to represent the infinite probability density function (PDF) is given by:

$$f_{KW}(x) = \alpha\beta x^{\alpha-1} \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m (x^{\alpha m})}{m!}, \alpha > 0, \beta > 0, x > 0 \quad (2.1)$$

where α, β both are the shape parameters representing the different pattern of the Kumarasway distribution PDF.

The cumulative distribution function (CDF) of Kumarasway probability distribution is denoted by $F_{KW}(x)$ and is defined as

$$F_{KW}(x) = 1 - \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m (x^{\alpha m})}{m!} \quad (2.2)$$

The reliability function (RF), denoted by $R_{KW}(x)$ is also known as the survivor function and is defined as $1 - F_{KW}(x)$

$$R_{KW}(x) = \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m (x^{\alpha m})}{m!} \quad (2.3)$$

The hazard function (HF) is also known as instantaneous failure rate denoted by $h_{KW}(x)$ and is defined as $f_{KW}(x) / R_{KW}(x)$

$$h_{KW}(x) = \alpha\beta x^{\alpha-1} \quad (2.4)$$

The cumulative hazard function (CHF), denoted by $H_{KW}(x)$ and is defined as

$$H_{KW}(x) = \beta x^{\alpha} \quad (2.5)$$

3. rth MOMENT ESTIMATION

The rth moment of Kumarasway distribution about origin is given by

$$\mu'_r = \int_0^{\infty} \alpha\beta x^{r+\alpha-1} \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m (x^{\alpha m})}{m!} dx \quad (3.1)$$

The above reliability model will provide the rth moment of Kumarasway distribution

$$\text{is } \mu'_r = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+r)+1}, \quad r = 1, 2, 3, 4 \quad (3.2)$$

The special cases of these rth moments of Kumarasway distribution are

$$\mu'_1 = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+1)+1} \quad (3.2a)$$

$$\mu'_2 = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+2)+1} \quad (3.2b)$$

$$\mu'_3 = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+3)+1} \quad (3.2c)$$

$$\mu'_4 = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+4)+1} \quad (3.2d)$$

The variance, skewness and kurtosis measures can now be calculated for the r th moments about mean of Kumarasway distribution using the relations

$$Var(x) = E(x^2) - (E(x))^2$$

$$Skewness(x) = \frac{E(x^3) - 3E(x)E(x^2) + 2(E(x))^3}{\left(E(x^2) - (E(x))^2\right)^{\frac{3}{2}}}$$

$$Kurtosis(x) = \frac{E(x^4) - 4E(x)E(x^3) + 6E(x^2)(E(x))^2 - 3(E(x))^4}{\left(E(x^2) - (E(x))^2\right)^2}$$

4. INVERSE r th MOMENT ESTIMATION

The Inverse r th moment estimation of Kumarasway distribution about origin is given by

$$\mu'_{r-1} = \int_0^{\infty} \alpha\beta x^{\alpha-r-1} \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m (x^{\alpha m})}{m!} dx \quad (4.1)$$

The above reliability model will provide the inverse r th moment of Kumarasway distribution is

$$\mu'_{r-1} = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+1)-r}, \quad r = 1, 2, 3, 4 \quad (4.2)$$

The special cases of these inverse r th moments of Kumarasway distribution are

$$\mu'_{1-1} = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+1)-1} \quad (4.2a)$$

$$\mu'_{2-1} = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+1)-2} \quad (4.2b)$$

$$\mu'_{3-1} = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+1)-3} \quad (4.2c)$$

$$\mu'_{4-1} = \alpha\beta \sum_{m=0}^{\infty} \frac{\Gamma\beta}{\Gamma(\beta-m)} \frac{(-1)^m}{m!} \frac{1}{\alpha(m+1)-4} \quad (4.2d)$$

The variance, skewness and kurtosis measures can now be calculated for the Inverse r th moments about mean of Kumarasway distribution using the relations

$$Var(x^{-1}) = E(x^{-2}) - (E(x^{-1}))^2$$

$$Skewness(x^{-1}) = \frac{E(x^{-3}) - 3E(x^{-1})E(x^{-2}) + 2(E(x^{-1}))^3}{\left(E(x^{-2}) - (E(x^{-1}))^2\right)^{\frac{3}{2}}}$$

$$Kurtosis(x^{-1}) = \frac{E(x^{-4}) - 4E(x^{-1})E(x^{-3}) + 6E(x^{-2})(E(x^{-1}))^2 - 3(E(x^{-1}))^4}{(E(x^{-2}) - (E(x^{-1}))^2)^2}$$

5. MAXIMUM LIKELIHOOD ESTIMATION

We consider estimation by the method of maximum likelihood for the Kumarasway distribution. The log likelihood for a random sample x_1, x_2, \dots, x_n from (2.1) is given by

$$\log L(\alpha, \beta) = n \log \alpha + n \log \beta + (\alpha - 1) \sum_{i=1}^n \log x_i + (\beta - 1) \sum_{i=1}^n \log(1 - x_i^\alpha) \quad (5.1)$$

The first order derivatives of (5.1) with respect to the two parameters are

$$\frac{\partial \log L}{\partial \beta} = \frac{n}{\beta} + \sum_{i=1}^n \log(1 - x_i^\alpha) \quad (5.2)$$

$$\frac{\partial \log L}{\partial \alpha} = \frac{n}{\alpha} + \sum_{i=1}^n \log x_i - (\beta - 1) \sum_{i=1}^n \frac{x_i^\alpha \log x_i}{1 - x_i^\alpha} \quad (5.3)$$

By setting these expressions equal to zero in (5.2) and (5.3), then solving them simultaneously yield the maximum likelihood estimates of the two parameters. The Minimum Variance Bound (MVB) for the Kumarasway distribution is

$$-E \left(\frac{\partial^2 \log L}{\partial \beta^2} \right) = \frac{n}{\beta^2} \quad (5.4)$$

$$-E \left(\frac{\partial^2 \log L}{\partial \beta \partial \alpha} \right) = \frac{-n}{\alpha^2 (m+2)^2} \quad (5.5)$$

$$-E \left(\frac{\partial^2 \log L}{\partial \alpha^2} \right) = \frac{n}{\alpha^2} + \frac{2\beta(\beta-1)}{\alpha^2} \sum_{m=0}^{\infty} \frac{\Gamma(\beta-2)}{\Gamma(\beta-m-2)} \frac{(-1)^m}{m!} \frac{1}{(m+2)^3} \quad (5.6)$$

Using (5.4), (5.5) and (5.6) we can find the minimum variance bound. By using these equations we can also find the fisher information matrix for finding the variances of these parameters.

REFERENCES

1. Kumaraswamy, P. (1980). A generalized probability density function for double-bounded random processes. *Journal of Hydrology*. 46: 79-88.
2. Fletcher, S.G., and Ponnambalam, K. (1996). Estimation of reservoir yield and storage distribution using moments analysis. *Journal of Hydrology*. 182: 259-275.
3. Liu, Chi-chao, (1997). *A Comparison between the Weibull and Lognormal Models used to Analyze Reliability Data*. University of Nottingham, UK.
4. Raqab, M.Z. (2002). Inferences for generalized exponential distribution based on record statistics. *J. Statist. Plann. Inference*. 104(2), 339-350.

**ARCH-M MODEL FOR BENCHMARK INDEX OF
PAKISTAN STOCK MARKET**

Samreen Fatima

NU-FAST, Karachi Campus, Karachi
Email: sf_qudduss@yahoo.com

ABSTRACT

The aim of this paper is to predict daily share price index of KSE-100 index using ARCH-M model. Much efforts have been done on the modeling of financial time series both theoretically and empirically for the international markets like; Asia, Europe etc. There is not very frequent research happening for Indian and Pakistani stock markets. The KSE-100 index is the benchmark index of Pakistan gained attention of investors and financial researchers for the last few years. In 2002, Karachi Stock Exchange declared as the “Best Performing Stock Market of the World” by “Business Week”. In this study we used Autoregressive Conditional Heteroskedasticity-in-mean model (ARCH-M) for forecasting KSE-100 index. Parameters of ARCH-M model were estimated using Marquardt algorithm. Forecasting performance of the estimated model was evaluated by forecast root mean square error.

KEYWORDS

Autoregressive Conditional Heteroskedasticity-in-mean model (ARCH-M), Karachi Stock Exchange (KSE) and Forecast Mean Square of error (FMSE).

1. INTRODUCTION

Predicting a financial series, such as stock market index and exchange rates etc. remains a very difficult task for the researchers and market practitioner because Stock Market provides dimension of investment opportunity for both individual and institutional investor. Many conventional time series and econometric models are applicable for constant variance. Much progress has been done on the modelling of financial time series both theoretically and empirically for the developed markets such as; Europe (for example UK, Switzerland, Germany, Turkish Spain and Italy stock markets), similarly United States, Latin America, Eastern and Central Europe and Asia etc. There is not very frequent research happening for bench mark index of Pakistan stock market; KSE-100 index. ANN model gave better forecasting performance as compared to GARCH and ARIMA models for KSE-100 index (daily share price data) by Samreen et al. (2001). Hybrid system of ANN_{ARCH/GARCH} was superior to simple ANN and ANN_{ARIMA} in forecasting for the same period of KSE-100 index daily share price data by Samreen et al. (2006 & 2008). Samreen et al. (2007) used APARCH to predict KSE-100 index using Maximum Likelihood (Marquardt and Berndt, Hall, Hall, and Hausman (BHHH)) method, with Gaussian and, Student's t distributions.

The outline of this paper is as follows. Section 2 is the brief introduction of ARCH-M model. Section 3 describes briefly introduction of Karachi Stock Market and data analysis. Section 4 deals with conclusion.

2. ARCH-IN-MEAN MODEL

The Auto Regressive Conditional Heteroskedasticity (ARCH) model introduced for modelling inflationary uncertainty of financial time series by R.F.Engle et al. in 1982 and further extended by T. Bollerslev (1986), R.F.Engle, et al. (1987) and L.R.Golsten, et al. (1993).

ARCH model deals with conditional variance, which is the linear function of q lags of the squares of the error terms and a constant term α_0 . ARCH (q) model is defined as:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 \quad (1)$$

ARCH-M model is the most recent development in the ARCH family, proposed by Engel et al. (1987), in which conditional mean is the implicit function of the conditional variance process. ARCH-M model is commonly used in those financial applications where the expected return on an asset is related to the expected asset risk.

The ARCH-M (1,1) model can be written as:

$$\begin{aligned} y_t &= \mu + \alpha y_{t-1} + \beta \sigma_t^2 + \varepsilon_t \quad (2) \\ \varepsilon_t &= z_t \sigma_t \\ \sigma_t^2 &= \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 \end{aligned}$$

where μ , α and β are constants. The parameter β is called the risk parameter, a negative value of β shows highly risk in return as compare to positive value of β .

Two variants of this ARCH-M specification use the conditional standard deviation or the log of the conditional variance in place of the variance in Equation (2). In order to evaluate the forecasting performance of the model mean absolute percentage error is used.

3. INTRODUCTION OF KSE

The Karachi Stock Exchange came into existence on September 18,1947. It was later converted and registered as a company limited by guarantee on March 10, 1949, Initially only 5 companies were listed with a paid up capital of Rs.37 million. Today Karachi Stock Exchange is the key institution in the financial sector of Pakistan and called benchmarked index of Pakistan Stock Market. On November 1, 1991 the KSE-100 introduced and remains to this date the most generally accepted measure of the Exchange. The KSE-100 is a capital weighted index and consists of 100 companies representing about 90 percent of market capitalization of the Exchange. In 2001, it attained 1,770 points and declared as the "Best Performing Stock Market of the World" by the "Business Week" and in 2005, it skyrocketed to 9,989 points. Foreign buying interest was very active on the KSE in 2006 and has continued in 2007 so far. In February 2007, it

then reached a peak of 12,285, KSE-100 index touched the highest ever benchmark of 14,814 points on December 26, 2007, a day before the assassination of former Prime Minister Benazir Bhutto, when the index nosedived. KSE has seen some fluctuations since the start of 2008 due to election. KSE has set an all time high of 15,000 points, before settling around the 14,000 mark see for more detail wikipedia.

3.1 Data And Methodology

The data used in the study is closing price of KSE-100 index from 1st January, 2004 to 15th February, 2008. The data is available on daily basis at the world wide web of www.kse.com.pk. We used 1st January 2004 to 31st January 2008 data for model building and from 1st February, 2008 to 15th February, 2008 for testing the estimated model. Closing price of KSE-100 index is shown in figure1 clearly exhibits nonstationary and radomcity in data. To test for stationary, the daily returns are calculated as:

$$r_t = \ln\left(\frac{p_t}{p_{t-1}}\right) * 100$$

where p_t is current closing price of index and p_{t-1} is the closing prise of the previous day.



Fig. I. Graph of KSE100 index daily closing price data.

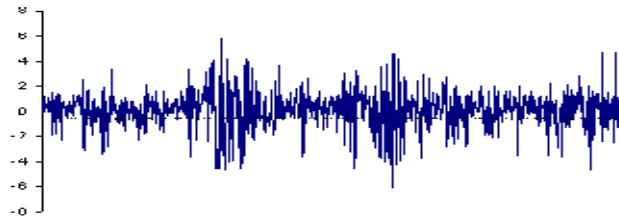


Figure. II. Return series of KSE100 index daily closing price

Some characteristics of the rate of returns, r_t , are given in the figure III. The number of observations is 1013, mean and standard deviation of daily returns are quite large with Kurtosis coefficient greater than 4.

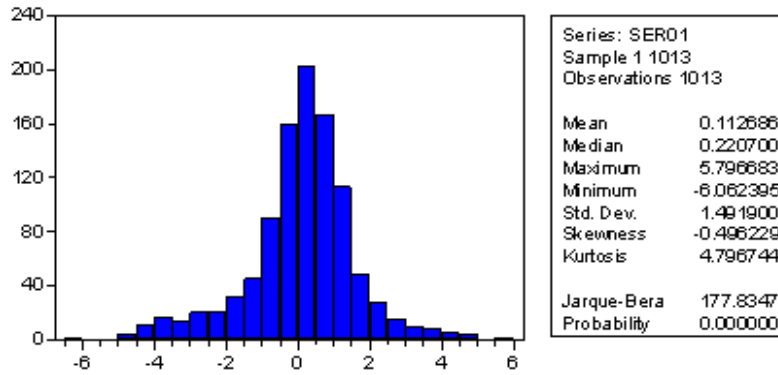


Figure III. Summary Statistics of data on rate of returns from 2004 to 2008.

The percentage changes and squared series of the percentage changes of daily closing prices for 1013 observations were plotted to obtain the order of ARCH-M. Parameters of the models were estimated using the Maximum Likelihood Marquardt algorithm. First we model the conditional mean process in which conditional standard deviation, variance and the log of the conditional variance were used with AR (1) and ARMA (1,1) process see equation 2.

AR (1) –ARCH-in –Mean (1) with standard

$$y_t = 0.000215 + 0.045692y_{t-1} + 0.120487\sigma_t + \varepsilon_t$$

$$[0.001206] [0.03027] [0.084817]$$

$$(0.8586) (0.1312) (0.1554)$$

$$\sigma_t^2 = 0.000121 + 0.458537\varepsilon_{t-1}^2$$

$$[5.57E-06] [0.059306]$$

$$(0.0000) (0.0000)$$

AR (1) –ARCH-in –Mean (1) with Variance

$$y_t = 0.001253 + 0.047042y_{t-1} + 0.2.875061\sigma_t^2 + \varepsilon_t$$

$$[0.000603] [0.030741] [2.188304]$$

$$(0.0376) (0.1259) (0.1889)$$

$$\sigma_t^2 = 0.000121 + 0.458652\varepsilon_{t-1}^2$$

$$[5.56E-06] [0.059102]$$

$$(0.0000) (0.0000)$$

AR (1) –ARCH-in –Mean (1) with log Variance

$$y_t = 0.010327 + 0.042536y_{t-1} + 0.0009781\log(\sigma_t^2) + \varepsilon_t$$

$$[0.000603] [0.029423] [0.00073]$$

$$(0.105) (0.1483) (0.1805)$$

$$\sigma_t^2 = 0.000121 + 0.459587\varepsilon_{t-1}^2$$

$$[5.59E-06] [0.059557]$$

$$(0.0000) (0.0000)$$

ARMA (1,1) –ARCH-in –Mean (1) with Standard Deviation

$$y_t = -0.00155 + 0.879494y_{t-1} - 0.879494e_{t-1} + 0.270239\sigma_t + \varepsilon_t$$

$$[0.001317] [0.050338] [0.050338] [0.097506]$$

$$(0.2391) (0.0000) (0.0000) (0.0056)$$

$$\sigma_t^2 = 0.00019 + 0.468288e_{t-1}^2$$

$$[5.65E-06] [0.061328]$$

$$(0.0000) (0.0000)$$

ARMA (1,1) –ARCH-in –Mean (1) with Variance

$$y_t = 0.000809 + 0.865176y_{t-1} - 0.80906e_{t-1} + 6.05066\sigma_t^2 + \varepsilon_t$$

$$[0.2411] [0.056278] [0.069728] [2.586508]$$

$$(0.2391) (0.0000) (0.0000) (0.0193)$$

$$\sigma_t^2 = 0.00019 + 0.46727e_{t-1}^2$$

$$[5.65E-06] [0.061328]$$

$$(0.0000) (0.0000)$$

ARMA (1,1) –ARCH-in –Mean (1) with log Variance

$$y_t = 0.002216 + 0.888786y_{t-1} - 0.84662e_{t-1} + 4.41E-05 \log \sigma_t^2 + \varepsilon_t$$

$$[0.005924] [0.06061] [0.07061] [0.000672]$$

$$(0.9477) (0.0000) (0.0000) (0.9477)$$

$$\sigma_t^2 = 0.000118 + 0.476785e_{t-1}^2$$

$$[5.55E-06] [0.059786]$$

$$(0.0000) (0.0000)$$

Note: Standard errors are given in square bracket, while the numbers in parentheses are the approximate probability. All the Models parameters were estimated using Eviews 5[®] software. The figures of standard error and approximate probability reported that some cases are significant.

Table 1
Forecast mean square error of ARCH-M model

Model	FMSE
ARCH-M (1) -AR(1) with std.dev	136.950831
ARCH-M(1) -AR(1) with variance	132.923
ARCH-M(1) -AR(1) with log (variance)	140.5181769
ARCH-M (1)-ARMA(1,1) with std.dev	152.4720522
ARCH-M(1) -ARMA(1,1) with variance	140.972
ARCH-M(1) -ARMA(1,1) with log (variance)	129.1681505

4. CONCLUSION

In this study ARCH-M model was used to forecast the closing price of KSE-100 index. In order to evaluate the forecasting performance of the estimated models forecast root mean squares error was calculated. In ARCH-M model most common choices for conditional mean standard deviation, variance and the log of the conditional variance

transformation were used with AR(1) and ARMA(1,1) process. Among all the studied models forecast root mean squares error is least in ARMA (1, 1) with log (variance).

REFERENCES

1. Engle, R.F.; Lilién, D.M. and Robins, R.P. (1987). Estimation of time varying risk Premia in the term structure: The ARCH-M model. *Econometrica*, 55, 391-407.
2. Engle, R.F. (1982). Autoregressive Conditional Heteroskedasticity with estimates of the variance of United Kingdom inflation, *Econometrica*, 50, 987-1007.
3. Golsten, L.R.; Jagannathan, R. and Runkle, D. (1993). Relation between the expected value and the volatility of the nominal excess returns on stocks, *J. Finance*, 48, 1779-801.
4. Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroskedasticity Journal, *Econometrics*, 31, 307-27.
5. Fatima, S. and Hussain, G. (2001). Use of Artificial Neural Network for predicting KSE100 index: A comparative study. *Proceedings: Eight Statistical Seminar 2001*. ISBN-969-8397-07-8.
6. Fatima, S. and Hussain, G. (2006). Statistical models of KSE100 index using Hybrid Financial Systems. *Proceedings: IEEE International Conference on Engineering of Intelligent Systems (ICEIS 2006)*.
7. Fatima, S. and Hussain, G. (2008). Statistical models of KSE100 index using Hybrid Financial Systems. Extended paper accepted for the *International Journal of Neurocomputing*.
8. http://en.wikipedia.org/wiki/KSE_100_Index

DEVELOPMENT OF SIMPLIFIED EQUATION FOR WIND LOAD CALCULATION FOR TALL BUILDINGS

Muhammad Azhar Saleem

Department of Civil and Environmental Engineering, Florida International University
10555 W. Flagler Street, EC 3781, Miami, FL 33174, USA
azhar696@hotmail.com

ABSTRACT

Various wind standards and building codes are available for evaluating wind loads on buildings with common shapes. International wind standards such as ASCE 7-05 and NBC 2005 are among the most commonly used building codes in various parts of the world. This research work is mainly focused on developing simplified equations for the approximate calculation of wind forces. A sixty storied tall building with box structure is analyzed for wind loads for different exposure conditions provided by these building codes. Based on these results, simplified equations are developed for the calculation of wind forces by using nonlinear regression. For each exposure condition a different equation is developed. These equations will help the beginners in the field of civil/structural engineering to calculate wind forces without going into the lengthy details.

1. INTRODUCTION

Wind loads are major concern while designing structures especially in strong wind regions. Unless properly accounted for, high speed winds can cause major destruction. While designing a structure for wind, safety and economy are the most important factors. It is always desirable to economize the design without compromising on safety. Wind standard and codes usually provide wind loads for buildings with common shapes, for complex situation they refer the practitioner for physical simulation in a boundary layer wind tunnel.

A sixty storied structure (100' x 100' x 720') is analyzed for wind loads provided by ASCE 7-05 and NBC 2005. The results of this analysis are further used for the development of simplified equations to calculate wind forces. Finally, the results given by these equations are compared with the code results to prove the validity of equations.

2. ASCE 7-05 WIND LOADS

ASCE 7-05 describes wind load calculations for buildings and other structures in two categories, wind loads on Main Wind Force Resisting System (MWFRS), and all components and claddings. It presents three methods. Methods-1 (Simplified Procedure) mainly deals with low-rise rigid buildings. Method-2 (Analytical Procedure) covers regular shaped flexible structures not subjected to cross wind loading, vortex shedding and instability due to galloping etc. For the structures having unusual shapes or response characteristics, Method-3 is recommended which is Wind Tunnel Procedure.

For Method-2, which is used in the present study, ASCE-70-5 presents following equation to calculate velocity pressure.

$$q_z = 0.00256k_zk_{zt}k_dV^2I \quad (\text{lb/ft}^2) \quad (1)$$

Design wind pressure for MWFRS of flexible building can be calculated by the following equation:

$$P = qG_fC_p - q_iGC_{pi} \quad (\text{lb/ft}^2) \quad (2)$$

3. NBC 2005 WIND LOADS

NBC 2005 is an updated version of NBCC 1995. Similar to ASCE 7-05, this code also presents three methods. For low and medium rise rigid buildings and claddings of all buildings, Static Procedure is presented. Tall buildings and slender structures are covered under Dynamic Procedure. Structures having irregular geometry or subjected to buffeting/channelling effect are recommended to be analysed by Wind Tunnel procedure. The following equation is used to calculate Reference Wind Pressure:

$$q = 0.00064645 V^2 \quad (\text{kPa}) \quad (3)$$

Design wind pressure is provided as follows:

$$P_e = I_w q C_g \left[(C_e C_p)_{WW} + (C_e C_p)_{LW} \right] \quad (\text{kPa}) \quad (4)$$

4. DESCRIPTION OF STRUCTURE

The tall building analysed has dimensions 100' x 100' x 720'. It is an RC structure having five bays in each direction, 20' x 20' each.

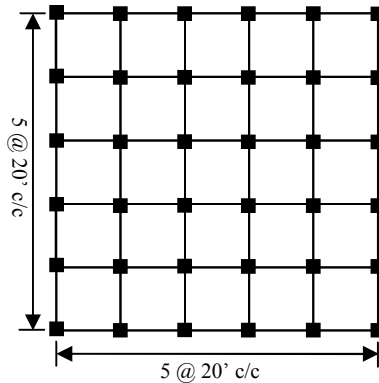


Figure 1: Basic layout of structure

The building has sixty stories with 12' ceiling height. Stories and height of structure are so selected to make the structure to behave as flexible. Figure-1 shows the basic plan of structure.

Following approximate natural frequency of structure was used to find the initial wind gust factor:

$$f = \frac{10}{\text{No. of Stories}} = \frac{10}{60} = 0.167 \text{ hz} \quad (5)$$

A structure having natural frequency less than one is considered flexible. Both codes provide a method to account for the resonance effects for flexible structure.

5. PARAMETERS OF ANALYSIS BY ASCE 7-05

Analysis is carried out for a basic wind speed of 100 mph applied parallel to global x-axis. Wind speed of 100 mph is selected for the present study. This is important to note that ASCE 7-05 is based on 3-second gust speed at 33' height. ASCE 7-05 describes four different wind load cases. In this exercise structure is analysed only for case-1, which is explained in figure-2.

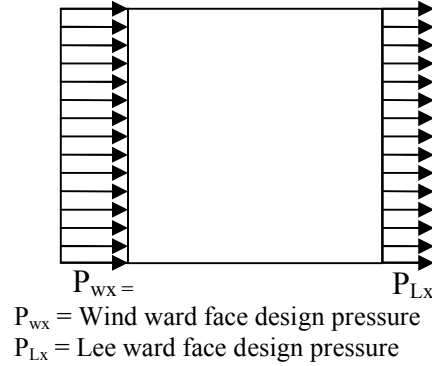


Figure 2: Full design wind pressure acting on both sides

Following are the parameters used in analysis.

Windward pressure coefficient, $C_p = 0.8$

Leeward pressure coefficient, $C_p = 0.5$

Exposure type: D (Flat, unobstructed areas and water surface outside hurricane prone zone)

Importance factor, $I = 1.0$

Topographical factor, $k_{zt} = 1.0$

Gust effect factor, $G_f = 1.03$

Directionality factor, $k_d = 0.8$

Velocity pressure coefficient, k_z : It varies with height and can be calculated by the following equation:

$$k_z = 2.01 \left(\frac{z}{z_g} \right)^{2/\alpha} \quad \text{for } 15' \leq z \leq z_g \quad (6)$$

$$k_z = 2.01 \left(\frac{15}{z_g} \right)^{2/\alpha} \quad \text{for } z < 15'$$

For exposure D:

$$\alpha = 11.5, z_g = 700 \text{ ft}$$

where z = Height above ground level in ft

z_g = Gradient height.

6. PARAMETERS OF ANALYSIS BY NBC 2005

Dynamic procedure is adopted for analysis as per NBC 2005 recommendation for building with total height more than 120m (394'). Note that NBC 2005 is based on a mean hourly wind speed unlike ASCE 7-05 which uses 3-second gust speed. Therefore mean hourly wind speed corresponding to 3-second gust speed of 100 mph is calculated by applying a conversion factor of 1.52 (Durst Curve) yielding in 65.79 mph (29.4 m/s). NBC 2005 describes exposure A for open terrain so it is used in analysis in comparison with exposure D (open terrain) of ASCE 7-05. Similar to ASCE 7-05, NBC 2005 also talks about four different load cases. Case-A is selected corresponding to case-1 of ASCE 7-05, which applies full wind pressure on WW and LW sides with zero eccentricity.

Following are some relevant parameters used in analysis:

Wind ward pressure coefficient, $C_p = 0.8$

Lee ward pressure coefficient, $C_p = 0.5$

Importance factor, $I_w = 1.0$

Gust effect factor, $C_g = 2.23$

Exposure factor C_e was calculated by following formula:

$$C_e = \left(\frac{h}{10} \right)^{0.28} \quad 1.0 \leq C_e \leq 2.5 \quad (7)$$

7. DEVELOPMENT OF NONLINEAR EQUATION

Design wind pressures are calculated at all story levels by ASCE 7-05 and NBC 2005 for different exposure conditions. Weighted average of design wind pressures is calculated by giving 60% weight to ASCE 7-05 and 40% weight to NBC 2005. Experience has shown that ASCE 7-05 ends up with economical design therefore it is given more weight. Equation 8 represents the final design pressure used for regression.

$$\text{Design Wind Pressure} = \left[\frac{0.6[\text{ASCE 7-05}] + 0.4[\text{NBC 2005}]}{3 \times 0.6 + 3 \times 0.4} \right] \quad (8)$$

Figure 3 presents the plot of variation of design wind pressure with height. It also includes the plot for weighted average. It is clear from the figure that weighted average is more than the wind pressures for the three exposure conditions of ASCE 7-05 and less than the NBC wind pressures. This difference demands for the adjustment for various exposure conditions. This adjustment will be discussed in the next section. Based on the weighted average wind pressures, nonlinear regression is carried out to establish a relationship between design wind pressure and height. Equation 9 presents this relationship.

$$P = 28.04 H^{0.13} \quad (9)$$

P = Design wind pressure in psf

H = height in ft.

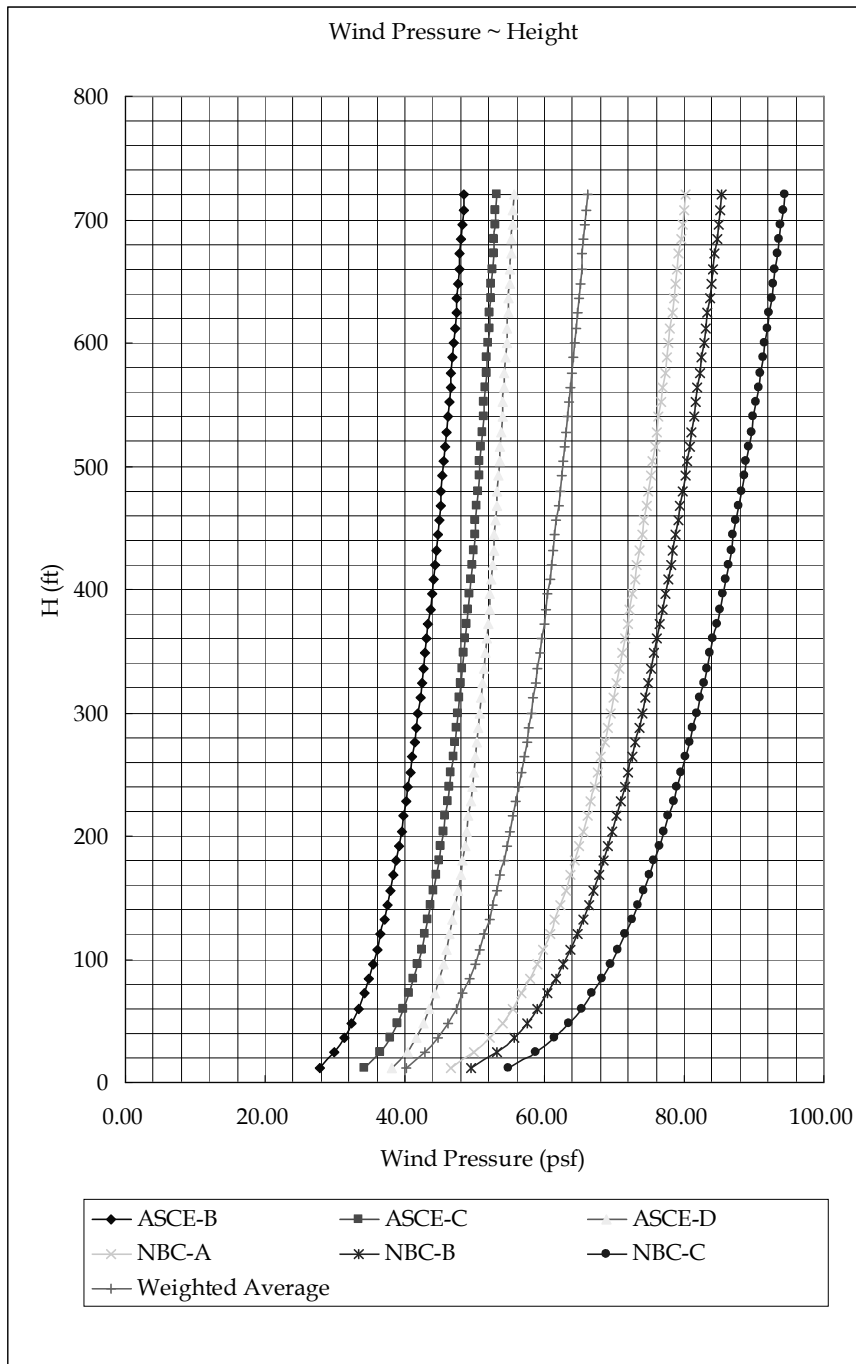


Figure 3: Variation of design wind pressure with height

8. ADJUSTMENT FOR EXPOSURE

As discussed earlier, equation 9 needs to be modified for different exposure conditions. For this purpose, differences (errors) are calculated between the wind pressures given by equation 9 and ASCE 7-05 & NBC 2005. Figure 4 presents the plot of these differences. Best fit curves are fitted and the resulting nonlinear equations are presented as alpha (α) factor to be added in equation 9 for respective exposure condition. Table 1 presents the summary of exposure adjustment factor alpha for both the codes. Final equation becomes:

$$P = 28.04 H^{0.13} + \alpha \tag{10}$$

where α is in psf.

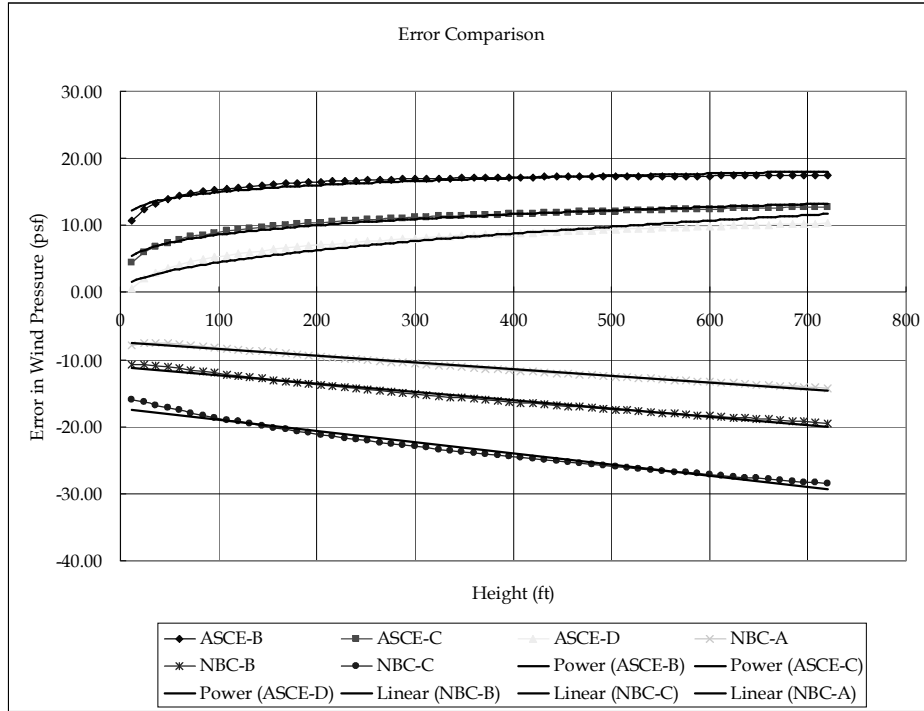


Figure 4: Variation of errors with height

Table-1
Summary of exposure adjustment factor (α) (H in feet, α in psf)

ASCE 7-05	Exposure B	$9.703 H^{0.0945}$
	Exposure C	$3.153 H^{0.2185}$
	Exposure D	$0.481 H^{0.4855}$
NBC 2005	Exposure A	$-0.0099H-7.456$
	Exposure B	$-0.0124H-11.079$
	Exposure C	$-0.0167H-17.368$

9. VERIFICATION OF RESULTS

For the purpose of verification, results from equation 10 are plotted with results provided by ASCE 7-05 and NBC 2005. Figure 5(a to f) presents this comparison. Figure 5 shows that proposed equation gives results on conservative side in comparison to ASCE 7-05. Results for all three exposure conditions of NBC 2005 are on unsafe side. It is therefore recommended that design wind pressures calculated by equation 12 for NBC 2005 exposure conditions should be increased by 10 to 12%.

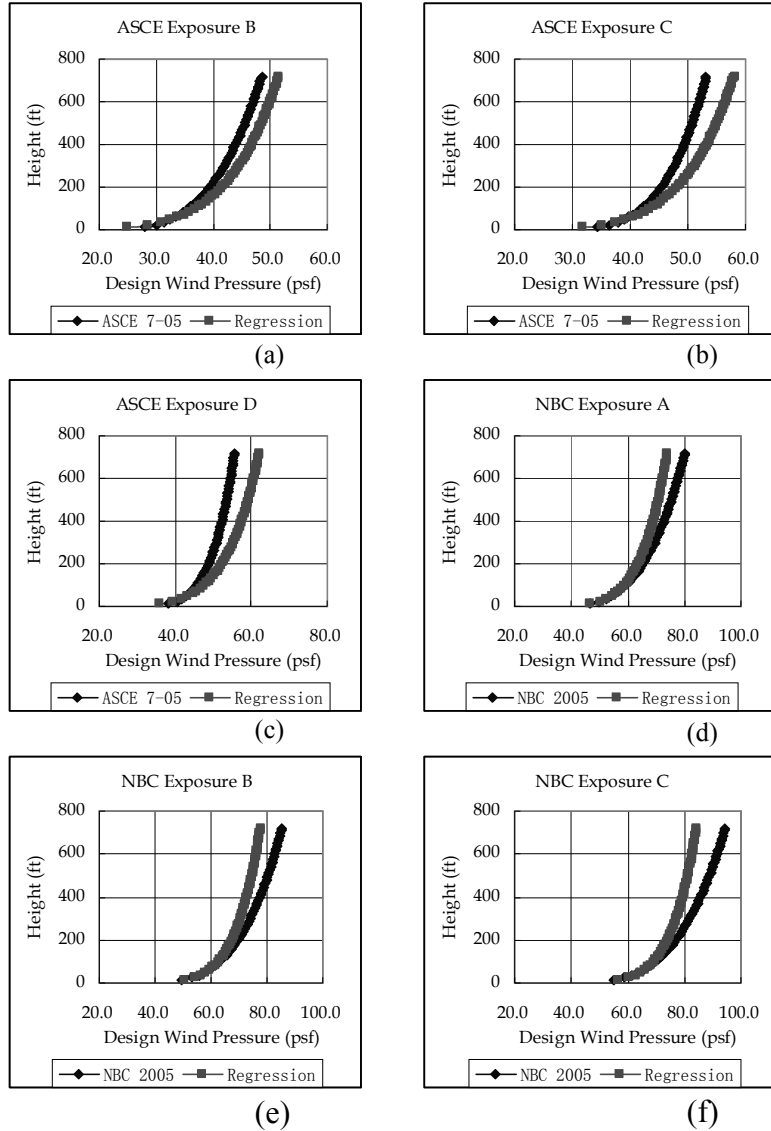


Figure 5: Comparison of Results

10. CONCLUSIONS

- Nonlinear regression is a powerful tool to solve the real life engineering problems.
- This type of exercise helps in thinking beyond the boundaries of codes.

11. RECOMMENDATIONS FOR FUTURE RESEARCH

- Size of building should also be incorporated as a variable for the development of equations.
- Equations should also be developed for the oblique wind direction.

REFERENCES

1. ASCE/SEI (2005). *Minimum design loads for buildings and other structures*. American Society of Civil Engineers, Virginia.
2. Durst, C.S. (1960). Wind speeds over short periods of time. *Meteorol. Mag.* 89. 181-186.
3. IBC (2006). *International building code*. International code council, Illinois.
4. NBC (2005). *National building code*. National Research Council Canada, Ottawa.
5. Simiu, E. and Miyata, T. (2006). *Design of buildings and bridges for wind*. John Wiley and Sons, INC, Hoboken, New Jersey.

**JOB EMBEDDEDNESS AND TURNOVER INTENTION OF
TEACHING FACULTY OF CHARTERED INSTITUTIONS IN LAHORE**

Muhammad Shafique¹, Munir Ahmad¹ and Rashid Rahman²

¹ National College of Business Administration & Economics, Lahore.
Email: shafiqkarim@gmail.com & shafiq_karim@hotmail.com

² Department of Management Science, Gomal University, D.I. Khan.
Email: drrashid.rehman@gmail.com

ABSTRACT

This study has been conducted to validate job embeddedness framework in academic setting of Lahore. By using revised multi-item construct along global item construct, organization embeddedness has full support from our findings but no support is available for community embeddedness. Moreover, various group comparisons have been made for job embeddedness and leave intention of faculty.

INTRODUCTION

HR systems of an organization are no more static but considered to be dynamic systems that consist of stocks and flows (David J. Bartholomew et al. 1991) and organizational turnover is one of the most fundamental flows of this system. In this context, the most important responsibilities of HR professional now a days is to control employee's turnover and retain high performing employees for a longer period within the organization.

Traditional approaches of employee turnover have focused on work-related attitudes, employment alternatives, or their integrated version. According to these approaches job satisfaction is considered to be an important determinant of leave intention. Many studies have proved job satisfaction as a reliable predictor of turnover (Oktay, 1992; Hellman, 1997; Manlove and Guzell, 1997). Some researchers contend that job satisfaction is a precursor to commitment, leading to higher levels of organizational commitment followed by lower intention to leave (Lachman and Aranya, 1986; Good et al. 1988; DeConinck and Bachmann, 1994; Lum et al. 1998).

Hom and Greiffeth (1995), Greiffeth et al. (2000) in their Meta analysis study of the determinants of turnover supported the opinion that work attitudes play only a small role in overall turnover and there is need for new theory. Unfolding model of employee turnover was an effort in search of this alternative theory. Lee and Mitchell (1994) presented this model that describes four paths that employees follow while considering to leave an organization. Later Lee et al. (1996), Lee et al. (1999) and Holtom et al. (2005) have extended this work.

Mitchell et al. (2001) have introduced unique organizational attachment construct: job embeddedness to help address the effect of both work and non-work related factors on

employee's stay in an organization which discourage their voluntary turnover. The critical aspects of job embeddedness are (1) the links that an individual has on and off their job, (2) the fit he or she perceives with environment where he or she lives and work and (3) the sacrifice that he or she has to make by giving up their job in terms of how this action would effect the other aspects of their life that are linked with their job. The three dimensions of job embeddedness are important in the organizational and community context that are perceived to have negative relation with their leave intention. Holtom and O' Neill (2004), Lee et al. (2004), Wijayanto and Kimono (2004), Cunningham et al. (2005), Tanova, C. (2006) and Mallol et al. (2006) have validated and extended the work of Mitchell et al. (2001).

STUDY OBJECTIVE AND HYPOTHESES

Current study is focused to develop multi items measure of job emebddedness and then validate it along global measure as has been proposed by Mitchell et al. (2001) and Cunningham et al. (2005). Following hypotheses are formulated.

Hypothesis 1:

There is no significant difference of job embeddedness of faculty due to sector, gender, job title, background, work nature, job category, education and marital status differences.

Hypothesis 2:

There is no significant difference of leave intention of faculty due to sector, gender, job title, background, work nature, job category, education and marital status differences.

Hypothesis 3:

Job embeddedness is negatively related to the faculty's leave intention.

Hypothesis 4:

Effects of global item measure are stronger than multi-item measure for prediction of leave intention.

Hypothesis 5:

Leave intention of faculty is positively related to the job alternatives.

METHODOLOGY AND MEASURES

This cross-sectional study is conducted on opinion based questionnaire survey from teaching faculty of 25-chartered institutions of Lahore that constitutes 20% of the total number of institutions of all Pakistan. Randomly selected 80 faculty members from strata of public and private institutions participated in survey. Pilot study was also conducted to test reliability of the measures. Scales and a few items of community and organization link dimensions of multi-item measure were improved.

Respondents were asked about personal identification, job title, institution name, job nature, job category, age, gender, education, and background by using fill in blanks space or provision of different categories. Revised multi-item construct of Mitchell et al. (2001) along with global construct (Cunningham et al., 2005) were used to record the

agreement responses on 7-point Likert scale from 1 (Not at all) to 7 (to a great extent). The mean of scales of all items in each dimension represent the score for that dimension and mean of all dimensions is the score of job embeddedness. Cunningham et al. (2005) has pointed out low internal consistency of the community and organization link items of Mitchell et al. (2005) construct because of non-uniformity of the scale and different interpretation of question. That's why a few items of community and organization link have been rephrased. Similarly, a few items were combined and some unnecessary items were omitted.

Leave Intention is "the extent to which an employee plans to leave an organization". Stronger feelings of withdrawal intentions typically result in an increased likelihood that the employee will leave (Steel and Ovalle, 1984). Three items were adapted from Home et al. (1984) for its measurement along 7-point Likert scale from 1 (Not at all) to 7 (to a great extent). The mean of means of all three items is the final score, which depicts leave intention.

Alternative job opportunity is the "availability of equivalent or better jobs in the immediate area outside the organization". Two questions were adopted from Lee and Mowday's work (1987) and were rephrased to measure alternative job opportunity. Similarly four items from Kopelman et al. (1992) were used to measure job search behaviour. Participants were given yes or no response options (Yes = 1, No = 2).

ANALYSIS AND INTERPRETATION

Internal reliability test was performed on each scale. All scales met or exceeded the minimum level of α . Other underlying assumptions were examined and no major violations are found (e.g. outlier, major deviations from normality etc).

Before conducting independent sample t-test for comparing means, equivalence of variance is assumed and verified through Levenza test. No significant difference is observed in job embeddedness of faculty irrespective of sector, gender, background, job nature, job category, education and marital status differences, so hypothesis 1 is fully supported. But difference in the leave intention on the basis of job category and marital basis is observed. Contractual faculty is more leave intended than permanent. Similarly unmarried faculty has more leave intention than the married and higher job search behaviour, so hypothesis 2 is not fully supported. (As shown in Tables 1 and 2)

Table-1
Comparative Statistics of Permanent and Contractual Faculty

S#	Measurement	Permanent		Contractual		Combined	
		Mean	SD	Mean	SD	Mean	SD
1	Link to community	4.81	1.36	4.68	1.53	4.77	1.41
2	Fit to community	4.60	1.29	4.62	1.38	4.60	1.31
3	Sacrifice to community	5.28	1.17	4.91	1.30	5.15	1.21
4	Link to organization	4.75	1.18	4.25	1.08	4.58	1.16
5	Fit to organization	5.05	1.26	5.16	0.93	5.08	1.15
6	Sacrifice to organization	4.16	1.34	4.12	0.94	4.14	1.22
7	Job Embeddedness-Multi item	4.77	0.95	4.59	0.76	4.71	0.89
8	Job Embeddedness-Global	4.76	1.21	4.73	1.10	4.75	1.17
9	Leave intention**	2.35	1.48	3.43	1.86	2.70	1.68
10	Job Alternatives	3.87	1.87	4.28	1.51	4.00	1.76
11	Job Search	1.61	0.33	1.51	0.38	1.58	0.34

p < .05, ** p < .01, *** p < .001

Means, standard deviations, bivariate correlations, and reliability estimates are presented in Table-3. The extent to which new global item relates to the revised multi-item measures is examined. The association between the multi-item measures and the global measures for all fit and sacrifice facets is high (all $r_s \geq .57$) except community-link ($r_{mm} = .70$, $r_{gm} = .44$) and organization-link ($r_{mm} = .61$, $r_{gm} = .28$) measures. These high associations indicate that these multi-item and global-item variables are likely measuring the same construct.

Table-2
Comparative Statistics (Marital Basis)

S#	Measurement	Married		Un-Married		Combined	
		Mean	SD	Mean	SD	Mean	SD
1	Link to community	4.80	1.49	4.71	1.20	4.77	1.41
2	Fit to community	4.54	1.44	4.76	0.97	4.60	1.31
3	Sacrifice to community	5.20	1.14	5.06	1.42	5.15	1.21
4	Link to organization***	4.90	1.12	3.82	0.91	4.58	1.16
5	Fit to organization	5.20	1.09	4.77	1.30	5.08	1.15
6	Sacrifice to organization	4.22	1.26	3.95	1.11	4.14	1.22
7	Job Embeddedness-Multi item	4.81	0.92	4.44	0.76	4.71	0.89
8	Job Embeddedness-Global	4.83	1.14	4.57	1.24	4.75	1.17
9	Leave intention*	2.45	1.54	3.29	1.89	2.70	1.68
10	Job Alternatives	3.87	1.91	4.30	1.33	4.00	1.76
11	Job Search*	1.63	0.34	1.46	0.33	1.58	0.34

p < .05, ** p < .01, *** p < .001

Table-3
Means, Standard Deviations, Reliability and Bivariate Correlations Estimates

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Sector																
2 Gender	-0.07															
3 Background	-0.07	-0.20														
4 Work Nature	0.07	-0.08	-0.08													
5 Job Category	0.01	0.16	0.10	-0.13												
6 Link to community	-0.04	-0.07	-0.04	-0.07	-0.04											
7 Fit to community	0.13	-0.09	0.04	-0.09	0.01	.67**										
8 Sacrifice to community	0.10	0.09	-0.06	-0.20	-0.14	.437**	.501**									
9 Link to organization	0.13	-.325**	-0.07	0.10	-0.20	.344**	.317**	.230*								
10 Fit to organization	0.10	-0.02	0.11	-0.19	0.04	0.12	.418**	.451**	.361**							
11 Sacrifice to organization	-0.09	0.04	0.13	-0.17	-0.01	.292**	.451**	.416**	.276*	.764**						
12 Leave intention	-0.01	-0.11	-0.03	0.14	.300**	-0.03	-0.13	-0.18	-0.08	-.412**	-.366**					
13 Job Alternatives	0.00	-0.07	-0.07	.34**	0.11	0.04	0.05	0.09	-0.02	-0.22	-.238*	.536**				
14 Job Search	-0.01	0.05	-0.07	-.243*	-0.13	0.04	0.08	0.05	0.00	0.19	.265*	-.463**	-.25*			
15 Job Embeddedness-Multi item	0.07	-0.10	0.01	-0.15	-0.09	.700**	.805**	.712**	.610**	.709**	.736**	-.280*	-0.08	0.15		
16 Job Embeddedness-Global	0.00	0.00	0.05	-.225*	-0.01	.445**	.572**	.699**	.287*	.712**	.675**	-.362**	-0.13	0.13	.797**	
Mean	1.30	1.21	1.21	1.41	1.33	4.77	4.59	4.61	5.08	5.16	4.14	2.7	4	1.58	4.71	4.75
Standard Deviation	0.46	0.41	0.41	0.77	0.47	1.41	1.17	1.32	1.16	1.22	1.22	1.68	1.76	0.34	0.89	1.17
Reliability						0.76	0.81	0.69	0.78	0.9	0.89	0.86	0.77	0.76	0.93	0.79

* Correlation is significant at .05 level (2-tailed).

** Correlation is significant at .01 level (2-tailed).

In order to test hypothesis 3 regression analysis with leave intention as dependent variable was run. Gender, Job category and marital status were entered in the first block and job embeddedness was entered in second block. On the basis of outcome of this test following set of regression equations are deduced which support hypothesis 3.

$Y_1 = 1.366 - .727X_1 + .926X_2 + .771X_3$ $Y_2 = 3.795 - .742X_1 + .919X_2 + .592X_3 - .459X_4^*$	Multi-item measure
$Y_1 = 1.432 - .786X_1 + .963X_2 + .726X_3$ $Y_2 = 3.877 - .748X_1 + .983X_2 + .587X_3 - .492X_4^{**}$	Global measure

* $p < .05$, ** $p < .01$, *** $p < .001$

Y = leave intention, X_1 = gender, X_2 = job category, X_3 = marital status, X_4 = job embeddedness.

Table 4 shows that multi-item measure contributed 23.4% ($p < .03$) unique variance beyond the control variables, whereas the global-item measure contributed 34.3% ($p < .001$) unique variance beyond the control variable. Additionally the effects of global item measure are stronger than were the effects of multi-item measure that supports to Hypothesis 4. While measuring with global measure, all organization specific facets (e.g. link, fit and sacrifice) significantly contribute unique variance, whereas for multi-item measure, two organization specific facets (e.g. fit to organization and sacrifice to organization) significantly contribute. This proves that community related facets of both measures did not significantly explain to leave intention.

Table-4
Impact of Job Embeddedness on Leave Intention

Variable	Multi Item Job Embeddedness			Global Item Job Embeddedness		
	β	R^2	Adjusted R^2	β	R^2	Adjusted R^2
Block 1		0.138	0.102		0.147	0.113
Gender	-0.727			-0.786		
Job Category	0.926*			0.963*		
Marital Status	0.771			0.726		
Block 2		0.326	0.234		0.42	0.343
Community Link	-0.014			-0.006		
Community Fit	-0.158			-0.186		
Community Sacrifice	-0.116			-0.081		
Organization Link	-0.012			-0.355**		
Organization Fit	-0.41**			-0.36**		
Organization Sacrifice	-0.344**			-0.42***		

Hypothesis 5 states that perception about job availability in market does influence positively to leave intention of an individual. Following regression analysis supports this hypothesis.

Y1=.628 +.522X ₁ *** Y2=2.654 +.504X ₁ ***-.455X ₂ *	Multi-item measure
Y1=.652 + .511x ₁ *** Y2= 2.834 + .475X ₁ ***-.429X ₂ **	Global measure

* p < .05, ** p < .01, *** p < .001

Y = leave intention, X₁ = job alternative, X₂ = job embeddedness

DISCUSSION AND RESEARCH DIRECTION

Mitchell et al. (2001) and others have recommended the improvement and development of job embeddedness construct. Revisions were made in community and organization link dimensions that resulted high reliability estimates. Similarly global measure of Cunningham et al. (2005) is validated and found that job embeddedness measured through global measure is strong predictor of leave intention. Thirdly this study has contributed in academic literature in a way that it is an extension of the unique work of Mitchell et al. (2001) in academic setting of Pakistan, which is a new context.

Results of this study also support the Mitchell et al. finding provided that job embeddedness has taken aggregate of all these forces. However, if it is disintegrated into its two major parts, we find that organization embeddedness has full support from our findings but no support is available for community embeddedness. This aspect needs to be empirically investigated in further research studies.

REFERENCES

1. Cunningham, G.B., Fink, J.S. and Saga, M. (2005). Extension and Further Examination of the Job Embedded ness Construct. *Journal of Sports Management*. 19, 319-335.
2. David J. Bartholomew, Andrew F. Forbes and Sally I. McClean (1991). *Statistical Techniques for Manpower Planning*. 2nd Edition.
3. DeConinck, J.B. and Bachmann, D.P. (1994). Organizational commitment and turnover intentions of marketing managers. *J. App. Bus. Res.* 10(3), 87-95.
4. Good, L.K., Sisler, G.F. and Gentry, J.W. (1988). Antecedents of turnover intentions among retail management personnel. *Journal of Retailing*. 64(3), 295-314.
5. Griffeth, R.W., Hom, P.W. and Gaertner, S. (2000). A meta-analysis of antecedents and correlates of employee turnover: Update, moderator tests, and research implications for the next millennium. *Journal of Management*. 26, 463-488.
6. Hellman, C.M. (1997). Job satisfaction and intent to leave. *Journal of Social Psychology*. 137(6), 677-689.
7. Holtom, B.C. and B.S. O' Neill (2004). Job Embeddedness: A theoretical foundation for developing a comprehensive nurse retention plan. *Journal of Nursing Administration*. 34, 216-227.
8. Holtom, B.C., Mitchell, T.R., Lee, T.W. and Inderrrieden, E.J. (2005). Shocks as causes of turnover: what they are and how organization can manage them. *Human Resource Management*. 44, 337-352.
9. Hom, P.W. and Griffeth, R.W. (1995). *Employees Turnover*. Cincinnati, OH: South Western College Publishing.

10. Hom, P.W., Griffeth, R.W. and Sellaro (1984). The validity of Mobley's 1977 model of employee turnover. *Organizational Behavior and Human Performance*. 34: 141-174.
11. Kopelman, R.E., Rovenpor, J.L. and Millsap, R.E. (1992). Rationale and construct validity evidence for the Job Search Behavior Index: Because intentions (and New Year's resolutions) often come to naught. *Journal of Vocational Behavior*. 40, 269-287.
12. Lachman, R. and Aranya, N. (1986). Job attitudes and turnover intentions among professionals in different work settings. *Organization Studies*. 7(3), 279-293.
13. Lee, T.W. and Mowday, R.T. (1987). Voluntary leaving an organization: An empirical investigation of Steers and Mowday's model of turnover. *Academy of Management Journal*. 30, 721-743.
14. Lee, T.W. and Mitchell, T.R. (1994). An alternative approach: The unfolding model of voluntary employees turnover. *Academy of Management Review*. 19, 51-89.
15. Lee, T.W., Mitchell, T.R., Wise, L. and Fireman, S. (1996). An unfolding model of voluntary employees turnover. *Academy of Management Journal*. 19, 51-89.
16. Lee, T.W. and Mitchell, T.R., Holtom, B.C., MacDanial, L.S. and Hill, J.W. (1999). The unfolding model of voluntary turnover: A replication and extension. *Academy of Management Journal*. 42, 450-462.
17. Lee, T.W., Chris J.Salynski, James P. Burton and Holtom Brooks. C. (2004). The effects of job embeddedness on organizational citizenship, job performance, volitional absences, and voluntary turnover. *Academy of Management Journal*. 47, 711-722
18. Lum, L, Kervin, J, Clark, K., Reid, F. and Sirola, W. (1998). Explaining nursing turnover intent: Job satisfaction, pay satisfaction, or organizational commitment? *Journal of Organizational Behavior*. 19, 305-320.
19. Mallol, Carlos. M, Holtom, B.C. and Lee, T.W. (2007). Job Embeddedness in a culturally diverse environment. *Journal of Business and Psychology*. 22(1), 35-44.
20. Manlove, E.E. and Guzell, J.R. (1997). Intention to leave, anticipated reasons for leaving, and 12-month turnover of child care center staff. *Early Childhood Research Quarterly*. 12, 145-167.
21. Mitchell, T.R., Holtom, B.C., Lee, T.W. and Erez, M. (2001). Why people stay: Using Job embeddedness to predict voluntary turnover. *Academy of Management Journal*. 44, 1102-1121.
22. Oktay, J.S. (1992). Burnout in hospital social workers who work with AIDS patients. *Social Work*. 37(5), 432-439.
23. Steel, R.P. and Ovalle, N.K. (1984). A review and meta-analysis of research on the relationship between behavioral intentions and employee turnover. *J. App. Psy.* 69, 673-686.
24. Tanova, Cem (2006). Using job embeddedness factors to explain voluntary turnover in five European countries. *IRISS Working Paper 2006-4, CEPS/INSTEAD, Differdange, Luxembourg*. (Retrieved from <http://idead.repec.org/p/irs/iriswp/2006-04.html>)
25. Wijayanto, B. Riwi and Kimono, Gugup (2004). The effect of job embeddedness on organizational citizenship behavior. *Gadjah Mada International Journal of Business*. 6(3), 335-354.

QURANIC STUDIES: A STATISTICAL PROFILE.

Muhammad Khyzer Bin Dost¹ and Munir Ahmad²

¹ Hailey College of Commerce, University of the Punjab,
 Lahore. Email: khyzer_bin_dost@hotmail.com

² National College of Business Administration & Economics,
 Lahore. Email : drmunir@brain.net.pk

ABSTRACT

In a previous paper, Dost and Ahmed (2007) have discussed the probability approach in studying Quranic Surras by word-size and word-length of Ayats. Many early authors have attempted to study the basic descriptive statistics of letters, words and Ayats (Al-Dargazelli, 2004).

In this paper, we have discussed the dispersion and shapes of word-size and word-length of Makki and Madni Surras at other compositions of Surras as introduced by Quran Mufassirs and scientists.

1. INTRODUCTION

This paper is continuation of our earlier paper (Dost et al 2007) where we discussed application of some basic statistical methods to Quran Surras, Ayat size, Word size and looked at the smallest and largest Ayats. It was observed that there are 5558 one word in Makki Surras and 3840 on-word in Madni Surras. There are eight Makki Surras with ten-word-size and 6 madni Surras with ten-word-size. Earlier some authors studies Quran numerically. (See Al-dargazali, 2004; Al-Shalabi, 2004; Al-Sawaindan, 2006; Mir, 1999; Naik, 2004; Naji, 2005; and rosty, 2007)

Earlier many suthors have studied Quran by counting words, Ayats, Surras, Zer, Zabar or Pash. Some authors have studied Ayats, Surras which are divisible by 19. Authors numerical miracle pointed out are given bellow.

S#	Pair of Words with Frequency		
1.	Muhammad (saw)	4	Sharee'ah
2.	Eblees	11	Seek refuge from Eblees
3.	Miss lead people	17	Dead people
4.	Speaking publicly	18	Publicizing
5.	Men	24	Women
6.	Tongue	25	Sermon
7.	Zakat	32	Barakah
8.	Muslimeen	41	Jihad
9.	Mind	49	Noor
10.	Benefit	50	Corrupt
11.	People	50	Messenger
12.	Magic	60	Fitnah

S#	Pair of Words with Frequency		
13.	Spending	73	Satisfaction
14.	Museebah	75	Thanks
15.	Al-Mala'ikah	88	Al-Shayateen
16.	Hardship	114	Patience
17.	Al-Dunya	115	Al-Akhira
18.	Al-Hayat	145	Al-Mout

(See Al-Suwaidan 2006).

Occurrences of Single words related to their meanings are given as: (see Al-Suwaidan).

S#	Words	Frequency
1.	Al-Shar (<i>Month</i>)	12
2.	Al-Yahom (<i>Day</i>)	365
3.	Al-Bahar (<i>Sea</i>)	32
4.	Al-Bar (<i>Land</i>)	13

Note that by adding up both “sea” and “land” we get 45 and proportion of sea and land is 71% and 29% respectively, which is same as the scientists discover.

It need to point out that numerical study of Quran does not display the beauty of Quran. The beauty of Quran lies in the Ayat structure and their meanings. The beauty of Quran given in the Quran lies in the construction of Ayats and Surras. No earthly human being can produce a single Ayat or Surra even with the help of Jins. However it is possible for any one to induct any number of word(s) in to any document in any language of same size. For example letter “is” can be written in a couple of hundred times that are divisible by any other number say 7 or 9. One may count all “is” and if it is not divisible by 7 then some sentences can be added with letter “is” so it is divisible by 7. As such beauty of Surras does not lie in numbers but its beauty is in the Ayat and Surras meanings. In this paper, we have attempted to look at the symmetry of makki and madni surras by studying the Skewness and Kurtosis.

2. SYMMETRY OF MAKKI AND MADNI SURRAS

In order to study the Skewness and kurtosis of Makki and Madni Surras, we have constructed bivariate table of β_1 and β_2 -3 in tables 1 and 2 below. It is seen that Makki Surras are closer to symmetrical functional from than Madni Surras. There are 41/89 Makki Surras whose β_1 and β_2 lie between (-1 to +10 and (+2 to +4) respectively whereas 7/25 Madni Surras β_1 and β_2 lie in (-1 to +1) and (+2 to +4) respectively. Almost half of Makkii Surras have β_1 (-1 to +1) and a little more than 50% Surras have β_2 -3 in (-1 to +1) interval. For Madni Surras, only 8 Surras out of 25 have β_1 in the interval (-1 to +1) and 10 out of 25 have β_2 -3 in the interval (-1 to +10).

Graphical representation of (β_1 , β_2 -3) are given in Fig (1) and (2).

Table-1
Bivariate Table of Makki Surras

B2 B1	-2, -1	-1, -0	0, 1	1, 2	2, 3	3, 4	4, 5	5, 6	6, 7	Total
(-4 to -3)		1								1
(-3 to -2)		1								1
(-2 to -1)		2								2
(-1 to -0)		3	19							22
(0 to 1)	2	1	17	3						23
(1 to 2)		1	2	8						11
(2 to 3)				6						6
(3 to 4)			1	6						7
(4 to 5)				2						2
(5 to 6)				2	1					3
(6 to 7)				1	2					3
(7 to 8)				1						1
(8 to 9)					1					1
(9 to 10)					1					1
(10 to 11)					2					2
(19 to 20)							1			1
(24 to 25)						1				1
(50 to 51)									1	1
Total	2	9	39	29	7	1	1	-	1	89

Table 2
Bivariate Table of Madni Surras

B2 B1	(-1 to -0)	(0 to 1)	(1 to 2)	(2 to 3)	Total
(-4 to -3)					
(-3 to -2)					
(-2 to -1)	1	1			2
(-1 to -0)	1	3			4
(0 to 1)	1	2	1		4
(1 to 2)		1	4		5
(2 to 3)			1		1
(3 to 4)			3		3
(4 to 5)			2	1	3
(5 to 6)				1	1
(6 to 7)					
(10 to 11)				1	2
(11 to 12)				1	1
Total	3	7	11	3	25

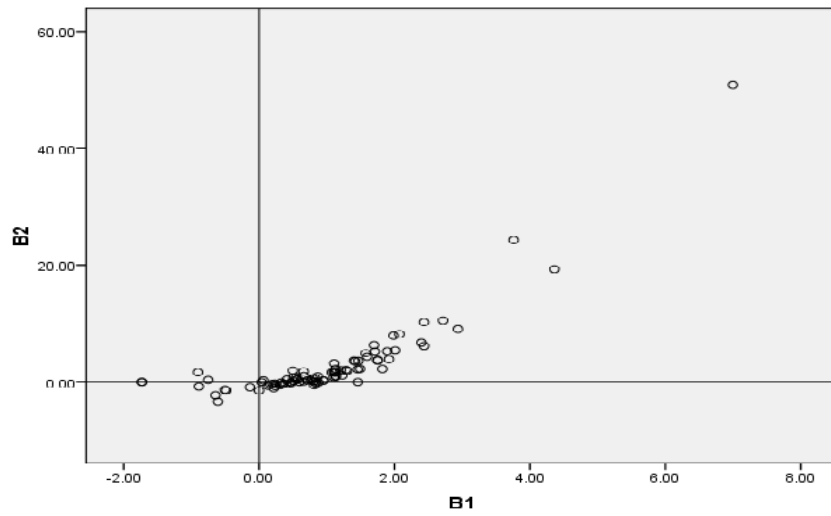


Fig. 1: Graphical representation of $(\beta_1, \beta_2 -3)$ of Makki Surras

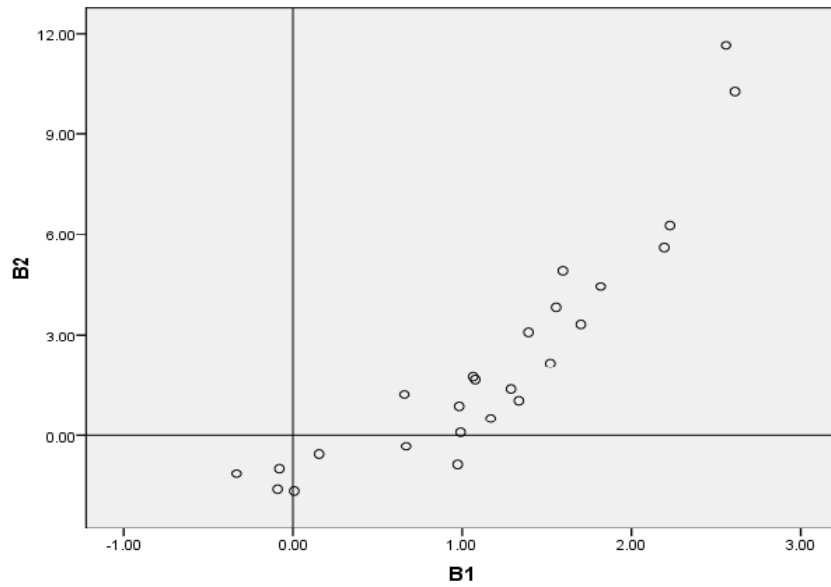


Fig. 2: Graphical representation of $(\beta_1, \beta_2 -3)$ of Madni Surras

3. REFERENCES

1. Al-Dargazelli, Shetha (2004). *A Statistical Studies of Holy Quran*. <http://www.quranicstudies.com/printout104.html>
2. Al-Shalabi, R.G.; Kanaan, J.M.; Jaam A. Hasnah and Hilat, E. (2004). Stop-word removal algorithm for Arabic language. Proceedings of 1st International Conference on Information and Communication Technologies from theory to applications. Damascus, Syria. IEEE, France, 545-550.
3. Al-Suwaindan, Tariq (2006). *The numerical miracles in the Holy Quran*. <http://islamicweb.com/beliefs/science/numbers.html>.
4. Mir, Mustaensir (1999). Is the Quran a shapeless book. *Renaissance*, August, 1999.
5. Naik A. Zakir (2004). *The Quran and the modern science: compatible or incompatible*. Islamic Research Foundation www.Alya.org
6. Naji Alkabi; Mohammad, Kanaan; Ghassan, Nahar; Khalid Mohammad Bani Ismail and Basal Mohammad. Statistical Classifier of the Holy QuranVerses (Fateha and Yaseen chapters) *J. App. Science*. Vol. 15(3), 580-583.
7. Rosty, Stefan (2007). A statistical analysis of the Holy Quran. <http://pressthat.wordpress.com/2007/05/06/62truthbook>.
8. Muhammad Khyzer Bin Dost and Munir Ahmad (2007). A short note on the statistical analysis of Surra Baqra and Surra Inam. *Proceedings of 3rd National Conference on Statistical Sciences*, Lahore, Pakistan.
9. Muhammad Khyzer Bin Dost, Zahoor Ahmed and Munir Ahmad (2007). A Short note on the frequency distribution of Quran word length. *Proceedings of 9th Islamic Countries Conference on Statistical Sciences*, Kula Lumpur, Malaysia.

Appendix A1

Table-A1:
Words per Ayat, Standard deviations, coefficient of variation,
 β_1 and β_2 of Makki Suras

Surra No.	Mean	S.D	C.V	β_1	β_2
1	3.8571	1.3452	34.8752	0.3521	-0.3025
6	20.8485	10.0745	48.3224	1.1287	0.9412
7	17.9320	10.2088	56.9305	1.1022	0.8326
10	18.5138	8.7174	47.0860	1.1311	1.6758
11	17.2927	7.2697	42.0390	0.8681	0.9757
12	17.6216	8.5089	48.2866	1.1200	1.6606
14	17.8654	9.0338	50.5658	1.2986	1.9168
15	7.3434	2.9903	40.7211	1.2047	2.0264
16	16.2422	6.6649	41.0346	0.6599	0.0853
17	15.7387	5.4784	34.8084	0.7691	0.2582
18	15.7727	8.2946	52.5885	1.1344	1.0126
19	11.0306	4.8065	43.5739	1.6976	6.3581
20	10.9704	6.4112	58.4411	1.1033	1.6856
21	11.6964	4.2614	36.4331	0.8014	0.1119
23	9.8814	5.3576	54.2192	2.0102	5.4461
25	13.1948	4.8802	36.9861	0.8215	0.7136
26	6.4185	2.8959	45.1174	2.0730	8.2165
27	13.7957	5.9720	43.2886	1.5954	4.3431
28	17.9773	7.0335	39.1246	0.4098	0.4132
29	16.2029	6.9379	42.8190	0.5075	0.1911
30	15.3000	7.0140	45.8433	0.5617	0.4573
31	18.1176	9.0110	49.7360	0.1307	-0.6546
32	13.6333	5.5490	40.7021	0.0624	0.2823
34	18.4259	8.0578	43.7309	0.9510	0.2347
35	19.3778	9.3597	48.3012	0.3109	-0.5623
36	9.6988	3.9346	40.5683	0.6578	1.7916
37	5.2418	2.4420	46.5873	3.7596	24.3203
38	9.2955	5.4734	58.8821	2.7161	10.5436
39	16.9200	8.5531	50.5503	0.9494	0.2602
40	15.7882	7.6222	48.2775	1.1191	1.5642
41	16.5926	7.7155	46.4997	0.5530	0.3464
42	18.4906	8.7346	47.2381	0.6613	1.0348
43	10.5730	4.5524	43.0571	1.0765	1.6419
44	6.4407	2.5139	39.0316	0.3284	-0.0663
45	14.9189	5.9971	40.1981	0.0392	-0.0108
46	20.4857	9.7268	47.4808	1.1082	3.1948
50	9.4000	3.3056	35.1664	0.5940	-0.0068
51	6.5833	2.5465	38.6804	0.1992	-0.3076
52	6.9592	3.2975	47.3830	1.9857	7.9494
53	6.5645	5.8467	89.0657	2.9370	9.0645
54	6.9636	1.9623	28.1788	0.2357	-0.6898
55	4.9103	2.4345	49.5804	2.4349	10.2465
56	4.4792	1.9028	42.4809	1.4652	3.5912

Contd.....Table-A1

Surra No.	Mean	S.D	C.V	β_1	β_2
67	12.1333	3.3086	27.2690	0.1682	-0.3965
68	6.2885	3.1644	50.3202	0.8752	-0.0781
69	5.4808	2.7260	49.7373	1.7100	5.2672
70	5.4545	2.3373	42.8506	0.8387	0.1044
71	9.4286	5.0216	53.2599	0.8140	-0.5563
72	11.4286	2.8078	24.5680	0.5084	0.7915
73	11.3500	18.8882	166.4163	4.3614	19.3145
74	5.1786	8.7430	168.8306	6.9975	50.8998
75	4.5000	1.0622	23.6038	0.4730	-0.0615
76	8.9677	2.3019	25.6691	0.4977	1.9482
77	3.9600	1.5513	39.1742	1.2309	1.1386
78	5.0250	3.1743	63.1705	2.4366	6.2089
79	4.2826	1.7469	40.7908	1.4012	3.6262
80	3.5952	0.9642	26.8195	0.2306	-0.2447
81	4.2069	1.3464	32.0047	1.5754	4.9456
82	4.6842	1.7655	37.6903	1.4189	3.5451
83	4.9722	1.8281	36.7669	-0.1349	-0.8902
84	4.9200	1.7059	34.6722	1.2844	2.0737
85	5.6364	3.9345	69.8062	1.8212	2.2384
86	4.1176	1.2690	30.8179	0.7931	0.5957
87	4.3158	1.7014	39.4225	2.3959	6.7502
88	3.9231	1.2304	31.3627	0.7153	0.2905
89	5.1333	2.4738	48.1903	1.4910	2.2507
90	4.6000	1.9574	42.5531	1.8919	5.3072
91	4.6000	1.3522	29.3967	1.4559	2.1770
92	4.2381	1.8413	43.4470	0.8346	-0.1709
93	4.5455	1.1282	24.8193	-0.9033	1.6575
94	3.6250	0.5175	14.2772	-0.6441	-2.2400
95	4.6250	2.4458	52.8831	1.7514	3.6586
96	4.0000	1.3333	33.3333	0.4715	-0.1355
97	6.4000	2.0736	32.4007	1.9178	3.8778
100	4.0000	1.5492	38.7298	0.3945	-0.3472
101	3.4545	1.4397	41.6754	-0.5037	-1.2992
102	3.5000	1.1952	34.1494	0.0000	-1.4560
103	6.0000	5.2915	88.1917	1.4579	0.0000
104	3.8889	0.7817	20.1018	0.2160	-1.0413
105	4.8000	1.4832	30.9008	0.5516	0.8678
106	4.5000	2.5166	55.9247	1.1293	2.2271
107	3.8571	1.3452	34.8752	0.3521	-0.3025
108	3.6667	0.5774	15.7459	-1.7321	0.0000
109	5.0000	1.2649	25.2982	-0.8894	-0.7813
110	7.3333	1.1547	15.7459	-1.7321	0.0000
111	5.4000	1.5166	28.0847	1.7488	3.7240
112	4.2500	1.7078	40.1841	-0.7528	0.3429
113	5.2000	1.0954	21.0663	-0.6086	-3.3333
114	3.5000	1.2247	34.9927	-0.4899	-1.4667

Appendix A2

Table-A2:
Words per Ayat, Standard deviations, coefficient of variation,
 β_1 and β_2 of Madni Suras

Surra No.	Mean	S.D	C.V	β_1	β_2
2	23.9860	15.8920	66.2551	2.5585	11.6524
3	19.6700	10.4252	53.0004	1.5947	4.9094
4	24.0227	13.9644	58.1301	1.8183	4.4431
5	26.3583	14.4768	54.9229	1.5203	2.1470
8	19.1467	8.9980	46.9953	1.5551	3.8307
9	22.0620	8.6112	39.0317	1.3919	3.0790
13	22.6512	11.0602	48.8284	0.9821	0.8574
22	18.3846	11.0445	60.0744	2.6115	10.2816
24	23.0938	15.2114	65.8682	2.1938	5.6098
33	20.5616	13.1667	64.0350	2.2272	6.2748
47	16.1842	9.9807	61.6692	1.7010	3.3044
48	22.0000	12.2066	55.4843	1.0646	1.7415
49	21.4444	9.7873	45.6402	0.6688	-0.3351
57	23.1034	10.7349	46.4647	0.9906	0.0858
58	23.9091	12.8356	53.6851	1.2881	1.3909
59	20.7917	9.9301	47.7600	1.3347	1.0169
60	30.2308	18.0100	59.5750	0.9731	-0.8729
61	17.4286	8.6799	49.8027	1.1684	0.4961
62	17.6364	5.8185	32.9913	0.0074	-1.6668
63	18.2727	4.6710	25.5627	-0.3331	-1.1517
64	15.9444	5.5357	34.7186	0.6584	1.2152
65	26.3333	10.7478	40.8144	0.1544	-0.5745
66	23.5833	10.3261	43.7857	1.0770	1.6588
98	12.8750	6.5995	51.2584	-0.0800	-0.9937
99	4.7500	1.1650	24.5256	-0.0904	-1.6133

**STRATEGIC INTEGRATION AND DEVOLVEMENT OF HRM IN PUBLIC
AND PRIVATE CHARTERED INSTITUTES OF PUNJAB, PAKISTAN**

Muhammad Faisal Qadeer¹, Munir Ahmad¹ and Rashid Rehman²

¹ National College of Business Administration & Economics, Lahore.
Email: mfaisalqr@hotmail.com

² Department of Management Science, Gomal University, D.I. Khan.
Email: drrashid.rehman@gmail.com

ABSTRACT

Budhwar and Sparrow (1997) have discussed strategic integration and devolvement of HRM in India and compared the results with those of ten European countries as presented by Brewster and Larsen (1992). Since similar work has not been done in Pakistan, we have made an attempt to discuss these variables in Pakistan. The results show that in public and private chartered institutes of Pakistan practice low level of integration and devolvement. A significant positive relationship between integration and devolvement has been found. A comparison between the two sector shows that there are not significantly different.

INTRODUCTION

The concepts of integration and devolvement have been regularly given importance in HRM literature (see for example, Brewster and Larsen 1992; Budhwar and Sparrow 1997; Budhwar 2000; McCourt and Wong 2003; Andolsek and Stebe 2005; Sheehan 2005; and Purcell and Hutchinson 2007). *Integration* is defined as ‘the degree to which the HRM issues are considered as part of the formulation of the business strategy’ (Brewster and Larsen 1992). *Devolvement* is defined as ‘the degree to which HRM practices involve and give responsibility to line managers rather than HR specialists’. Many rationales for integration and devolvement have been identified in literature (see for example, Lengnick-Hall and Lengnick-Hall 1988, Schuler, 1992; Cunningham and Hyman's, 1999; and Budhwar, 2000).

Organizational characteristics selected for this study include nature of organization - private or public; presence of HR department; existence of HR department since incorporation, main emphasis of HR strategies, age; size; and life-cycle-stage of organization. Several studies have confirmed the influence of one or more than one of these characteristic on HRM (see for example, Jackson et al., 1989; Galang and Ferris, 1997; Muller, 1998; Valle et al., 1999; Hsu and Leat, 2000; Cleland et al., 2000; Horwitz et al., 2002; Thang and Quang, 2005; Ercek, 2006; and Bartram et al., 2007). But there are also studies which do not appreciate the influence of some of these characteristics to HRM (see for example, Poole and Jenkins, 1997; Budhwar and Boyne, 2004; and Pearson et al., 2006). Interestingly, there are some studies which do realize a weak influence of some of these characteristics but they consider some other influence more

importance than these variables (see for example, Budhwar and Sparrow, 1997; Budhwar, 2000; Andolsek and Stebe, 2005)

Generally in the literature, integration and devolvement are described as one process (Andolsek and Stebe 2005). These variables were popularized by Brewster and Larsen, (1992) when they said that these 'two paradoxical elements in particular stand out as common to many analyses of HRM'. Both integration and devolvement can be divided into two levels low and high. Budhwar and Sparrow, (1997) found that in Indian industries about 66% and 67% of organizations were practicing low level of integration and devolvement respectively. Again, Budhwar, (2000) found that over about 50% and 61% of the British firms under study practice a low level of strategic integration and devolvement respectively. They were not in a position to suggest a clear relationship between the practices of integration and devolvement.

Hsu and Leat,, (2000) obtained evidence in Taiwan that some HRM decisions are shared between line management and HR specialists and that line managers had a particularly influential role in decisions regarding recruitment and selection, training and development, and workforce expansion/reduction. According to Cleland et al., (2000) the role of the HR function in New Zealand has changed dramatically. It is becoming more integrated into the overall business planning process and is being linked to organizational objectives. But there was a little evidence of the devolution of HR responsibilities to line managers.

In Mauritius civil service McCourt and Wong, (2003) found that 'integration is, very simply, not practiced and Line manager ownership have little role to play in staff management'. Cardoso, (2004) found HRM function has some degree of strategic integration, but there is an apparent reluctance to devolve HR responsibilities to line managers. Andolsek and Stebe, (2005) suggested that the country sets the limits or encourages devolution. HRM policy within the individual institutional context is of only secondary importance. Country is a factor that fosters divergent tendencies and HRM policy accelerates convergence in HRM practice.

HRM research in HEIs is confined to developed countries. Despite the lack of strategic focus in HRM literature covering HEIs, there is a realization of the fact that the role of faculty is becoming more complex and fragmented (Coaldrake and Steadman, 1998), and more pressured (McInnis, 2000). It has been realized that 'workforce development had become a critical issue in enabling universities to deliver multiple agendas in complex environments' (Gordon and Whitchurch, 2007). Furthermore, Higher Education is being seen as an integrated "project" in which the delivery of multiple agendas in a knowledge environment can only be achieved through a range of contributions from different groups of staff (Duke, 2003; Rhoades, 2005; Sharrock, 2005; and Gordon and Whitchurch, 2007). HR and staff development professionals are also considering how they might interface most effectively with line managers, at all levels, in the field (Knight, 2005). Archer, (2005) is of the view that HR departments have become more involved with strategy than day to-day line management issues.

As for HRM research in Pakistan is concerned, Khilji was the first internationally recognized researcher who opened the window for HRM research in Pakistan (See Khilji, 2001). She had conducted research on banking industry, particularly multinational banks

operating in Pakistan. She extended the on going convergence-divergence debate in HRM (Khilji, 2002). She found that 'the influences of the parent companies of multinationals are weakened by the national characteristics of the environments in which they operate' and the impact of HRM is 'similar to what has been previously documented by researchers in the UK and the USA', (Khilji, 2003). Going further in depth she argued that 'implemented' HRM may be substantially different from 'intended' HRM. Therefore, she suggested that a mere imitation of HRM in the hopes of improving organizational performance creates no value. It is crucial that HR people remain committed and supportive to the development of effective HRM systems by focusing upon actual 'implementation' within their organizations ((Khilji, 2006).

Higher Education Institutes (HEIs) in Pakistan have shown a tremendous growth over the last decade or so and are gaining more and more attention both at locale and international level. HEIs are supposed to be highly knowledge intensive, which makes the management of human capital even more important in them. This paper will provide an excellent opportunity to investigate this dynamic sector and add to the existent HRM literature.

METHODOLOGY

All HEC-institutes of Punjab including Islamabad listed on the official website of HEC is our population. In order to have a complete picture and minimize errors, sampling was intentionally avoided. A standard questionnaire was used for data collection. The registrars' offices were contacted for this purpose. In most of the cases (61.5%) registrar offices responded the questionnaire. We were referred to HR department in those institutes which have formal HR departments (17.3%). In case of non existence of registrar office or non availability of the registrar we were advised to contact administration department (9.6%) and also to other departments (11.5%). Nature of questionnaire was such that we found all categories of respondents equally helpful. Official websites of almost all the institutes were studied. This was very helpful for obtaining basic information and cross checking.

The existing measures of integration and devolvement in the field (see for example, Brewster and Larsen, 1992; Budhwar 2000; Andolsek and Stebe, 2005; Özçelik and Aydinl, 2006) were used in this study. The level of integration is measured on the basis a) Representation of HR/personnel head on the board; b) Presence of a written personnel strategy; c) Consultation of HR/personnel (from the outset) in the development of corporate strategy; and d) Translation of HR strategy into a clear set of work programs. All the scales were dichotomous in nature. Therefore, possible value for each institute ranges from 0 – 4. A score less than or equal to 2 is taken as low and the score of 3 or more is taken as high level of integration. Reliability coefficients alpha for this measurement scale is 0.6318.

In HEIs it seems more appropriate to replace the term line manager with a suitable term in HEIs. Line mangers are 'individuals directly involved in accomplishing the primary purpose of the organization' (Mondy and Noe, 2006). They are not dedicated HR specialist, but have immediate staff management responsibility. In chartered institutes of Pakistan there is usually subject-wise departmentalization. The heads of these

departments/faculties/schools/colleges etc. perform exactly similar activities as those of line managers. Therefore, for customization and to make the terminology more understandable to our respondents, we used departmental heads (DHs) in place of line managers.

The level of devolvement is measured on the basis of a) Change in the responsibility of DHs for HRM (regarding pay and benefits, recruitment and selection, training and development, employee relations, health and safety, and work-force expansion/reduction) b) Primary responsibility for HRM decision making (regarding six HR activities mentioned above; and c) Presence of at least one-third trained DHs. Possible scores of each institute for the three scale range from 0-12, 0-18 and 0-5 respectively. Therefore, an institute's score may ranges from 0–35. A score less than or equal to 18 is taken as Low and a score of 19 or more is taken as High. The alpha values for the three scales are 0.9231, 0.5911 and 0.7428 respectively. And the combined alpha for the measurement scale of devolvement is 0.8051. We have formulated following research hypothesis for this study:

Hypothesis 1: Chartered institutes in Pakistan practice a low level of integration.

Hypothesis 2: Chartered institutes in Pakistan practice a low level of devolvement of HRM.

Hypothesis 3: There is no relationship between levels of integration and devolvement.

Hypothesis 4: There is no difference between public and private sector institutes in their levels of integration and devolvement.

Hypothesis 5: There is no difference between public and private sector institutes regarding their patterns of HRM.

Hypothesis 6: There is no difference between public and private sector institutes regarding their age and size.

DATA ANALYSIS AND INTERPRETATIONS:

Table 1 show that about 73% of the institutes under study practice a low level of integration and about 52% of them practice a low level of devolvement. Thus there is a support for *Hypothesis 1 and 2*. The cross tabulation of the levels of integration and devolvement is also presented in this table. The p-value of the chi-square test is $0.000 < .01$. So, *Hypothesis 3* is strongly rejected. To further support this argument if take devolvement (in numerical form) as a dependant variable and integration (in numerical form) as independent variable and run regression. R-square for the model is 0.259 and p-value in this case is $0.00 < .01$. The regression model is as under:

$$Y (\text{devolvement}) = 15.164 + 1.937 X (\text{integration})$$

Table-1: Levels of integration and devolvement (cross tabulation)

		Level of Devolvement				Total		P-value
		Low		High				
		Freq.	%	Freq.	%	Freq.	%	
Level of Integration	High	1	1.9	13	25.0	14	26.9	0.000
	Low	26	50.0	12	23.1	38	73.1	
Total		27	51.9	25	48.1	52	100.0	

Table-2: Comparison between public and private Sector

Item	Category	Sector		Total	P-Value
		Public	Private		
1. Level of integration	High	7	7	14	0.299
	Low	25	13	38	
2. Level of devolvement	High	13	12	25	0.174
	Low	19	8	27	

Table 2 shows p-value of chi-square test for the level of integration is $0.29 > 0.05$, and p-value for the level of devolvement is $0.17 > 0.05$. Therefore, *Hypothesis 4* is accepted. Similarly, Table 3 shows that the p-values of the chi-square test for seven items are all greater than 0.05. Thus *Hypothesis 5* is also accepted.

Table-3: Comparison of HRM Patterns in Public and Private Sector

Item	Category	Sector		Total	P-Value
		Public	Private		
1. Presence of HR Dept	Yes	7	9	16	0.078
	No	25	11	36	
2. Existence of HR Dept Since incorporation	Yes	6	5	11	0.591
	No	26	15	41	
3. In-charge HRM* having a place on the board	Yes	12	10	22	0.375
	No	20	10	30	
4. In-charge HRM* recruited from	Within the HR Dept.	3	4	7	0.645
	Internal Non-HR Dept.	16	10	26	
	External HR Dept.	7	4	11	
	External Non-HR Dept.	6	2	8	
5. Written HR Strategy	Yes	8	10	18	0.065
	No	24	10	34	
6. Main emphasis of HR strategy	Cost reduction	2	1	3	0.837
	Talent Improvement	8	3	11	
	Ef. Resource allocation	6	4	10	
	Talent acquisition	16	12	28	
7. Life-cycle stage	Maturity	2	1	3	0.437
	Expansion	16	9	25	
	Growth	11	10	21	
	Introduction	3	0	3	

* Including both HR heads and other person in-charge of HR related activities.

Table 4 shows that the p-value for independent-sample T-test in two sectors for age (number of years) is $0.004 < .01$ and p-value that for size (number of employees) is $0.002 < .01$. Therefore, we have to reject *Hypothesis 6*.

Table-4: Comparison between Public and Private Sector

Item	Sector						P-values
	Public			Private			
	N	Mean	s.d.	N	Mean	s.d.	
1. Age (in years)	32	36	47	20	10	6	0.004
2. Size (no of employees)	32	1035	1179	20	318	290	0.002

DISCUSSION AND CONCLUSION

Keeping in view the levels of integration and devolvement in UK and India the results in the chartered institutes of Pakistan are not unexpected. We found that a very low level of integration is prevailing in this sector. Only 16 out of 52 instituted reported the presence of HR department. In most of the cases the registrars are controlling the activities of HRM. By nature, the post a registrar is more a legal oriented post than an HR specialist. They seem not all interested in knowing the difference between personnel and HRM let alone strategic HRM. They have to be always present in board meeting not for the sake of human resource but to perform the duty of secretary to the board. So it would not be fair to put any kind of responsibility upon them to help improve the integration of HRM. The comparison between the two sectors shows that they are similar in all patterns of HRM. The significant difference between them regarding age and size have made no impact at all on Patterns of HRM. This is consistence with some recent studies (see for example Budhwar and Boyne, 2004; and Pearson et al., 2006).

In Pakistan HEIs, we have not yet been able to separate the HR function from registrar oriented approach. First of all we have to pass this barrier, only then we can find ways and means of integration. We must realize that the criticality of the issue of human capital capacity due to increasing pressure of government and global markets in HEIs demand an instant change. Khilji (2001) had described Pakistan culture as an amalgamation of four characteristics namely *Islam religion, Indian origins, British inheritance* and *American influences*. Still another factor *military intervention* can be added to this list. Despite the laps of six decades the centralized structure inherited from colonial period; elite classes created during that and repeated military interventions are maintaining this rigidity. Therefore, centralized decision making is obvious. Private sector institutes are owned by individual or groups representing the elite classes. They are following the traditional approach. That is why private institutes and are not much different than the public one in both of these levels.

There are certain limitations of the study. Being sector specific, the results cannot be generalized for whole Pakistan. More measures of integration can be added from the other frameworks of integration available in the literature. The criticism of top management bias also hold true for this study. So the future research should also include line managers/DHs for investigation to model the change process within HRM. The third party, employees, is most important but has yet been ignored in this discussion.

REFERENCES

1. Andolsek, D.M. and Stebe, J. (2005). 'Devolution or (de)centralization of HRM function in European organizations. *International Journal of Human Resource Management*. 16:3, 11-29.
2. Archer, W. (2005). *Mission Critical? Modernizing Human Resource Management in Higher Education*. Higher Education Policy Institute, Oxford.
3. Bartram, T.; Stanton, P.; Leggat, S.; Casimir, G. and Fraser, B. (2007). Lost in translation: exploring the link between HRM and performance in healthcare. *Human Resource Management Journal*. 17:1, 21-41.
4. Brewster, C. and Larsen. H.H. (1992). Human resource management in Europe: evidence from ten countries. *International Journal of Human Resource Management*. 3, 409-32.
5. Budhwar, P.S. and Sparrow, P. (1997). Evaluating levels of strategic integration and devolvement of human resource management in India. *International Journal of Human Resource Management*. 8:4, 476-94.
6. Budhwar, P.S. (2000). Evaluating levels of strategic integration and devolvement of human resource management in UK. *Personnel Review*. 29:2, 141-57.
7. Budhwar, P.S. and Boyne, G. (2004). Human resource management in the Indian public and private sectors: an empirical comparison. *International Journal of Human Resource Management*. 15:2, 346-70.
8. Cardoso, C.C. (2004). The evolving Portuguese model of HRM. *International Journal of Human Resource Management*. 15:6, 959-77.
9. Cleland, J.; Pajo, K. and Toulson, P. (2000). Move it or lose it: an examination of the evolving role of the human resource professional in New Zealand. *International Journal of Human Resource Management*. 11:1, 143-60.
10. Coaldrake, P. and L. Stedman (1998). *On the Brink: Australian Universities Confronting their Future*. University of Queensland Press, Queensland.
11. Cunningham, I., Hyman, J. (1999). Devolving human resource responsibilities to the line: beginning of the end or a new beginning for personnel? *Personnel Review*, 28:1/2, 9-27.
12. Duke, C. (2003). Changing Identity in an Ambiguous Environment-A Work in Progress Report. *Higher Education Management and Policy*, 15:3, 51-67.
13. Ercek, M. (2006). HRMization in Turkey: expanding the rhetoric-reality debate in space and time. *International Journal of Human Resource Management*, 17:4, 648-72.
14. Galang, M.C. and Ferris, G.R. (1997). Human Resource Department Power and Influence through Symbolic Action. *Human Relations*. 50, 1403-26.
15. Gordon, G. and Whitchurch, C. (2007). Managing Human Resources in Higher Education: The Implications of a Diversifying Workforce. *Higher Education Management and Policy*. 19:2, 135-55.
16. Horwitz et al., (2002). Looking East: diffusing high performance work practices in the southern Afro-Asian context. *International Journal of Human Resource Management*. 13:7, 1019-41.
17. Hsu, Y.R. and Leat, M. (2000). A study of HRM and recruitment and selection policies and practices in Taiwan. *International Journal of Human Resource Management*. 11:2, 413-35.
18. Jackson, S.; Schuler, R. and Rivero, J. (1989). Organizational Characteristics as Predictors of Personnel Practice. *Personnel Psychology*. 42:4: 727-86.
19. Khilji, S.E. (2001). Human Resource Management in Pakistan. In P. Budhwar and D. Yaw (eds) *Human Resource Management in Developing Countries*. London: Rutledge.

20. Khilji, S.E. (2002). Modes of Convergence and Divergence: An Integrative View of Multinationals in Pakistan. *International Journal of Human Resource Management*, 13:2, 232-53.
21. Khilji, S.E. (2003). To Adapt or Not to Adapt? Exploring the Role of National Culture in HRM. *International Journal of Cross-Cultural Management*. 3:2, 121-44.
22. Khilji, S.E. (2006). 'Intended' and 'implemented' HRM: the missing linchpin in strategic human resource management research. *International Journal of Human Resource Management*. 17:7, 1171-89.
23. Knight, P. (2005). The Professional Formation of University Teachers: The Contribution of Human Resource Departments, paper presented at the OECD conference on "*Trends in the Management of Human Resources in Higher Education*". Paris.
24. Lengnick-Hall, C.A. and Lengnick-Hall, M.L. (1988). Strategic human resource management: A review of the literature and a proposed typology, *Academy of Management Review*. 13:3, 454-70.
25. McCourt, W. and Ramguttty, W.A. (2003). Limits to Strategic HRM: The Case of the Mauritian Civil Service. *International Journal of Human Resources Management*. 14:4, 600-18.
26. McInnis, C. (2000). Towards New Balance or New Divide? The Changing Work Roles of Academics in Australia. In M. Tight (ed.). *International Perspectives on Higher Education Research*. Elsevier, London.
27. Mondy, R.W. and Noe, R.M. (2006). *Human Resource Management*, London, UK.
28. Muller, M. (1998). Human resource and industrial relations practices of UK and US multinationals in Germany. *The International Journal of Human Resource Management*. 9:4, 733-49.
29. Özçelik, A.O. and Aydinli, F. (2006). Strategic role of HRM in Turkey: a three-country comparative analysis. *Journal of European Industrial Training*. 30:4, 310-27.
30. Pearson et al. (2006). Micro vs. Small Enterprises: A Profile of Human Resource Personnel, Practices and Support Systems. *Journal of Management Research*. 6:2, 102-12.
31. Poole, P. and Jenkins, G. (1997). Responsibilities for human resource management practices in the modern enterprise: evidence from Britain, *Personnel Review*, 26: 333-56.
32. Purcell, J. and Hutchinson, S. (2007). Front-line managers as agents in the HRM-performance causal chain: theory, analysis and evidence. *Human Resource Management Journal*. 17:1, 3-20.
33. Rhoades, G. (2005). Capitalism, Academic Style, and Shared Governance. *Academe* 91:3.
34. Schuler, R.S. (1992). Linking the people with the strategic needs of the business. *Organizational Dynamics*. 4: 18-32.
35. Sharrock, G. (2005). Leadership and Change in an Australian University, Ph.D. Thesis, Royal Melbourne Institute of Technology, Melbourne.
36. Sheehan, C. (2005). A model for HRM strategic integration. *Personnel Review*, 34:2, 192-209.
37. Thang, L.C. and Quang, T. (2005). Antecedents and consequences of dimensions of human resource management practices in Vietnam. *International Journal of Human Resource Management*, 16:10, 1830-46.
38. Valle et al. (1999). Human resource management and business strategy links: an empirical study, *The International Journal of Human Resource Management*. 10:4, 655-71.

**SKILL BASED MANAGEMENT PARADIGM: A COMPARATIVE STUDY OF
ASKARI COMMERCIAL BANK AND BANK ALFALAH LIMITED**

Neelum Noureen, Shehryar Naveed and Shoaib Akhtar

Department of Public Administration
Fatima Jinnah Women University, Rawalpindi
Email: neelum.neelo@gmail.com

ABSTRACT

The present study was conducted to investigate the relationship between skill-based management and the productivity of organization. The study also looked at the level of skills and productivity in Askari Commercial Bank and Bank Alfalah Ltd. In a correlational as well as comparative study 50 participants were selected from both banks through non-probability purposive sampling technique. Skills and productivity level were assessed by two questionnaires. Result of the study revealed that significant positive correlation was found between skills based management and productivity of organization. The study highlights the important of skills on an organization.

INTRODUCTION

In today's world, competition has become one of the most important elements to survive in any kind of environment, so at this point a question arises that what are the factors that differentiate organizations from each other in this competitive era. To compete with each other, organizations must need to have skilled workers that can directly affect the productivity of organization. To understand causes of productivity growth or decline, economists look at productivity changes from three sources; one is the worker themselves. Part of their skills they acquire before entering the labor force and the skills that workers acquire on the job. (David S. Dahl, 1995)

The word skill refers to task-related behavior that can be acquired through learning and improved with practice and help. The skills are grouped in to five domains: interacting with the environment, managing the job, developing the organization, working with others and knowing self. (Dale, M. 2004). Skills can at times be synonymous with the related concepts of competence, expertise, knowledge and human capital. There are many different kinds of skills. The types considered include pure science, engineering, problem-solving, language skills, team working and communication skills. At a broad level a skill is a human ability coupled with an actual or potential demand for that ability. Skills are directly related to employment, and productivity (Tether, B., Mina, A., Consoli, D. and Gagliardi, D. 2005)

Skills-Based Management (SBM) is a concept about instilling change and real change into the organizational mind-set and value-set. Skills-based management may offer that mechanism through a disciplined program where skills are measured, tracked and combined into job descriptions, where employee's skill gaps are identified as areas of

positive growth. In short, it is creating an environment where individual competence in vital skills is measured. (Riehl and Hank 1998)

A substantial body of research evidence indicates that increasing skills has a significant impact on productivity growth. (Dearden, L., Reed, H. and Reenen, J. 2000) There is number of drivers of productivity performance including investment in physical capital, innovation and technological progress. But 'Skills' play an important role, both directly and indirectly. Blundell, (1999) emphasis that skills along with training increases productivity.

Since the deregulation of the financial sector in Pakistan, Banking Industry has grown from few local banks to the entry of MNB. The SBP regulations have improved tremendously over the last few years. In this competitive environment in Pakistan, traditional employment practices & transformation of work ethics have led to the development of new skills required for sustainability.

The objectives of the study were to find the skill based management practices that enhances productivity of an organization; to investigate the impact of teamwork for accomplishments of organizations' mission; thirdly, to explore the role of communications in problem solving.

Hypothesis

Skills based Management practices are directly related to the productivity of an organization.

Literature Review

Workers with more skills are demonstrably more productive and also more flexible and adaptable. They will contribute more to growth. Most academic evidence shows that improving the skills and qualifications of workers increases growth and boosts national prosperity. There is consensus that improvements in skills provide a boost to growth and are associated with higher levels of national income in the long term. . (Delbridge, R., Edwards, P., Forth, J., Miskell, P. and Payne, J. 2006)

According to the 2005 National Employers Skills Survey, the proportion of establishments spontaneously reporting 'Skill shortage vacancies' has remained unchanged since 2001 at around 4%. The incidence of 'skills gaps', where members of the workforce were deemed to lack sufficient skills for their current job role, fell from 22% of establishments in 2003 to 16% in 2005, accounting for just 6% of the workforce. Furthermore, around three quarters of this Skill gaps' were transitory in that they applied to new recruits or recently promoted staff. (Holzer et al. 1993.)

According to the Scottish Employers Skill Survey of 2004, amongst the 20% of establishments that reported skill shortage vacancies, the four most widely identified skills lacking were all 'soft skills'. That is inadequate. Oral communication skills were identified by 57% of these employers, 52% complained of applicants' customer handling skills, 50% of their proficiency at problem solving; and 43% at their abilities to engage in teamwork. (Moore, 1978). The Nelson Report²⁵, states that young people require a set of skills to prepare them for employment and to ensure they are able to retain that employment in the future. Eight 'key skills' were identified: Communication skills,

Teamwork skills, Problem solving skills, Initiative and enterprise skills, Planning and organizing skills, Self-management skills, Learning skills, Technology skills. Practices aimed at the development of employee skills are an essential part of high performance workplaces, (Nelson, B. 2002a) and skills associated with problem solving and contributing to workplace innovation are amongst those that the literature has identified as significant. (Ramsay, H., Scholarios, D. and Harley, B. 2000).

Team building will occur more easily when all team members work jointly on a task of mutual importance. This allows each member to provide their technical knowledge and skills in helping to solve the problem, complete the project, and develop new programs. During this process, team building can be facilitated as members evaluate their working relationship as a team and then develop and articulate guidelines that will lead to increased productivity and team member cooperation (Woodcock, M., and Francis, D. 1994)

Communication skills are required in most occupations. Employers identify communication as one of the basic competencies, asserting that the ability to communicate is valuable for obtaining employment and maintaining successful job performance. The communication skills essential in the workplace include basic oral and writing skills, and the ability to communicate in work groups and teams, with persons of diverse background, and when engaged in problem solving and conflict management (Morreale, S.P., Osborn, M.M., and Pearson, J.C. 2000)

METHODOLOGY

The present co relational study was conducted to investigate the effect of Skill based management practices on the productivity of Askari Commercial Bank and Bank Alfalah Limited. The non-probability purposive sampling technique was used. The present study had a total of 50 participants out of which 20 were from Management, divided equally between Askari Commercial Bank and Bank Alfalah Limited. And 30 Participants were General Employees, divided equally between ACB & BAL. Variable of the research study were as follows: Skill Based Competencies were independent Variables of the study. Organizational Productivity was the dependent Variable. As the study involved six variables, namely, skill based management, Productivity, Team building skill, Innovation skill, Problem-solving skill, and Communication skill. All variables of skills were measured with the help of Skill assessment Questionnaire, which was developed by Canada's Campus Connection updated in 2003, and adapted to the requirements of the present study. This questionnaire was consisted of 50 items, but for the purpose of this research 20 items have been studied that were more related with the variables of skills taken. For measuring the productivity of organization, employee engagement questionnaire was used which was developed by "The Gallup Organization, Princeton, NJ. 2003" and adapted to the requirements of the present study. The Questionnaire consisted of 12 items but for the purpose of this study 11 items have been taken for this research. Response options of both the questionnaire were scored on five- point Likert Scale. The score ranged from 1 (Strongly Agree) to 5(Strongly Disagree) for each item.

RESULTS

Relationship between Skills and Productivity of organization

To find out the relationship between skills and productivity Pearson correlation was computed which came out to be 0.716**, which was highly significant. To check the organizational differences on productivity t-test was computed. The result shows that there is a significant difference ($P < .05$) between the scores of Askari Commercial Bank and Bank Alfalah Ltd on the scores of productivity questionnaire. Bank Alfalah scored relatively higher on SAQ ($M=33.20$, $SD=10.075$). Level of probability $< .05$ show significance and acceptance of hypothesis. This indicates that Bank Alfalah's productivity is higher as compared to Askari Bank. Regarding skill assessment of both the organizations, the result shows that there is a significant difference ($P \leq .05$) between the scores of Askari Commercial Bank and Bank Alfalah Ltd on the scores of Skill assessment questionnaire. Bank Alfalah scored relatively higher on EEQ ($M= 67.12$, $SD= 9.846$). This indicates that employees of Bank Alfalah are more skilled as compared to Askari Bank. Level of probability $< .05$ show significance and acceptance of hypothesis.

DISCUSSION

The present study was conducted to investigate the relationship between Skill based management and the productivity of organization as well as to compare the level of skills and productivity in Askari commercial Bank and Bank Alfalah Ltd. On the basis of co relational values it can be stated that Hypothesis, Skills based Management practices are directly related to the productivity of an organization is accepted. Results of the present study indicate that productivity of organization is highly dependent on the skills of their employees. If the management focus on the skill developments of employees, identify the gaps among their skills and try to fulfill those gaps then it will give a positive impact to organizational productivity. This finding is consistent with the study, conducted by (Blundell, 1999) According to which there is number of drivers of productivity performance but 'Skills' play an important role, both directly and indirectly. Skills make a real difference to organizational performance.

Skills Based Management Practices are playing vital role in the productivity of Askari Commercial Bank as compared to Bank Alfalah. Although Bank Alfalah has high mean value, may be this is because of the neutral responses in lots of questions. But Results show that Skills based management practices in Askari bank are higher than Bank Alfalah. Majority of respondents in Askari bank strongly agree to the fact that they are well aware of expectations of organization at work; they have required knowledge and skills to do work right as well as have opportunities to do best. As compared to Askari bank, Bank Alfalah shows a slight low level of skills. May be they are lacking in skills or may be the facilities given to the employees do not enable to enhance their skills. It is supported by a research finding, conducted by (Greenan, 2003), according to which Skill changes emerge as more closely connected to organizational than technical change. Much of the literature emphasizes the systemic nature of the relationships between innovation, skills and productivity.

Productivity of Askari bank is higher than Bank Alfalah. It is further supported by the comparison of income statements and balance sheets of both banks. It gives the

profitability ratio by applying the formula of Return on Asset (Net Income / Total Assets). In year 2005 profitability of Bank Alfalah was 0.7083% but in year 2006 the ratio was 0.63938%. And the ratios of Askari Bank in year 2005 were 0.5769% but in year 2006 it was 0.66064%. It shows that Bank Alfalah has decreased its level of profitability from the last year and from Askari Bank as well. And Askari Bank has improved itself from last year as well. It is further supported by research findings conducted by (Hogarth, 2001) according to that at least a third of organizations that experience skill shortages or skill gaps report negative effects on organization performance.

Results of the study indicate that as compared to Bank Alfalah, Askari bank shows a satisfactory level of Team building skills, Communication Skills, Problem solving Skills, and Innovation skills. A study findings conducted by (Bateman, 1990) supported team building in a way that Team building allows each member to provide their technical knowledge and skills in helping to solve the problem, complete the project, and develop new programs. And it will lead to increased productivity and team member cooperation.

Results of the study also indicate the level of communication skills in both banks. Communication skill was assessed by the results of effective use of communication skills and technologies by management, Majority of employees of Askari bank agree but management shows a neutral response. In Bank Alfalah almost equal proportion of management as well as employees agree to the fact. While in response to focusing on open door policy by management encourages participation, ideas & creative thinking, majority from the management of both banks were neutral in response to this question. But some of them agree as well. And from the employees of both banks majority were agree. Askari bank shows a high level of this skill in management as well employee level. According to a research finding conducted by (Marjatta Huhta, 1999) which states that Communication skills are a bridge of understanding between cultures and individuals. Another research finding conducted by (Morreale, Osborn, & Pearson, 2000) states that Communication skill is required in most occupations. Employers identify communication as one of the basic competencies.

Indicators to measure the Productivity of organization for this study were Employee performance, motivation by management, working environment, Skills of employees, Opportunities to grow, and Procedure knowledge. The results of the study indicate that recognition or praise for doing good work, care by supervisor, encouragement, importance of opinion at work are the most important factors, which motivates employees towards better performance and it directly effects the productivity of organization. This is supported by research findings conducted by (Cochrane et al, 2005), According to that as employees are trained to do new tasks and as their skill levels increase, so their job security becomes greater as their value to the firm increases. Results show that majority of respondents from management as well as employees of Askari bank have high level of required knowledge and skills as compared to bank Alfalah. In response to expectations of organization, both organizations are highly aware about the fact. In response to the question about opportunity to do best at work place. Majority of respondents from the management and high number of employees of bank Alfalah respond very positively. According to results bank Alfalah possess high level of opportunities to do best work as compared to Askari bank. In response to recognition or

praise for good work at workplace, management of Askari bank shows a positive attitude than bank Alfalah. But equal numbers of employees of both banks agree to the fact. Overall Askari bank possesses high level of praise for good work.

LIMITATIONS

The study has few limitations which when overcome can be generalized for the whole of the banking industry. The study was limited to the main branches of both the banks in the Rawalpindi/Islamabad region and the sample size was limited because of the time constraint.

CONCLUSION

From the above discussion and analysis of all the results it can be concluded that Skills based management practice increases the productivity of organization. As the skills are the competencies and abilities of employees and plays an important role in the productivity of organization, it is confirmed with the help of this research that there is a positive relationship between skills and productivity of organization both directly and indirectly. Therefore, our hypothesis Skill Based Management is directly related to the productivity of an organization is accepted according to the results of research. Workers with more skills are demonstrably more productive and contribute to organizational growth.

REFERENCES

1. David S. (1995). *Productivity primer: How does economy grow?* Dahl Economics Editor.
2. Tether, B., Mina, A., Consoli, D. and Gagliardi, D. (2005). *A literature Review on Skill and Innovation*. UK.
3. Riehl and Hank (1998). *Work Process Improvement Today*. Skills-based management.
4. Dearden, L., Reed, H., and Reenen, J. (2000). *Who Gains when Worker Train? Training and Corporate productivity in a Panel of British Industries*, IFS Working Paper No. 00/04. Cited In ESRC Seminar Series (2004) Mapping the public policy landscape, The UK's productivity Gap. What research tells us and what we need to find out?
5. Blundell, R. (1999). Human Capital Investment: The Returns from Education and Training to the Individual, *The Firm and the Economy*, Fiscal Studies, 20(1), 1-23.
6. Patterson, M. (1997). *Impact of People Management Practices on Business Performance*, Issues in People Management No. 22, London, CIPD. Cited In Campbell, M., and Giles, L., The Skill and Productivity challenge: A summary of the evidence Base for the ssda's, Strategic plan 2003-2006.
7. Hogarth, T. (2001). *Employers Skill Survey 2001*. Nottingham: Department for Education and Skills. Cited in Campbell, M. and Giles, L., The Skill and Productivity challenge: A summary of the evidence Base for the ssda's, Strategic plan 2003-2006.
8. Paul Krugman (1990). *The Age of Diminished Expectations*.
9. Cuenca, J. (2006). Productivity: *Putting the Use of Resources at their Best*. PIDS Economic Issue of the day.

10. Ruch, W.A. (1992). The measurement of white-collar productivity. *National Productivity Review*, No. Autumn, 416-26. Cited In: Atul Gupta, Productivity measurement in service operations: a case study from the health-care environment, New Jersey, USA.
11. Delbridge, R., Edwards, P., Forth, J., Miskell, P. and Payne, J. (2006). *AIM Research-The Organization of Productivity*. Re-thinking Skills and Work Organization.
12. Sianesi and Reenan, V. (2002). *The returns to education*.
13. Haskel, J. (2004). *How much do Skills Raise Productivity?* UK Evidence from Matched Plant, Worker and Workforce Data', draft note, CeRiBA, Centre for Research into Business Activity. Cited In ESRC Seminar Series: Mapping the public policy landscape, The UK's productivity Gap. What research tells us and what we need to find out?
14. Holzer et al (1993). Are training subsidies for firms effective? *The Michigan experience, Industrial and Labour Relations Review*.
15. Iranzo, S., Schivardi, F. and Tosetti, E. (2006). *Skill dispersion and firm productivity: an analysis with employer-employee matched data*.
16. Allen, G. (1998). *Management Modern: Supervision*.
17. Moore (1978). *The Scanlon Way to Improved Productivity*. Cited in: Thomas, B., and Baron, J. (1994), Evaluating Knowledge Worker Productivity: Literature Review, USACERL Interim Report FF-94/27.
18. Nelson, B. (2002a). Employability Skills for the Future. *Ministerial discussion paper*, Canberra: Commonwealth of Australia. Retrieved from:http://www.dest.gov.au/ty/publications/employability_skills/index.htm.on25th April, 2007.
19. Ramsay, H., Scholarios, D. and Harley, B. (2000). Employees and high-performance work systems: Testing inside the black box. *British Journal of Industrial Relations*, 38(4), 501-531.
20. Lee, B.H., Kim, D.B. and Kim, D.O. (2004). High Performance Work System in Korea. http://www.kli.re.kr/20_english/02_work/file.
21. State of Wisconsin. (1999). *High-Performance Partnerships: Winning Solutions for Employers & Workers*. State of Wisconsin: Department of Workforce Development.
22. Hutt, D. and Read, V. (2003). *Simply the best: Workplaces in Australia*. (Australian Centre for Industrial Relations Research & Training (ACIRRT) working paper 88).
23. Cochrane, B., Harris, P., Law, M. and Piercy, G. (2005). *Skill Needs and Worker Voice in High Performance Workplaces: A Case Study Of The Dairy Industry*, Selected Literature Review, University Of Waikato Hamilton, New Zealand.
24. Woodcock, M. and Francis, D. (1994). Team building strategy. Hampshire, England: Alder shot. Cited in: Gordon, A., Bloom, & Diane, E. Stevens Case Study: A Team-Building Mental Skills Training Program with an Intercollegiate Equestrian Team, Athletic insight: *The Online Journal of Sport Psychology*.
25. Greenan, N. and Guellec, D. (1998). Firm organization, technology and performance: An empirical study. *Economics of Innovation and New Technology*, 6, 313-347.
26. Greenan, N. (2003). Organizational change, technology, employment and skills: An empirical study of French manufacturing, *Cambridge Journal of Economics*, 27, 287-316.

27. Hanel, P. (2006). Working Paper Skills Required for Innovation: A Review of the Literature [Université De Sherbrooke and Centre Interuniversitaire de Recherche Sur La Science Et La Technologie (CIRST)].
28. Gray, P. (2000). A problem-solving Perspective on Knowledge Management Practices, Forthcoming In Decision Support Systems, *Working Paper 00-01*, *Queen's Management Research Centre for Knowledge-Based Enterprises*.
<http://www.Business.Queensu.Ca/Kbe>
29. Morreale, S.P., Osborn, M.M. and Pearson, J.C. (2000). Why communication is important: A rationale for the centrality of the study of communication, *Journal of the Association for communication Administration*, 29, 1-25.

**ENTREPRENEURIAL ACHIEVEMENTS AND HIGHER EDUCATION
(A SURVEY STUDY OF SMALL BUSINESS ESTABLISHMENTS)**

Nida Rehman, Shehryar Naveed and Shoaib Akhter

Department of Public Administration, Fatima Jinnah Women University
Rawalpindi.

ABSTRACT

The present study was conducted to analyze whether the successes gained by the entrepreneur is positively related to higher education or not. In this study sample of 50 local entrepreneurs was taken, from the area of Rawalpindi and Islamabad. Non-probability convenience sampling technique was used in this research. The attitudes of the respondents were assessed with the help of self-designed questionnaire. Results showed that there is non-significant relationship between higher education and successful enterprises.

1. INTRODUCTION

Entrepreneurship as a topic was introduced in eighteenth century. Now presently the term entrepreneurship is become synonyms or at least closely linked with free enterprise. Entrepreneurship is a difficult concept to define and measure. It is more than starting up a new business; it encompasses risk, new and innovative ideas and addressing problems through radical thinking. The verb entrepreneur was used in France in the early 1500's to mean, "To undertake". Entrepreneurs have many of the same character as leaders. Entrepreneurs are often contrasted with managers and administrators who are said to be more methodical and less prone to risk-taking. Many people define the term entrepreneur differently as, David McClelland (1961) described the entrepreneur as primarily motivated by an overwhelming need for achievement and strong urge to build. Collins and Moore (1970) studied 150 entrepreneurs and concluded that they are tough, pragmatic people driven by needs of independence and achievement. They seldom are willing to submit to authority. Bird (1992) sees entrepreneurs as mercurial, that is, prone to insights, brainstorming, deceptions, ingeniousness and resourcefulness. They are cunning, opportunistic, creative, and unsentimental. Busenitz and Barney (1997) claim entrepreneurs are prone to overconfidence and over generalizations. According to Cole (1959), there are four types of entrepreneur: the innovator, the calculating inventor, the over-optimistic promoter, and the organization builder. These types are not related to the personality but to the type of opportunity the entrepreneur faces. Burton W. Folsom, Jr. distinguishes between what he calls a political entrepreneur and a market entrepreneur. The political entrepreneur uses political influences to gain income through subsidies, protectionism, government-granted monopoly, government contracts, or other such favorable arrangements with government. The market entrepreneur operates without special favors from government.¹

More recent definitions of entrepreneurship differ from each other, but they generally encompass some or all of the following elements:

- Identifying opportunities
- Creating a business
- Being innovative
- The taking of risks
- Creating value.²

2. LITERATURE REVIEW

According to a study conducted by Babson Executive Education (2003) it was found that every human being has naturally entrepreneur skills in it. The characteristics that are naturally found in human beings include intelligence; health; perseverance; attention span and Optimism. The same study also indicated that there are skills that can be learnt through proper education. The learnt skills include listening capacity; knowledge; identifying goals and objective, skepticism and advocacy.³

A survey conducted by Northeastern University's School of Technological Entrepreneurship (2006) concluded that nearly two-thirds of entrepreneurs were inspired by start their own companies by their innate desire and determination, to start their own businesses rather than by their education or work experience. Only 1 percent of more than 200 U.S. entrepreneurs surveyed cited higher education as a significant motivator toward starting their own venture, while 61 percent cited their "innate drive." Other motivators cited were work experience 21 percent and success of entrepreneurial peers within their industry 16 percent. Thirty-three percent of respondents launched their first venture between the ages of 18 and 30; 13 percent between 30 and 40; and only 12 percent started their first business after the age of 40. The survey also suggested that the majority of entrepreneurs were confident about the success of their first venture. Thirty-two percent said they had no fear that their venture would not succeed, while 42 percent had some fear but characterized themselves as confident. Only 14 percent said they experienced significant fear that their first venture would fail, while 12 percent said fear of failure delayed their leap into entrepreneurship.⁴

A study was conducted by the students of entrepreneurial education on the comparison of old way of teaching of entrepreneurial education with new method of teaching entrepreneurial education. As an old method students take case method as most of the institutes were using this method in early period of introducing of entrepreneurial education and project method as a new method of teaching as at that time most of the universities use this method for teaching entrepreneurial education. By conducting a survey amongst current MBA students and alumni at the University of Calgary they discovered that the students felt the case method was effective in developing analytical skills and the ability to synthesize information. However, courses based on the project method were perceived to develop and enhance knowledge and understanding of the subject area, as well as the ability to evaluate, and were felt to be more effective in teaching entrepreneurship. (McMullan and Boberg, 1991)⁵

Entrepreneurship is an ongoing lifelong learning experience and, as such, the best way to learn is to combine experience with formal educational activities. Based on their

study of 100 established entrepreneurs attending a management program at Harvard Business School, they claim that analytical thinking; accounting, finance, marketing, management information systems and manufacturing are among those aspects of entrepreneurship that can be taught. However, other more critical skills such as judgment, handling people, patience and responsibility cannot be taught directly and can only be learned in the real world. (Timmons and Stevenson, 1985)⁶

According to the study conducted by Australian Government in January 2001, “Back Australia’s Ability”, it was recommended that higher education institutes should be established to foster enterprise culture, the study also did comparison between the United States Universities offering entrepreneurial education and Australian institutes offering entrepreneurial education. The elements that were considered in this study were:

1. To strengthen the ability
2. To generate ideas
3. To developing and retaining skills. (Lord, 1999)⁷

The study also did the comparison of traditional and new trends of entrepreneurial education according to the study traditional business education programs emphasizes on imagination, creativity, and risk taking in business whereas traditional business schools tend to over-emphasize quantitative and corporate techniques at the expense of more creative skills (Porter, 1994)⁸

However, new entrepreneurial education has firmly established a beachhead in academia as a result of a shift in academic thinking about the value of this field. It is now recognized that entrepreneurship is an important educational innovation that provides the impetus to learning about learning (Charney and Libecap, 2003)⁹

According to a research report “Entrepreneurial Disposition, Skills, and Knowledge” have lasting impacts on students of all ages. Like research has indicated that students who participated in entrepreneurial education programs at the elementary level have increased attendance, higher academic achievement, fewer discipline referrals, and an increased awareness of career and entrepreneurial options (Consortium, 2006).¹⁰

As far as the Middle school students who participated in entrepreneurial education were more likely to continue to high school, have improved academic skills, increased self-esteem and respect, improved financial literacy, and develop essential workplace literacy skills (NFTE 2006).¹¹

At the high school level, entrepreneurship education has further benefits including increased economic, marketing, and personal finance content knowledge; an increase in idea generation skills; the development of abilities to evaluate problems and translate them into opportunities; and the development of ethical business practices and attitudes.

In an Article written by Javed Chaudary in The Express Newspaper on life history of Ingvar Kamprad who was the 4th richest man in the whole world owner on IKEA Company the words of Ingvar Kamprad shows the education is not necessary for operating a business as according to the article, if we look at his education than we come to know that he has never been to college in his life but still at that time he interpreted the market signals so well like a professional of business administration that he got succeeded in his life although no one could say that he would accomplish his idea. When

Ingvar Kamprad was asked about relationship between success and education than he that, Success and prosperity have nothing to do with education, statistically it was pointed out there are nine hundred and fifty billionaires in the world but none of them is a teacher or doctor. But most of them started their business either in student life or very early without wasting time on the education because they understood the worth of time. So this worth of time takes them to the market to do everything practically from college so no successful businessman is highly qualified, and that is how they just get successful through their courage, devotion, hard work and the best use of their abilities.¹²

AIM/ OBJECTIVE OF STUDY

- To test out that the achievements of local entrepreneurs are due to their higher education.
- To test out that the achievements of the local entrepreneurs are due to their long time experience in the market.
- To test out that the achievements of the local entrepreneurs are due to their family background.

HYPOTHESIS

- H1: Entrepreneurial success is dependent on higher education.
 H2: Entrepreneurial success is independent of higher education.

RESEARCH QUESTIONS

- Whether the achievements of the local entrepreneurs are because of their higher education?
- Whether the achievements of the local entrepreneurs are because of their long time experience in the market?
- Whether the achievements of the local entrepreneurs are due to their family background?

3. METHODOLOGY

The present exploratory study was conducted to check that whether the success of an entrepreneur is due to higher education or not. Sample was selected by non-probability convenience sampling technique. Sample comprised of 50 local entrepreneurs who were taken in order to check the acceptance or rejection of our hypothesis. The entrepreneurs were taken randomly from the area of Rawalpindi and Islamabad. Entrepreneurial Achievements (Dependant Variable): Signify that the achievements gained by the local entrepreneurs are dependent on Higher Education. Higher Education (Independent variable): Signify that the Educational degree related to work of the entrepreneurs is one of the reasons of their success.

Entrepreneurial Achievements: Signify that the achievements gained by the local entrepreneurs in the market. Higher Education: Signify that the Educational degree related to work of the entrepreneurs

The entrepreneurs who are well established were taken randomly from the area of Rawalpindi and Islamabad. The inclusion criterion in the study was to have an experience of self-business for at least five years. Questionnaire (Self made) was used in order to

check the validity of our hypothesis. The reliability value of questionnaire was found to be 0.760, which signifies that the questionnaire was reliable for future researches on the same topic. So the questionnaire used was at 95% confidence level. A questionnaire based on categorical scale was prepared containing 12 items rating, Yes and No. A number of primary sources consisted of self-made questionnaire (Reliability Level 0.760) and secondary sources like articles, journals, were used. Data is entered in SPSS software and then results were to be analyzed by frequency distribution. The participants were approached at their workplace. The participation was voluntary in order to have honest answers. They were briefed about the nature of research being carried out, and informed consent was obtained. Participants were assured that their responses and identity would remain confidential.

RESULTS

The purpose of the present study was to check that the achievements gain by the local entrepreneurs is positively related to higher education or not. For this purpose a self-made questionnaire was used which was made with the help of supervisors.

To prove the results in a better way the comparison of frequency of different questions are as follows:

- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business and do entrepreneurs acquire any kind of education to run business; The result shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, 30 entrepreneurs acquired education to run their business.
- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business and do entrepreneurs acquire high education to run business or not; responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business but out of 50 only 16 entrepreneurs get high education. This shows that local entrepreneurs do give importance to education but they do not acquire higher education in order to run their business.
- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business and do entrepreneurs believe that education do help in achieving the goals of the business; The responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, 41 respondents believe that education do help in achieving the goals of the business. This shows that local entrepreneurs do give importance to education and they also think that education do help in achieving goals set by them for their business.
- While comparing the questions that whether; The responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, 30 respondents believe that education do help in the better utilization of their resources. This shows that local entrepreneurs do give

importance to education and they also think that education do help in better utilization of their resources.

- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business and do entrepreneurs believe that education help in retaining customers; the responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, 30 respondents do believe that education do help in retaining customers. This shows that local entrepreneurs do give importance to education and they also think that education do help in retaining their customers.
- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business and what they think is there any kind of difference between educated and uneducated entrepreneurs; the responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, 26 respondents give opinion that there is a difference between educated and un-educated businessmen. It verifies that local entrepreneurs do give importance to education and almost half of the sample size did believe that there is a difference between educated and un-educated businessmen.
- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business and what they think that the outcomes of their business would be different if they were educated / un-educated; the responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, 29 respondents give opinion that the outcomes of their business would be different if they were educated / un-educated. This reveals that local entrepreneurs do give importance to education and majority of the sample size did believe that outcomes of their business would be different if they were educated / un-educated.
- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business and if government offers courses to entrepreneurs they would have gone for them or not; the responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, 26 respondents think that if government offers courses they would have gone for that. This shows that local entrepreneurs do give importance to education but half of them do not want to take courses offered by government related to their business.
- While comparing the questions that whether entrepreneurs believe that education is very important to run any kind of business; the responses shows that out of 50, 41 entrepreneurs believe that education is very important to run any kind of business and out of 50, only 11 respondents believe that they usually hire educated staff. This shows that local entrepreneurs do give importance to education but at the time of hiring they give importance to experience rather than education.
- While comparing the questions that whether entrepreneurs believe that they acquired education to run business properly and education plays important role in

achieving goals of the business; the responses shows that out of 50, 30 entrepreneurs believe that they acquired education to run business and out of 50, 40 respondents believe that education plays important role in achieving goals of the business. This shows that local entrepreneurs do acquire education and they also acknowledge that education play important role in achieving goals set by them for their business.

- While comparing the questions that whether entrepreneurs believe that education is very important for achieving goals of the business and if government offers courses whether entrepreneurs do go for it; the responses shows that out of 50, 40 entrepreneurs believe that education is very important for achieving goals of the business and out of 50, 24 respondents believe that if government offers courses they do go for it. This shows that local entrepreneurs assume that education play important role in achieving goals of the business but half of them do not want to take courses offered by government related to their business.
- While comparing the questions that whether entrepreneurs believe that education plays important role in better utilization of resources and if government offers courses whether entrepreneurs do go for it; the responses shows that out of 50, 39 entrepreneurs believe that education plays important role in better utilization of resources and out of 50, 24 respondents believe that if government offers courses they do go for it. This shows that local entrepreneurs do believe that education plays important role in better utilization of resources but half of them do not want to take courses offered by government related to there business.

DISCUSSION AND ANALYSIS

The present study was conducted to investigate that the achievements of the entrepreneurs are dependent on higher education or not. On the basis of results and analysis of questionnaires it can be stated that the hypothesis of the study; “Entrepreneurial success is dependent on higher education”(H1), is rejected and the second hypothesis of the study “Entrepreneurial success is independent of higher education”(H2), is accepted. So result of the present study indicates that for entrepreneurial achievement the higher education is not of much importance. This finding is also supported by the article (Javed Chuhadry, 2007), as that article comprised of the interview of world’s fourth richest man Ingvar Kamprad according to him, Success has nothing to do with education, if it is so then the thirty thousand people who used to work for him and were more educated than him would have there own businesses. It was further supported by the research (North Eastern University's School of Technological Entrepreneurship, 2006), and according to that study, out of two hundred entrepreneurs 42% of respondents said that they launched their first venture in childhood, it seems as though the enterprising spirit resides within the individual, is not developed in the individual through higher education. In this research it was also stated that out of 200 only 1 respondent said that he started business because of his studies.

The findings of the study also indicates that the local entrepreneurs do believe that skill acquisition is very important to run any business but the fact is that only few of them acquire higher education. Because entrepreneurs believe that due to proper skill set they

can achieve their goals and can also utilize their resources in better way so it reveal that entrepreneurs consider skills to plays important role to operate business properly but it was said by any one of the entrepreneur that higher education is important. Most of the entrepreneurs think that education can let them retain their customers more easily and in a better way. There is also a significant difference between educated and uneducated entrepreneurs and their outcomes also vary. This thing was also supported by a research (Babson Executive Education, 2003), as the conclusion of the research is that, almost all human beings are born entrepreneurs so anyone can start business and become an entrepreneur and that research also stated that there are some learnable skills like better utilization of resources, techniques to retain customers etc, due to those skills a person can handle the problems of the business in better way as proved by this research paper that entrepreneurs do acquire some skills in order to run business but not higher education. So as in research it was not stated that those skills can only be learn due to higher education so it support our finding.

Another point which comes forward from this study is that almost all of the entrepreneurs run this business because their parents were in same business and others being motivated by their relatives to start such business.

As the findings of the study also shows that the entrepreneurs are not too much interested in the courses related to their work because they think that after having such time and exposure in market they do not need to get any kind of extra education at present, and it was also shown from the research that according to the entrepreneurs basic education is important but the experience is much more important than education as they are used to hire more experienced staff rather than highly educated staff.

LIMITATIONS

Present study was conducted to investigate that whether Entrepreneurial Achievements is Dependent on Higher Education or not following are the few limitations of the present study

- Ideally the scope of the research could be the whole Entrepreneurs of Pakistan. However it is confined to the Entrepreneurs of Islamabad and Rawalpindi.
- Due to the busy schedule of Entrepreneurs, Limited time was given to respond the questionnaire.
- Due to the lack of Time and resource, only 50 entrepreneurs were taken as a sample randomly from Rawalpindi and Islamabad.

RECOMMENDATIONS

Present study was conducted to investigate t that whether Entrepreneurial Achievements is Dependent on Higher Education or not. Following are the few recommendations:

1. Education must be essential for every entrepreneur in order to run any kind of business.
2. There should be special courses for entrepreneurs in order to give them expertise in a particular type of business.

3. This study becomes more authentic if further anyone can do research on it and as a sample he select the entrepreneurs all over the Pakistan.

CONCLUSION

From the interpretation of the results and discussion it has become obvious that the local entrepreneurs consider basic skills and knowledge related to their profession as fundamental key to operate their business and after regarding them most of the successful entrepreneurs also acquired the basic skill in order to run their business smoothly but they do not think that higher education is important to run business because they believe that after being educated entrepreneurs become more conscious for taking bold steps in business operations. It was also come to light that education is not only the motivation for entrepreneurs to start the business most of them were in this business because their parents, and from our research it was also concluded that although education is important to run any business but at the time of hiring entrepreneurs do prefer those people who are less educated but experienced.

So from this it is concluded that Success of entrepreneur is not dependent higher education.

REFERENCES

1. Entrepreneur retrieved from <http://en.wikipedia.org/wiki/Entrepreneurship>
2. Entrepreneur activities retrieved from <http://en.wikipedia.org/wiki/Entrepreneurship>
3. Babson Executive Education (2003). Entrepreneurs: Born or made? A conversation with Herb Kelleher of Southwest Airlines.
4. Leslie Taylor (2006). Are Entrepreneur are born or made.
5. McMullan, C.A. and Boberg, A.L. (1991). The relative effectiveness of projects in teaching entrepreneurship. *Journal of Small Business and Entrepreneurship*, Vol. 9, 14-24. Sited in Entrepreneurship Education And Training By Colette Henry Dundalk Institute of Technology, Dundalk, Co Louth, Ireland Frances Hill and Claire Leitch School of Management, Queen's University Belfast, Belfast, Northern Ireland, UK.
6. Timmons, J.A. and Stevenson, H.H. (1985). *Entrepreneurship education in the 1980s – what entrepreneurs say*. in Kao, J. and Stevenson, H.H. (Eds), *Entrepreneurship – What it is and How to Teach it*, Harvard Business School, Cambridge, MA, 115-34. Sited in Entrepreneurship Education And Training By Colette Henry Dundalk Institute of Technology, Dundalk, Co Louth, Ireland Frances Hill and Claire Leitch School of Management, Queen's University Belfast, Belfast, Northern Ireland, UK.
7. Lord, M. (1999). *Attention, aspiring capitalists: B-school students are studying entrepreneurship*. US News Online, available at: www.usnews.com. Sited in A contemporary approach to entrepreneurship education By Colin Jones and Jack English. 46(8/9), 2004, 416-423.
8. Porter, L. (1994). The relation of entrepreneurship education to business education. *Simulation and Gaming*, 25(3), 416-9. Sited in A contemporary approach to entrepreneurship education By Colin Jones and Jack English 46(8/9) 2004, 416-423.
9. Charney, A.H. and Libecap, G.D. (2003). The contribution of entrepreneurship education: an analysis of the Berger program. *International Journal of*

- Entrepreneurship Education*, 1(3), 385-417. Sited in A contemporary approach to entrepreneurship education By Colin Jones and Jack English. 46(8/9), 2004, 416-423.
10. Consortium for Entrepreneurship Education (2006). *The Journal for the Liberal Arts and Sciences* 10(3) Entrepreneurship Education: Sited in Empowering Student Thinking, Creativity, and Lifelong Success Kimberly P. Code, Northern Kentucky University.
 11. National Foundation for Teaching Entrepreneurship (2006). [On-Line]. Available: <http://www.nfte.com/>. *The Journal for the Liberal Arts and Sciences*, 10(3). Entrepreneurship Education: Sited in Empowering Student Thinking, Creativity, and Lifelong Success Kimberly P. Code, Northern Kentucky University.
 12. Zero Point (2007). The article by Javed Chaudhry in The Express Newspaper.

**REAL CAUSES OF SICKNESS IN SMALL-SCALE INDUSTRIES:
PROBLEMS AND REMEDIES**

A case study of Sukkur Estate Area since 1990 to 2004

**Mumtaz Ali Junejo¹, Muhammad Nawaz Chand²
and Muhammad Abdul Majid Makki³**

¹ Deptt. of Commerce, Shah Abdul Latif University, Khairpur Mirs,
Email: prof.junejomumtazali@yahoo.com

² Faculty of Arts, Shah Abdul Latif University, Khairpur Mirs.

³ Deptt. of Commerce, The Islamia University of Bahawalpur,
Bahawalpur. Email: abdul7896@yahoo.com.au

ABSTRACT

The purpose of this study is to analyze the actors and factors of sickness in Small-Scale Industries, managerial competencies and causes of emergence of entrepreneurs at Sukkur Estate Area of Sindh Province. This study examines the role of Directorate of Sindh Small Industries Corporation Sukkur for growth of small-scale industries in the region.

In this research paper, we have found the high correlation ship factor between high educations with sales. Strong evidences emerge that owners of small industrial firms are family concern having low educational base, inadequate feasibility, lack of marketing and managerial knowledge and rigid attitude result in under utilization of capacity.

We have analyzed the characteristics of small business owners for the success of enterprise in the light of McClelland model.

RESEARCH METHODOLOGY

This research study is based on descriptive, quantitative and qualitative methods. We have concentrated on the various variables and asked the relevant questions from the owners of the small-scale industries which are located in estate area of Sindh Small Industries Corporation at Sukkur. In order to increase the value of research, qualitative methods along with quantitative techniques have been used to interpret the results.

Descriptive research seeks to determine the answers to, 'who', 'what', 'when', 'where', and how questions (Zikmund William G. 1986, p. 36), states a phenomenon or a situation as it actually exists and it describes Characteristics of Small Industrial Owners (CSIO).

SAMPLING

The samples were selected on the basis of economically important, homogeneous. Localized, reasonably amenable to research and also representative of small firms weaknesses and strength.

The samples of Small-Scale Industries have been selected according to the definition of State Bank of Pakistan.

Small-Scale Industry: Less than 50 persons with project cost (inclusive of cost of land and building) Rupees 200 million.

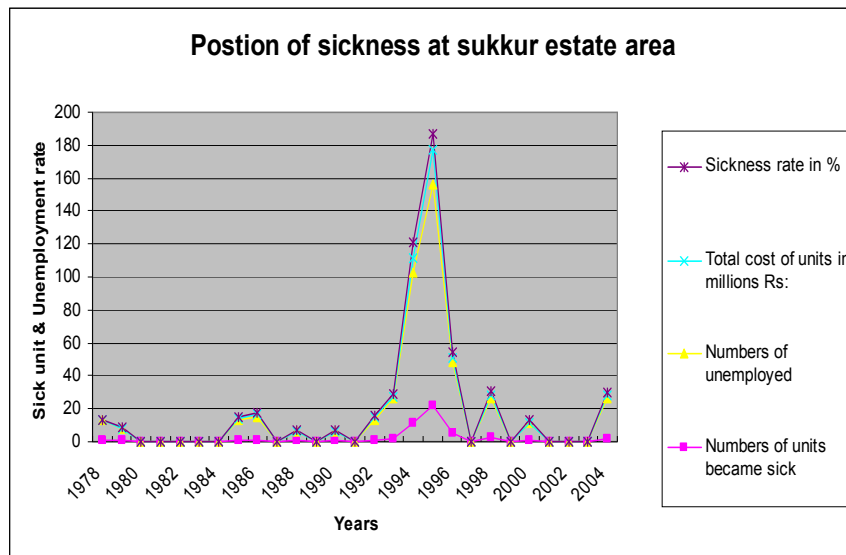
Table-1
Sukkur Estate Area

Oil mills	14
Flour mills	11
Biscuit Industries	10
Food Industries	10
Dall Industries	04
Total industries	49

INTRODUCTION OF INDUSTRIAL ESTATE SUKKUR

Industrial Estate at Sukkur was established in the year 1963 over an area of 1060 acres. Of this an area of 530 comprising 186 plots was allotted for industrial use and rest of the area was utilized for development of infrastructure, utilities, etc, except that 41 acres of land is still available for allotment of industrial purpose. 85 industrial units are in production at the Estate.

The management of this Estate remained with the Directorate of Industrial till 1975 when it was transferred to SITE Ltd.



Position of Sickness at Sukkur Estate Area
Graph No. 1

Result: in the year 1978 only one unit was closed and total 12 peoples were unemployed and the sickness rate was .17. In the year 1979 one unit was closed and 7 people were employed the rate of sickness was .19. in the year 1985 one unit was closed and total 12 people were unemployed and rate of sickness was .66. In the year 1986 one unit was closed and 14 people were unemployed at the rate of sickness was .79. In the year 1988 one unit was closed and 5 people were unemployed the rate of sickness was .8. In the year of 1990 one unit was closed.

Table-2
Results of Competencies of Owners/Managers as per
Model of Mc.clelland of Sukkur Estate Area

Q.No.	A	B	C	D
1	5	14	05	10
2	10	20	08	10
3	17	20	10	00
4	19	15	05	10
5	05	18	06	08
6	06	16	10	09
7	03	04	15	15
8	09	14	08	08
9	06	10	10	18
10	08	10	06	06
11	10	10	06	18
12	09	20	05	07
13	02	15	10	18
14	11	18	09	08
15	18	22	12	04
16	07	12	12	15
17	12	20	02	03
18	09	24	06	02
19	09	22	10	05
20	08	11	06	16
21	10	11	07	08
22	04	08	10	22
23	04	06	12	25
24	19	15	05	07
25	02	09	09	14
Total	125	100	50	24

A Category Firms 24x1=24 B Category Firms 25x2=50 C Category Firms 25x4=100 D Category Firms 25x5=125

According to the Professor Mc.Clelland model

Result:

“A” Category Firms Total samples 11

According to above mentioned results two owners of Oil Mills, three from Biscuits Industries, two from Marble & Tiles Industries and four Flour mills are coming in the A Category Form because the owners of these industries are highly qualified and they have high need achievement as per the model.

“B” Category Firms Total samples 14

Seven Intermediate Owners from flour mills and one from Biscuits Industries, two from food industries, two from Marble and tiles and one from Dall Industries and one from Oil mills are coming in the B category forms. Because the owners of above mentioned industries low need achievement as per the model.

“C” Category Firms Total samples 11

Six Matriculate owners from the oil mills, one from Biscuits, two from food industries, two from flour mills because owners of these industries have no any need achievement.

“D” Category Firms Total samples 13

Five owners from oil mills, three from flour mills, one from biscuit industries, two from food industries and two from Dall mills. They have also no any need achievement as per the model.

Total samples 49

Table-3
Major causes of Sickness in small scale industries in Sukkur estate area

Serial No.	Major causes	Respondents of Firms	Results in %
1	Lack of good management	55	62.15
2	Inadequate Feasibility	15	16.95
3	Marketing Problems	10	11.30
4	Poor Credit Facilities	10	11.30
5	Shortfall of working capita	9	10.17
6	Load shedding problem	5	5.65
7	Tax problem	8	9.04
8	Law & Order problem	1	1.13
Total Respondents of the firms		113	

Growth Rate of Small scale industries at Sukkur estate area

$$P = \frac{\text{Number of Projects in Operation}}{\text{Number of Plots Available to the Estate}} \times 100$$

$$P = \frac{113}{298} \times 100$$

$$= 37.91$$

Average income of the individual employee & daily wage worker 60,000 per year.

Result of regression analysis:

1. Uneducated Samples of small firm.

According to simple linear regression analysis of uneducated owners of Sukkur Estate Area it shows that the impact factor of uneducated entrepreneurs is very high with regard to sales of the Small-Scale Industries per year i.e., 0.9.

This model shows that P value is zero it means these owners either graduate and uneducated are failed to increase the sales of respective small firms per year.

Result of regression analysis of education

2. Above model has proved that “x” is significantly related to “y” it proves that slope is significant at the 0.5 this test is shows strong evidence is proved to the null hypothesis

Over all fit test is proving that there is insignificant error i.e. 1.00.

This R.sq. test has also found the high reliability validity of model i.e. nearer to 1.00

CONCLUSION

In certain case, the small-scale units have been offered extra financial and non-financial inputs. But despite this facility, they have not improved. It is perhaps better to a decent funeral to such units without a further drain on financial and other resources. The following measures, however, may to some extent reduce the incidence of industrial sickness:

- (1) The man behind the project plays a vital role in the sickness of the enterprise. In the case of first generation entrepreneurs, financial agencies should select the enterprise very carefully and evolve a thorough screening mechanism.
- (2) Project appraisals should be more realistic with the best standards of appraisal.
- (3) The SSIC, chamber of commerce and industries should shoulder the responsibility for preventing industrial sickness from the Sukkur Estate Area.
- (4) As far as possible some outside professional experts from the management, marketing and engineering side should be appointed for the purpose of counseling and necessary support to the entrepreneurs.

As small-scale units are vulnerable to sickness because of their weak production and financial base, inefficient management and narrow customer-oriented market, need-based credit facilities on the simple procedure and minimum rate of interest are required to be made available by banks to rehabilitate units falling sick.

The magnitude of industrial sickness, especially in the Small Industrial Estate Sukkur, is staggering. What is worse, the number of sick units and the amounts of outstanding Rs. 43.049 millions bank advances have been steadily increasing in recent years. Industrial sickness has grave socio-economic consequences. It leads to unemployment, loss of production, under-utilization of productive assets, and blockage of the savings of the community. A vicious circle is built into the economy. Industrial sickness adversely affects the morale of the entrepreneurs, banks, financial institutions, general public and governmental authorities. Because of all these adverse effects of sickness, it is in the

interest of all parties, i.e., the Government banks, financial institutions and entrepreneurs, that the magnitude of sickness should be minimized as quickly as possible.

On the basis of the analysis made and the cases studied, we may conclude that whatever may be the apparent cause or causes of sickness, the root cause is poor management and the resultant cause finance. The first generation entrepreneurs, without proper motivation, financial base and insight into the problem, are often lured by different schemes and set up industries, after some time, they lose interest, divert their attention and cause industrial sickness. To succeed, an entrepreneur must be able to manage men, material and money. The term men include not only the men employed in his industrial unit but also the men responsible for the issue of various licenses and the sanction of loans. An inability and inefficiency to deal with these important factors, coupled with lack of motivation and diversified, interest, result in under-utilization of capacity and dearth of working capital, cause disease and end in the closure of the enterprise.

REFERENCES

1. Bates, Timothy (1990). Entrepreneur Human Capital Inputs and Small Business Longevity. *The Review of Economics and Statistics* Vol. LXXXII No. 4.
2. Bates, Timothy (1987). Self-employed Minorities; Traits and Trends. *Social Sciences Quarterly* 68, 539-550.
3. Brock, Willian and Devid Evans (1986). *The Economics of Small Business* (New York, Holmes and Meir.
4. Douglass, Merrill (1976). Relating Education to Entrepreneurial success. *Business Horizons* 19, 40-44.
5. Jovanovic, Boyan, (1982). Selection and Evolution in Industry. *Econometrica* 50, 649-670.
6. Lucas, Robert (1978). On the Size of Distribution of Business Firms. *The Bell Journal of Economics*-9, 508-523.
7. Shapiro, Albert (1975). The Displaced Uncomfortable Enterprenuer. *Psychology Today* 9 83-88.
8. Zeira, Joseph (1987). Investment as a Process of Search. *Journal of Political Economy*. 95 204-210.
9. Advanced Engineering Centre for Manufacturing (1995). ISO 9000 Survey Report. *Quality Certification News, Special Report*, 2(2), 1-8.
10. Chittenden, F., Poutziouris, P. and Mukhtar, S.M. (1998). Small Firms and the ISO 9000 Approach to Quality Management. *International Small Business Journal*, 17(1), 73-88.
11. Department of Industry, Science & Tourism (1997). A Portrait of Australian Business: Results of the 1995 Business Longitudinal Survey–Small Business Research Program, *Joint Productivity Commission and Department of Science and Technology Publication*, Canberra, Australia.
12. Freedman, J. and Godwin. M. (1994). Incorporating the micro business: Perceptions and misperceptions. In *Finance and the small firm* eds A., Hughes & Storey, D. 232-283. Routledge, London.

13. Hanks, S.H., Watson, C., Jansen, E. and Chandler, G. (1993). Tightening the life-cycle construct: Ataxonomic study of growth stage configurations in high-technology organisations. *Entrepreneurship Theory and Practice* 18(2), 5-29.
14. Husband, S. and Mandal, P. (1999). Perceptions and Realities of Quality Methods in Australian Small-to Medium-sized Enterprises. *Proceedings of the 12th Annual SEAAZ Conference*, Victoria University of Technology, May, 143-157.
15. Kuratko, D.F., Goodale, J.C. and Hornsby, J.S. (2001). Quality Practices for a Competitive Advantage in Smaller Firms. *Journal of Small Business Management*, 39(4), 293-311.
16. McMahon, R.G.P. (2001). Deriving an empirical development taxonomy for manufacturing SMEs using data from Australia's business longitudinal survey. *Small Business Economics* 17(3), 197-212.
17. McMahon, R.G.P., Holmes, S., Hutchinson, P. and Forsaith, D. (1993). *Small enterprise financial management: Theory and practice*. Harcourt Brace, Sydney, New South Wales.
18. Pappas, Carter, Evans and Koop/Telesis. (1990). *The global challenge: Australian manufacturing in the 1990s*. Australian Manufacturing Council, Melbourne.
19. Ramsey, J. (1998). The Value of ISO 9000 Certification to a Small Business, *Proceedings: Second International and Fifth National Research Conference on Quality Management*, 145-156.
20. Terziovski, M., Samson, D. and Dow, D. (1997). The Business Value of Quality Management Systems Certification: Evidence from Australia and New Zealand. *Journal of Operations Management*, 15(1), pp.1-18.
21. Wiele van der, T., & Brown, A. (1998). Venturing Down the TQM Path for SMEs. *International Small Business Journal*, 16(2), 50-68.
22. Gopa consultants study on Small-Scale Industries in Pakistan volume I, Vienna: UNDO, 1981.
23. Malik Muhammad Hussain and Aftab Ahmed Cheema (1986). The role of Small-Scale Industry in Pakistan Economy and Government Incentives. *The Pakistan Development Review*, Vol. xxv(4).
24. Anderson, P. (1982). Small Industry in developing countries. A discussion of issues. *World Development*, 10(11).
25. Berry A. and Armando Pinell – Siles (1979). *Small-Scale Enterprises in Columbia A Case Study*. Studies in Employment and Rural Development No. 56, (Department of Development Economics, World Bank).
26. Hussain S.I, (1983). *Allocate and technical efficiency a study of small enterprise in rural Bangladesh*. (World Bank).
27. Kilby. P. (1981). *Small-Scale Industry in Kenya*. (Development Economics Department, World Banks).
28. Muzmdar, D. (1979). *A descriptive Analysis of the role of Small-Scale Enterprise in the Indian Economy*, (World Bank).
29. Staley, e, and R, Morse (1965). *Modern Small-Scale Industry for Developing Countries*. McGraw Hill.
30. World Bank (1978). *Experiment and Development of Small Enterprise*. Washington D.C.

31. Pasha, Hafiz A and Zafar H. Ismail (1989). *Determinants of Success of Industrial Estate in Pakistan*. Discussion Paper # 103.
32. Navid Hamid and Ijaz Nabi (1984). Role of Small-Scale Industries in employment generation. *Pakistan Economic and Social Review*. Vol. XXII(1 and 2), 43-64.
33. Federal Bureau of Statistics, Census of Manifesting Industries 1990-2004, Karachi Government of Pakistan.
34. Cohn, T. and Lindberg, R.A. (1974). *Survival and Growth: Management Strategies for the Small Firm*, New York: AMACON.
35. Khanka, S.S. (1999). *Entrepreneurial Development*. First Edition.
36. Feddy T.S. and Reddy L.V. *Sickness in Small Industry*. Himalaya Publishing House.
37. Iqbal M. Khan (2004). *Unlocking the Potential of Small Enterprises for Economic Development*.

**A TIME SERIES ANALYSIS OF PSO AND SHELL
VOLUME INDICES AT KSE-100**

Asia Catherine and Kalsoom Akhtar Chaudhry
Kinnaird College for Women, Lahore

ABSTRACT

Bloomberg ranks the KSE-100, the benchmark Pakistani index, as the world's top-performing stock market in 2002. This year, the KSE 100 has jumped 54 percent, led by a doubling in the share price of Pakistan Telecom and Oil & Gas Development Co., the country's largest exploration company. The benchmark climbed 9.2 percent last week for its biggest weekly gain in three years. Saleem (2007) model the most prominent features of the time series of KSE such as volatility clustering, excess kurtosis, and fat-tailedness by applying the most popular techniques like Garch (1,1) and Egarch(1,1). Mamoon(2007) examines the short to medium term trends and volatility in Karachi Stock Exchange and further explore the nature of relationship between stock market activities and a set of macroeconomic variables in 1990s. We have taken the daily volume index of PSO and Shell for 13 years (1995-2007) of Karachi stock exchange. The data is based on stock exchange's opening, closing, high and low values and also the turnover of PSO and Shell. The variable of interest is the turnover of PSO, Shell and KSE-100 index respectively. The main objective of this paper is to compare the stability of PSO, Shell and KSE-100 volume index on yearly and monthly basis. And, further to foresee the trend in the two series. The specific statistical model is also suggested to make the forecasts.

Keywords: Volume, Time Series Models, Growth, Stability

1. INTRODUCTION

We have taken secondary data and the source of data is Karachi Stock Exchange. The daily volume index of PSO and Shell for 13 years (1995-2007) is taken. The data is based on stock exchange's opening, closing, high and low values and also the turnover of PSO and SHELL. The variable of interest is the turnover of two companies i.e. PSO and SHELL. The main objective of this research is to compare the stability of PSO and SHELL volume index and further to foresee the trend in the two series. Also, the forecasting by applying the specific statistical model will be carried out. We have daily base data, but due to variation in the data, we are unable to see the clear picture of the data. So we convert the data into monthly bases by taking monthly averages of the PSO and SHELL volumes respectively. In this our study, we make time series plot, the purpose of making this plot is to check whether there exist some trend in each series and if so which type of the trend. The two trends would indicate whether there is consistency in the movement of PSO and SHELL indices series.

2. LITERATURE REVIEW

Memoon (2007) in his article “Macro Economic Uncertainty of 1990s and Volatility at Karachi Stock” examines the medium term trends and volatility in Karachi Stock Exchange and further explore the nature of relationship between stock market activities and a set of macroeconomic variables. Mehmood(2007) describe the “Market Efficiency: An Empirical Analysis of KSE 100 Index” historical stock prices on a monthly and daily basis used from a sample period of July 1996 to June 2006 of KSE 100 Index Companies.

Saleem(2007) discuss the “Modeling Time Varying Volatility and Asymmetry of Karachi Stock Exchange (KSE)” Extensive work has been done on the modeling of financial time series, both theoretically and empirically, on developed markets of Europe, Asia and United states. Naeem(2002) examine the “Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries” the long-run and short-run association between stock prices and exchange rates. The results of this study show no short-run association between the said variables for all four countries. There is no long-run relationship between stock prices and exchange rates for Pakistan and India as well.

Farid and Ashraf (1995) “Volatility at Karachi Stock Exchange” examine the effect of trading on the volatility of stock prices at Karachi Stock Exchange (KSE). Findings of the study will help understand the mechanism of the rise and fall of stock prices at the Karachi bourse.

3. OBJECTIVES OF THE STUDY

Our first objective is to determine and compare the general trends of PSO and SHELL monthly volume indices. For this we observe whether there exists trend in each series and if so what the trend is. The two trends would indicate whether there is consistency in the movement of PSO and SHELL indices series. The hypothesis is that the two trends fluctuate similarly.

Our second objective is to isolate seasonal influences in KSE, PSO and SHELL data on volume indices. A model is also suggested for PSO, Shell and KSE-100 monthly indices.

4. DATA ANALYSIS AND RESULTS

To study the general trend of the volume of oil companies we select two companies PSO and Shell from the hundred companies enlisted on the KSE-100 Index. The KSE-100 Index is the most widely used indicator of the performance of Karachi’s equity market and includes almost all leading companies enlisted by the Karachi Stock Exchange. The average monthly turnover of each selected company’s shares was calculated from the year 1995-2007. This average turnover of each company was expressed as a percentage of the total number of shares of that company and was used as an indicator of the volume of trading of each of those companies. Volume is perhaps the most important indicator of the activity in any stock market. Without taking the volume of trading into consideration, any upward or downward fluctuation of the price cannot allow correct analysis of price movements.

Our analysis covers only the volume index on daily basis. The period chosen for the study is January 1995 to Dec 2007. Volume of PSO and Shell are converted into monthly values by taking averages. The study analyzes to check the stability of PSO and Shell. The data for these variables are obtained for monthly basis (from January 1995 to Dec 2007) from Karachi Stock Exchange. The time series plots of PSO and Shell volumes at Karachi Stock Exchange are shown graphically in figures 1 and 2.

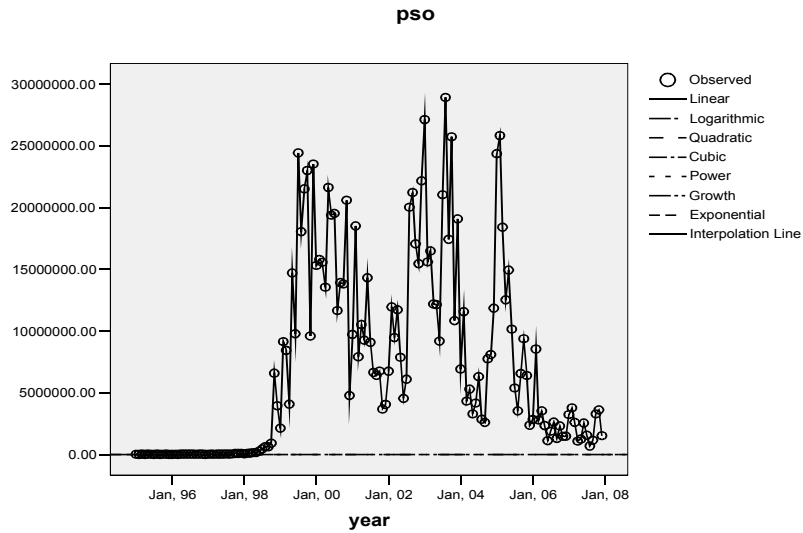


Figure 4.1

The time series plot of PSO volume index shows greater variation in the data. It is observed that most of the variation lies within the period 1999-2005 and it goes to its maximum within the period 2002-2004.

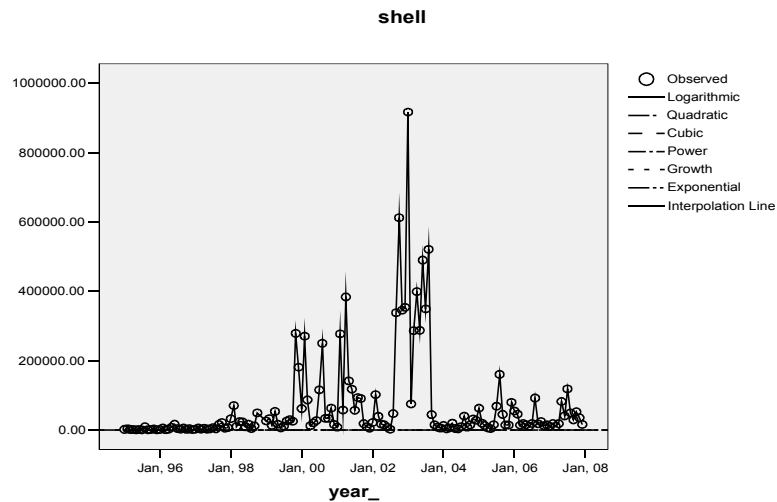


Figure 4.2

The time series plot of Shell Volume index shows greater variation in the data. It is observed that most of the variation lies within the period 1999-2005 and it goes to its maximum within the period 2002-2004.

In addition for the forecasting purpose, we check that which model best suit the PSO volume index. The table of different models along with their significance and R^2 is shown in table 1.1

Table-4.1
Model Summary and Parameter Estimates of PSO

Dependent Variable: PSO

The independent variable is year.

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Logarithmic	.063	10.162	1	152	.002	-4997835892.614	214767495.293		
Quadratic	.061	9.950	1	152	.002	-205483704.767	.016	.000	
Cubic	.061	9.950	1	152	.002	-205483704.767	.016	.000	.000
Growth	.449	123.848	1	152	.000	-185.894	1.51E-008		

Interpretation: It is observed that almost all the models which we have applied are significant. But the R^2 for Growth model is higher as compared to the other models. So we say the Growth model is the best model for PSO forecasting purpose.

The Growth Model for PSO is $Y = e^{(-185.894 + 1.51E-008 * t)}$ or
 $\ln(Y) = -185.894 + 1.51E-008 * t$

Table 4.2:
Model Summary and Parameter Estimates of Shell

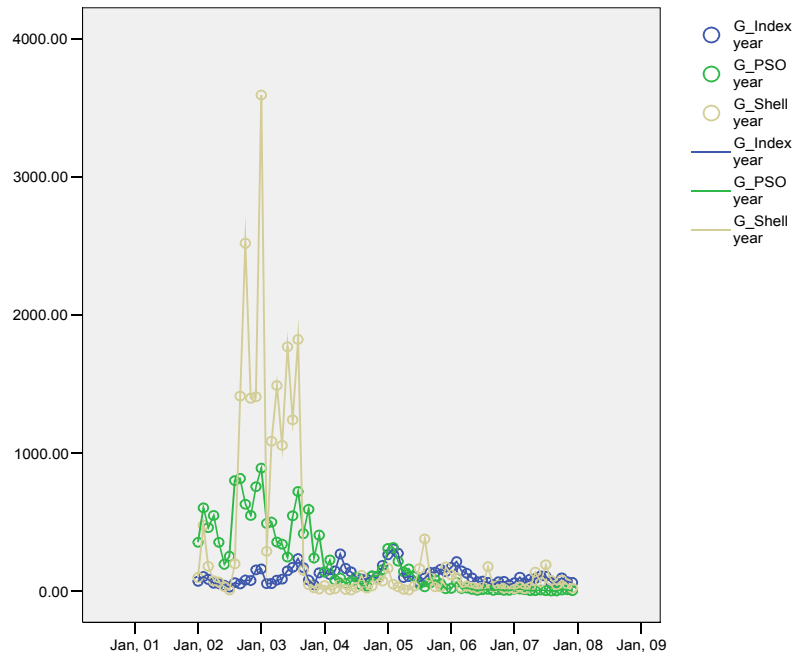
Dependent Variable: shell

The independent variable is year.

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Logarithmic	.024	3.730	1	152	.055	-51607085.198	2217310.036		
Quadratic	.024	3.664	1	152	.057	-2132487.830	.000	.000	
Cubic	.024	3.664	1	152	.057	-2132487.830	.000	.000	.000
Growth	.207	39.636	1	152	.000	-71.741	6.18E-009		

Interpretation: It is observed that only Growth model is significant. And there R^2 are also higher then others so, we can say that Growth is the best model.

The Growth Model for Shell is $Y = e^{(71.741 + 6.18E-009 * t)}$ or
 $\ln(Y) = 71.741 + 6.18E-009 * t$



Interpretation: After Applying the Growth model we calculate the seasonal forecast for PSO, Shell and KSE-100 index. There seem fluctuations in the Shell indices throughout but PSO is somewhat stable. The graph shows improvement. From the analysis we conclude that PSO is stable and due to its stability it attracts more share holders as compared to the Shell.

5. CONCLUSION AND RECOMMENDATION

This paper has been an attempt to study the volume behavior of PSO and Shell in Karachi Stock Exchange and to explore the relationship of PSO and Shell volume with KSE-100 volume. Our objective is to see whether there exists trend in each series and if so what the trend is. The analysis of monthly indices of PSO and Shell shows an upward trend in the year 2000-2002. The trends indicate that there is consistency in the movement of PSO and SHELL indices series. The hypothesis is that the two trends fluctuate similarly. So we conclude that PSO is more consistent than Shell. For forecasting purpose we suggests that Growth is the best model for PSO and Shell and then using Growth model we calculate the seasonal forecast for PSO, Shell and KSE-100 index. And again we conclude that PSO is stable and due to its stability, PSO Company is attracting more share holders. In the over overall stock market almost stable from the year 2004 to date.

In future, the study will be conducted to see the relative change of the volume of PSO, Shell and KSE-100 Index

6. REFERENCES

1. Farid, A. and Ashraf, J. (1995). Volatility at Karachi Stock Exchange. *The Pakistan Development Review* 34: 4 Part II (Winter 1995) 651-657.
2. Mehmood, H. (2007). Market Efficiency: An Empirical Analysis of KSE 100 Index. *Journal of Business*, Submitted for Publication.
3. Memoon, D. (2007). Macro Economic Uncertainty of 1990s and Volatility at Karachi Stock. Submitted for Publication.
4. Naeem, M. (2002). Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries. 41(4), 535-550.
5. Saleem, K. (2007). Modeling time varying volatility and asymmetry of Karachi stock exchange (KSE). *International Journal of Economic Perspectives* 1, 1-9.

THE FACTORS INFLUENCE THE LIFE SATISFACTION IN PAKISTAN

Zahid Iqbal¹ and Junaid Saghir Siddiqi²

¹ Institute of Clinical Psychology, University of Karachi,
Karachi. Email: zahidstat@yahoo.com

² Department of Statistics, University of Karachi, Karachi

ABSTRACT

This study explored the predictive values of income, and depression on life satisfaction. After detailed literature review, it was hypothesized that life satisfaction is positively associated with income and negatively related with depression. A sample of 207 blue-collar participants (140 males and 67 females) from diverse vicinity of Karachi, participated in the study. The mean age was 40 years. Life satisfaction was assessed by the Life Satisfaction Scale (Diener, Emmons, Larsen & Griffin, 1985) and depression assessed by using Beck Depression Inventory (Beck, & Beck, 1972). The data was analyzed by using the SPSS program in order to analyze the relationship via step wise regression analysis.

Regression analysis identified income as significant and depression emerged as highly significant predictor of life satisfaction. The variance accounted for income 3.73 % and depression accounted for -0.351 % of the variance in life satisfaction. All of them explained 8 % ($R = 0.08$) of the total variance in life satisfaction.

It was concluded that: (1) Income positively contributes to overall life satisfaction, and (2) Depression negatively contribute to life satisfaction strongly.

KEY WORDS

Satisfaction with life, Income, Depression, Stepwise regression

1. INTRODUCTION

The development of positive psychology has stimulated a growing interest in the studies of what constitutes people's happiness and social well-being and an increasing body of research has focused on what contributes to people's satisfaction with their lives. Life satisfaction is a multifaceted construct that refers to one's overall evaluation of life domains such as health, finances, job, self-esteem, and interpersonal relationships (Michalos, 1991). Life satisfaction is studied by other researchers as a part of one's subjective well-being, refers to an overall assessment of an individual's quality of life based on one's own criteria. Among these criterion, health seems to be crucial.

Low levels of life satisfaction are similarly predictive of a variety of negative outcomes, including mental and physical health problems (Frisch, 2000). An example of this is the UK Government's recent report 'Opportunity for All: Tackling Poverty and Social Exclusion', which clearly identified poor health as one of the major problems associated with low income (Department of Social Security, 1999). Most studies correlates life satisfaction and psychopathological symptoms including anxiety, stress, low efficacy, loneliness and depression in individual's which make dissatisfaction in life.

This is particularly true with depression, which was the fifth leading cause of disease burden in the world in 1999, when both fatal and non-fatal consequences were measured.

Life dissatisfaction, even when reported by health populations and measured with simple scales, is strongly related with poor mental health (Horley J, 1984), including depressive symptoms (Headley BW, Kelley J, Wearing AJ, 1993). Low life satisfaction may also be an early sign of depression or predict future depression. However, few studies have examined the relationship between dissatisfaction and depression in any detail. Most studies have only examined this relationship in the elderly (Green BH, Copeland JR, Dewey ME, Sharma V, Saunders PA, Davidson IA, Sullivan C, McWilliams C, 1992) However, the results of one recent study with a general population sample revealed that self-reported life satisfaction was strongly associated with concurrent depressive symptoms (Koivumaa-Honkanen HT, Kaprio J, Honkanen R, Viinama`ki H, Koskenvuo M, 2004).

As such, income plays an essential role in explaining the factors influential for life satisfaction. Perhaps the most widely accepted viewpoint is that income does matter, but not very much (Easterlin, 1995; Oswald, 1997; Diener and Oishi, 2000; Frey and Stutzer, 2002). This has led to interest in the role of relative rather than absolute income in determining life satisfaction (Clark and Oswald, 1994; McBride, 2001) and the relationship between income and life satisfactions (e.g. Easterlin, 2001).

Examining the effect of income and depression on life satisfaction is a relatively new research field. Therefore, the primary aims of the current study are twofold. One, our study attempts to provide a life-course perspective to examining economic influences on life satisfaction. Two, the study also looks at a relative analysis, in terms of mental health influence on satisfaction with life.

2. METHODOLOGY

The sample for this study consisted of 207 participants (140 males; 67 females) of blue-collar from diverse vicinity of Karachi. The mean age was 40 years with a standard deviation of 10.45 and a range from 24 through 69. The median income was Rs 20,000.00 (range was from less than Rs 15,000.00 to greater than Rs 1,00,000.00). The sample included 145 married (70%) and 62 unmarried (30%). All subjects volunteered to participate in the study.

A short demographic questionnaire was also used, consisting of several questions about gender, age, education level, marital status, and income. The monthly income amount was used as a measure of economic status. *Satisfaction with life* was measured by the Satisfaction with Life Scale SWLS (Diener, Emmons, Larsen, & Griffin, 1985). It consisted of five statements, such as 'In most ways my life is close to ideal'. The participants indicated how strongly they agreed with each item from 1 ('strongly disagree') to 7 ('strongly agree'). The final scale had a range of 5–35 with a Cronbach's alpha value of 0.85.

The Beck Depression Inventory (BDI; Beck, Steer & Garbin, 1988). BDI is a 21-item self-report inventory of depressive symptoms. The BDI does not provide diagnostic information but evidence supports its use as reliable & valid measures of the extent of depressive symptomatology. Therefore, this study examined individual differences as a function of level of depressive symptoms.

After participants who met study criteria were identified, of a potential participant explaining the investigation ongoing study life satisfaction and income level. At the beginning of each questionnaire, an overview was provided. The researcher gave directions for the Beck Depression Inventory and then for the Life Satisfaction Scale. All respondent were also asked to indicate their gender, age, educational background, marital status, and occupation. As with study participants, they were assured that all information would be kept confidential.

3. RESULTS

After collection of data the test sheets were scored. Satisfaction with life Scale and Beck Depression Inventory were scored according to the instructions given in the manual. Statistical Package for the Social Sciences (SPSS), version 12.0 was used for all statistical analyses. Stepwise Regression analysis was performed in first step income and 2nd step depression included with some demographic variable as a predictor while dependent variable is life satisfaction.

Descriptive Statistics

Variables	N	Mean	Std.	Min.	Max	Q1	Q3
Income	207	20,000	50.38	15000	100,000	20,000	50,000
Age	207	40.5	10.40	24	69	32	49
SWL	207	26.08	6.20	6	35	22	31

Model Summary of regression equation

Model Summary^h

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.204 ^a	.042	.037	6.086
2	.257 ^b	.066	.057	6.023
3	.279 ^c	.078	.064	6.000
4	.280 ^d	.078	.060	6.013
5	.280 ^e	.078	.055	6.027
6	.282 ^f	.080	.052	6.038
7	.421 ^g	.178	.149	5.722

- a. Predictors: (Constant), lincome
 b. Predictors: (Constant), lincome, age
 c. Predictors: (Constant), lincome, age, sex_m_f
 d. Predictors: (Constant), lincome, age, sex_m_f, educ
 e. Predictors: (Constant), lincome, age, sex_m_f, educ, familystruc
 f. Predictors: (Constant), lincome, age, sex_m_f, educ, familystruc, professionc
 g. Predictors: (Constant), lincome, age, sex_m_f, educ, familystruc, professionc, dep
 h. Dependent Variable: SWL

ANOVA ^h

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	329.019	1	329.019	8.882	.003 ^a
	Residual	7593.744	205	37.043		
	Total	7922.763	206			
2	Regression	521.539	2	260.770	7.188	.001 ^b
	Residual	7401.224	204	36.281		
	Total	7922.763	206			
3	Regression	615.654	3	205.218	5.701	.001 ^c
	Residual	7307.109	203	35.996		
	Total	7922.763	206			
4	Regression	620.311	4	155.078	4.290	.002 ^d
	Residual	7302.452	202	36.151		
	Total	7922.763	206			
5	Regression	620.980	5	124.196	3.419	.005 ^e
	Residual	7301.784	201	36.327		
	Total	7922.763	206			
6	Regression	630.305	6	105.051	2.881	.010 ^f
	Residual	7292.458	200	36.462		
	Total	7922.763	206			
7	Regression	1406.807	7	200.972	6.138	.000 ^g
	Residual	6515.956	199	32.743		
	Total	7922.763	206			

a. Predictors: (Constant), lincome

b. Predictors: (Constant), lincome, age

c. Predictors: (Constant), lincome, age, sex_m_f

d. Predictors: (Constant), lincome, age, sex_m_f, educ

e. Predictors: (Constant), lincome, age, sex_m_f, educ, familystruc

f. Predictors: (Constant), lincome, age, sex_m_f, educ, familystruc, professionc

g. Predictors: (Constant), lincome, age, sex_m_f, educ, familystruc, professionc, dep

h. Dependent Variable: SWL

Coefficients ^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	9.254	5.661		1.635	.104	-1.907	20.415
	lincome	3.954	1.327	.204	2.980	.003	1.338	6.570
2	(Constant)	10.644	5.635		1.889	.060	-.465	21.754
	lincome	4.529	1.337	.233	3.389	.001	1.894	7.165
	age	-.095	.041	-.159	-2.304	.022	-.176	-.014
3	(Constant)	13.244	5.838		2.269	.024	1.733	24.756
	lincome	3.730	1.420	.192	2.626	.009	.930	6.530
	age	-.101	.041	-.169	-2.453	.015	-.182	-.020
	sex_m_f	1.556	.962	.118	1.617	.107	-.341	3.453
4	(Constant)	14.793	7.269		2.035	.043	.459	29.126
	lincome	3.830	1.450	.197	2.641	.009	.970	6.689
	age	-.102	.041	-.170	-2.463	.015	-.183	-.020
	sex_m_f	1.475	.990	.112	1.489	.138	-.478	3.427
	educ	-.128	.357	-.025	-.359	.720	-.832	.576
5	(Constant)	14.562	7.483		1.946	.053	-.193	29.317
	lincome	3.829	1.454	.197	2.634	.009	.962	6.695
	age	-.100	.042	-.168	-2.368	.019	-.184	-.017
	sex_m_f	1.465	.995	.111	1.472	.143	-.497	3.428
	educ	-.127	.358	-.025	-.354	.723	-.833	.579
	familystruc	.117	.861	.009	.136	.892	-1.580	1.814
6	(Constant)	13.659	7.707		1.772	.078	-1.538	28.856
	lincome	3.717	1.473	.192	2.523	.012	.812	6.622
	age	-.094	.044	-.158	-2.146	.033	-.181	-.008
	sex_m_f	1.296	1.052	.098	1.232	.219	-.778	3.370
	educ	-.100	.362	-.020	-.276	.782	-.815	.614
	familystruc	.144	.864	.012	.167	.868	-1.560	1.848
	professionc	.499	.988	.039	.506	.614	-1.448	2.447
	dep	-.396	.081	-.330	-4.870	.000	-.556	-.236
7	(Constant)	25.049	7.669		3.266	.001	9.927	40.171
	lincome	3.601	1.396	.186	2.579	.011	.848	6.354
	age	-.092	.042	-.154	-2.208	.028	-.174	-.010
	sex_m_f	.462	1.011	.035	.457	.648	-1.532	2.457
	educ	-.507	.353	-.099	-1.434	.153	-1.204	.190
	familystruc	-.239	.822	-.019	-.291	.771	-1.861	1.383
	professionc	1.061	.943	.082	1.126	.262	-.798	2.921
	dep	-.396	.081	-.330	-4.870	.000	-.556	-.236

a. Dependent Variable: SWL

4. DISCUSSION

The focus of this analysis was detecting life satisfaction, and what contribution of income and depression is on a life satisfaction.

The main findings support the idea that life satisfaction increases with the growth of income. Respondents with higher income felt happier and more satisfied with their lives. According to comparison Theory, Income and life satisfaction are relatively related. Contrary to need theory which postulates an absolute positive relation between economic prosperity and life satisfaction, comparison theory, used here for an amalgam of different relative theories, sees this relationship in a relative light. *Social comparison theory*, which finds its early roots in the work of, among others, Festinger (1954), is further developed in the quality of life field by Easterlin (1974, 1995, and 2001). Easterlin stated that, although within a country richer people are happier than poor peoples; this is merely a matter of relative standing. It depends on the social reference points people use for comparison. This finding supports the findings of other studies conducted in different European countries (Fahey T, Whelan CT, Maitre B. 2005; Bohnke P. 2005; Delhey J. 2004).

Additionally, higher income would allow the family to enjoy a higher standard of living. An analysis of individual statements suggests that the subjects who had relatively higher levels of income were more satisfied as they reflected on their lives than were subjects with lower income levels. For instance, their expectations for life seemed to be in line with what they actually had gotten out of life. This may indicate that income is a resource that allows one to obtain those things in life that are perceived as important and desired. Such results could best be interpreted in terms of Maslow's theory of human motivation (Maslow AH,1970)), people who have a higher income are better able to fulfill basic needs such as the need for food, shelter and security, and will therefore be more satisfied with their lives. Similarly, the higher income people appeared to be more optimistic in their outlook on life. Adequate financial resources would likely make life look better rather than worse.

The hypothesis that depression would be inversely related to satisfaction with life was supported. These results are consistent with the findings of Simpson et al (1996), who reported a significant inverse relationship between depression and life satisfaction.

A final pointer is the policy relevance of this study. Although it was not the goal of this study to derive policy implications, nevertheless, some tentative comments are made here. Do the results found in this study support the 'more, more, more' adage in terms of economic growth which has been part of most governments' policy concerns for many years now, or should we join the more critical group who argue that economic growth can eventually harm people?

To conclude, the results of the study showed that income have a positive an influence on life satisfaction. This study can serve as a starting point for further research which would study the influence of ongoing economic and social changes on the psychological health, and life satisfaction of its people.

REFERENCES

1. Campbell, A. (1981). *The sense of well being in America*. New York: McGraw-Hill.
2. Clark, A., Oswald, A. (1994). Unhappiness and unemployment. *Economic Journal*, 104, 648-59.
3. Culter, S. (1973). Volunteer association participation and life satisfaction: A cautionary research note. *Journal of Gerontology*, 28, 96-100.
4. Delhey J. (2004). *Life satisfaction in an enlarged Europe*. Luxembourg: Office for Official Publications of the European Commission.
5. Department of Social Security (1999). *Opportunity for All: Tackling Poverty and Social Exclusion*. London.
6. Diener, E., and Oishi, S. (2000). Money and happiness: Income and subjective wellbeing across nations, in: Diener, E., Eunkook, S. (Eds.), *Culture and Subjective Wellbeing*. The MIT Press, Cambridge, MA.
7. Easterlin, R. (1995). Will raising the incomes of all increase the happiness of all? *Journal of Economic Organisation*, 27, 35-48.
8. Easterlin, R. (2001). Income and happiness: A unified theory. *Economic Journal*. 111, 1-20.
9. Easterlin, R. (2003). Explaining happiness. *Proceedings of the National Academy of Sciences*, 100, 11176-11183.
10. Edwards, J., and Klemmock, P. (1973). Correlates of life satisfaction: A reexamination. *Journal of Gerontology*, 28, 497-502.
11. Fahey T, Whelan CT, and Maitre B. (2005). First European quality of life survey: income inequalities and deprivation. Luxembourg: Office for Official Publications of the European Communities.
12. Ferrer-i-Carbonell, A. and Van Praag, B. (2003). Income Satisfaction Inequality and its Causes. *IZA, Working Paper 854*.
13. Fisher, B.J. (1995). Successful aging, life satisfaction, and generativity in later life. *International Journal of Aging and Human Development*, 41(3), 239-250.
14. Frey, B. and Stutzer, A. (2002). What can economists learn from happiness research? *Journal of Economic Literature*, XL, 402-435.
15. Frisch, M.B. (2000). Improving mental and physical health care through quality of life therapy and assessment. In E. Diener & D. R. Rahtz (eds.) *Advances in quality of life theory and research*, 207-241. Great Britain: Kluwer Academic Publishers.
16. Girzadas, P. M., Counte, M. A., Glandon, G. L., and Tancredi, D. (1993). An analysis of elderly health and life satisfaction. *Behavior, Health, and Aging*, 3(2), 103-117.
17. Gray, G. R., Ventis, D. G., Hayslip, B. (1992). Socio-cognitive skills as a determinant of life satisfaction in aged persons. *International Journal of Aging and Human Development*, 35(3), 205-218.
18. Green BH, Copeland JR, Dewey ME, Sharma V, Saunders PA, Davidson IA, Sullivan C, and McWilliams C. (1992). Risk factors for depression in elderly people: a prospective study. *Acta Psychiatr Scand* 86, 213-217.
19. Headley BW, Kelley J, Wearing AJ (1993). Dimensions of mental health: life satisfaction, positive affect, anxiety and depression. *Soc Ind Res* 29, 63-82.
20. Horley J. (1984). Life satisfaction, happiness and morale: two problems with the use of subjective well-being indicators. *Gerontologist* 24, 124-127.

21. Idler EL, Benyamini Y. (1997) Self-rated health and mortality: a review of twenty seven community studies. *J. Health Soc. Behav.* 38, 21-37.
22. Koivumaa-Honkanen HT, Kaprio J, Honkanen R, Viinama`ki H, Koskenvuo M (2004). Life satisfaction and depression in a 15- 165 year follow-up of health adults. *Soc Psychiatr Psychiatr Epidem* 39, 994-999.
23. Lane, Robert E (1994). Does money buy happiness? *Current*, n 360, 27-31.
24. Larson, R. (1978). Thirty years of research on the subjective well-being of older Americans. *Journal of Gerontology*, 33, 109-129.
25. Levitt, M.J., Antonucci, T.C., Clark, M.C., Rotton, J., and Finley, G.E. (1986). Social support and well-being: Preliminary indicators based on two samples of the elderly. *International Journal of Aging and Human Development*, 21(1), 61-77.
26. Mancini, J.A. (1981). Effects of health and income on control orientation and life satisfaction among aged public housing residents. *International Journal of Aging and Human Development*, 1980-81, 12, 215-220.
27. Maslow AH. (1970). *Motivation and personality*. New York (NY): Harper & Row Publishers.
28. McBride, M. (2001). Relative-income effects on subjective wellbeing in the cross-section. *Journal of Economic Behavior and Organization*, 45, 251-278.
29. McGhee, J.L. (1984). The influence of qualitative assessments of the social and physical environment on the morale of the rural elderly. *American Journal of Community Psychology*, 12(6), 709-723.
30. Michalos, A.C. (1991). *Global report of student well-being*. New York: Springer.
31. Myers, D. G. & Diener, E. (1995). Who is happy? *Psychological Science*, 6, 10-19.
32. National Opinion Research Center (1999). *General social surveys, 1972-1998: Cumulative codebook*. Chicago: Author.
33. Neugarten, B.L., Havighurst, R.J., and Tobin, S.S. The measurement of life satisfaction. *Journal of Gerontology*, 1961, 16, 134-143.
34. Oswald, A. (1997). Happiness and economic performance. *Economic Journal*, 107, 1815-1831
35. Revicki, D.A. and Mitchell, J. (1986). Social support factor structure in the elderly. *Research on Aging*, 8(2), 232-248.
36. Rogers WH, Wilson IB, Bungay KM, Cynn DJ, and Adler DA (2002) Assessing the performance of a new depression screener for primary care (PC-SAD). *J. Clin. Epidem* 55:164-175.
37. Schwarze, J. (2003). Using Panel Data on Income Satisfaction to Estimate Equivalence Scale Elasticity. *Review of Income and Wealth* 49, 359-372
38. Spreitzer, E., Snyder, E., and Larsen, P. (1979). The relative effects of health and income on life satisfaction. *International Journal of Aging and Human Development*, 10, 283-288.
39. Wing-Leung Lai, D. and McDonald, J.R. (1995). Life satisfaction of Chinese elderly immigrants in Calgary. *Canadian Journal on Aging*, 14(3), 536-551.

A STUDY AS THE CAREER AND DOMESTIC RESPONSIBILITIES OF WORKING WOMEN

Muhammad Azhar Sheikh¹ and Jamal Abdul Nasir²

¹ Department of Commerce, The Islamia University of
Bahawalpur. Email: sheikhazhar2005@yahoo.com

² Department of Statistics, The Islamia University of
Bahawalpur. Email: njamal76@hotmail.com

ABSTRACT

Career and domestic responsibilities are collectively known as dual responsibilities. These dual responsibilities play a key role in measuring the professional productivity under the scope of human development paradigm. In this study, an attempt is made to explore the professional productivity of women involved in income generating activities. By using the standard statistical strategies, husband sharing of responsibility, hours for rest and supporting family members are found to be most influential factors of professional productivity.

INTRODUCTION

Many women work in our society because of economic necessity and for those who do a work of their liking there is a price for what they achieve. Women have to deal with conflicting situations: pursuing a career and taking care of their family. They have to spend as much hours in doing household chores (cleaning, cooking, ironing...) as in their job. This gives rise to guilt, tension, which can in long term, affects their health (center de yoga, 2006).

It has been observed that productivity of the women particularly at work place is affected by the working conditions available at workplace on which a lot of researches have been made so far. I intend to focus the conditions which do not directly connected with workplace working conditions but have the significant effect on productivity at work place especially for women providing education. One of the factors other than workplace is "Domestic Responsibility" which is crucial in nature and significant on social relations and peace of mind at home directly related to the working in the college and University.

Domestic Responsibility does include the following activities:-

- 1) Care of family members in all respects:
 - a) father & mother, sisters, brothers;
 - b) husband, children;
 - c) father in law and mother in law etc.
- 2) Listing of commodities and its procurement to provide nutrition need or basic need of food to the family members.
- 3) Maintenance of social relations with relatives.
- 4) House maintenance including supervision of servants etc.

To be more specific amongst the above functions of a woman, *we are going to focus only the aspect of care of family members and due to which sleep hours of the working woman are disturbed and causing stress to her.* Meltzer (2002:71) is of the view that good quality sleep plays an important role in the general well being of an individual. Factors that adversely affect sleep lead to an overall poor quality of life as well as increase the economic burden on both the individual and society and ultimately reduction in their daytime productivity.

$$\text{Productivity} = f(\text{Exp}, \text{H. sharing}, \text{F.M}, \text{Noc}, \text{Sup .F.M}, \text{Maid}, \text{Rest hours})$$

where

Productivity is measured in terms of:

A: Improvement in qualification

B: Writing of research papers

C: participation in extra curricular activities

Exp = Experience of Length of service

H. sharing = Husbands sharing of child care Responsibility

Noc = Number of children

F.M = family members at home of family size

Sup. F.M = supporting family member to share domestic responsibility
Including child care

LITERATURE REVIEW

While talking about the stress and its effect on the health, Kumar and Clark (2005: 336) argued that psychological stress can exacerbate gastrointestinal symptoms, and psychological disturbances are more common in patients with FGIDs (Functional Gastrointestinal Disorders). These disturbances alter attitude to illness, promote healthcare seeking, and often lead to a poor clinical outcome. They have psychosocial consequences with poor quality of life at home and work. Early in life, genetic and environmental influences (e.g. family attitudes towards bowel training, verbal or sexual abuse, exposure to an infection) may affect psychosocial development (susceptibility to life stress, psychological state, coping skills, development of social support) or the development of gut dysfunction (abnormal motility or visceral hypersensitivity).

It has also proved that whilst acute pain or stress can raise blood pressure, the relationship between chronic stress and blood pressure is uncertain.

In their further studies they state physiological 'stress' and acute illness produce rapid increases in ACTH (Adrenocorticotropic hormone) and Cortisol, growth hormone (GH), prolactin, epinephrine (adrenaline and norepinephrine (noradrenaline). These can occur within seconds or minute.

It has been observed with great concern that *working women in recent decade have experienced increasing stress in their personal and work lives due to multiple roles in a society.* The women have to take care of the family as a grater part of the responsibility, particularly when they are employed in public education sector. It has been concluded in

as empirical research that both work stress and family stress should be considered together when addressing the health of working women Kim (2005).

Stress is an important factor to be managed for workers health. According to a report by the Ministry of Health and Welfare (1999), (Pavalko and Smith 1999; Walters, Lenon, and McKeary, 1994), many women workers experience the double burden of two kinds of work. The first is the “real” work of paid employment, and the second is the women’s work at home that is unpaid. Because Korean women bear the major burden of household chores, the double burden of working women may cause more stress to them. Roxburgh (1996) showed that employed women and homemakers had higher level of stress than employed men, and she asserted that attention should be paid to the gender difference in exposure and vulnerability to home stressors.

This echoes the assertion by Ross and Halatin (1982), who stressed the importance of paying attention to the effect of family stress on work performance, because it could bring out negative effects on workers performance.

No doubt the study is being conducted at small level but its implications is general to the society to consider and concentrate on this very significant issue.

About the role of the woman in the National Development Fasahat H. Syed (1994:211) argued that a healthy mother can contribute to a healthy nation, If a nation is healthy, aware of the problems and educated to overcome them it can tap all natural resources and wealth for the development of the country. Thus we can achieve the goal of self - reliance, self - support and a strong independent nation. Our development is our strength, which we can achieve by putting in joint efforts of both sexes. ? According to Labor Protection Policy, 2006 the maintenance of health of informal sector workers is the responsibility of the Government. Why we have focus on education sector? The enforcing argument is that education department is the department having the largest ratio of female employees as well as it is the largest department of the Government.

Hofferth and Collins (2000) describe 1990 data from the National Child Care Survey. They examine the linkages between child care availability and mothers’ employment exits. They find that all mothers face higher labor force exit probabilities associated with child care disruption and that the availability of substitute arrangements is important. Not all researchers agree, however, that child care disruptions are associated with job turnover. In fact, over the past thirty years, although the gender wage gap has narrowed, the percentage of that gap attributable to motherhood and its resulting family responsibilities is growing (Waldfogel, 1998). Boushey (2003) analyzes 1999 SIPP data that includes mothers’ self-reports concerning days lost at work because of child care problems. She reports that 8.8% of working mothers report losing work hours because of child care problems, with the percentages higher for mothers using non-institutional care.

Child Care Modal Choices

Researchers in child care often categorize different child care choices into five composite modes of care: parent and other care; relative care; nanny and babysitter care; family child care (care by a non-relative in a home other than the child’s home);and center based care. For pre-kindergarten children, parental choices among these modes of

care are known to vary by the age of the child, marital status of the mother, family income, parental education, and ethnicity.

Table 1 presents data from the 2002 NSAF survey and shows the arrangements for primary child care for children with employed mothers, broken down by child's age and family income level. Families are stratified into two family income groups: poor and non-poor, where the dividing line is 200% of the federal poverty level. For all children under the age of 5, we can see that the most noticeable difference in modal choice by income level lies with relative and parent care. Poor families more likely to choose both (compared to higher income families). Non-poor children are more likely to be in center-based care. The finding of less utilization of center-based care by lower income families is common, with important decision factors including the ability to afford center-income levels more often choose relative and parent care.

Table 1. Primary Child Care Utilization Patterns by Income Level for Children of Employed Mothers

	Center-Based Care*	Family Care	Nanny/Sitter	Relative Care	Parent Care	Self Care
1. Child < 5 Poor Family	24.9%	10.7%	3.5%	29.5%	31.3%	-
2. Child < 5 Non-Poor	31.2%	14.2%	5.3%	23.9%	25.4%	-
3. Child < 3 Poor	16.2%	11.0%	3.3%	31.7%	37.7%	-
4. Child < 3 Non-Poor	20.6%	14.7%	6.5%	25.8%	32.4%	-
5. Child 3-4 Poor	36.4%	10.3%	3.8%	26.5%	23.0%	-
6. Child 3-4 Non-Poor	45.5%	13.6%	3.7%	21.3%	15.9%	-
7. Child 6-12 Poor	11.0%	6.0%	4.0%	21.0%	44.0%	8.0%
8. Child 6-12 Non-Poor	17.0%	7.0%	4.0%	21.0%	40.0%	11.0%

* For school-age children, this category is before/after school care programs. These data are from the National Survey of America's Families, 2002 survey year.

Finally, Table 1 shows the breakdown of child care modes for school-aged children (i.e., children ages 6 through 12). For school-age children, the formal care arrangement is before/after school programs, and a sixth category, self care, is added. Non-poor school-aged children are more likely to participate in before/after school programs and to be in self care (17 and 11 %) than poor school-aged children are likely to participate.

Table 2. Distribution of Children Ages 0-4 Primary Care Arrangements

	Mother Employed				Mother Not Employed			
	Parent	Relative	Non-Relative	Center	Parent	Relative	Non-relative	Center
Caucasian	26.5	23.7	23.4	26.3	70	12.5	5.7	11.7
African American	16.7	36.2	13.4	33.6	46.7	25.4	10.7	17.2
Hispanic	26.2	38.4	20	15.3	76.2	14	1.9	7.9
Urban	25.8	28.9	26.7	24.6	68.5	13.5	6	12
Rural	19.8	28.9	26.7	24.6	68	20.4	2.7	8.9
Mother Works Full Time	17.5	30.1	24.1	28.3	-	-	-	-
Mother Works Part Time	38.2	26.9	15.7	19.2	-	-	-	-

Data are drawn from wave 10 of the 1996 SIPP panel and acquired from Table 1 & 2, Blau and Currie (2006).

Data presented by Blau and Currie (2006) provide further detail concerning differences in child care modal choices by ethnicity, rural and urban residence, and mother's work hours. As presented in Table 2, the placement of Caucasian children is spread fairly even across four modes (parent, relative, non-relative, and center), although African American children are more concentrated in relative care (36.2 %) and center-based care (33.6 %).

About a third of Latino/a or Hispanic children is placed in relative care, with only 15.3% in center-based care. Regarding urban versus rural residence, there is little difference in placement rates in relative or center-based care, but only a fifth of rural children is placed in parent care. Although one-fourth of urban children has the same placement, the percentages are reversed for non-relative care. Finally, there are clear differences in modal choices based on the mother's work intensity. Only 17.5% of children of mothers working fulltime in the paid workforce is in parent care, versus 38.2% of the children of mothers working part-time. Additionally, non-relative care and center-based care are both more common choices for children of fulltime, employed mothers.

RESEARCH METHODOLOGY

This study was conducted over one month (January 2008) in Bahawalpur with a total of three Govt. Colleges for women comprising population of approximately 300 teachers and one university having approximately 100 women teachers, with two sub Campuses located at Bahawal Nagar and Rahimyar Khan. Our key respondent is the ever married female teacher, who is currently working in Govt. Colleges or University. A total of 120 participants/ respondents of at least 30 year of age have been selected for this study and a sample frame is constructed by using simple random sampling procedure of which 108

are found to be eligible for interview. Finally a total of 80 respondents have been interviewed successfully, thus having a response rate of 74% (80/108). The structured questionnaires includes questions of work stress, family stress, sleeping hours and general characteristic and a face to face interview schedule was held in the absence of respondent's colleagues within the institutional premises. . Logistic regression analysis is used to assess the productivity in this study which is taken as dependent variable it is dichotomous in nature, so the statistical strategies reinforces us to consider the logistic regression analysis. . Moreover, descriptive statistical techniques are used to analyze the data which includes frequency distribution tables and bar charts.

Logistic Regression

The Logistic regression modal was used to describe the relationship between response variable and set of independent factors for convince, we define productivity status to be $Y=1$ denoting the presence of productivity for the i th respondent and '0' for otherwise. Following Agresti (1995), Hosmer and Lemeshow (1989) and Harrell (2001). Consider a collection of 'P' indicators Mentioned in Section 01(Introduction) be denoted by vector $Z' = \{Z_1, Z_2 \dots Z_p\}$ and the vector of respective coefficients is $\beta' = \{\beta_1, \beta_2 \dots \beta_p\}$.

Productivity Models

Productivity status	Indicators	Coefficient	S.E	P-value	Odds Ratio	95% CI
Improvement in qualification	1. Hrs for Rest	.092	.254	.717	1.097	.666-1.805
	2. Maid	.263	.613	.669	1.300	.391-4.325
	3. Supporting Family member	.042	.648	.949	1.043	.293-3.711
	4. Husband Sharing of Child care responsibility	1.325	.597	.027	3.761	1.166-12.129
	5. Experience	.197	.245	.421	1.218	.754-1.968
	6 Family members	-.804	.420	.056	.447	.196-1.020
	7. No of Children	.464	.265	.080	1.590	.947-2.672
Research Paper	1. Hrs for Rest	.722	.339	.033	2.058	1.059-4.001
	2. Maid	1.497	.826	.070	4.466	.885-22.550
	3. Supporting Family member	2.298	.976	.018	9.958	1.471-67.407
	4. Husband Sharing of Child care responsibility	-.456	.750	.543	.634	.146-2.759
	5. Experience	-.829	.405	.041	.436	.197-.965
	6 Family members	.612	.529	.248	1.844	.653-5.202
	7. No of Children	-.039	.297	.896	.962	.537-1.722
Participation in extra curricular activities	1. Hrs for Rest	-.225	.231	.329	.798	.508-1.255
	2. Maid	-.186	.562	.740	.830	.276-2.500
	3. Supporting Family member	.542	.604	.369	1.720	.527-5.614
	4. Husband Sharing of Child care responsibility	-.904	.541	.095	.405	.140-1.168
	5. Experience	-.463	.242	.05	.630	.392-1.012
	6 Family members	.738	.388	.057	2.092	.977-4.478
	7. No of Children	-.22	.230	.922	.978	.623-1.534

The results of logistic regression analysis to the modal

Model 01

The productivity of working women are shown/displayed in the above table. The most significant indicators that predicts productivity status of working women are 'husband's sharing of responsibility, no of family members, no of children, hours for rest (sleeping hours), supporting family members at home experience.

The 'p' value for the variable 'husband's sharing of child care responsibility' is '0.027' which is least as compared to other variables, meaning that the working women whose husband's share the responsibilities of child care their productivity is 3.761 times(Odds ratio) higher than the working women whose husband's do not share the child care productivity.

Modal 02

The productivity of working women is greater who availed more hours for rest as the 'p' value is .033 and also of those women who have any supporting family member at home for sharing domestic responsibility and child care as the 'p' value is 0.018 its odds ration is 9.958.

Modal 03

The independent variable 'experience' also has great impact over the productivity of working women in terms of her taking part is extra curricular activities. In this case the 'p' value is 0.05.

DISCUSSIONS AND CONCLUSION

More than two-third of the working women taken as a sample having up to six family members including one or two children to take care, and their husband's working hours are more than thirty hours weekly so they don't share childcare and other domestic responsibilities with wives.

Moreover, two-third of the women teachers have to spend almost sixty hours in child care weekly and they don't have any supporting family member. More than 50 percent of the women teachers are taking rest up to forty two hours in a week, which is below the standard/ normal sleeping hours i.e. 49 to 56 hours and they feel anxiety and stress which ultimately affecting their productivity (teaching) at work place. So it can be said that Women can have fame and fortune, office affairs and dazzling designer clothes. But the one thing she can't have is a man who shares the work at home.

SUGGESTIONS / PROPOSALS

- Family members of working women should participate in each and every domestic affairs lessens the stress of the lady. Therefore, all the family members should sincerely and open heartedly cooperate in such a positive way that problem which is going to create stress or anxiety vanished once for all.
- Problem of the workplace of husband should not be soumoto brought to the home rather that should be left over there. However, it can be discussed up to the extent without creating any stress for the women (wife).

- The most terrible home stressor is suspiciousness that is to whom the lady was talking on cell phone? Where has she gone for such a long time? Why is she too late? Therefore these should be avoided. The male family members should more broad minded and confident about his love and affectionate.
- It is world wide perception that seven to eight hours sleep is necessary for stress less health. Hence, it is suggested that these eight hours may be bifurcated into two spells i.e. once at noon and the remaining at night.
- Well planned and systematic routine should be established.
- It is suggested that when a problem can be anticipated and perceived well before its occurrence it can be managed properly. For instance, when a lady is pregnant then utilizing the ultrasound facility she can know whether new born child would be boy , girl or twin, then accordingly a servant or maid can be managed. No heed should be paid to the trivial matters.
- It is strongly recommended that the working hours of the women may be reduced.
- Procrastination is stressful. Whatever you want to do tomorrow, do today; whatever you want to do today, do it now.
- Relax your standards. The world will not end if the grass doesn't get mowed this weekend.
- Become more flexible. Some things are worth not doing perfectly and some issues are fine to compromise upon.
- Eliminate destructive self-talk: "I'm too old to . . .," "I'm too fat to . . .," etc.
- If an especially unpleasant task faces you, do it early in the day and get it over with, then the rest of your day will be free of anxiety.
- Have an optimistic view of the world. Believe that most people are doing the best they can.

REFERENCES

1. Boon A. Nicholas Colledge R. Nicki and Walker R. Brian (2006). *Davidson's Principles and Practices of Medicine*. Elsevier Limited, Delhi, India, p. 236
2. Center de yoga. Working Women and Stress. 2006.
3. Chatterjee and Meera, (1990). *Indian women Health and Productivity*. wsp-442.
4. Clark, Michael and Perveen Kumar (2005). *Clinical Medicine*, Elsevier Limited, London.
5. Farahat H. Syed (1994). *Role of Women in National Development*. (FRIENDS), Rawalpindi, Pakistan, p. 211.
6. Gini Al (1998). Women in the Workplace. *Business and Society Review*, 99: 3-17.
7. Kim and Marion. The relationship of work stress and family stress to the self-Rated health of women employed in the Industrial Sector in Korea.
8. Lerner Gerda (1976). *Working Women*. University of Illinois Press.
9. Meltzer E.O. (2002). Does rhinitis compromise night-time sleep and daytime productivity. *Clinical and Experimental Allergy Reviews*, 2: 67-72. RePEc:wbk:wbrwps:442.
10. Platzer E. (2007). Dual Responsibilities of Working Women.
11. Wal S. and Banerji Shruti, (2001). *Encyclopedia of Women As Human Resource In 21st Century And Beyond*. Sarup and Sons New Delhi, p. 35.

A STUDY OF RESIDENTS OF AN ORPHANAGE HOME IN THE CITY OF LAHORE

Haleema Azhar and Saleha Naghmi Habibullah

Statistics Department, Kinnaird College for Women, Lahore
Email: salehahabibullah@hotmail.com

ABSTRACT

This paper presents a statistical study of experiences of the children who are residing in Dar-ul-Shafkat, Chouk Yateem Khana, Lahore. The main objectives of the study were to analyze the causes that lead children to orphanage home, the extent to which they are satisfied and happy with the facilities which are being provided to them, and to explore the areas in which there is some room for further improvement. It was interesting to find that although, by and large, children are satisfied with the facilities provided to them; approximately half of the residents want to go back to their homes. Not only does this finding generates a number of recommendations for the administration for Dar-ul-Shafkat but also provides food for thought for the society at large.

1. INTRODUCTION

The orphanage home can be defined as: "A public institution for the care and protection of children without parents", and can be categorized into one of the following two types: (a) A *free type* orphanage home provides care, shelter, food and clothing to children for free, who have no one to look after their needs; (b) a *paid type* orphanage home is the one in which care, shelter, food and clothing are provided for fee. An orphanage is devoted to the care of children whose parents are deceased or otherwise unable to care for them. Parents, and sometimes grandparents, are legally responsible for supporting children, but in the absence of these or other relatives willing to care for the children they become a ward of the state, and orphanages are a way of providing for their care and housing.

Many developed nations have phased out orphanages in favor of foster care and more extensive adoption programs. In developing countries like Pakistan, orphanage homes are still very much in vogue, and, in the absence of more advanced systems of foster care, these institutions are playing an important role in the area of social welfare.

2. LITERATURE REVIEW

Mitchell & Santo (1978) conducted a survey on nutritional improvement in Hokkaido orphanage children, which showed Japanese orphanage children to be shorter in stature than Japanese children in general. The study focuses on the need to increase food budgets for orphanages. Chisholm et al. (1995) carried out a study on Attachment Security and Indiscriminate Friendliness in children adopted from Romanian orphanages. Dr. Zhang Shuyun (1996) had reported the horrific maltreatment of children in the Shanghai

Children's Welfare Institute. She observed that new orphans who were healthy when they were admitted, but within a short period they died. Chisholm (1998) carried out a three – year follow – up study on the same children. Linde (2002) produced a thesis on abuse of children in welfare institutions on the basis of scientific literature, questionnaires, essays of children in orphanages and everyday experience. Sigal JJ et al. (2003) conducted the research on psychological and physical consequences of inadequate orphanage care 50 years later. Sharon Judge (2004) conducted the research on Developmental Recovery and Deficit in Children Adopted from Eastern European Orphanages. Miller et al. (2007) Survey the health of young children residing in Russian orphanages. The study reveals that young institutionalized children in Murmansk have complex medical status, social histories, frequent growth and developmental delays.

3. OBJECTIVES AND METHODOLOGY

The objectives of the study are to ascertain the causes that lead the children to orphanage homes, the extent to which they are satisfied with their lives in the orphanage home, and the areas where there is room for further improvement.

One particular orphanage home located at the environs of Chouk Yateem Khana, Lahore was selected for the purpose of this study, details of which are as follows:

Dar-ul-Shafkat Male has been established by Anjuman Himayat-i-Islam for the education and upbringing of orphan children in 1884. A Complex was built for male children at 119 Multan Road Lahore. Presently 200 boys are living in this institution. The Anjuman is spending about 15 million rupees annually on these children for their upbringing, accommodation, education, food, health and other necessities. All these facilities are made available to the inmates through donations, zakat and sadqaat as well as the co-operation of philanthropists.

Having selected this particular orphanage, we designed a semi – structured questionnaire consisting of twenty - eight questions in order to obtain information from the children with reference to the objectives given above. The questionnaire was administered on 151 children living in the orphanage by the face to face interview method.

4. DATA ANALYSIS AND RESULTS

4.1 Background of the Child

The first section of our questionnaire pertains to the background of the child. Analysis of the collected data provides the following basic information about our respondents:

- 66% of them are between 7 and 12 years of age whereas the remaining 34% were between 13 and 17 years of age.
- 57% of them are of rural origin, and 43% of urban origin.
- 54% of them have been in the orphanage home for the past 2 to 3 years, 15% of them have been there for about a year, whereas the remaining 31% have been there for more than three years.

“Where did you live before coming to orphanage home?” In response to this question, almost half of the respondents indicated that they were living with one of their real parents, whereas the remaining half were living with close relatives such as grandparents, paternal / maternal uncle / aunt and brother / sister.

4.2 What Brought the Child to the Orphanage

Our analysis shows that, understandably, a huge majority of 86% of the children are living in the orphanage home because their father or both parents have died, we have found that a small minority of 9% are such whose fathers are alive but whose mothers have passed away, and an even smaller proportion of 5% are such whose both parents are alive but have been sent to the orphanage either because of lack of financial support or because of separation between parents.

4.3 Daily Routine

The second section of our questionnaire pertains to the daily routine of the child. Analysis of their responses reveals that as far as provision of basic necessities such as food, clothing, medical care and education is concerned, every child is being provided with these facilities. The chi-square test indicates a very strong evidence of positive association between *the amount of time that has elapsed ever since a child has been living in the orphanage home and the number of clothing items that he has*. This result provides a clear indication about the overall policy of this institution.

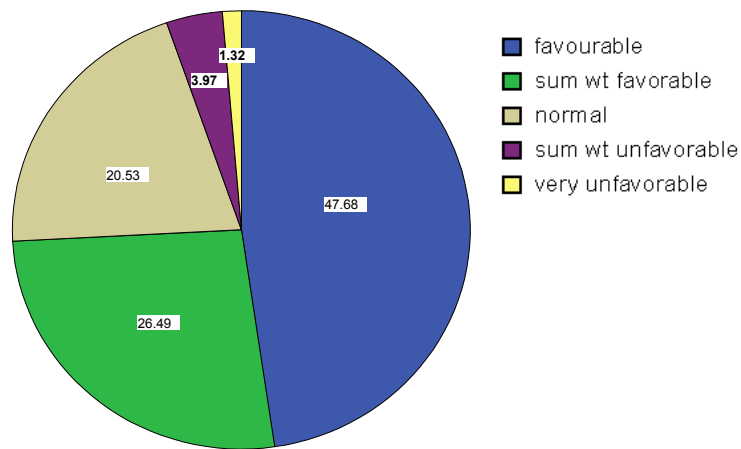
The questionnaire also reveals that children are been taken yearly, in summer vacations, for recreation to the places like zoo, cinema, joyland etc to the younger children and skyland, murree or northern areas to the elder children.

In the orphanage children are also being provided with sports facilities like, cricket, football, volleyball, badminton, hockey, table tennis etc. A large majority of 64% of the children enjoys playing cricket, football is the second most favourite game among the children.

4.4 Extent of Satisfaction

The figures clearly indicate that Dar-ul-Shafkat Male can be regarded as one of the better institutions for the orphan children.

Overall Stay in Orphanage Home



In order to explore the variables that might have an effect on the level of satisfaction of the children, the technique of Logistic Regression was applied by categorizing the various options regarding satisfaction into binary form, and following as predictor variables:

- Age of the child
- Area the child belongs to (urban / rural)
- When did the child come to the orphanage home
- How often do their relatives visit them.
- Does their siblings lives in the same orphanage home
- In which class do they study
- Are they satisfied with the quality of food available
- How many clothes do they have

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-.041	.137	.091	1	.763	.959
Area	-1.097	.484	5.133	1	.023	.334
When you came to orphanage	.136	.148	.852	1	.356	1.146
How often your relatives visit you	.081	.190	.183	1	.669	1.085
Siblings live here	-1.079	.472	5.224	1	.022	.340
In which class you study	-.035	.125	.080	1	.778	.965
Satisfied with the quality of food	.679	.239	8.035	1	.005	1.971
How many clothes you have	-.359	.374	.924	1	.336	.698
Constant	1.254	1.462	.735	1	.391	3.503

The above table clearly indicates that the following three variables have a significant impact on the level of satisfaction of the child:

- Area the child belongs to (urban / rural).
- Does their siblings lives in the same orphanage home.
- Are they satisfied with the quality of food available.

4.5 Does the Child wish to Stay in the Orphanage?

The very last question of the questionnaire enquired: "Overall how would you evaluate your experience so far at orphanage home?". Analysis of the data generated the following information:

Would you prefer to stay at orphanage?	Favorable	Unfavorable
Yes	63	7
No	49	32
Total	112	39

Out of those who indicated that they were not satisfied in the orphanage home, as many as 82% said that do not want to stay there, whereas out of those who said that the situation in the orphanage home is favourable, as many as 44% do not want to stay there.

4.6 Recommendations For Improvement

One of the important questions of our questionnaire invited the respondent to come up with any recommendations that he might have for improving the quality of life in the orphanage home. Young as they may be, the children came up with a *number* of useful suggestions and recommendations for the institution ranging from the relatively unimportant to the most important, as given below:

- Cable should be available
- Sweet dishes should be included in the menu
- Toys should be given
- Need cricket pitch
- More clothes should be provided
- Fruits should be given more often
- Variety of food should be available
- Educational trips should be planed
- Behaviour among children should improve
- Needs a computer lab
- Teachers should be more qualified
- Educational level should improve

5. CONCLUSIONS

This study reveals that at least in this particular orphanage home, the situation of the facilities provided to the children are fairly satisfactory. More than 50% indicated that they were satisfied with the basic facilities as well as the educational and recreational activities that were provided to them. Nonetheless, the children came up with the useful recommendations which are given above.

Their desire to leave the orphanage home and to live with their relatives should not be regarded as a reflection on the quality of orphanage home; rather it should be kept in mind that living with one's loved ones is a basic psychological/emotional need of all human beings, particularly those of children.

REFERENCES:

1. Chisholm, K. (1998). A Three Year Follow-Up of Attachment and Indiscriminate Friendliness in Children Adopted from Romanian Orphanages. *Child Development*, 69(4), 1092-1106.
2. Chisholm, K. Carter, M.C. Ames E.W. and Morison, S.J. (1995). Attachment Security and Indiscriminately Friendly Behaviour in Children Adopted from Romanian Orphanages. *Development and Psychopathology*, 7(2), 283-294.
3. Zhang Shuyun (1996). Exposing the abuse of Chinese orphans, *Education and Debate*, Vol. 312(7029), 495-496.
4. Judge Sharon (2004), Developmental Recovery and Deficit in Children Adopted from Eastern European Orphanages. *Child Psychiatry and Human Development*, 34(1), 49-62.
5. Mitchell and Santo S. (1978). Nutritional improvement in Hokkaido orphanage children, Vol. 72(5), 506-509.
6. Miller, Laurie C.; Chan, Wilma; Litvinova, Aina; Rubin, Arkady; Tirella, Linda; Cermak and Sharon (2007). Medical diagnoses and health of children residing in Russian orphanages, Vol. 96(12), 1765-1769(5).
7. Siret Linde (2002). Reflections of violence by children living at social welfare institutions of Ida-Virumaa.
8. Sigal JJ, Perry JC, Rossignol M and Ouitmet MC (2003). Psychological and physical consequences of inadequate orphanage care 50 years later. *Am J Orthopsychiatry*, Vol. 73(1), 3-12.

A STUDY OF THE PROBLEMS FACED BY PHYSICALLY HANDICAPPED CHILDREN IN PAKISTANI SOCIETY

Amina Zahoor

Kinnaird College for Women, Lahore

ABSTRACT

Disability is a social problem for whole of the world and especially in developing countries like Pakistan. The physically handicapped children are not considered very seriously disabled. The hindrance of movement is equally as pinching as is somebody being unable to watch or listen. The same lack of confidence / emotional disorder is produced with physically disabled children. This paper investigates the problems faced by the physically handicapped children in our society. The research has been conducted on the basis of data that has been collected from Alkhawarzmi Center, the only governmental institute for the physically handicapped children in Lahore, Pakistan. The analysis of the collected data throws light on the potential role of the government and the society at large in the progress of physically handicapped children.

1. INTRODUCTION

Disability means lack of ability to perform an activity in a manner, which is considered to be normal. So is the matter with physically handicapped children. Physically handicapped (like other disables) face several serious problems not only in daily activities, but also in studies and in personal life. Their education, teaching and government's role is vital for their upgrading to lead them better life.

The generally known types of physically handicapped are mentioned below:

Locomotors Disability: Locomotors Disability means disability of the bones, joints or muscles leading to substantial restriction of the movement of the limbs or any form of cerebral palsy.

Orthopedic Impairment: Orthopedic impairment means a severe orthopedic impairment that adversely affects a child's educational performance. The term includes impairments caused by a congenital anomaly, impairments caused by disease (e.g., poliomyelitis, bone tuberculosis), and impairments from other causes (e.g., cerebral palsy, amputations, and fractures or burns that cause contractures).

2. LITERATURE REVIEW

Anne, E. (1986) conducted a research on Families with Physically Handicapped Children: Social Ecology and Family Systems in Philadelphia.^[1] Thomas, A. (1988) conducted a research on Health care of physically handicapped young adults.^[2] Boyce et al. (2000) conducted a research on physically disabled children in Nepal.^[3] Larter & Sylvia conducted a research on physically handicapped and health impaired children in Singapore.^[4] Shah. & Bano. (2002) conducted a research on emotional problems faced by

physically handicapped children in North West Frontier Province (NWFP), Pakistan.^[5] Leong and Susan conducted a research on public library services for wheelchair-bound young people in Singapore.^[6] Tabassum & Rehman (2005) conducted a research on relationship between self-efficiency and depression in physically handicapped children of Islamabad and Rawalpindi cities.^[7]

3. OBJECTIVES

The overall objective of the study is to investigate the lives of the physically handicapped children in the Pakistani society. In particular, the study focuses on:

- The problems faced by physically handicapped children during their educational phase.
- The role of the immediate family in the progress of physically handicapped children.
- The role of the society and the government for the well – being of physically handicapped children.

4. METHODOLOGY

4.1 Source of Data

The data was collected from Alkhawarzmi Center for Physically Handicapped Children situated at Johar Town, Lahore. There were about **45** students studying there upto the 5th standard 43 of whom were available during the time of data collection.

4.2 Instrument

A semi - structured questionnaire containing 20 questions was designed, and the data was collected from the children by the interview method. The SPSS software was used for the analysis of the collected information.

5. DATA ANALYSIS AND RESULTS

The questionnaire was designed reflecting the objectives; the results inferred from a well structured questionnaire are presented below:

5.1 Basic information

Our sample consisted of 28 boys and 15 girls. Analysis of the first few questions revealed that:

- The ages of these children range from 9 to 19, the average age being 14 years.
- Most of the children are the only special child in their family.
- 42% had the disability by birth, 44% children had physical disability due to disease, and 14% of students accidentally were disabled.

5.2 Activities of the Children

The following questions relates to the routine of the child.

- The main hobby of most of these children is painting,
- Approximately 50% of the children participate in extra curricular activities.

5.3 Immediate Family

The next four questions deal with the role of immediate family members in the life of the child.

- Almost all the respondents said that their parent's behavior is more positive towards them as compared to their other brother and sisters.
- Most of the children are not being taking for outing by their parents.
- Above half of the children were positively treated by their family and 30% by their friends.
- More than half of students stated that no body has negative behavior with them.

5.4 Educational Institution

The next three questions highlight the responsibility of institute in the life of a child.

- 89% respondents are satisfied with their teacher's behavior and helpfulness.
- The teacher's behavior and the teacher's help in learning process are highly associated with each other.
- 80% children responded that their institute does not offer them scholarship.

5.5 Society / Government

These three questions depict the contribution of the Government during education of the child.

- 80% students have free transportation facility.
- Only 50% of the students have access to free medical facilities.
- A large majority is provided free medical instruments.

5.6 Psychological disposition

The following questions indicate the psyche of the child.

- Two-thirds of the children stated that they do not do not experience any hesitation in communicating with others.
- Most of the children prefer the profession of teaching and medicine.
- 21% children do not like sympathetic attitude, 30% feel good and 49% felt very good when people are sympathetic with them.

6. OVERALL CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

A study was conducted among 43 students of Institute for Physically Handicapped Children at Lahore. It was found that the average age of the students is approximately 14 years. The percentage of male students was 65, whereas female student was 35%. The study reflects that 71% children are the only disable in their families. The 44.19% children had physical disability due to disease; 41.86% children had the disability by birth and 13.95% of students accidentally were disabled. The result also shows that more than 50% children participate in extra curriculum activities and 67.44% children do not have communication problem. This is also remarkable that 72 % children were quite satisfied with their teachers' behavior and the teachers also motivate them to learn new things. Only a smaller number of children are offered scholarship from the institute. Most of the students are provided free transportation facilities. 50% of students have access to free medical facilities and a majority is provided free medical instruments.

6.2 Recommendation

There are several problems faced by the physically handicapped children during the education process. A large number of children at institute were physically disabled due to

some disease, which is quite alarming and need extra attention and care by the families and also by the government health department. The serious measures need to be taken to avoid physically handicapped children due to disease at different levels. The disability by accidents similarly requires attention and preventive actions. The disability by birth can also be reduced by taking proper health care of the mother, as this matter is not considered seriously. The education for all causes of disability is imperative. Only a small number of students are entitled to scholarship while the scholarship should be offered by the Government to all the students with no difference. Similarly the medical facilities should also be offered to all of the students without exception. Though large numbers of students do have free transportation but still they have to walk a lot to catch up the transport offered by the institute.

Overall the Institute is a better place for the physically handicapped children, where they do have facility to participate in even extra curricular activities, and also have very positive behavior of their teachers. They are also encouraged to learn different new things, and they are confident while interacting with normal people. The students feel good favorable atmosphere at institute. They do not have lack of confidence being among other children like them.

This is also important that such institutes should be large in numbers to give benefit to more disable children.

7. REFERENCES

1. Anne, E. (1986). *Families with Physically Handicapped Children: Social Ecology and Family Systems*. <http://www.blackwell-synergy.com/doi/abs/10.1111/j.1545-5300.1986.00265.x>
2. Thomas, A. (1988). *Health care of physically handicapped young adults*. <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1833380>
3. Boyce, W. Malakar, S. Millman, R. and Bhattarai, K. (2000). *Physically Handicapped Children in Nepal: A follow up study*. <http://www.dinf.ne.jp/doc/English/Asia/resource/apdrj/z13jo0300/z13jo0301.html>
4. Shah, A. and Bano, M. (2002). *Emotional Problems Faced by Physically Handicapped Children in North West Frontier Province, Pakistan*. [http://www.sjdr.net/july 02/July 02178.htm#ICDR#ICDR](http://www.sjdr.net/july%20July%20178.htm#ICDR#ICDR)
5. Tabassum, U. and Rehman, G. (2005). *The Relationship between Self-Efficiency and Depression in Physically Handicapped Children*. http://www.jpps.com.pk/show_article.php?jID=1 & Art ID=13.
6. Larter and Sylvia, E. *The Physically Handicapped and Health Impaired Children: Do They Prosper in Regular Toronto Elementary Schools?* http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_ERICExtSearch_SearchValue_0=ED227641&ERICExtSearch_SearchType_0=no&accno=ED227641
7. Leong, I. and Susan, E. *Public Library Services For Wheelchair-Bound Young People In Singapore*. <http://libres.curtin.edu.au/libres12n1/ChewHiggins.htm>

A STUDY ON FOREIGN TOURISTS' PERCEPTION REGARDING FACILITIES AND BEHAVIOUR OF LOCAL POPULATION

Asenath Naeem

Kinnaird College for Women, Lahore

ABSTRACT

The focus of this study is on foreign tourists' perception regarding the facilities and behavior of the local population. An interview schedule comprising of twenty questions was used a tool for data-collection. The foreign tourists who were interviewed belonged to different cultural backgrounds and had different perceptions regarding the facilities and behavior of the locals. analysis of the collected data reveals that most of the foreign tourists are not satisfied with the facilities in Pakistan but are highly satisfied with the behavior of the locals.

1. INTRODUCTION

Pakistan is geographically and historically very popular and is one of those few countries of the world which have remarkable tourism potential. The inspiring mountain peaks, valleys, beautiful lakes, Mughal Monuments, Prehistoric sites of Moenjodaro, Harrapa, Taxila and Shrines are some of the many attractive tourist's site . Each region of the country offers the tourists of Pakistan a colorful variety of attractions. And a warm welcome and convenient foreign tourists facilities awaits tourists in every part of the country[1]. Recognizing the potential of tourism as a means of boosting national income in a relatively short time, the government has declared 2007 as "Visit Pakistan Year". It has also set in motion a number of useful changes, including a liberal visa policy for visitors from "tourist friendly countries" and a generous depreciation allowance of 50 per cent for new investment in tourism.[2]

The reported presence in Pakistan of some of the world's diehard terrorists may have something to do with the dearth of tourists. A reputation for religious and cultural intolerance, undeserved by the population as a whole, does not help either. The third deficiency is that Pakistan lacks the infrastructure that a modern tourism industry demands. Power failures are common, speeding buses on crowded highways are a menace to passengers, pedestrians and smaller vehicles, the railway system is old, decent accommodation is scarce and costly, and the natural environment is becoming degraded. Pakistanis, who frequently travel abroad, may wonder why countries with similar cultural and religious backgrounds are able to attract so many more tourists, therefore the study is carried out to investigate that *why is Pakistan one of the least frequented and most under-appreciated tourists destination in the world?*

2. LITERATURE REVIEW

A review of the relevant literature helps the researcher to have a better understanding of is study. An attempt has been made to provide such studies which are relevant to the present research on foreign tourists' perceptions regarding facilities and behavior of the

local population. As a research By School of Tourism and Hospitality Management Metin Kozak analyzed The sample population consisting of 1180 international travelers visiting Hong Kong in the fall of 2003.[3]] The research findings show that the majority of travelers are more likely to change their travel plans to a destination that has elevated risk while the minority reports they are more unlikely. These findings suggest that international travelers appear to be sensitive towards the occurrence of any type of risk in their evoked destinations. Differences were also observed from one continent to another in terms of the influence of perceived risks. The final note is that travellers from different national cultures may have varying degrees of the perceived risk. Implications both for theory and practitioners are also discussed. Another research by Mugla University, Mugla, Turkey:A substantial amount of research has been carried out on foreign tourists' perceptions of the attitude and behavior of locals. However, locals' perceptions of foreign tourists' attitude and behavior has not received as much attention from researchers. The aim of this study was to empirically investigate the locals' perceptions of attitude and behavior of those foreign tourists who regularly visit a destination. The study was undertaken on various local service providers in the tourism and hotel industry, such as hotels, restaurants, travel agencies and gift shops in the central part of Fethiye, a popular tourist town in southwest Turkey. Using both open-ended and structured questions, locals' perceptions of two nationalities of foreign tourists, namely British and Germans, were measured. Findings revealed that, overall British tourists were viewed as more positive than their German counterparts. Theoretical and practical implications are provided, followed by limitations and future research suggestions.[4] By 1983 edition of *Pakistan: A Country Study*, edited by Richard F. Nyrop. Portions of their work were incorporated into this volume stated that as of early 1994, foreign tourism remained relatively undeveloped. Annual tourist arrivals averaged 442,136 for the period 1985-89 but fell to 284,779 in 1990 because of uncertainties generated from the Persian Gulf War. The number of tourist arrivals rose to 415,529 in 1991. Many of the arrivals are visitors of Pakistani origin who have settled in Europe and North America. Pakistan has considerable tourist potential, but the generally poor law and order situation in the late 1980s and early 1990s discouraged rapid growth. Hotels meeting international standards are concentrated in the larger cities, especially Islamabad, Karachi, Lahore, Peshawar, and Rawalpindi.[5]

3. OBJECTIVES OF THE STUDY

The overall objective of this study is to analyze (i) the foreign tourists' perception regarding the facilities available in Pakistan and the behavior of the local population, and (ii) the security concerns. In doing so, we aim at putting forward some recommendations regarding the kinds of arrangements that are required to give boost to the tourism industry in Pakistan.

4. METHODOLOGY

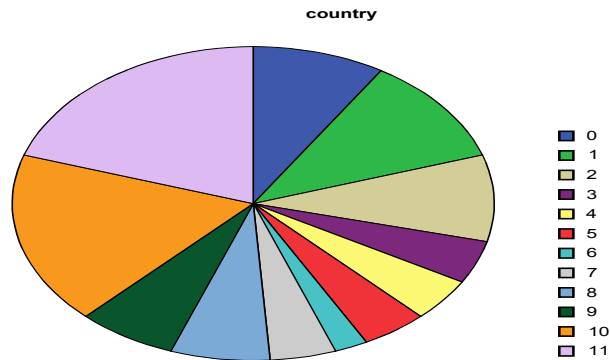
As the total number of foreign tourists staying at Lahore city was not known, as it remains changing, so to carry out the analysis work Pearl Continental Hotel (lhr) among many hotels was randomly selected as a source of data collection, while a semi-structured interview schedule comprising of 20 questions was used as a tool of collecting data through which response of 45 respondents was obtained.

5. DATA ANALYSIS

Keeping in view the objectives determined in this study , following is the analysis done after the data collection:

5.1 Country of Origin

It was observed that among 45 respondents the number of male tourists was more (30) than those of female tourists(15) . As the country of origin was necessary to know as it was perceived that responses will be given according to the mind-set of one's culture and country conditions. Among many countries the most of the tourists belonged to United States of America (20%) while 17.8% belonged United Kingdom.



5.2 Perceptions regarding the facilities provided

Few questions were asked in order to inquire that to what extent tourists are satisfied regarding the facilities that have been provided to them by local Government and Pakistan tourism development cooperation.

Facilities provided	Satisfaction level	
	satisfied	unsatisfied
Transportation	17	28
Food facilities	19	26
Accommodation	15	30
Security	5	40
Health	23	22
Visa access	39	6

There are also some problems that are mentioned by the tourists which include pollution, unclean water, Pakistani police disturbances, security issues ,medical facilities , poor transportation while 2% mentioned that they had faced no problem.

5.3 Perceptions regarding the behavior of local population

The perceptions of the tourists regarding the behavior of local population towards them turned out to be positive to great extent as according to tourists they found behavior of locals to be cooperative (60%), tolerant (75%), friendly (35.6%), helpful (35.6%), hospitable (15.6%) and only 4.4% of the tourists mentioned that they found that locals have cold behavior towards them.

5.4 Association between duration of stay and fulfillment of activities

It is interesting to note that there is a significant association (measure of association is 60%) between duration of stay in Pakistan which is dependent on the fulfillment of tourist's recreational activities which include

- Mountaineering
- Exploring historical places
- Shopping cultural handicrafts
- Site visitation
- photography

5.5 Security Concerns

According to the third objective few questions were asked in order to measure security issues that foreign tourists face while their visit in Pakistan. 11% of the tourists mentioned that they feel safe to great extent, while 88% responded that they have security issues and mentioned some fears such as terrorism (40%), cheating (8.9%), kidnapping (7%).

5.6 Recommendations:

The third and the final objective of the study was to put forward some recommendations regarding the type of arrangements that are required to give boost to the tourism industry in Pakistan, the recommending arrangements are as below :

- Government should take measure to control pollution.
- Credit card facility should be available in small cities too.
- Need to keep check on the police which bother tourists.
- Cleanliness/hygienic conditions should be improved.
- The tourists site should be well maintained .

6. CONCLUSION AND RECOMMENDATIONS:

Keeping in view the objectives of the study and the facts yielded by the present research, following conclusions were drawn.

After data analysis it was found out that perceptions regarding provided facilities were not as satisfactory as those regarding the behavior of the locals., from the whole study it was concluded that the main problem faced by foreign tourists is pollution as 36.78%, while the major cause of insecurity was terrorism.

REFERENCES

1. Akhtar S. (1994). *Pakistan year book*: 132.
2. Nuwaz. M. (2006). *Dawn Editorial*. 21st Nov.
3. Isam-ul-Haq (2001). *Yearly book on Tourism*. http-insaf_files_wordpress_com-2006-11-header_1_jpg.htm
4. Khan, M. (2004). *Yearly book on tourism*. http--insaf_files_wordpress_com-2006-11-header_1_jpg_files\promoting-tourism-in-pakistan.htm
5. Abbudullah, Shah (2006). *Country Reports*. <http://www.glaa.org/archive/2007/CountryReports2006.shtmls/Chaerudin03.pdf>.
6. John Wisely (2002). *Interscience*. <http://www3.interscience.wiley.com/cgi-bin/abstract/112217217/ABSTRACT>.

A STUDY ON LIFE IN WOMEN WELFARE CENTER

Bushra Mukhtar and Farah Anjum
Department of Statistics
Kinnaird College for Women, Lahore

ABSTRACT

A women welfare center is defined as a place committed to the betterment and uplift of women in society, to provide them with good health, comfort and happiness. Dar-ul-Aman is one of the well-known women welfare centers of Lahore. They provide shelter, food, medical and many other facilities to women. In this paper, we present an analysis of data collected from the residents of this center regarding the facilities that are provided to them in order to assist them in developing some skills by which they are able to earn in the future. In addition, we investigate (a) the causes that lead women to welfare centers, (b) whether or not they are in contact with their families, and (c) whether or not they are desirous of going back home.

1. INTRODUCTION

Welfare can be defined as a suitable quality of life. Welfare can also be defined as financial aid given by taxpayers to people who are unable to support themselves and /or their family. Welfare is also important for society for the stabilization of our society, for the benefits of our people, in order to promote prosperity. Therefore women welfare is defined as satisfactory quality of life for women. Women welfare is also defined as a government program to support the women of low-income group and make them able to move in the society.

During my research I found that there are two type of women welfare center,

Free type women welfare center:

Free type women welfare centers are those which provide shelter, food, training and medical facilities to women who are facing some problem.

Paid type women welfare center:

Paid type women welfare centers are those where women have to pay for every facility.

Many women welfare centers have been established which provide shelter and other facilities to the women. These kinds of centers are all over the world including Afghanistan, Burkina Faso, Cameroon, Ghana, Honduras, India, Iran, Iraq, Kenya, Mexico, Nepal, Nicaragua, Pakistan, Peru, Senegal, Tanzania, Uganda, United States.^[1]

2. LITERATURE REVIEW

Kurz, D (1998) published a journal article on “Women, welfare and domestic violence”.^[2] Hanmer, J. et al. (1999) conducted a research on “Gendering research on

men's violence to know women".^[3] Coker, AL, et al. (2000) published a journal article on "Frequency and correlates of intimate partner violence by type: physical, sexual, and psychological battering".^[4] Tolman, R.M, et al. (2001) conducted a survey on "Domestic violence in the lives of women receiving welfare".^[5] Lyon, E (2002) conducted a research on "Welfare and domestic violence against women: lessons from research".^[6] A research conducted by Feroze, M.H, a student of department of economics, GC College Lahore (2002), on topic "Women and development in Pakistan: A case study".^[7] Goodwin, S.N. et al. (2003) had conducted a research on "Violence against women: The role of welfare reform".^[8] Ministry of Health and Family Welfare (2007) conducted "National Family Health Survey" one of the surveys was on "Domestic Violence Widespread".^[9]

3. OBJECTIVES

The overall objective of the study is to investigate the quality of life of the women in the welfare center. This study has been undertaken to ascertain the causes that lead women to welfare center. To determine the kind of facilities being provided, what kind of measure center take in order to empower the women to develop some skill, which will enable them to earn. In addition want to check these women are in contact with their family or not, they wanted to go back or not.

4. METHODOLOGY

4.1 Source of Data

There are two women welfare center working under government for the welfare of the women in Lahore.

- ❖ Dar-ul-Aman
- ❖ Dar-ul-Falah

Dar-ul-Aman was selected for the purpose of the study.

Detail of the center:

Social welfare, women development and Bait-ul-Maal Department, Punjab, established Dar-ul-Aman in 34 district of the Punjab to protect the women in distress. Dar-ul-Aman in Lahore was established on 28 August 2004. It started working one year before it actually came to being. It is located at 298 Chowk Yateem Khana near Police Station Nawan Kot, Band Road Lahore. The motto of Dar-ul-Aman is "Residence is our priority".

4.2 Instrument

We have administrated a semi-structure open ended questionnaire. The questionnaire consist of 32 questions. We have conducted face-to-face survey. In Dar-ul-Aman number of women varies everyday. We have taken all the women in Dar-ul-Aman at the time of our data collection. There were 40 women in the center at the time of our data collection.

5. DATA ANALYSIS AND RESULT

The source of our data collection is an open-ended questionnaire. We have divided this questionnaire into three parts. The first part is related to their back ground in which we have asked them about their age, qualification, martial status, the number of children,

the area they belong, about their class of society, who bought them to the welfare center and the reason for coming to the welfare center. The second part is related to the facilities that are provided to them in the center like training, education, medical, food, clothes, and education and security facility. The third part is related to their satisfaction with the facilities that are provided to them in this center.

5.1 Background

In the first part we found that average age of the women coming to the welfare center is 24. It is determined that 53% of the women in the center are illiterate, 20% are those who have primary education and only 8% of the women have high secondary education. In Dar-ul-Aman half of women are from rural area. From the analysis we found that 48% of the women belong to the middle class where as only 10% are from upper class of society. There are 83% of women who are married where as 15% are single. Out of married women 50% of the women have children. Majority of the women in Dar-ul-Aman has one child. The average time of the women staying in Dar-ul-Aman is four months. About 38% are coming themselves whereas 25% brought by the lawyer, and 10% by the police.

The one of the most important objective was to check the causes that lead the women to welfare center. Almost 60% of respondent indicated that they are victim of physical beating and it is alarming to find that nearly half of them said that their life is in thread.

5.2 Facilities

In the second part of the questionnaire, it determined that about 78% of resident said that the center does not help them in solving their problem whereas only 15 % said that it does help them. Out of those who said that center help them, 78% said that center had helped them in hiring a lawyer. The analysis shows that half of women are learning nothing in the center because they were not force to learn, the one who are willing to learn take these training classes. 33% of women were learning handicraft and sewing. There are 53% of women who said that they couldn't earn in future whereas 47.5% of women said that they could earn in future with the help of these skill. About 95% said that they are not facilitated with education. Women in the center are satisfied with the quality of food where as half of the women said that the center provides them with the clothes. When we asked them whether they wanted to go out for recreation? It is surprising to find that 100% of the women said that they do not want to go out for recreation. When they were asked about the religious study, 40% said that religious study is offered here, whereas 35% said that it is not offered. It is quite strange to note that 40% of women in Dar-ul-Aman said that religious study not at all help them in understanding their life, and only 27.5% said that religious study help them a lot in understanding their life.

Does the institute help in your confidence building?

		Frequency	Percent	Cumulative Percent
Valid	Yes	18	45.0	45.0
	To some extend	12	30.0	75.0
	No	10	25.0	100.0
	Total	40	100.0	

Looking at this table we came up with the very interesting result that 45% said that they had gained confidence after coming to this center.

When they were asked about the social event celebration in Dar-ul-Aman 58% said social events are celebrated. There are about 98% who reported that they are not provided financial help even in the case of their need.

About the higher authorities behavior with women in the center, 48% said that higher authorities behave normally with the women. In answer to the question "How do you behave with the other women in the center?" 53% reported that they behave normally, where as only 23% reported offensive behavior with the other women in the center.

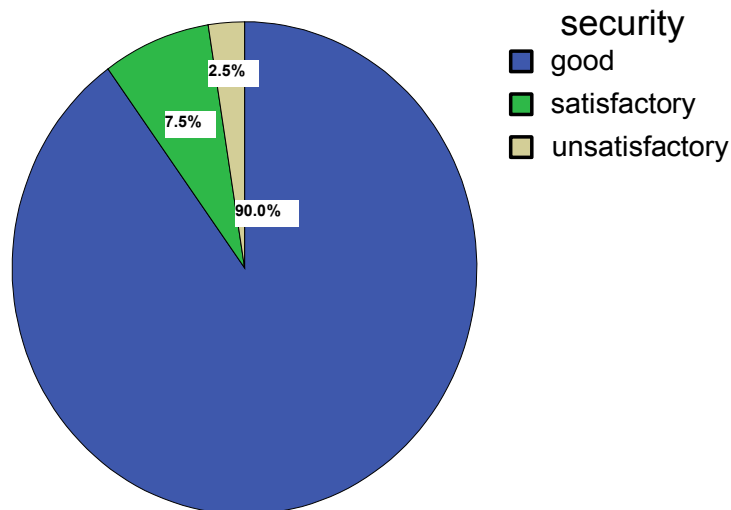
Association was check between different variables and following are found to be significant:

- Training facilities and confidence building are associated. Therefore we conclude that training facilities are playing an important role in building up their confidence.
- Quality of food and level of satisfaction are significantly associated. This indicates that resident are satisfied with the quality of food.
- Clothes facility and level of satisfaction are also significantly associated. From this we conclude that they are satisfied with the clothes facility that is provided to them.
- Medical facility and satisfaction with medical facilities are associated. From this we conclude that women are satisfied with the medical facility.

5.3 Satisfaction

The third part of the questionnaire is related to the level of satisfaction, which indicates that 52.5% of women are very happy with the medical facility, and 35% are just satisfied, whereas 5% said that medical facility that is provided is poor.

Extent of satisfaction with security facility:



Women are happy with the security facility 90% said that security is good whereas only 3% said that it is unsatisfactory.

There are about 65% of the women who are satisfied with all facilities, whereas only 35% are not satisfied with the facilities. It is very strange to know that 68% reported that they are not in contact with their families.

Do you like to go back home?

		Frequency	Percent	Cumulative Percent
Valid	Yes	16	40.0	40.0
	No	24	60.0	100.0
Total		40	100.0	

In the answer to this question we came up with the very surprising result that 60% do not want to go back to their own home and only 40% reported they are willing to go back.

When resident are asked about the promotion of these kind of center at government level 75% said that this kind of center should be promoted at the government level.

6. CONCLUSIONS

From the analysis we came up with some conclusion that:

- Physical beating and thread of life has emerged to be two of the main causes that bring women to the welfare center.
- Women in the center are very happy with the security facility. In addition most of them said that the center help them in building up their confidence.
- Most of resident are so much satisfied with the facilities that are provided and they do not want to go back to their homes.
- Maximum women want that this kind of center should be promoted at government level.

From the above conclusion we can interpret that women in the center are happy and they do not want to go back but we should keep this think in mind that the place where they are living is welfare center not their own home where they can live happy life with her family.

7. RECOMMENDATION

Overall center is playing an important role for the protection and prosperity of women but we came up with some recommendation:

- The quality of food should be improved.
- The arrangement should be made for the promotion of education in the center.
- Council room for the women should be made where women can discuss their problem related to the center.
- All of the women want that they do not want to go out for recreation but we would like to prefer that they should taken out for recreation so they can forget their problem for some time.

REFERENCES

1. *Centers in the world*. www.jagriti-international.org/organizations.asp?Country=Pakistan-28k.
2. Demie Kurz (1998). *Women, Welfare, and Domestic Violence*. Vol. 25. www.questia.com/PM.qst?a=o&se=gglsc&d=5001359170
3. Jalna Hanmer and Jeff Hearn (1999). *Gendering research on men's violence to know women*. www.eurowrc.org/13.institutions/3.coe/en-violence-coe/05.en-coe-oct099.htm-43k
4. AL Coker, PH Smith, RE McKeown and MJ King. (2000). Frequency and correlates of intimate partner violence by type: physical, sexual, and psychological battering. *American Journal of Public Health*. 90(4). 553-559. www.ajph.org/cgi/content/abstract/90/4/553
5. Richard M. Tolman and Daniel Rosen (2001). Domestic violence in the lives of women receiving welfare. *SAGE Journal Online*. Vol. 7, No. 2, 141-158. vaw.sagepub.com/cgi/content/short/7/2/141
6. Eleanor Lyon (2002). *Welfare and domestic violence against women: lessons from research*. <http://new.vawnet.org/category/Main Doc.php?docid=317>
7. Muhammad Hasan Feroze (2002). *Women and development in Pakistan: A case study*. MH Feroze - brain.net.pk
8. Sandra Naylor Goodwin MSW, Daniel Chandler, and Joan Meisel (2003). *Violence against women: The role of welfare reform*. www.ncjrs.gov/pdffiles1/nij/grants/205792.pdf
9. National Family Health Survey (2007). *Domestic Violence Widespread*. www.nfhsindia.org/NFHS-3%20Data/press-released.pdf

**A STUDY ON HARASSMENT FACED BY FEMALE STUDENTS
AT THEIR CO-EDUCATION INSTITUTE**

Aisha Ehtisham and Kalsoom Akhtar Chaudhry

Department of Statistics
Kinnaird College for Women, Lahore

ABSTRACT

A recent study by Huda (2003) on harassment faced by females indicates that professional women including lawyers, teachers, doctors, staff of private companies, government officials, bankers, journalists and NGO workers within the age - bracket of 20-60 years complain about harassment by male colleagues in the form of teasing, sexually explicit jokes, bad behavior, unwanted touching and insinuated comments. Although the state constitution guarantees equal protection and equal access to the law, it does not seem to guarantee security to the vulnerable and powerless. This paper presents a similar study that has been carried out in a renowned university of Lahore. The objectives of our study were to ascertain the problems faced by female students due to the behavior of their college fellows / teachers towards them, to determine the extent to which they were aware about harassment and about the policies that are in place to overcome harassment. Data was collected from female students of Bachelors, Masters and M.Phil/Ph.D. who were single, committed, engaged or married and whose ages ranged from 16-30. Analysis of the collected data has led to some recommendations for the general public and the government and particularly for the university authorities.

1. INTRODUCTION

Our study is based on the harassment faced by the female students at their co-education institute. Harassment is any unwelcome behavior that interferes in a student's ability to study, work or participate in activities.

1.1 Main Types of Harassment

Racial harassment, religious harassment, sexual harassment, police harassment, technological harassment, psychological harassment and community based harassment are the seven main types of harassment.

World wide the previous three decades witnessed great advances in female betterment covering all aspects of life and yet they continue leading complexly difficult lives (Niaz (2001)). In Pakistan it has been difficult for women to fully contribute to their country's development because the environment to study or to work, in general, is difficult and un-supportive. Women commonly face inappropriate behavior and harassment on the streets, in public places, at the workplace and sometimes at their institution. The general belief that women are subordinate and inferior to men also prevails in the society and therefore an environment where women have the same or higher authority at work becomes unacceptable and this uncomfortable feeling leads to harassment. Not all people think like this. Many who are enlightened and wise realize that society has developed and so has the role of women. Women now can and should contribute to the society, not only at home but also in every aspect of life. No country can progress if half of its population is restricted

from contributing to its progress. Women have rights like men as citizens of our country and they should have equal opportunity at work. Men and women both have the right to work in an environment free of discrimination, intimidation and harassment (Saeed (2006)).

In addition, for an institute to be productive it is extremely important for its students to feel safe and respected. This is their right. Therefore it is important to resolve/address any issue of discrimination and harassment at the institute and make the study environment a healthy and supportive place where people can fully contribute to the institution, make full use of their abilities and participate in the development of their country.

2. LITERATURE REVIEW

Jawaid et al. (2006) conducted a research on sexual harassment faced by females. The topic of the research was "Situational analysis on sexual harassment at the workplace". Huda (2003) presented a paper in a seminar at Bangladesh. The topic of the paper was "Spate of sexual harassment in workplace alleged". Waqar (2006) has written the article on "Additional secretary to investigate harassment charges against GCU, Faisalabad". Asian human rights commission (2006) has investigated a report on "Sexual assault at educational institution, no rule of law, law enforcement agencies are protecting the culprits".

3. OBJECTIVES AND METHODOLOGY

The main objective of the study is to make female community aware of the facts related to harassment. To determine whether female student is a victim of harassment. To know the problems faced by female students due to their male fellow's/male teacher's behavior. To investigate that whether this co-educational institute have any policies to control harassment.

One particular university of Lahore is selected for the study and the population of our study is all the female students of a specific department of the university. Tool for the data collection is semi-structured questionnaire and the data was collected from 70 female students. Most of the variables are qualitative and binary. The analysis is carried out using a statistical package, SPSS 14.0.

In the present study three demographic variables (enrollment, age and marital status) and twenty two variables about harassment (victim of harassment, harasser, remarks about personality, irrelevant phone calls, lunch outside college premises, unwanted emails, jokes about disgracing females, dedicating songs, having tea at college cafeteria, lunch outside college premises, staring, comments about the clothing, whistling, treating as inferior being, reaction on harassment issues, discussion about harassment, complaint about harassment, reported the harassment, feel homely at institute, punishment to the harasser, steps and policies to overcome harassment) are included in the questionnaire.

4. DATA ANALYSIS AND RESULTS

4.1. Background of the Student

The first 3 demographic variables are analyzed graphically and their descriptive statistics were found. Total numbers of respondents were 70. Out of 70, 47 (67%) respondents were from Bachelors, 20(29%) respondents were from Masters and 3 (4%) respondents were from M.phill/phd. Majority of the respondent were in the age-group of 20-23 years. 34 (49%) of the students were single, 15 (21%) were committed, 14 (20%) were engaged and 7 (10%) were married.

4.2. Victim of Harassment and the Harasser

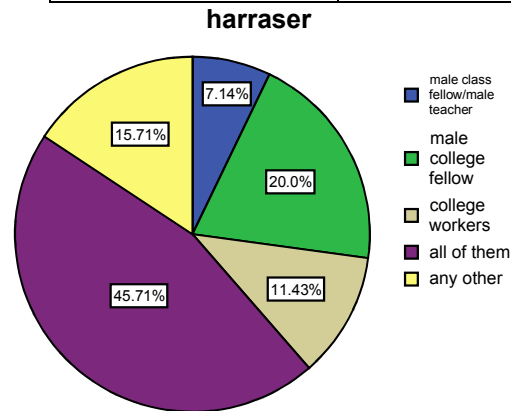
The 57% of the respondents said that they were a victim of harassment, 40% discuss the harassment with their friends, 20% discuss the harassment with their family, 20.0% discuss it with their teachers and 10.0% discuss the harassment with others.

“Have you ever been a victim of harassment?”	Percentage of Respondents
Yes	57%
No	43%

Out of 100%, the total of 7% said that the harasser was male class fellow/male teacher, 20.0% said the harasser was male college fellow, 11% said the harasser was college worker, 45% said that all of them were the harassers.

4.3. Problems Faced by Female Students

60% of the respondents said that their male fellow whistles or dedicate songs to them and 47% said they ignore such issues, 31% said that they humbly tackle it, 20.0% said that they shout on such issues. Similarly 36% said that they made a formal complaint of the harassment and 8% said that they made a complaint to their families, 92% said they made a complaint to their teachers. While 64% said that they didn't made any formal complaint of the harassment and 16% said that they were ashamed to make a formal complaint of their harassment, 39% said that they were unsure of the action. While 27% respondents said that they were afraid of the accused so they do not make a complaint of the harassment.



4.4. Policies Regarding Harassment

67% said that they strongly agree that they feel at home in their institute. 60% respondents said that their institute have not established policies prohibiting any sort of harassment. The 98% respondents said that people who exhibit harassing behaviors should be punished. The 53% respondents suggest that warning cards should be issued to overcome any sort of harassment while 43% said that the institute should develop some specific cell to overcome harassment issues.

We have applied the technique of logistic regression to check the significance between different variables.

In order to forecast the binary variable on the basis of a number of factors, which are significant. The two predictor variables are:

- Age group
- Status

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	age group	-.021	.226	.009	1	.924	.979
	status	1.159	.488	5.626	1	.018	3.185
	Constant	-.555	4.266	.017	1	.896	.574

a Variable(s) entered on step 1: age group, status.

The above table indicates that status has a significant affect on stopping the harassment by the respondent herself. The logistic regression also showed some significant results between the following variables:

- ✓ Remarks and status
- ✓ Unwanted emails with status and age group
- ✓ Tea at cafeteria and status
- ✓ Lunch outside college premises with age group and status
- ✓ Comments about clothing and status
- ✓ Complaints about the harassment and status
- ✓ Dedicating songs/whistling with status and age group.

5.3 Test of Significance

5.3.1. Interpretation of the Associations

Significant association is observed among status and victim of harassment. The results show that in the study, single females get more harassed than married or committed. It is observed that as age of a person increase, one get more confident to discuss her issues with the closed ones.

6. CONCLUSIONS AND RECOMMENDATIONS

The finding of this study indicates that those who are single or committed face more harassment than those who are engaged or married and as one reaches the higher degree of qualification then confidence among the females also increases. From the Fisher's exact test one can conclude that as one grows older she discusses their problems more easily with her family, friends and others. Almost all of us face these type of problems in our lives because 60% of the females said that they were the victim of harassment. If these types of issues are not being resolved then the efficiency of the students would be reduced so the coeducation institutions/universities should administer these issues carefully. The strong policies can evacuate these sorts of harassment issues. We recommend that further some in-depth subsequent analyses should be applied to explore different factors causing harassment.

7. REFERENCES

1. Asian Human Rights Commission (2006). *Sexual assault at educational institution, no rule of law, law enforcement agencies are protecting the culprits*. AHRC.
2. Huda, S. (2003). A seminar on sexual harassment and professional women: Perspectives, experience and response organized by Forums on Women in Security and International Affairs (FOWSIA) and supported by Bangladesh Freedom Foundation (BFF), *Bangladesh Observer*.
3. Jawaid, R., Khan, A. and Batool, M. (2006). Situational analysis on sexual harassment at the workplace, *AASHA*. 6-17.
4. Niaz, U. (2001). Overview of Women's Mental health In Pakistan, *Pakistan Journal of Medical Sciences*, 17(4), 203-209.
5. Saeed, F. (2006). Guidelines for creating a work environment free of discrimination and harassment, *AASHA*. 2-3.
6. Waqar, A. (2006). Additional Secretary to investigate harassment charges against GCU Faisalabad, *Daily Times*.

A REVIEW ON GRID COMPUTING ARCHITECTURE

Muhammad Qasim Sadiq¹ and Abdus Salam²

Department of Computer Science, City University of Science and Technology, Karachi
Email: ¹ms_research@yahoo.com; ²abduslam@hotmail.com

ABSTRACT

Grid computing is a critical shift in thinking about how to maximize the value of computing resources. It has emerged as an important new field, distinguished from conventional distributed computing by its focus on large-scale resource sharing, innovative applications, and, in some cases, high-performance orientation. In this paper, we review a number of approaches and alternatives that will help research communities in understanding well on Grid Architecture, in which protocols, services, application programming interfaces, and software development kits are categorized according to their roles in enabling resource sharing, so that one can know Grid Computing Architecture in detail. We also discuss the services in Grid Architecture namely Open Grid Services Architecture (OGSA). We also highlight future of grid computing in Pakistan at the end of the paper.

1. INTRODUCTION

Grid computing embodies a combination of a decentralized architecture for resource management, and a layered hierarchical architecture for implementation of various constituent services. A grid goes beyond client-server linkage in that it provides distributed data analysis, computation, and collaboration [2]. Grid computing is concerned with “coordinated resource sharing and problem solving in dynamic, multi institutional virtual organizations [3]. A Grid is built from multipurpose protocols and interfaces that address such fundamental issues as authentication, authorization, resource discovery, and resource access [2]. Given that grid solutions are adaptable to meet the needs of various business problems, differing types of grids are designed to meet specific usage requirements and constraints..A business that wants to tap into unused resources for calculating risk analysis within their corporate data center will have a much different design than a company that wants to open their distributed network to create a federated database with one or two of their main suppliers. Such different types of grid applications will require different designs, based on their respective unique requirements [3]. Using the design objectives and target applications of the Grid systems, they can be categorized into (a) computational Grids, (b) data Grids, and (c) service Grids. *Computational Grids* have higher aggregate computational capacity available for single applications than the capacity of any constituent machine in the system. *Data Grids* provide an infrastructure for synthesizing new information from data repositories such as digital libraries or data warehouses that are distributed in a wide area network. *Service Grids* provide services that are not provided by any single machine [4].

Now imagine a world in which computer power is as easily accessible as electrical power. In this scenario computer tasks are run on the resources best suited to perform them. A numerically intensive task might be run on a remote supercomputer, while a less-

demanding task might run on a smaller, local machine. The assignment of computing tasks to computing resources is determined by a scheduler, and ideally this process is hidden from the end user.

The Coordination among resources must be very high, so that tasks can be completed in a timely manner, without prior interruption.

2. GRID TYPES

The grids can be divided into a number of types according to their use. We discuss only some of them:

2.1 Local Grid [1]

The simplest grid consists of just a few processors, all of which have the same hardware architecture and utilize the same operating system. These processors are connected in a data center on a LAN or storage area network (SAN); [1]

You can call it an organizational grid, but in limited scope. Data grid and computational grid comes in this category, but scope is limited.

2.2 IntraGrid [1]

Next level of complexity is reached when one includes heterogeneous processors in the grid ensemble. These grids are also referred to as an “intragrids” and/or “enterprise grids.” As the term implies, processors participating in the enterprise grid may include devices owned and maintained by multiple departments, but still within one firm. The grid may span a number of geographic locations, where computing facilities (e.g., servers) may be located. These larger grids may have a hierarchical topology, although this is not a strict requirement. For example, processors locally connected in a data center or server room form a “cluster” of processors; in turn, the overall enterprise grid may be organized hierarchically consisting clusters of clusters [1]

2.3 InterGrid

Third Type of grid is called a pure grid, in which the grid expands to a number of organizations. So the scope of grid widened and hundreds of thousands of resources came under this grid

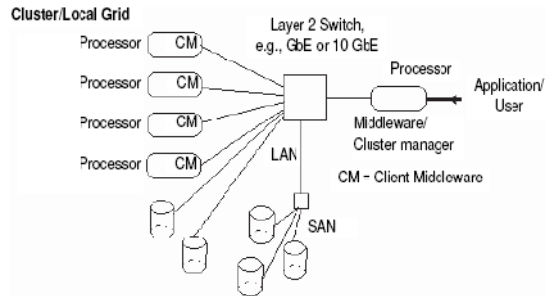


Fig. 2.1: Local Grid

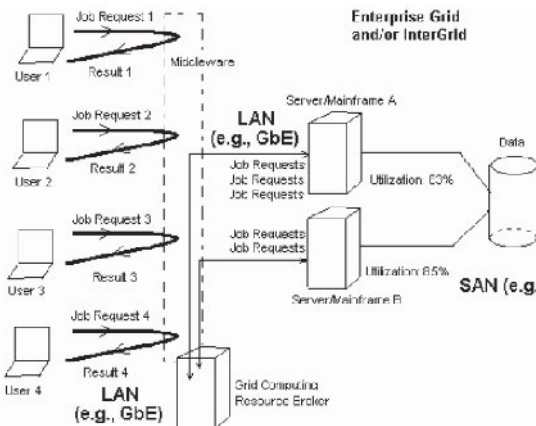


Fig. 2.2: InterGrid

3. GRID ARCHITECTURE

The architecture can be defined in terms of logical and physical building blocks from which one can categorize different functions. For example, if you want to build a house, the logical and physical building blocks are:

- Idea and Planning (logical)
- Money (logical)
- Foundation (Physical)
- Resources(Bricks, Sand, Soil, Workers etc)
- Time (logical).

With all this, a house can be built.

Similarly, Grid Computing has its architecture, building blocks, both in terms of logical and physical. We discuss here a number of approaches in the following sections.

3.1 Most Common Approach

This is the most common layered architecture of Grid Computing. The Grid architecture is first and foremost protocol architecture, with protocols defining the basic mechanisms by which users and resources negotiate, establish, manage, and exploit sharing relationships. A standards-based open architecture

facilitates extensibility, interoperability, portability, and code sharing; standard protocols make it easy to define standard services that provide enhanced capabilities. [5]

In the *Fabric*, we have the resources that we wish to share: computers, storage systems, data, catalogs, etc. The *Connectivity* layer provides communication and authentication services needed to communicate with these resources. *Resource* protocols (and, as in each layer, associated APIs) negotiate access to individual resources. *Collective* protocols, APIs, and services are concerned with coordinating the use of multiple resources, and finally application toolkits and applications themselves are defined in terms of services of these various kinds [3] has unique modes of operation, and collaboration between multiple organizations is hindered by incompatibility of resources such as data archives, computers, and networks. The Globus Toolkit was conceived to remove obstacles that prevent seamless collaboration. Its core services, interfaces and protocols allow users to access remote resources as if they were located within their own machine room while simultaneously preserving local control over who can use resources. The Globus Toolkit has grown through an open-source strategy similar to the Linux operating systems, and distinct from proprietary attempts at resource-sharing software. This encourages broader, more rapid adoption and leads to greater technical innovation, as the open source community provides continual enhancements to the product.

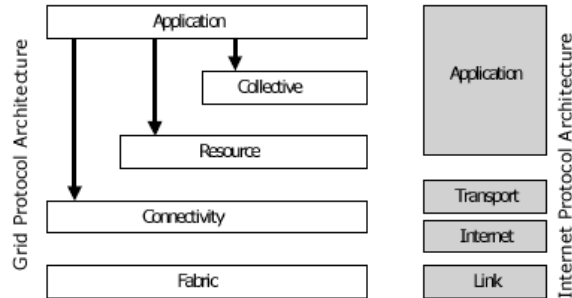


Fig. 3.1 Common Layered Architecture

"layers", each providing a specific function. The higher layers are generally user-centric, whereas lower layers are more focused on computers and networks: hardware-centric. **The lowest layer is the network**, which connects Grid resources. Above the network layer lays the **resource layer**: actual Grid resources, such as computers, storage systems, electronic data catalogues, sensors and telescopes that are connected to the network. The **middleware layer** provides the tools that enable the various elements (servers, storage, networks, etc.) to participate in the Grid. The middleware layer can be thought of as the intelligence that brings the various elements together - **the "brain" of the Grid!** **The highest layer of the structure is the application layer**, which includes applications in science, engineering, business, finance and more, as well as portals and development toolkits to support the applications. **This is the layer that users of the grid will "see"**.

In most common Grid architectures, the application layer also provides the so-called **serviceware**, the sort of general management functions such as measuring the amount a particular user employs the Grid, billing for this use (assuming a commercial model), and generally keeping accounts of who is providing resources and who is using them - an important activity when sharing the resources of a variety of institutions amongst large numbers of different users.

3.2 Grid Architecture, Concise Layered Approach [8]

There are other ways to describe this layered structure. For example, experts like to use the term **fabric** for the physical infrastructure of the Grid: things like computers and networks.

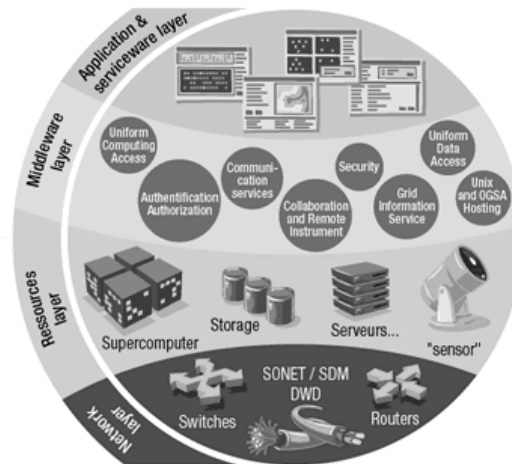


Fig. 3.2: Layered Architecture [6]

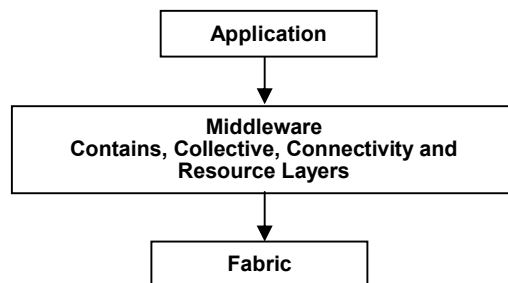


Fig. 3.3: Concise Layer Approach

- Within the middleware layer, there is a layer of resource and connectivity protocols, and a higher layer of collective services. **Resource and connectivity protocols** handle all "Grid-specific" network transactions between different computers and Grid resources. The Grid's network is the Internet, the same network used by the World Wide Web, e-mail and many other services. Computers contributing to the Grid must recognize Grid-relevant messages and ignore the rest. This is done with **communication protocols**, which allow the resources to communicate with each other, enabling exchange of data, and **authentication protocols**, which provide secure mechanisms for verifying the identity of both users and resources. The **collective services** are also based on protocols: **information protocols**, which obtain information about the structure and state of the resources on the Grid, and **management protocols** which negotiate access to resources in a uniform way.

The topmost layer is always the applications layer. Applications rely on the layers below them to run on the Grid. Consider a user application that needs to analyze data contained in several independent files. It will have to:

- **obtain the necessary authentication credentials** to open the files (resource and connectivity protocols)
- **query an information system and replica catalogue** to determine where the files are and which computational resources can do the data analysis (collective services)
- **submit requests to the fabric** - the appropriate computers, storage systems, and networks - to extract the data, initiate computations, and provide the results (resource and connectivity protocols)
- **Monitor progress** of the various computations and data transfers, notifying the user when analysis is complete, and detecting and responding to failures (collective services)

3.3 Grid Architecture, Expanded Layered Approach [1]

More specifically, grid computing can be viewed as being comprised of a number of logical hierarchical layers. Figure 1.5 depicts a first view of the layered architecture of a grid environment. At the base of the grid stack, one finds the *grid fabric*, namely, the distributed resources that are managed by a local resource manager with a local policy; these resources are interconnected via local, metropolitan, or wide-area networks. The grid fabric includes and incorporates networks; computers such as PCs and processors using operating systems such as UNIX, Linux, or Windows; clusters using various operating systems; resource management systems; storage devices; and data bases. The *security infrastructure* layer provides secure and authorized access to grid resources. Above this layer, the *core grid middleware* provides uniform access to the resources in the fabric—the middleware designed to hide complexities of partitioning, distributing, and load balancing. The next layer, the *user-level middleware* layer, consists of resource brokers or schedulers responsible for aggregating resources

The *grid programming environments and tools* layer includes the compilers, libraries, development tools, and so on, that are required to run the applications (resource brokers manage execution of applications on distributed resources using appropriate scheduling strategies and grid development tools to grid-enable applications). The top layer consists of

grid applications themselves. [13] Shows four layers architecture with fabric at the bottom, then core middleware, user level middleware and applications at the top.

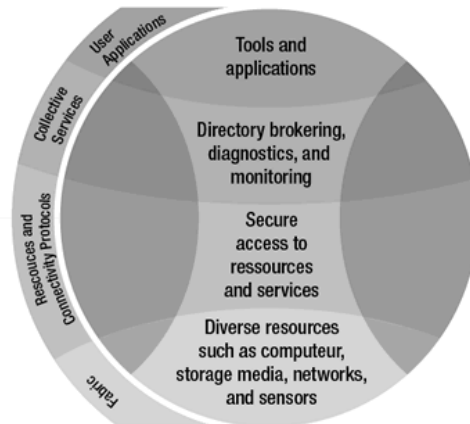


Fig 3.4 Grid Architecture [8]

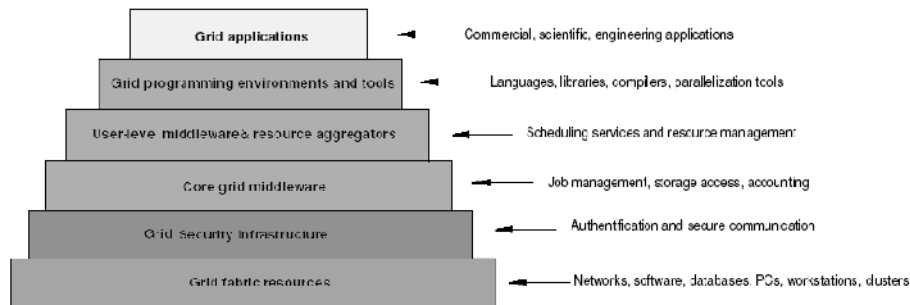


Fig. 3.5: Expanded Layered Architecture [1].

3.4 Open Grid Services Architecture

OGSA aims at addressing standardization (for interoperability) by defining the basic framework of a grid application structure. In essence, the OGSA standard defines what grid services are, what they should be capable of, and what technologies they are based on. OGSA, however, does not go into specifics of the technicalities of the specification; instead, the aim is to help classify what is and is not a grid system. It is called architecture because it is mainly about describing and building a well-defined set of interfaces from which systems can be built, based on open standards such as WSDL.

The objectives of OGSA are to:

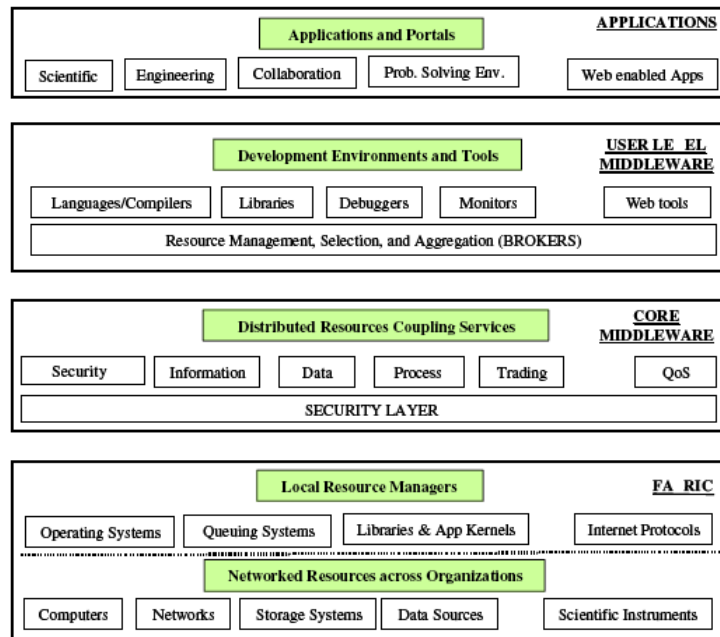


Fig. 3.6 A layered Grid architecture and components.

- Manage resources across distributed heterogeneous platforms.
- Support QoS-oriented Service Level Agreements (SLAs). The topology of grids is often complex; the interactions between/among grid resources are almost invariably dynamic. It is critical that the grid provide robust services such as authorization, access control, and delegation.
- Provide a common base for autonomic management. A grid can contain a plethora of resources, along with an abundance of combinations of resource configurations, conceivable resource-to-resource interactions, and a litany of changing state and failure modes. Intelligent self-regulation and autonomic management of these resources is highly desirable.
- Define open, published interfaces and protocols for the interoperability diverse resources. OGSA is an open standard managed by a standards body.
- Exploit industry standard integration technologies and leverage existing solutions where appropriate. The foundation of OGSA is rooted in Web services, for example, SOAP and WSDL, are a major part of this specification.

[12] Shows grid in three basic layers the network of distributed resources, the grid middleware and the grid applications. In the following, the grid technology is addressed according to this conceptual architecture view, considering the widely recognized Open Grid Services Architecture (OGSA) standard, and its related requirements and implementation tools



Figure: 3.7 The conceptual layers of the grid

Figure 3.8 is an extension of Figure 3.7, giving further details associated with OGSA.

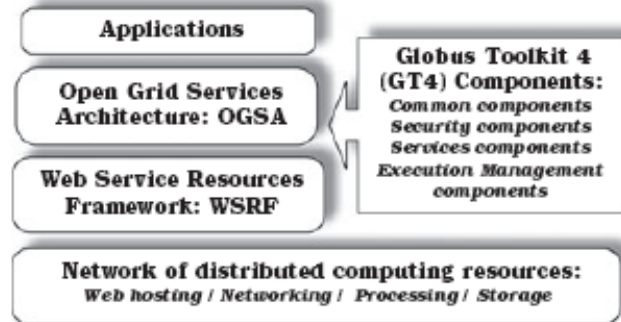


Figure 3.8: Grid layers and middleware tools

The basic function of the WSRF standards is to have the resource management requirements of the grid merged with the web services standards. The OGSA standard is concerned with the activities of the grid. It deals with the clients subscribing to the grid, manages the services of the grid, and implements the dynamic operation of the grid in providing the services. The services are considered as objects with state data and behavior, in a similar way to object-oriented programming.

4. GRID IN PAKISTAN

Today in Pakistan, educational standards has been improving and on the rise for the last 5 years or so. With Higher Education Commission's (HEC) policies, all the universities in the country can bringing themselves to the desired level of excellence in promoting education to the level, which can be compared to the international universities, with the target of making the students to have research oriented mind and capabilities. Having said that all, Pakistan is now in the developing phase, in building science, engineering and different communities of research and development. Grid Computing is still in the evolutionary phases in US, Europe and other developed countries. You can compare it with the early age of World Wide Web.

So, the future of Grid Computing is very bright in Pakistan. Different communities of science and engineering can collaborate on intensive tasks by having their resources connected in Grid. For example, PK-GRID-CA at National Centre for Physics (NCP) is an accredited certification Authority (CA) under the European Grid Policy Management Authority (EUGridPMA). The EUGridPMA is the international organization to co-ordinate the trust fabric for e-science grid authentication in Europe. It co-ordinates with the regional peers APGridPMA for Asia Pacific and The American Grid PMA in the

International Grid Trust Federation. It is the first only Certification Authority in Pakistan. PK-GRID-CA issues X.509 digital certificates to users/hosts to use grid resources under secure environment. By virtue of the Certificate Policy and Certification Practice Statement (CP-CPS), these digital certificates are issued only to users/communities participating in High Energy Physics (HEP) Program in collaboration with NCP. PK-GRID-CA is run and maintained by NCP. The effort in this regard started in October 2003. The first CP-CPS document was produced in December 2003. Several revisions were made and the final version of the CP-CPS was published in April 2004. The PK-GRID-CA was presented at the 2nd meeting of the EUGridPMA in Brussels in September 2004, where it was formally approved and accredited by the PMA. PK-GRID-CA started its operations since then. [12]

4.1 Recommendations

In the light of above discussions, following are some recommendations that must be adopted, in order to promote and adopt Grid Computing in Pakistan:

- The Higher Education Commission (HEC) must start a new program, aiming at providing in depth information on Grid Computing, from its concepts to its implementations.
- Universities must take part, by making themselves a member of PK-GRID-CA, not only providing their resources, but also gaining access to the resources of member communities and organizations and widening the scope of PK-GRID-CA, because currently it is only allowing access to High Energy Physics Program.
- The key to success in any field is by starting at small level and then enhancing it step by step. Universities must adopt Grid Computing, by first implementing it at the department level, then after analyzing the results, widening it to other departments, campuses, other universities etc.
- As web is used for Grid Operations and all other activities related to Grid, a compensation system must be introduced for those communities, who are allowing access to their resources, so that users can pay a fixed amount for accessing resources. This will encourage more communities and universities to come up and engage their resources. This will be better done through ISPs (internet service providers), because they already have a settled network.

4.2 Challenges

Computational Grid infrastructure consists of geographically distributed computers connected by high latency network. Each site has its own policy for resource usage and maintenance schedule. In such an infrastructure, the availability of resources may change during the execution of the application and faults cannot be avoided. The following three points are requirements of Grid enabled applications which are the sources of challenges for Grid computing [11].

4.2.1 Flexibility

Grid-enabled applications are expected to be executed on a large number of CPUs for long time, but it is not practical to occupy a large-scale single system for long duration since the availability of computers may change during the execution of the application. In addition, Grid-enabled applications may change necessary CPUs during their executions on-the-fly. Therefore, Grid-enabled applications should be capable of dynamic resource allocation and migration according to the availability of resources and the requirements by the application itself. [11]

4.2.2 Robustness

Since Grid infrastructure is less stable compared to a single system and large-scale infrastructure and long-run execution increase possibility of encountering faults, Grid-enabled applications should have a capability for error detection and automatic recovery from the faults. [11]

4.2.3 Efficiency

Naturally, Grid-enabled applications should be able to handle hundreds to thousands of CPUs with reasonable performance. [11]

5. SUMMARY

In this paper, we first introduced Grid Computing, and then review its architecture from different approaches, and Open Grid Services Architecture (OGSA). We highlight its future in Pakistan and future challenges. At the end, its on to the research communities as well as Higher Education Commission (HEC) to come up and produce more work on Grid Computing, so that we can adapt it as earliest as possible.

6. REFERENCES

1. Daniel Minoli (2005). *A Networking Approach to Grid Computing*. ISBN 0-471-68756-1, John Wiley & Sons, Inc.
2. Ian Foster (2002). What is the Grid? A Three Point Checklist. Argonne National Laboratory & University of Chicago. www.fp.mcs.anl.gov/~foster/Articles/WhatIsTheGrid.pdf
3. Ian Foster (2001). *Grid Technologies & Applications: Architecture & Achievements Computing in High Energy and Nuclear Physics*. Beijing, P.R. China.
4. Mauro Migliardia (2002). Muthucumar Maheswaranb, Balasubramaniam Maniyaranb, Paul Card and Farag Azzedin. Mobile Interfaces to Computational, Data, and Service Grid Systems. *ACM Sigmobile Mobile Computing and Communications Review*. 6(4): 71-73.
5. Ian Foster, Carl Kesselman and Steven Tuecke (2001). The Anatomy of the Grid Enabling Scalable Virtual Organizations. *Lecture Notes in Computer Science* Vol. 2150. *Proceedings of the 7th International Euro-Par Conference Manchester on Parallel*, 1-4.
6. <http://gridcafe.web.cern.ch/gridcafe/gridatwork/architecture.html>
7. <http://ludit.kuleuven.be/nieuws/pdf/grid.pdf>
8. <http://users.cs.cf.ac.uk/David.W.Walker/IGDS/GridCourse.htm>
9. <http://www.sei.cmu.edu/isis/guide/technologies/ogsa.htm>
10. <http://www.ncp.edu.pk/pk-grid-ca/>
11. Yoshio Tanaka (2007). Status and Future Direction of Grid Computing. *Medical Imaging Technology*. 25(5).
12. Mohammad Amer Arafah, Hazza S. Al-Harbi and Saad Haj Bakry (2007). Grid computing: a STOPE view. *Int. J. Network Mgmt.* 17: 295-305.
13. Mark Baker, Rajkumar Buyya, and Domenico Laforenza (2002). Grids and Grid technologies for wide-area distributed computing. *Softw. Pract. Exper.* 32(15): 1437-1466.

**MODELING AND FORECASTING GROSS DOMESTIC
PRODUCT DEFLATOR FOR PAKISTAN**

**Ghulam Mustafa¹, Iram Yasmin¹,
Muhammad Yaseen² and Sami Ullah³**

¹ GC University, Faisalabad. Email: gmustafa_208@yahoo.com

² University of Agriculture, Faisalabad-38040

³ University College of Agriculture, University of Sargodha, Sargodha.

ABSTRACT

Gross Domestic Product Deflator (GDPD) is an important indicator of the economic status of a country. In this study the objective was to model and forecast the GDPD for Pakistan by using the ARIMA methodology and found that the ARIMA (1,1,3) model explained the behavior of GDPD for Pakistan appropriately. Then the selected model was used to forecast the GDPD for Pakistan if the same conditions prevail.

INTRODUCTION

Accurate forecasts of macroeconomic time series, e.g., gross domestic product deflator and labor employment, are important to economic policy-makers and other economic decision makers. Among other benefits, good forecasts provide early-warning signals about the onset of economic recessions and consequently, opportunities for these decision makers to respond more effectively to the upcoming adverse changes in macroeconomic conditions.

We can measure the GDP for a particular year using the actual market prices of that year; this gives us the nominal GDP or GDP at current Prices. But we are usually more interested in determining what has happened to the real GDP, which is an index of the volume or quantity of goods and services produced. More precisely, we measure real GDP by multiplying the quantities of goods by an invariant or fixed set of prices. Hence, nominal GDP is calculated using changing prices while real GDP is calculated using constant prices.

When we divide nominal GDP by real GDP, we obtain the GDP deflator, which serves as a measure of the overall price level.

METHODOLOGY

The main objective of our study is to develop a model and forecast GDPD of Pakistan.

In this particular study we have univariate time series. Time series which contains no trend or from which trend has been removed, known as stationary time series, can be dealt as comprising of two parts, a self-deterministic part, and a disturbance component. To fulfill our objective i.e. to develop a model first part, self-deterministic part, of the series should be forecast able from its own past by an autoregressive (AR) model with some number of terms, p , that could be written as

$$Y_t = b_0 + b_1 Y_{t-1} + b_2 Y_{t-2} + \dots + b_p Y_{t-p}$$

It would also be possible to model the residuals from the above given model component by a moving average (MA) with a large enough number (q) of elements,

$$Y_t = w_1 e_{t-1} + w_2 e_{t-2} + \dots + w_q e_{t-q},$$

Where the symbols w and e represents the weight and the disturbance in time period $t-q$ respectively. In this connection an AR model of order p may find an equivalent MA model with a large enough number q of disturbance term elements in it. In practice a time series can be modeled with only modest numbers of terms p or only a modest number of q in the form of an AR, or an MA, or it may consist of both that can be called as ARMA model. These models, forecasted from only its past p values known as an autoregressive model of order p can be classified as AR (p) and the moving average model with q terms is classified as MA (q) and if we combine both of these, then it is known as ARMA (p, q). Now if we have non stationary time series and we take d differences to achieve stationarity, the model is classified as ARIMA (p, d, q), where the symbol "I" signifies "integrated." In the above model if we have stationary that is we have $d = 0$, no differences taken to obtain the stationarity than ARIMA ($p, 0, q$) is the same as an ARMA (p, q) model; Similarly a model may not consist moving average part that is ARIMA ($p, 0, 0$) it would be same model as an AR (p) model, and if we have not included auto regressive part then our model can be classified as ARIMA ($0, 0, q$) it would be same as an MA (q) model. Various approaches have been developed for ARIMA modeling. The procedure, which has become the standard for estimating ARIMA models, was proposed by G.E.P. Box and G. M. Jenkins involves making successive approximations through three stages: identification, estimation, and diagnostic checking. Once a functional relationship between yield and time (in other words, a time series model) is established, it can be used for forecasting for the period $t+1$. The process for developing this model begins by examining whether the time series under study is stationary or non-stationary. The GDP deflator data were forecasted for 2004 to 2010 by modeling the GDPD data for 1953 to 2005 taken from IFS.

RESULTS AND DISCUSSION

The Histogram and Correlogram of the level of Gross Domestic Product Deflator (GDPD) showed that the series wasn't stationary. The unit root test, Dicky Fuller (DF) test, of the GDPD without intercept and trend, with intercept and with intercept and trend also supported the clue drawn from the histogram and the correlogram of the level of GDPD.

The Histogram, correlogram and the unit root test of the first difference of GDPD showed that the GDPD series after the first difference is stationary. The correlogram and the partial correlogram of the first difference of GDPD were used to identify the tentative values of p , order of AR, and q , the order of MA. Then the

Table 1: Estimation of ARIMA Model of GDPD

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.355	2.643	1.648	0.107
AR(1)	0.921	0.055	16.690	0.000
MA(1)	-0.696	0.022	-31.721	0.000
MA(2)	-0.627	0.033	-18.951	0.000
MA(3)	0.933	0.031	30.179	0.000
R-squared	0.632	Mean dependent var		2.297
Adjusted R-squared	0.599	S.D. dependent var		3.308
S.E. of regression	2.095	Akaike info criterion		4.414
Sum squared resid	193.158	Schwarz criterion		4.607
Log likelihood	-103.134	F-statistic		18.908
Durbin-Watson stat	1.861	Prob(F-statistic)		0.000
Inverted AR Roots	.92			
Inverted MA Roots	.83-.53i		.83+.53i	-.96

tentative model, ARIMA (1, 1, 3), was estimated by using data from 1953 to 2003, leaving two values of 2004 and 2005 for comparison purpose.

To test the goodness of fit of the estimated model different diagnostic checks were used. One of them is the ARMA structure; if all the AR and MA roots are within the unit circle then the model is appropriate one. We found that the all AR roots are within in unit circle so the model is acceptable.

Correlogram of the residuals and the squared residuals of the fitted model also suggested that the model is good because these statistics (ACF and PACF) are within the bounds.

After gone through all diagnostic checks, the fitted model was used to forecast the value of GDPD. Low values of Root Mean Squared Error, Mean Absolute Error, Mean Absolute Percent Error and Theil's Inequality coefficient showed that the model was good. This was also supported by the closeness between the actual and the forecasted values.

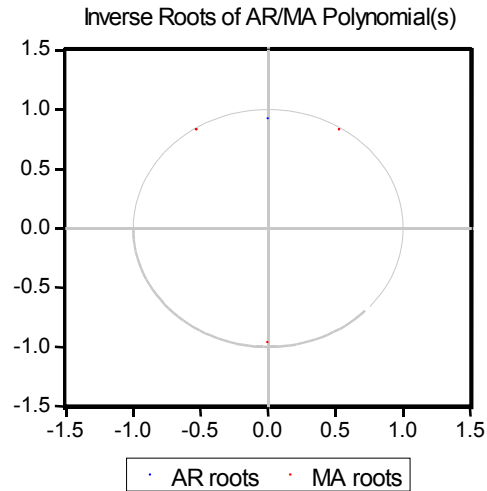


Fig. 1 ARMA structure of first difference of GDPD

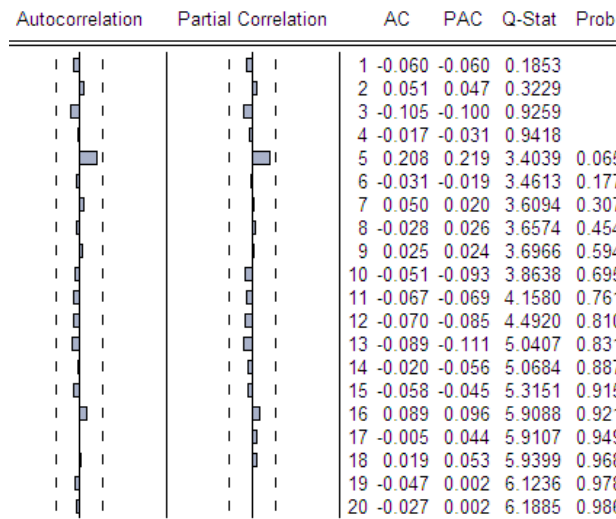


Fig. 2: Correlogram of residuals of ARIMA (1, 1, 3) of GDPD

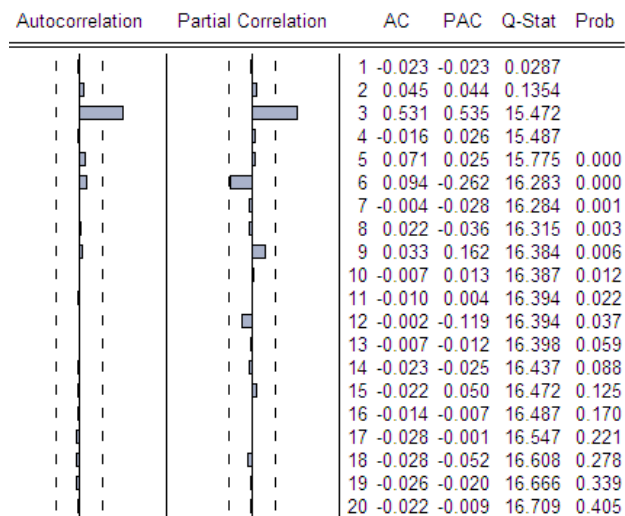


Fig. 3: Correlogram of squared residuals of ARIMA (1, 1, 3) of GDPD

Table 2: Forecasting of ARIMA (1,1, 3) of GDPD

Year	GDPD	GDPD Forecasted	SE
2004	124.403	123.432	2.115
2005	135.282	136.128	3.385
2006		141.577	3.939
2007		146.939	5.082
2008		152.223	6.645
2009		157.433	8.472
2010		162.577	10.468

REFERENCES

1. Abel B. Andrew and Bernanke, S. Ben (2001). *Macroeconomics*, 4th ed., Pearson Education, Inc.
2. Baumol J. William and Blinder S. Alan (2005). *Economics Principles and policy*. 9th ed.
3. Box, G.E.P., G.M. Jenkins and G. Reinsel (1994). *Time Series Analysis: Forecasting and Control*. 3rd Edition. Prentice Hall.
4. Gujarati, D.N. (2002). *Basic Econometrics*, 4th ed. New York: McGraw-Hill
5. McConnell, R. Campbell and Brue, L. Stanley (2002). *Economics Principles, Problems, and Policies*. 15th ed., McGraw Hill.
6. Sylviane G.J., P. Hua and Z. Liang (2006). Financial development, economic efficiency, and productivity growth: evidence from china. *The Developing Economies* 44(1).
7. Yasmin J. (2007). Forecasting the Non-GDP in the United Arab Emirates, *International Review of Business Research Papers*, 3(2), 162-183.

SEASONAL ADJUSTMENT OF FINANCIAL TIME SERIES USING THE X-12-ARIMA PROCEDURE

S.M. Husnain Bokhari¹

Statistics & DWH Department, State Bank of Pakistan, Karachi.
Email: husnain.bokhari@sbp.org.pk

ABSTRACT

The paper describes the applied seasonal adjustment procedures used for analysis of the financial time series compiled by SBP. We have applied the X-12-ARIMA method in adjusting five important financial series: currency in circulation, broad money, remittances, exports and imports (from the balance of payments data). Adjusted series were found to be satisfactory, with in the tests and practices followed in X-12-ARIMA.

1. INTRODUCTION

Economic and financial data series are often subject to seasonal variation. Seasonal fluctuations in data make it difficult to analyze whether the changes in data for a specified period reflect increases or decreases in the level of the data due to some underlying forces, or otherwise due to regularly occurring variation. Hence, the use of raw data in such cases can be quite misleading and necessitates the use of seasonally adjusted data. Generally, seasonal adjustment is based on time series models which decompose an unadjusted series into the sum or the product of four unobservable components: trend- cycle, seasonal, calendar and irregular. It is a process of estimating and removing seasonal effects from a time series. Seasonally adjusted data is useful for financial institutions, government, policy makers, statisticians, econometricians and economists working in research institutions and universities. This paper applies X-12-ARIMA methodology to estimate seasonal effects for time series of five financial variables compiled and disseminated by the State Bank. The five financial data series represent a number of challenges to seasonal adjustment and two of the series have raw data on stock basis, while the rest on monthly flow basis.

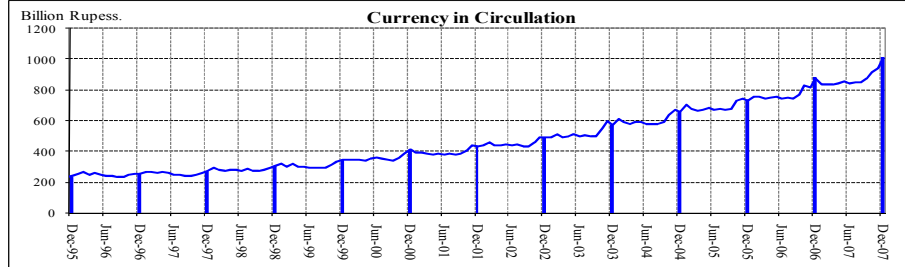
After introduction in Section-1, Section-2 describes the concept and presence of seasonality in the economic time series. Seasonal adjustment methodology behind the X-12-ARIMA procedure is discussed in Section-3. We briefly describe the choice between indirect and direct adjustment. Then we discussed the statistical tests and diagnostics. We also discussed the preadjustments of data series which are carried out prior to ARIMA modeling and seasonal adjustment. We also talked about the model selection criteria. The assessment of the final seasonal adjustment is explained in Section-4. The revision of seasonally adjusted data is discussed in Section-5. We concluded our paper in Section-6.

Disclaimer: The views expressed in this paper are those of authors and do not necessarily represent those of the State Bank of Pakistan.

2. SEASONALITY

Seasonality means particular annual dependence. Many economic time series reveal seasonality. Seasonal effects can either be ascribed to the passing of seasons, e.g. harvesting or to more specific calendar effects resulting from Ramadan and Eid holidays, or specific days of the week. If seasonality is present in the time series data, it must be removed to give a clear picture of the data. The procedures of seasonal adjustment of financial time series do not vary from that of real economic time series. Financial time series are, however, to a higher degree than real economic time series affected by institutional changes.

Chart 1:- Currency in Circulation in the period Jul 95 – Dec 07



Note: The vertical lines indicate the month of December each year

Currency in circulation can succinctly exhibit the seasonal variation of financial time series as shown in Chart 1. There is a clear trend for currency demand showing an upward trend from November to December and from December to January and a strong peak is also visible in December. This is, perhaps to a large extent caused by harvesting season - due to cash payments made to the rural sector. This variation also effected by Eid shopping when Eid occurs in this period, which actually accentuates the regular Gregorian Calendar seasonal due to overlapping with moving effect of Hijri Calendar.

3. SEASONAL ADJUSTMENT METHODOLOGY

3.1. The basic model used for seasonal adjustment

Observed economic time series Y_t can be decomposed into many unobserved seasonal and non-seasonal components that will provide useful and easily interpretable information. The model used for seasonal adjustment is quite simple. The basic principle is that an observed or actual time series is made up of three components:

- The long-term direction of the series removing all short-term fluctuations is referred to as the trend (T_t).
- Short term fluctuations in the series which are assumed to occur annually including calendar effects (such as trading day effects, Ramadan effect etc.) called the seasonal component (S_t).
- The irregular component (I_t), which contains all effects not explained by the trend or the seasonal component (including extreme observations such as outliers) but these can be due to a variety of reasons: abnormal weather, natural disasters, strikes and other unidentified reasons.

The decomposition can be either additive or multiplicative. Often financial and real macroeconomic time series are treated as multiplicative since the seasonal variation is dependent on the observed level. The decomposition can therefore be expressed as follows:

The multiplicative model:

$$Actual(Y_t) = Trendcycle(T_t) \times Seasonal(S_t) \times Irregular(I_t) \quad t = 1, 2, \dots, T$$

and the additive model is:

$$Actual(Y_t) = Trendcycle(T_t) + Seasonal(S_t) + Irregular(I_t) \quad t = 1, 2, \dots, T$$

Most adjusted series use a multiplicative decomposition however a multiplicative model cannot be implemented if there is zero or negative observed values in the series. It is assumed that the seasonal component is exogenous and that its movements are predictable.

3.2. X-12-ARIMA²

The X-11 software was the most widely used statistical method as developed by the US Census Bureau. The X-11 method has evolved as an experimental statistical method of seasonal adjustment implemented in early mainframe computers (Univac)³. The X-12-ARIMA is the most recent software package in the X-11 family⁴. It now merges the moving average technique with time series modeling. X-12-ARIMA procedure mainly consists of two stages: (i) a RegARIMA model is built for the time series under examination or its transformed values, e.g. log. Then the model is used to preadjust the series for several effects and for forecasting and backcasting. The RegARIMA time series regression error is the output of this stage; and (ii) this error is fed into X-12-ARIMA for seasonal adjustment. The adjusted series is decomposed into trend, seasonal and irregular components. The adjusted series are inspected through X-12-ARIMA diagnostics tests.

3.2.1. The RegARIMA models

RegARIMA models are the widely used approach to preadjust the series for various effects and for forecasting and backcasting. These models are used to preadjust a series before seasonal adjustment by removing calendar effects such as trading-day, moving holidays and outliers. The series adjusted for such effects is extended for forecasts and backcasts with ARIMA models to avoid any loss of data while using moving average filters. The linear regression is applied for removing the day-of-the-week effect. The linear regression equation can be written as:

$$y_t = \sum_{i=1}^k \beta_i x_{it} + \varepsilon_t, \quad (3.2.1.1)$$

where y_t is the observed time series, x_{it} are regression variables (modeling the day-of-the-week effect and the outliers), β_i are regression parameters, k is the number of regressors, ε_t the residual from the regression model, ($t = 1 \dots n$) and ($i = 1 \dots k$). The regARIMA model then becomes of the following type:

² Seasonal Adjustment software developed by US Census Bureau <http://www.2010census.biz/rsd/www/x12a/>

³ A brief history is provided by Julius Shiskin, (1978) originator of X-11 method, in his Keynote Address: Seasonal Adjustment of Sensitive Indicators.

⁴ See Findley, Monsell, Bell, Otto and Chen (1998)

$$\varphi_p(B)\Phi_P(B^s)(1-B)^d(1-B^s)^D \left[y_t - \sum_{i=1}^r \beta_i X_{it} \right] = \theta_q(B)\Theta_Q(B^s)\varepsilon_t, \quad (3.2.1.2)$$

where ε_t is white noise with mean 0 and variance σ^2 , B is the backshift operator, where $\varphi_p, \Phi_P, \theta_q$ and Θ_Q are polynomials of order (p, P, q, Q) respectively and have all roots outside unit circle.

3.2.2. The ARIMA model

It indicates the ARIMA part of the RegARIMA models. It describes a pure ARIMA model if the regression model is absent. The ARIMA part of the model may include multiplicative seasonal factors and operators with missing lags. The format follows standard Box-Jenkins (1976) notation. A multiplicative seasonal ARIMA model is specified as $(p, d, q)(P, D, Q)$, where $p, d,$ and q are as defined above, P is the seasonal AR order, D is the number of seasonal differences, and Q is the seasonal MA order. Here, the first ARIMA factor (p, d, q) is assumed to be nonseasonal (i.e. its period is one) and the second ARIMA factor (P, D, Q) is assumed to be seasonal with the seasonal period set in the series spec. The general form of the ARIMA model can be written as:

$$\varphi_p(B)\Phi_P(B^s)(1-B)^d(1-B^s)^D y_t = \theta_q(B)\Theta_Q(B^s)\varepsilon_t, \quad (3.2.2.1)$$

where ε_t is white noise with mean 0 and variance σ^2 , B is the backshift operator, where $\varphi_p, \Phi_P, \theta_q$ and Θ_Q are polynomials of order (p, P, q, Q) respectively and have all roots outside unit circle. The RegARIMA model is estimated by exact maximum by exact maximum likelihood⁵.

3.2.3. The X-11 procedure

The actual seasonal adjustment is carried out using the outcome of the ARIMA modeling as input. This X-11 procedure is based on a moving average approach. The X-12-ARIMA uses an iterative approach to estimate the seasonal, trend and irregular components.

3.3. Direct versus indirect adjustment

The direct adjustment means the adjustment of aggregated raw components of a series; however, the indirect approach refers to the aggregation of seasonally adjusted components. The indirect approach should be selected if the components of the series reveal different stochastic properties and also if the data sources of the components are different. However, the direct approach should be used if there exist a high correlation between the components.

3.4. Preadjustments

Regression models in X-12-ARIMA are used to preadjust the series. The series are preadjusted for different breaks in the series, outliers, and for holidays. If the data is not preadjusted, the seasonal component will not be valid in the sense that it will be estimated

⁵ See X-12-ARIMA Reference Manual

on the basis of observations which represent more than the seasonal pattern in the series. The quality of the final seasonal adjustment is strongly dependent on the outlier detection, because the seasonal filters are directly derived from the ARIMA model. The outlier detection and parameter estimation is performed by an automatic iterative procedure built into the X-12-ARIMA, where AO, TC and LS⁶ can be identified⁷.

3.5. Statistical tests and diagnostics

X-12-ARIMA incorporates a set of statistical tests and diagnostics to evaluate the quality of the original series and the reliability of the seasonal adjustment. The seasonality in financial time series can be concluded both by visual inspection and by formal tests such as F-test for presence of seasonality and M-tests for presence of moving seasonality. The F-test, M-tests, M7 and SI ratios are used to assess the significance of seasonality in the series and how the seasonal filter should be incorporated. However, the quality of the seasonal adjustment can be assessed by test for presence of residual seasonality, M statistics and their summary Q statistic and the spectrum to detect remaining seasonal or trading-day effects in the residual. A smaller M / Q value indicates better quality of a seasonal adjustment. A smaller value of standard deviation indicates better quality of a seasonal adjustment.

3.5.1. Test for presence of seasonality

This test is based on a one-way analysis of the variance of the SI ratios (differences). The estimate of the trend-cycle is made directly from the original series by a centered 12-term moving average. The estimate of the trend-cycle is removed from the original series by division into (subtraction from) the raw data for a multiplicative (additive) model. It is based on the assumption that seasonality is stable so that the seasonal component can be approximated by the monthly averages of the series. If stable seasonality presents then it is a good seasonal adjustment. Stable seasonality is present in all the data series indicating a good seasonal adjustment.

3.5.2. Test for moving seasonality

The test for moving seasonality is important because it shows the size of the filter required and how it is even possible to detain the seasonal variation. It tests for the presence of moving seasonality characterized by steady changes in the seasonal amplitude but not in the period.

3.5.3. M7

Statistic M7 compares, on the basis of F-test statistics as described above, the relative contribution of stable statistic (F_S) and moving statistic (F_M) seasonality. It is used to determine whether seasonality can or cannot be identified by X-11. If M7 exceeds one the test suggests that it will be difficult to seasonally adjust the series in an appropriate way.

4. SEASONAL ADJUSTMENT OF FINANCIAL DATA SERIES

The seasonal adjustment of five data series of Broad Money (M2), Currency in Circulation (CIC), Workers' Remittances (WR), Exports (BOP) and Imports (BOP) is

⁶ Additive outliers (AO), transitory change (TC), and level shift (LS)

⁷ See Chang Tiao and Chen (1988) and Kathleen M. McDonald-Johnson and Catherine C. Hood (2001); for detail description of the procedure

based on Census X-12-ARIMA, Version 0.2.10. All data series are unadjusted monthly series. All have a time span of length more than ten years (from July 1995 to December 2007). All five data series showing upward trending, therefore, stationarity is not achieved by simple logarithmic transformation. By taking first differences, which are equal to having a series integrated of order 1, the series becomes stationary.

The above-mentioned test statistics confirm the seasonal adjustment of the data series. In Table-1 of the Annexure some of the various test statistics are presented and by inspection it becomes clear that none of the estimated models suffer from serious autocorrelation or lack of normality. Broad money having moving seasonality as defined by the F_M statistics, but none of the data series violate the assumption of identifiable seasonality. It means the seasonal adjustment of the data series is manageable. There is no sign of residual seasonality in either of the seasonally adjusted series. There are no problems with M1-M11 and Q statistics (see Annexure). Generally, the seasonal adjustment of all the data series investigated seems stable as can be seen from the Chart-7 of Annexure for original and seasonally adjusted series of all the data series; showing seasonally adjusted series are smoother than the original series.

5. REVISIONS

Generally, when new data become available, revisions are important in order to make improvement of the seasonally adjusted series. The revision can be made either in each month when new data become available (i.e. concurrent adjustment⁸) or seasonal factors projected at predetermined longer intervals such as semi-annual/annual (i.e. factor projected adjustment). The use of concurrent adjustment is preferable since new data always reveal new information and thus should be used. But the problem with this adjustment is that the recent data is not as reliable as historical data. Therefore, factor projected adjustment is preferred.

6. CONCLUSION

This paper has illustrated that a seasonal adjustment procedure can be set up in more than one way. Accordingly, seasonally adjusted data cannot have the same official status as unadjusted data, and it is important that the chosen method for seasonal adjustment is explained and documented properly. It is also clear that the specific application of the X-12-ARIMA package may change as experience accumulates. We have applied the X-12-ARIMA method in adjusting five important financial series compiled by SBP: currency in circulation, broad money, remittances, exports and imports (from the balance of payments data). Adjusted series were found to be satisfactory, with in the tests and practices followed in X-12-ARIMA.

7. ACKNOWLEDGMENTS

The author would like to thank Riaz Riazuddin, Dr. Ishaque Ahmad Ansari, and Saghir Pervaiz Ghauri for their helpful comments, and also to thank Syed Kamran Najam for research assistance.

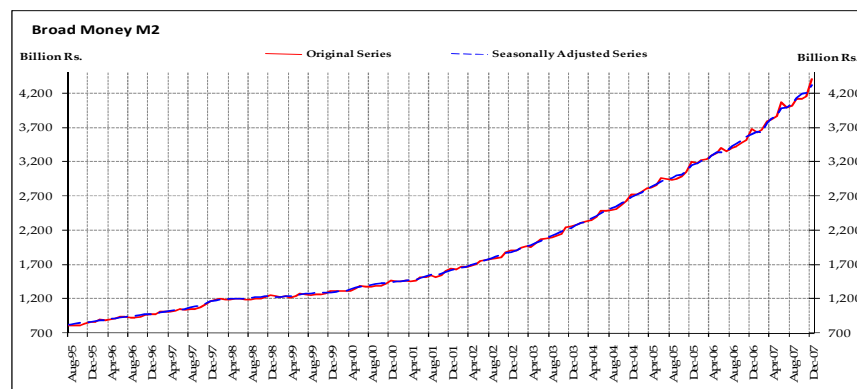
⁸ See Pierce, David and Sandra McKenzie (1987)

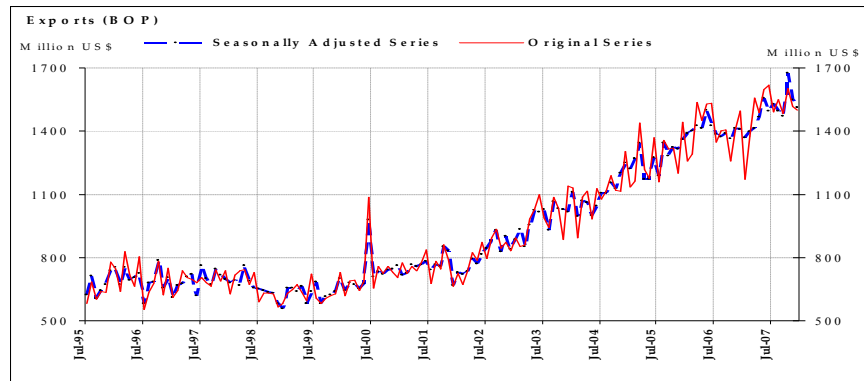
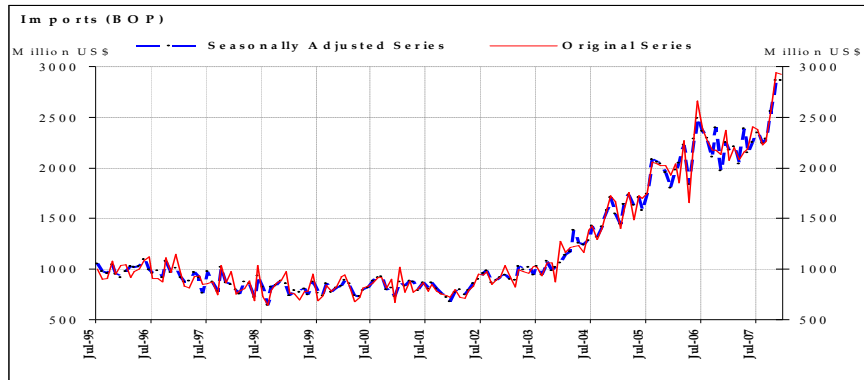
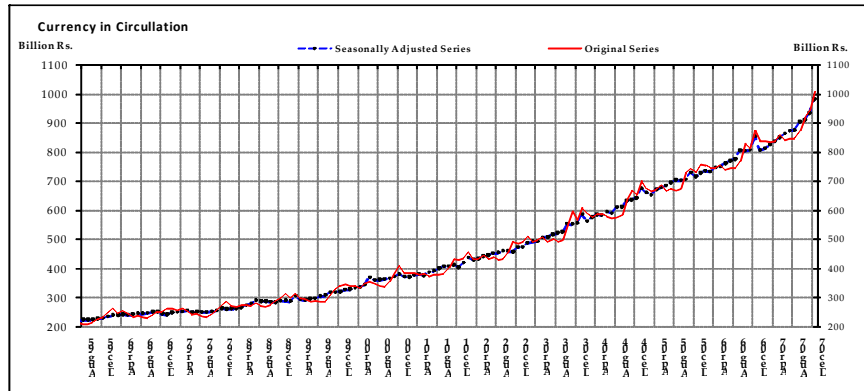
8. REFERENCES

1. Bell, W.R. and S.C. Hillmer (1984). Issues involved with the seasonal adjustment of economic time series. *J. Bus. and Econ. Statist.* 2(4), 98-127.
2. Chang, I.; G.C. Tiao, and C. Chen (1988). Estimation of Time Series Parameters in the Presence of Outliers. *Technometrics*, 30 (2), 193-204.
3. Chiu K. Higginson J. and Huot G. (1985). Performance of ARIMA models in Time Series. *Survey Methodology*, II, 51-64.
4. Cleveland, W.S. and Devlin, S.J. (1980). Calendar Effects in Monthly Time Series: detection by Spectrum Analysis and Graphical Methods., *J. Amer. Statist. Assoc.* 75, 487-496.
5. Findley, D.F., B.C. Monsell, W.R. Bell, M.C. Otto, and B.C. Chen (1998). New Capabilities and Methods of the X-12-ARIMA Seasonal Adjustment Program. *J. Bus. and Econ. Statist.* 16(2), 127-176.
6. Granger, Clive, W.J. (1979). Seasonality: Causation, Interpretation, and Implications, Chapter in NBER book *Seasonal Analysis of Economic Time Series*. 33-56. Retrieved from <http://www.nber.org/chapters/c3896>
7. Ladiray, D. and Quenneville, B. (1999). *Understanding the X11 Method: The Various Tables*. Working paper series, Time series research and analysis centre, Statistics Canada.
8. Pierce, D.A. and S.K. McKenzie (1985). *On concurrent seasonal adjustment*. Bureau of the Census, statistical research division report series, July 1985, No. CENSUS/SRD/RD-85/09.
9. Riazuddin, R. and Khan, M.H. (2002). Detection and Forecasting of Islamic Calendar Effects in Time Series data. *State Bank of Pakistan Working Papers*.
10. Shiskin, Julius (1978). Keynote Address: Seasonal Adjustment of Sensitive Indicators. In A. Zellner, Editor, *Seasonal Analysis of Economic Time Series*, 97-103. US Census Bureau. Retrieved from www.nber.org/chapters/c3898.pdf
11. U.S. Census Bureau, Time Series Staff (2006). X-12-ARIMA Reference Manual. Ver. 0.3, US Census Bureau. Retrieved from <http://www.census.gov/srd/www/x12a/>

ANNEXURE

Original versus Seasonally Adjusted Data Series





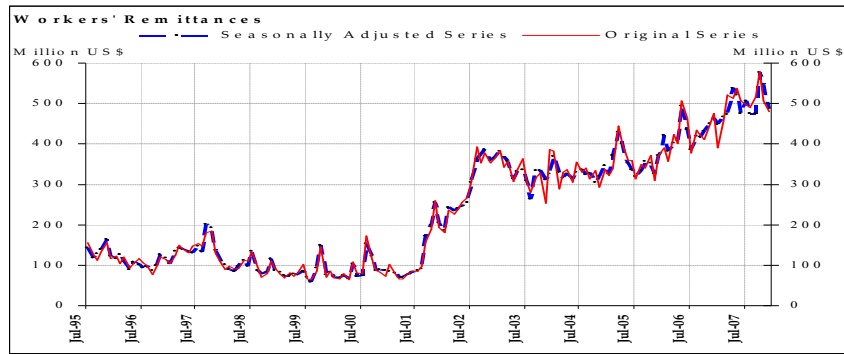


Table-1: Seasonal Adjustment Results for the Five Monthly Financial Data Series

Statistics	Currency in Circulation (CIC)	Broad Money (M2)	Workers' Remittances (WR)	Export (BOP)	Import (BOP)
Model	(311)(011)	(011)(011)	(210)(011)	(011)(011)	(011)(100)
No of Estimated Parameters	20	16	26	23	18
No of Observations	150	150	150	150	150
RegARIMA Related					
Adjusted log likelihood	-1408	-1526	-625.377	-741.959	-905.001
AIC	2856	3084	1302.754	1529.918	1846.002
Hannan-Quinn	2880	3103	1333.606	1557.209	1867.970
BIC	2915	3131	1378.674	1597.077	1900.073
Residual Normality & Autocorrelations					
Kurtosis	3.43	3.25	3.3850	2.5715	2.6874
Forecasting Performance					
Average absolute percentage error in out-of-sample forecasts(last 3 years)	1.48	1.57	10.59	4.13	8.90
Preliminary & Evaluating tests					
FS Test	117.53	46.01	9.942	16.910	7.098
Presence of stable seasonality	Yes	Yes	Yes	Yes	Yes
FM Test	0.37	2.40	1.18	0.849	1.584
Presence of moving seasonality	No	Yes	No	No	No
FS test (residual seasonality)	0.53	0.05	0.60	0.19	0.24
Presence of residual seasonality	No	No	No	No	No
Series	Stock	Stock	Flows	Flows	Flows
Data Source	Weekly	Weekly	Monthly	Monthly	Monthly

**STOCK MARKET DAILY RETURNS VOLATILITY:
A CASE STUDY OF PAKISTAN (FY94-FY07)**

Khalid Sarwar Qureshi¹ and Saghir Pervaiz Ghauri²

¹ Statistics & DWH Department, State Bank of Pakistan,
Karachi. Email: Khalid.Sarwar@sbp.org.pk

² Economic Analysis Department, State Bank of Pakistan,
Karachi.

ABSTRACT

This paper investigates daily stock returns volatility of the Karachi Stock Exchange (KSE). Using 100 indices for the period *FY94-FY07*, the close to close market standard deviation of returns, alternative estimators incorporating the daily high and low of the index, and a robust estimator was applied to measure the volatility of stock index returns. The normality assumption was also tested on the daily returns data and strongly rejected.

There is a strong evidence of persistence in variance in returns implying that shocks to volatility continue for a long period. We concluded that normality may be plausible assumption for monthly stock returns but not for daily returns.

Key Words: Volatility, Non-normality

Disclaimer: Observations/Results made in the study will be entirely our own judgments. These will do not necessarily represent the views of the State Bank of Pakistan management.

1. INTRODUCTION

The study shows the presence of significant effect of volatility in stock market daily return. It is found that current volatility is significantly affected by past volatility. This paper attempts to investigate the stock market daily volatility to the Pakistan equity market.

Over the last many years, much literature has focused on a perception of unusually high stock market volatility. This perceived has been often associated with the derivative securities markets and package trading. Moreover, there is no evidence that daily stock market volatility is actually higher than or even different from its long-time average.

Most recent studies have examined stock market volatility from the perspective of standard deviation as measured from market close to market close. It is demonstrated of using various estimators which incorporate market high and low price information [See Parkinson (1980), German and Klass (1980)]Volatility is defined as tendency of the assets price to fluctuate either up or down. Increased volatility is apparent as indicating a rise in financial risk which can adversely affect investor assets and wealth. It is pragmatic that when stock market shows increase volatility indicating a trend on part of the

investors to lose confidence in the market and they want to quit the market. However, if increased volatility is not defined by level indicated by the fundamentals of economic factors, there is a propensity that stock will lead to misallocation of resources. Stock Market performs as an intermediary and channels funds from savers to companies who utilize it to accomplish profits. In addition, if the general opinion established in the market is that prices accurately reflect information, participation cost will be low and stock market will effectively carry out its function of channeling resources to productive projects. In view of the above, it is essential to empirically identify the volatility of daily stock returns in Pakistan equity market. This paper is organized as follows: The next section describes the market volatility. Section III discusses the market review. Section IV describes the data and estimators, whereas the tests of normality are discussed in Section V. The final Section consists of conclusion and summary.

2. STOCK MARKET VOLATILITY

Stock Market Volatility is a polite way of referring to investors' nervousness. Investors may think volatility indicates a problem. But many analysts believe that increased volatility can indicate a rebound. Volatility is more dependent on mass hysteria—fear and greed—than on underlying economic or financial events. In this section we examine the alternative measures of volatility. In the following discussion we will focus on the volatility of the KSE-100 index. Our Measure of stock return volatility is based on daily price changes (close to close price changes). The measures of stock market changes used the continuous compound returns

$$R_t = \ln \left(\frac{P_t}{P_{t-1}} \right)$$

where P_{t-1} and P_t is level of the index at date t and t-1 respectively; r_t is the stock return at date t. The Most common indicator for measuring volatility is standard deviation given by:

$$\sigma_1 = \sqrt{\frac{\sum_{t=1}^n (r_t - \bar{r})^2}{n-1}}$$

where r_t is the close-to-close return on the market index at date t, \bar{r} is the average stock return over the period of observation, n corresponds to the number of data points. As the standard deviation of stock returns is not always give the good picture of volatility because of the fact that it calculated by using only the closing prices and the price changes during the day are not considered. The above mentioned lacking can be covered by using some alternate measures of volatility in which the high and low point during the day are also used.

We uses volatility estimators purposed by Parkinson (1980) and German and Klass (1980) which incorporates both high & low prices and found more efficient then typical standard deviation.

$$\sigma_2 = \sqrt{\frac{\sum_{t=1}^n [(H_t - L_t)^2 / 4 \ln 2]}{n}}$$

$$\sigma_3 = \sqrt{\frac{\sum_{t=1}^n [0.50(H_t - L_{t-1})^2 - 0.39(C_t - C_{t-1})^2]}{n}}$$

where H_t and H_{t-1} are natural log of daily high and low index levels during time period t and $t-1$ respectively whereas C_t and C_{t-1} are the natural log of closing levels at time t and $t-1$ respectively. The above given estimator σ_2 is given by Parkinson and has shown 5.2 times more efficient than typical standard deviation. The second estimator σ_3 is the weight average of Parkinson and close to close standard deviation of the daily returns. German and Klass have shown that it is 7.4 times more efficient than close to close variance estimator. A robust estimator is also needed to deal with the departure from Normality. Inter quartile range is found a good measure in this case (proposed by Leglewicz-1983).

$$IQ = (Q_{3t} - Q_{1t})$$

IQ is the difference of 75 percentile and 25 percentile of the stock returns. This will give the dispersion around sample median and thus less affected by the outliers than the sample mean.

Under the assumption of normality the coefficient of skewness is distributed with mean zero and variance $6/n$ and excess kurtosis coefficient is distributed as mean zero and variance $24/n$. The statistics hence calculated includes mean, standard deviation, minimum, maximum return during the sample period, coefficient of skewness & kurtosis, and standardized coefficient of skewness & kurtosis.

3. MARKET REVIEW

It would be better to present an over view of the Pakistani market for the sample period. The sampled period is selected due the reason this period witnessed some of the historic events of Pakistan. The Karachi Stock Exchange (KSE) established just one year after the independence of the country that is in September, 1948. It remain the only stock market in the country up to 1970. Later the other two markets are established in Lahore and Islamabad in 1970 & 1992 respectively. It took twenty years to regain the lost momentum and a bullish trend was witnessed when it was opened for international investors in 1990. The KSE showed remarkable improvement in 1997 but due to sharp fall in far eastern markets badly affect it again. The stock market came under severe pressure when India did nuclear test on 11th and 13th May, 1998. The KSE 100 index dropped to 1514.11 points on 11th May, 1998 to 1551.91 points on 8th May, 1998 and 1412.36 points on 14th May, 1998. This down sliding go on increasing due to Indian threats and other security reasons. The KSE 100 index further declined when Pakistan made its own nuclear test on 28th May, 1998. This became worst due to the decision of freezing foreign currency accounts and the sanctions imposed by countries like USA,

Japan, Australia and donor agencies like World Bank & ADB. On 14th July 1998 KSE 100 index touched the lowest level of 765.4 points. This downward trend continued till Government succeeds in rescheduling the foreign debt with Paris & London club. The steps taken by the Govt. helped a lot in improving the stock market and KSE100 index went up to 1104.68 points on 1st October, 1998 & 1416.62 points on 24th May 1999. The Security and Exchange Commission of Pakistan introduced various reforms which became the vital reason for the improvement of the stock market in the year 2000 & 2001. The stock market showed remarkable growth and KSE 100 index touched the high level of 10,303 points on 15th March 2005. Unfortunately some of these gains have been lost due to the factors like withdrawal of funds by COT financiers, the lock in effects of circuit breakers and exit of small investors. The stock market turned bearish since 16th March, 2005 and 100 index dropped as low as 6939 points on 12th April, 2005. The market which was already in bearish phase was shocked again on 8th October 2005 when a severe earthquake struck the Northern part of the country and Azad Jammu & Kashmir. At this point KSE 100 index fell from 8542 to 8520 points and this trend continued till it touched the lowest level of 8247 points in the same month. The interesting point to note in this contest is that the prices of the scripts of banks, cements, food and chemical industry showed upward trend. In November 2005 KSE 100 index raised and this upward bull trend continued in 2006. The KSE 100 index crossed the barrier of 12000 points for the first time in history on 13th April 2006, which is about 65% growth over 2005. If one goes through the figures, KSE 100-share index registered an amazing return of 38 percent in 2006-07 against 34 percent in last fiscal year. The index starting from 9,989 points level on July 01, 2006 breaching psychological barrier of 10,000, 11,000, 12,000 and 13,000 levels, finally closed at the level of 13,772 on the last trading day of the week (2006-07) on Friday.

4. DATA AND ESTIMATION

The data series used in this paper consist of daily KSE-100 index over the period FY94 through FY 2007. These returns are close to close stock price changes during all the years. The daily return comprise of 3374 observations. The returns are calculated as the natural logarithm of ratio of the price today to price yesterday. Table 1 summarizes the descriptive statistics of the return series. The mean of this series is 0.071 per cent per trading day. The standard deviation is 1.693 per cent per trading day showing that a high risk market. The value of kurtosis, which is the measure of whether the data is peaked or flat to normal distribution, is 5.392 which indicates that data is leptokurtic. The value of skewness is -0.250 which shows that the returns are negatively skewed. Finally the descriptive statistics given in the above table depicts that daily returns of KSE 100 index are not normally distributed. This conclusion is reconfirmed by the significant Jarque-Bera test for normality.

Table 1 Descriptive Statistics

Mean	0.071
Standard Error	0.029
Median	0.135
Standard Deviation	1.693
Sample Variance	0.029
Kurtosis	5.392
Skewness	-0.250
Range	0.260
Minimum	-0.132
Maximum	0.128
Count	3374
Jarque Bera	3622.29
p value	0.000

Table 2 Basic Statistics

Years	Mean %	S.D %	Skewness	Stand. Skewness	Kurtosis	Stand. Kurtosis
FY94	0.263	1.346	-0.431	-10.229	1.926	22.838
FY95	-0.158	1.071	-0.311	-7.381	1.291	15.303
FY96	0.025	1.412	0.257	6.095	0.265	3.138
FY97	-0.035	1.299	0.756	17.929	2.330	27.631
FY98	-0.245	2.486	-0.308	-7.308	6.581	78.034
FY99	0.167	2.628	-0.068	-1.601	2.346	27.820
FY00	0.147	2.066	-0.300	-7.124	2.477	29.370
FY01	-0.044	1.112	0.228	5.406	0.353	4.185
FY02	0.107	1.866	0.191	4.527	3.717	44.071
FY03	0.266	1.362	-0.483	-11.453	2.511	29.774
FY04	0.176	1.372	-0.542	-12.844	1.775	21.041
FY05	0.137	1.766	-0.349	-8.283	1.071	12.704
FY06	0.120	1.695	-0.600	-14.237	1.490	17.663
FY07	0.132	1.185	-0.683	-16.199	1.256	14.898

The highest and lowest returns are also recorded along with mean and standard deviations for all the years. Sample departures from normality are summarized by coefficient of skewness and kurtosis along with standardized Skewness and standardized kurtosis. When volatility is measured by standard deviation, FY98, FY99, FY00 and FY05 are found more volatile then others years in the sample data.

Figure 2 shows that not all the years are negatively skewed. According to the results given in the above table out of fourteen years only four years are positively skewed and the rest of ten years are negatively skewed. Under the assumption of normality the values of standardized coefficients of skewness and kurtosis out side the range -1.96 & +1.96

Indicate significant departure from normality (at 5% level of significance).

The standardized coefficients of skewness and kurtosis observed for the sample period (FY94–FY07) depict that for only a single year i.e. FY99 the asymmetry is not significant, while it is significant for rest of thirteen years.

Fig 2: Year wise Skewness

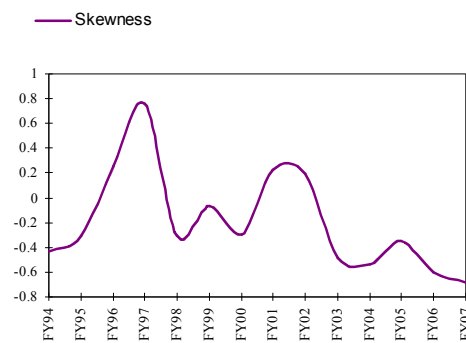
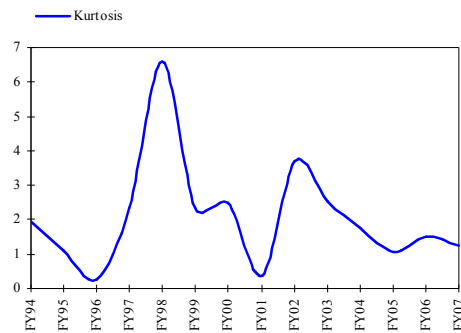


Fig 3: Year wise Kurtosis



While observing the kurtosis in column 5 of the above table it is found that all the years included in the data are platykurtic except FY98. Moreover, observing the results given in the last column the standardized kurtosis also indicates the departure from normality.

Alternate Volatility Estimator:

Daily high and low prices of KSE 100 index were the primary source for the calculation of alternate volatility estimators σ_2 and σ_3 . The daily high and low prices during the sample period FY94 though FY07 are calculated and the values of σ_2 and σ_3 are presented in the under given table:

Years	σ_1	σ_2	σ_3	IQ
FY94	1.346	1.062	6.884	1.624
FY95	1.071	0.762	4.941	1.205
FY96	1.412	0.905	5.664	1.848
FY97	1.299	1.011	6.637	1.416
FY98	2.486	2.821	18.367	2.259
FY99	2.628	2.112	14.095	2.849
FY00	2.066	1.596	10.693	2.085
FY01	1.112	0.648	4.301	1.390
FY02	1.866	1.743	11.489	1.686
FY03	1.362	1.027	6.840	1.320
FY04	1.372	0.979	6.560	1.333
FY05	1.766	1.101	7.424	1.614
FY06	1.695	1.132	7.522	1.536
FY07	1.185	0.739	4.905	1.195

In terms of High Low volatility estimators FY98 & FY99 depicting the high volatility when the Pakistan & India experienced the nuclear detonation. The results of σ_2 are almost matched with that of typical standard deviation for some years but for all years the values of σ_3 are higher then it. During FY00 σ_2 is not much higher to standard deviation but σ_3 is very high, the same behavior is seen in FY07 where σ_3 is giving high volatility then σ_2 and σ_1 . The interesting point to note is that higher volatility in terms of all volatility estimators is witnessed during FY98-FY00 & FY02. Another point to note is that the track of both σ_1 & σ_2 is almost same for all years. Thus making it clearer then low high estimators' points to a higher level of financial market volatility then encompassed in classical standard deviation.

Robust Estimator:

The result of non normality obtained in Table 1 using the coefficient of skewness and kurtosis needed some robust estimator to deal with non

Fig. 4: Alternative Measures of Volatility Estimator

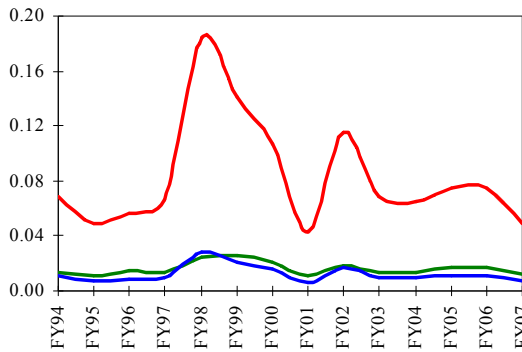
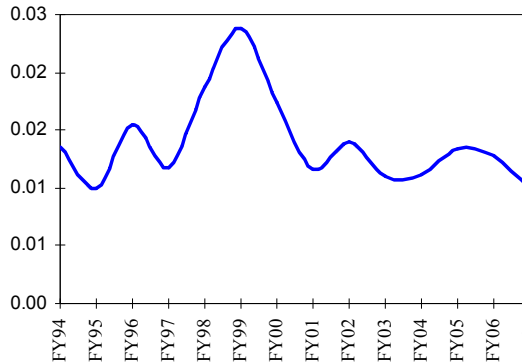


Fig 5 : Inter Quartile Range



normality. Interquartile range is being used for this purpose. The values of the inter quartile range for the sample period are given in Table 3. Fig 2 depicts the interquartile range of daily stock returns of KSE 100 index during FY94 through FY07. Like the previously described estimators, the IQ is very high during FY98-FY00. It remained low and stable in during the years FY 03, FY 04 & FY06. The IQ during FY07 witnesses the lowest in the data series.

5. TEST OF NORMALITY

The coefficient of skewness and kurtosis provided valid evidence about the departure of KSE 100 index (daily returns) from normality, but more formal conclusions can be reached through the test of normality. For this purpose two tests were applied. The goodness of fit test follows a Chi-square Distribution with degree of freedom (DF) and the Jarque-Bera test asymptotically distributed as a Chi-square distribution with 2 degree of freedom i.e. critical value at the 5% significance level is 5.99. The results shown in the above table indicates that ignoring the four years (FY94, 95, 96 & FY01) for rest of sample period showed non normality using the goodness of fit test and Jarque-Bera describe the non-normality of the daily returns.

YEARS	Goodness of Fit			Jarque -Bera	
	Statistic	df	p-value	Statistic	p-value
FY94	10.02	5	0.0747	43.77	0.0000
FY95	7.90	4	0.0953	08.47	0.0015
FY96	3.00	5	0.7000	02.70	0.2590
FY97	11.40	5	0.0440	44.88	0.0000
FY98	15.66	4	0.0035	389.81	0.0000
FY99	14.68	5	0.0118	45.49	0.0000
FY00	34.25	8	0.0001	58.03	0.0000
FY01	1.21	3	0.7506	01.34	0.5120
FY02	14.73	4	0.0053	138.68	0.0000
FY03	61.56	6	0.0001	68.03	0.0000
FY04	33.88	5	0.0001	40.00	0.0000
FY05	48.01	7	0.0001	12.23	0.0030
FY06	70.39	7	0.0001	31.51	0.0000
FY07	60.62	5	0.0001	34.58	0.0000

6. SUMMARY

The objective of this paper was to examine stock market daily returns volatility in the Pakistan equity market. Using daily KSE-100 Index over the period FY94-FY07, the results were obtained using typical standard deviation and low high alternative estimators. To deal with the non normality a robust estimator was also used. The data was tested for normality using the Chi-square goodness of fit test and Jarque-Bera test indicating daily returns of KSE-100 index are not normally distributed. The results suggested that FY98-FY00 and FY 05 are more volatile then remaining years. It is also evident from the analysis that FY98 and FY99 depicting the high volatility when Pakistan and India experienced nuclear detonation. The coefficient of skewness and Kurtosis gave valid evidence about the departure of KSE-100 Index from normality. However, more formal conclusion could be made by applying the test of normality and thus two different tests have been applied so far indicating the rejection of normality assumption.

ACKNOWLEDGEMENTS

The authors would like to thank Mr. S.M. Husnain Bokhari and Syed Kamran Najam for research assistance.

REFERENCES

1. Andrew L. Turner and Eric J. Weigle (1992). *Daily Stock Market Volatility: 1928-1989*. Frank Russell Company, Washington.
2. Bekaert, G. and Harvey, C. (1997). Emerging equity market volatility. *Journal of Financial Economics*. 43, 29-78.
3. Mark and Michael Klass (1980). On the Estimation of Security price volatilities from historic data *J. Business*, 53, 67-68.
4. Parkinson, Michael (1980). The Extreme value Method for estimating the variance of the Rate of Return. *J. Business*. 53(1), 61-65.
5. E. Clark, O. Masood and R. Tunaru (2006). *Political Events Affecting the Pakistan Stock Exchange: An Analysis of the Past and Forecasting the Future*. presented QQASS Special issue conference.
6. Attiya Y. Javed (1997). Stock Market Reaction to Catastrophic Shock: Evidence from Pakistani Listed Companies. *PIDE-Working Papers*, 37.
7. Felipe Aparicio Javier Estrada: Empirical Distribution of Stock Returns: European Security Markets, 1990-95 *Working paper, Business Economic Series 02*.
8. Felipe M. Aparicio and Javier Estrada (2001). Empirical distributions of stock returns: European securities markets, 1990-95. *European Journal of Finance, Taylor and Francis Journals*, 7(1), 1-21.
9. Dawood Mamoon. *Macro Economic Uncertainty of 1990s and Volatility at Karachi Stock Exchange Institute of Social Studies (ISS)*. 2502 LT, The Hague, The Netherlands.
10. Abid Hameed and Hammad Ashraf. *Stock Market volatility and weak form efficiency: Evidence from an emerging market*.
11. Attiya Y. Javed and Ayaz Ahmad (1999). The response of Karachi Stock Exchange to Nuclear Detonation. *The Pakistan Development Review*. 38:4, 778-786.

INFLATION AND INFLATION UNCERTAINTY IN PAKISTAN: EVIDENCE FROM GARCH MODELING

Ikramullah¹, Waliullah² and Mehmood Khan Kakar³

¹ Applied Economics Research Centre, University of Karachi.
Karachi. Email: jahanzebian@gmail.com

² Economics Department, University of Malakand, NWFP.
Email: wali76@yahoo.com

³ Applied Economics Research Centre, University of Karachi.
Email: mehka1@yahoo.com

ABSTRACT

This paper examines the empirical relationship between inflation, inflation uncertainty from January 1970 to December 2007 using the Pakistani consumer price index (CPI). Uncertainty was measured using different Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model and compared them. Our results suggest that inflation volatility will persist in future. The study also compares the persistence of shocks into volatility before and after Pakistan's nuclear test in 1998 and 9/11

INTRODUCTION

Can inflation uncertainty raise inflation? M. Friedman was the first to pose the question in his address at the Nobel Prize Award Ceremony. L. Ball proposed a model in which he formalized M. Friedman's arguments within the framework of asymmetric information game between economic agents and policymakers. Why inflation is so volatile? Why can inflation uncertainty increase (decrease) along with inflation rate? When inflation is low, policymakers attempt to maintain it low and do not engage in any policy adjustments. When inflation is high, inflation reducing policy is likely to be launched. The latter will lead to raised inflation uncertainty. The effects of monetary policy on inflation are ambiguous, and it will take some time for monetary policy to affect inflation. First, monetary policy affects the banking system; then, through the banking system, the effect will spill over to the real sector, and, finally, a pass-through to inflation will be observed. The timing and the extent to which monetary policy affects inflation depend on the economic circumstances and are difficult to predict. Empirical investigations by Fischer (1993), Kormendi and Meguire (1995), De Gregoio (1992, 1993) and Smyth (1992) found that inflation uncertainty was relatively lower in economies with low inflationary rates. It was concluded that inflation uncertainty increases mainly when monetary policy changes.

Researchers have used a variety of approaches to measure uncertainty. If they are right about the relationship between the level and volatility of inflation, then we can feel more confident about explaining why high inflation is costly: high inflation may generate significant real costs by creating high inflation uncertainty that creates welfare losses from relative price distortions, lack of long-term contracting, and even possibly lower

short-run output growth. So far, however, no empirical consensus has been reached on the relation between the level and volatility of inflation. Early studies use an unconditional variance measure as a proxy for inflation uncertainty and often find a positive relationship between the level of inflation and variability of inflation in a cross-section of countries. Recent empirical work generally estimates a conditional variance measure with an ARCH (or GARCH) model to measure inflation volatility and provides mixed results on the inflation level-volatility relation.

The standard GARCH approach is an improvement in that it provides a time varying measure of uncertainty as opposed to a simple measure of volatility like the standard deviation, but it suffers from the problem that innovations enter the conditional variance equation as squares so that surprise falls in inflation raise uncertainty the same amount as do surprise increases in inflation, which is clearly not what the Friedman hypothesis is saying. Holland (1995), on the other hand, attempts to answer the question whether an increase in rate of inflation causes increase in inflation uncertainty. The author stresses the fact that a positive association between the rate of inflation and inflation uncertainty implies a particular temporal ordering. He uses three different tests of temporal ordering and concludes that an increase in the rate of inflation Granger causes an increase in inflation uncertainty.

Although GARCH models measure conditional variation of volatility, the unconditional volatility remains constant. Evans and Wachtel (1993) point out the paucity of literature dealing with issue that the uncertainty concerning the inflation regime may be the underlying source of the observation on positive relation between inflation rates and its uncertainty.

METHODOLOGY

GARCH Models

The Autoregressive Conditional Heteroskedasticity (ARCH) models were introduced by Engle (1982) and make the conditional variance of the time t prediction error a function of time, system parameter, exogenous and lagged endogenous variables, and past predictions errors. Let r be Inflation measure, which is considered to be linearly dependent on a vector of explanatory variables x_t , b a vector of parameters, a disturbance term u_t , with $u_t = z_t - a z_{t-1}$ and σ_t^2 the variance of z_t given information at time t . A univariate ARCH model based on Engle (1982) methodology is given as:

$$r_t = b' x_t + u_t \quad (1)$$

$$u_t \sim z_t - a z_{t-1} \quad (2)$$

$$z_t | \Omega_{t-1} \sim (0, h_t) \\ \sigma_t^2 = h_t = f(z_{t-1}^2, z_{t-2}^2, \dots) \quad (3)$$

where Ω_{t-1} indicates the set of all relevant and available information at time $t-1$. The model of (1)-(3) is an ARCH model. The most widely used specification for the function f in (3) is the linear generalized ARCH (GARCH) model introduced by Bollerslev (1986). This particular specification makes σ_t^2 linear in lagged values of z_{t-1}^2 .

$$h_t = \sigma^2 = \omega_2 + \sum_{i=1}^q b_i h_{t-i} + \sum_{j=1}^p a_j z_{t-j}^2$$

where $q \geq 0$ and $p > 0$ define the orders of the processes while ω , the a_j and b_i are nonnegative parameters to be estimated, while the restriction $\sum b_i + \sum a_j < 1$ must also be satisfied to ensure stationarity in the variance equation. If $\sum b_i + \sum a_j = 1$, then shocks to the current volatility of inflation may remain persistent for a long time in the future, and this process is known as “Integrated GARCH (IGARCH)” (Nelson 1990). In other words, if the estimated coefficients sum close to unity, then strong persistence of shocks is present.

The GARCH model can be extended to the “GARCH in mean, GARCH-M” specification (Chou 1988; Engle 1990; Bollerslev et al. 1992). If h_t is introduced in (1), with ν taking values as 1 and $1/2$, the conditional mean of inflation is expressed as a function of the conditional variance with the coefficient of this term capturing the magnitude of uncertainty of inflation.

The E-GARCH Model

According to Nelson (1991), to allow the conditional volatility to be an asymmetric function of the past data its functional form can be written as:

$$\ln h_t = \sigma_t^2 = \omega_3 + \sum_{i=1}^q c_i h_{t-i} + \sum_{j=1}^p d_j \left[\Theta \gamma_{t-j} + \Psi \left(\left| \gamma_{t-j} \right| - \left(\frac{2}{\pi} \right)^{\frac{1}{2}} \right) \right]^2 \quad (5)$$

where $\gamma_t = z_t / h_t^{1/2}$ is the standardized residual series and (5) forms the exponential GARCH (p, q) model. For estimation proposes the parameter η is set equal to one. The model in (5) is capable of capturing any asymmetric impact of shocks on volatility. The EGARCH model allows good news and bad news to affect volatility in a different manner. The term in the parentheses represents a magnitude effect. In particular, residuals that are greater in magnitude than expected have a positive effect on the conditional variance. In other words, if $\eta > 0$, then the conditional volatility tends to rise (falls) when the absolute value of standardized residuals is larger (smaller). In other words, a positive η implies that large (small) price changes tend to follow a large (small) price change. A negative θ captures asymmetry. If $\theta < 0$, then conditional volatility tends to rise (fall) when the standardized residual is negative (positive). That is, bad news increases volatility.

EMPIRICAL ANALYSIS

Data

Inflation (Π_t) is measured as the first difference of consumer price index (CPI) as: $\Pi_t = \log(\text{CPI}_t / \text{CPI}_{t-1}) * 100$, using monthly data in order to examine the relationship between inflation and inflation uncertainty. Two dummy variables D1 and D2. D1 is capturing the effect of the nuclear detonation and D2 captures the effect of 9/11.

The sample data set covers the period from January 1970 to December 2006M12 (on monthly basis) which includes 444 monthly observations. The data are obtained from CD Rom International Financial Statistics, International Monetary Fund.

STATISTICAL DATA ANALYSIS

The first data column of Table reports summary statistics for the monthly CPI. The mean change in the monthly CPI is 0.001568 and the standard deviation is 0.010628. The skewness statistics shows that the distribution is positively skewed relative to the normal distribution. This is an indication of non-symmetric series. The value of kurtosis statistics suggests that the CPI series leptokurtic compared to the normal distribution; that is, it is more peaked than the normal distribution. The Ljung-Box portmanteau test statistics, $LB(n)$ and $LB(n)^2$, provide test for the absence of autocorrelation and homoskedasticity, respectively. The significant of LB statistics indicates the presence of autocorrelation in the CPI series. The null hypothesis of white noise is rejected. The value of the $LB^2(n)$ statistics points to strong autocorrelation in the squares of the CPI, a property that results in volatility clustering in the distribution of the CPI series. In addition, the Bera-Jarque normality test rejects the assumption of normality. Finally, the negative size bias test is statistically insignificant, while the positive size bias test is statistically significant; this implies that positive shocks in CPI tend to increase volatility. The residual pattern is shown in graph at the end.

In term of the conditional volatility, the sum of coefficient turns out to be $(0.066031+0.891636)$, less but close to one, suggesting that the GARCH-M (1,1) process is stationary, while demand have persistent impacts on the changes of prices. The value of Wald test confirms the acceptance of the null hypotheses that sum is equal to one. The impact of D1 is significant while D2 have no effect on the CPI series.

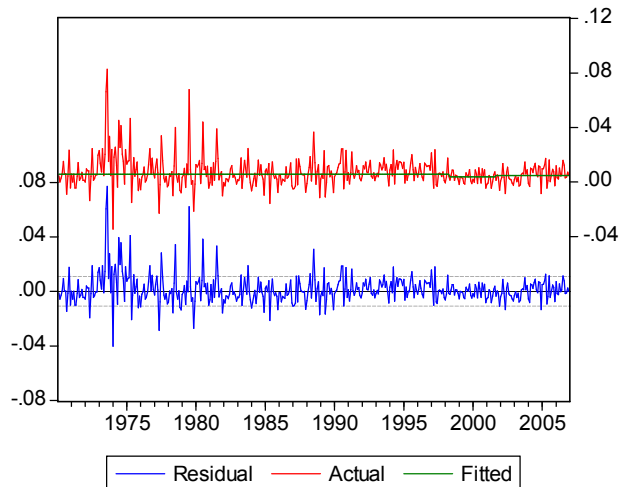
The second column of the Table contains the diagnostic tests on the residuals from the GARCH-M model. The residuals reveal strong serial correlation. The Bera-Jarque statistics rejects the hypotheses of normality. Both the skewness and the kurtosis statistics turn out to be higher compared to the original data. Similarly, the positive size effect is significant and the negative size bias test is insignificant. These results are the failure of the GARCH-M model to capture the size effect.

In the last column, the higher value of the log likelihood suggests that the E-GARCH model is superior to both the models estimated before. The persistence measures is high and close to one (Wald test =1.4). In other words, once volatility increases, it is likely to remain higher over several future periods.

Table

	GARCH	GARCH-M	E-GARCH
Mean	0.001568	0.001481	0.001601
Median	7.64E-05	6.76E-06	6.20E-05
Maximum	0.077177	0.076110	0.076890
Minimum	-0.039863	-0.041233	-0.040149
Std. Dev.	0.010628	0.010515	0.010558
Skewness	1.999486	1.928485	1.972284
Kurtosis	14.02242	14.10142	14.13452
Negative size bias test	-2.1	-3.11	1.4
positive size bias test	77.88	73.13	2.17
Jarque-Bera	2537.755	2549.422	2575.621
Probability	0.000000	0.000000	0.000000
LB(24)	159.9 (0.00)	586.2 (0.00)	33.1 (0.10)
LB ² (24)	901.5 (0.00)	763.1 (0.00)	46.2 (0.12)
Sum	0.694837	0.656088	0.709315
Sum Sq. Dev.	0.049923	0.048870	0.049272
Log likelihood	1477.665	1483.455	1487.292
Wald test	2.11 (0.09)	3.11 (0.11)	1.4 (0.23)
Observations	444	444	444

Notes: P-values are given in the parentheses. LB is the Ljung-Box statistics identifying the presence of autocorrelation, while LB2 is the Ljung-Box statistic identifying the presence of heteroskedasticity (upto 24th order). B-J is the Bera-Jarque test for the null hypotheses of normality. The negative sign bias test examines the different effects that large and small shocks have on volatility not predicted by the conditional volatility model. Finally, positive sign bias test does the same job.



REFERENCES

1. Bollerslev, T. (1987). Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics*. 31, 307-327.
2. Engle, R.F. (1982). Autoregressive Conditional Heteroskedasticity with estimates of the variance of UK Inflation. *Econometrica*. 50, 987-1007.
3. Evans, M. and Wachtel, P. (1993). Inflation Regimes and Sources of Inflation Uncertainty, *Journal of Money, Credit and Banking*. 25(3), 475-511.
4. Ball, L. (1992). Why Does High Inflation Raise Inflation Uncertainty? *Journal of Monetary Economics*, 29(3), 371-388.
5. Friedman, M. (1977). Nobel lecture: Inflation and unemployment, *Journal of Political Economy*, 85, 451-472.
6. Holland, S. (1995), Inflation and Uncertainty: Tests for Temporal Ordering, *Journal of Money, Credit and Banking*. 27(3), 827-837.
7. De Gregorio, J. (1992). The Effects of Inflation on Economic Growth. *European Economic Review*, 36(3), 152-173.
8. De Gregorio, J. (1993). The Inflation Taxation, and Long-run Growth. *Journal of Monetary Economics*, 31(2), 115-131.
9. Fischer, S. (1993). The Role of Macroeconomics and Development. *NBER Macroeconomics Annual*, 329-379.
10. Kormendi, R.C. and Meguire, P.G. (1995). Macroeconomic Determinants of Growth: Cross Country Evidence. *Journal of Monetary Economics*, 16, 141-163.
11. Smyth, D.J. (1992). Inflation and Growth Rate in the United States' National Output. *Applied Economics*. 24, 567-570.

A STUDY ON THE LIFE OF A DIABETIC TEENAGER

Samia Tanveer and Asifa Arif

Department of Statistics, Kinnaird College for Women, Lahore

ABSTRACT

In this paper, we present a study aimed at investigating the life of a diabetic teenager– the extent to which it is similar to the life of a normal teenager, the manner in which young persons suffering from diabetes are managing this problem, the extent to which they refrain from unhealthy food, the exercises that they prefer, the difficulties that they experience in dealing with diabetes, and the factors (e.g. will power) that are really getting affected due to diabetes. The overall objective of this research is to determine whether our teenagers suffering from this ongoing disease are competent enough to face the difficulties with courage and attain whatever they want to achieve in life. In addition, the study seeks to ascertain whether or not inheritance is the main cause of diabetes.

1. INTRODUCTION

The problem under consideration is to investigate the life of a diabetic teenager. Diabetes is a chronic disease, currently affecting 246 million people worldwide and is expected to affect 380 million by 2025. Pakistan alone currently counts 6.2 million people with diabetes and estimated figures for 2025 suggest that this will almost double and reach 11.6 million people. Indubitably, mega – efforts are required to curb the problem of diabetes in our country. According to WHO, an annual 2% reduction in chronic disease death rates in Pakistan would provide an economic gain of 1 billion dollars over the next 10 years [1].

Diabetes is a life-long disease marked by high levels of sugar in the blood [2]. It is a disorder of the chemical reactions that are necessary for proper utilization for carbohydrates, fats and proteins from the diet, along with inadequate insulin [3]. In other words, diabetes can be caused by too little insulin (a hormone produced by the pancreas to control blood sugar), resistance to insulin, or both [2].

Major types of diabetes

- Type 1 diabetes is usually diagnosed in childhood.
- Type 2 diabetes usually occurs in adulthood.
- Gestational diabetes develops at any time during pregnancy in a woman who does not have diabetes.

Diabetes can affect people of any age group, but we have chosen to study the teenage – group particularly because teenage is a tough time for all children and their parents, as he/she goes through the sexual and emotional changes of puberty. Teenage years can be more stressful for those suffering from diabetes.

2. LITERATURE REVIEW

Faulkner Melissa (2003) performed a study on “Quality of life for adolescents with type 1 diabetes: parental and Youth perspective”⁽⁴⁾. McMillian Carolyn V et al. (2004) studied regarding “The psychometric properties of the ADDQol-Teen”, an innovative

individualized, patient-centered questionnaire ⁽⁵⁾. McMillian Carolyn V et al. (2004) studied regarding “The psychometric properties of the ADDQol-Teen”, an innovative individualized, patient-centered questionnaire ⁽⁶⁾. A study is conducted by A Karlsson et al. (2006) regarding “Teenagers with type 1 diabetes – a phenomenological study of the transition towards autonomy in self-management” ⁽⁷⁾. GE Viklund et al. (2007) have conducted a study on “Teenagers with diabetes: Self-management education and training on a big schooner” ⁽⁸⁾. Morrato D.M. et al.(2007) have conducted a research on “Physical activity in U.S. adults with diabetes and at risk for developing diabetes” ⁽⁹⁾.

3. OBJECTIVES

The study aims at investigating the salient features of the life of a diabetic teenager –the manner in which young persons suffering from diabetes are managing this problem, the difficulties that they experience in dealing with diabetes, and the extent to which they feel competent enough to face the difficulties in their lives with courage and to attain whatever they want to achieve in life.

In addition, the study seeks to ascertain whether or not inheritance is the main cause of diabetes.

4. METHODOLOGY

The data is collected from diabetic teenage year patients of a diabetic centre – the Diabetic’s Institute Pakistan in Samanabad, Lahore. A telephonic survey was conducted on 39 registered patients of this center, 24 of whom were females and 15 males.

Diabetic’s Institute Pakistan was established in Lahore in 1997. It is located at 71-Jail Road, Near Apwa College, Lahore. It is the only independent diabetic centre in Lahore also considered an institute where information is provided on diabetes management, and educates patients regarding the disease.

The basis of data collection is the semi-structured, open-ended questionnaire. As per the objectives, the questionnaire is divided into different parts accordingly, the preliminary part, particulars regarding the family history, certain aspects affected in their lives because of diabetes, information concerning their daily routine, and whether or not they feel hard to deal with diabetes?

5. DATA ANALYSIS AND RESULTS

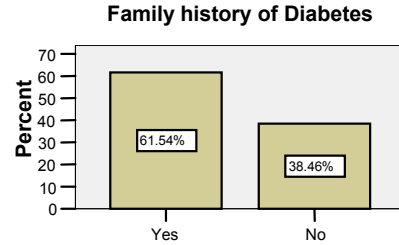
5.1 Background

Analysis of the data reveals that:

- Most of the respondents fall in the age group 18-19. All the teenagers are school/college going students.
- The average age at which diabetes was diagnosed first time is 11 yrs, where minimum age at which diabetes was first time diagnosed is 4 yrs, and maximum age is 19 yrs.
- When enquired about the symptoms they have faced, before diabetes was first time diagnosed, majority of diabetic teenagers stated weakness and frequent urination, whereas considering only males, majority faced frequent urination and weakness, and mostly females faced weight loss, extreme thirst, frequent urination, headache, blurred vision, and dehydration. Because of diabetes 23.08% teenagers undergo complications, and among these 20.51% are suffering from weak-eyesight, and 2.56% from T.B.

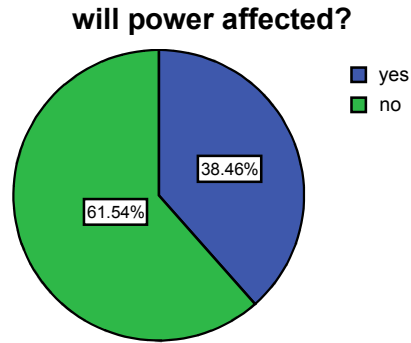
5.2 Family History of Diabetes

- About 62% teenagers have significant family history of diabetes, in which 58% stated that diabetes is present in their maternal side and paternal side.
- About 26% teenagers responded that their parents are diabetic. Further 18.26% stated that their siblings are diabetic.
- An important aspect of the study is that, family history of diabetes is highly associated to whether or not one’s parents are diabetic, and latter is associated with whether diabetes is present in one’s maternal side or paternal side.



5.3 Important Aspect of Diabetic Teenager’s Life

- About 38% diabetic teenagers have indicated that their will power is affected due to diabetes. It is further observed that will power is strongly associated to worrying about future aim. Hence we see that those diabetic teenagers whose will-power is affected due to diabetes are more likely to worry about how to achieve their future aim besides this endless disease. Also those teenagers whose will power is affected are expected to affect their studies due to diabetes.
- It is really appealing that about 51% diabetic teenagers do not feel hesitant in freely telling people that they are diabetic.
- About 64% respondents stated that due to diabetes our studies get affected. It is also observed that 59% teenagers feel that diabetes can play a barrier role in achieving their future aim.



5.4 Daily Routine

- Considering diabetic teenagers daily routine, about 85% refrain from unhealthy food lightly, 56% said their daily food timing is planned, and 44% did not keep a check on the content of food they eat. In addition, significant association is observed between those diabetic teenagers who plan their daily food timings are also conscious about the intake of the content of food.
- About 33% and 44% indicated that they fast regularly and irregularly respectively.
- An equal response is perceived regarding how important is exercise for you? 46% believed it is important and extremely important respectively, preferring walk and jogging.
- It is impressive that 62% diabetic teenagers visit their doctor’s monthly, 92% injecting insulin themselves, along with 85% having knowledge of when to increase/decrease the quantity of insulin.

Your daily routine makes you frustrated?			
		Frequency	Percent
Valid	Most of the timings	8	20.5
	Sometimes	18	46.2
	Never	13	33.3
	Total	39	100.0

- An important aspect of the study is whether or not the diabetic teenagers get angry and frustrated by their daily routine? About 46% said sometimes, 21% responded many times, where 33% never get frustrated by their daily routine.
- 54% diabetic teenagers felt hard dealing with diabetes, where, 10% and 31% believed they have become active, and more responsible after being diabetic, respectively, and 36% believed they feel weak because of diabetes.

6. CONCLUSION AND RECOMMENDATIONS

The study concludes that mostly diabetic teenagers felt that it is hard to deal with diabetes and got frustrated by their daily routine; still they are independent and are managing the disease themselves. There is a strong association between family history and parent's diabetic, which means that diabetes cycle starts from one's grand parent's moving towards one's parents and then children themselves. The positive part is that mostly teenagers have become more responsible after being diabetic, and will never let their will power go down. We conclude that our teenagers are competent enough and have true sense of how to manage their lives with this endless disease. Further studies needed to be conducted regarding the problems of the diabetic teenagers, also including psychological problems, in our society, and the lifestyles of lower class diabetic teenagers. We recommend people to study different causes of diabetes, other than inheritance.

REFERENCES

1. International Diabetes Federation (2007). <http://www.idf2006.org.html>
2. Robert Hurd (2007). Review provided by VeriMed Healthcare Network. *ADAM Health Illustrated Encyclopedia*.
3. Albere, R.G. and Zanmet, P. (1998). Definition, diagnosis, and classification of DM and its complications Part 1. *Diabetic Med.* 15, 539-53.
4. Melissa Spezia Faulkner (2003). *Quality of life for adolescents with Type 1 Diabetes: Parental and Youth perspective*. University of Illinois at Chicago, College of Nursing, Department of Maternal Child Nursing, Chicago, IL.
5. Carolyn V. McMillian, Rachael J. Honeyford, Jessica Datta, Nichola J.H. Madge and Clare Bradley (2004). *The development of a new measure of quality of life for young people with diabetes mellitus*, <http://www.hqlo.com/content/2/1/61.html>.
6. Singh Harsimran and Bradley Clare (2006). *Quality of life in diabetes*. <http://www.Quality of life in diabetes Singh H, Bradley C, , Int J Diab Dev Ctries.html>.
7. Karlsson A., Arman M. and Wikblad K. (2006). *Teenagers with type 1 diabetes – A Phenomenological study of the transition towards autonomy in Self-management*. [http://www.Teenagers with type 1 diabetes-a phenomenological_\[Int J Nurs Stud_2008\]-PubMed Result.html](http://www.Teenagers with type 1 diabetes-a phenomenological_[Int J Nurs Stud_2008]-PubMed Result.html).
8. Viklund G.E., Rudberg S. and Wikblad K.F. (2007). Teenagers with diabetes: Self-management education and training on a big schooner, *International Journal of Nursing Practice*, 13, 385-392.
9. Morrato, D.M. et al (2007). *Physical activity in U.S. adults with diabetes and at risk for developing diabetes*. <http://www.Physical Activity Helps Prevent and Manage Diabetes-American Diabetes Association.html>.

A STUDY ON PARENT - DAUGHTER RELATIONSHIP

Khadija Tariq Cheema and Asifa Arif

Department of Statistics, Kinnaird College for Women, Lahore

ABSTRACT

In this paper, we present a study aimed at investigating the nature of the relationship that exists between parents and daughters --- how daughters are treated by their parents, and how much importance do the daughters give to their parents in their life. The data has been collected from one of the top – most women’s colleges in Lahore. Analysis of the collected data has led to some important and interesting results.

1. INTRODUCTION

In a society like that of Pakistan where parents play a very important role in their children’s upbringing as well as decisions regarding their education. Career and marriage and parents have a more protective and dominating attitude regarding their daughters.

Parent-daughter bonding starts at an early age. As Gina Shaw states, “The mother and daughter share everything even times of love and the times of hate”. Every mother and daughter had a connection that leads them so close to each other. As Gina Shaw states, “No relationship is quite as primal as the one between a mother and her daughter. It’s the original relationship”. mother-daughter relation ship can b a best friend relationship .says Lee Sharkey, Ph.D. "Women grow up and our energy is largely turned toward men, but the original love relationship is with a mother. If we as daughters don't acknowledge that, we're closing ourselves off from a great source of power and fulfillment and understanding of ourselves."

Fathers play an essential role in their daughter's lives. Many things are learned and many things are taught in this relation. This is her first male-female relationship. Daughters need to be affectionate, and know that they are safe with certain males. If a father is fair and listens to his daughter's thoughts, she will gain self-confidence and pride in her own opinion. It is important for parents to listen to their daughters and appreciate their views, even if they don't agree. Daughters learn about the marriage life from their parents.

2. LITERATURE REVIEW

Habibullah (1991) conducted a survey on parent-daughter relationship in Pakistan, data for which was collected from none other than Kinnaird College, Lahore --- the same institution which has acted as the source of data for this particular study. Rosalind (1991) carried out a study on adult daughter-parent relationships and their associations with daughters. Tenn. (1999) carried out a research entitled”Father-daughter relationship crucial to when girls enter puberty”. Goetz (2000) explored the mother-daughter relationship in the USA, Germany and Austria and among Pakistani immigrants to the

U.S. Chowdhury Afra (2005) analyzed the importance of parent-daughter relationship quality. Texas (2006) carried out a research entitled “Strong relationship with father may delay daughter's sexual activity”. Dradomir conducted a study on Yolmo mother-daughter relationship in Nepal”. Lafayette (2007) carried out a research entitled “Aging improves parent, child relationships”. Chowdhury Afra (2005) analyzed the importance of parent-daughter relationship quality. Dixson conducted study on parent-child relationship inventory.

1. OBJECTIVES OF THE STUDY

The overall objective of the study is to explore the nature of the relation between parents and their college-going daughters. Specifically; it is of interest to determine the following:

- How the daughter is treated by her parents..
- The extent to which the daughter shares her personal matters with her parents
- To what extent the daughter follows her parents’ advice
- To examine the impact of mother’s occupation on parent -daughter relationship.

2. METHODOLOGY

A fairly detailed questionnaire consisting of 29 questions was developed in order to obtain information from the college – going girls with reference to the objectives given above. The data has been collected from Kinnaird College for Women, Lahore --- one of the top – most women’s colleges in the city. The sample size is 90 students. We analyze our data by using SPSS.

3. DATA ANALYSIS

5.1 How daughters are treated by their parents:

Analysis of the data yields the following information:

- “To what extent your parents are supportive?”
An overwhelming majority of 96% of the respondents indicated that their parents are supportive:. This result is a clear indicator of the fact that even today the Pakistani society is blessed with the quality that there exist very strong bonds in the family setup.

Option	Percentage of Respondents
Quite Supportive	36%
Not Supportive	4%

- “Have you ever felt lack of confidence due to over protection of your parents”?
66.67% of the respondents indicated that they have never felt lack of confidence due to the over protection of their parents, **23.33%** of the respondents indicated that some times they felt lack of confidence due to the over protection of their parents and **10%** of the respondents indicated that most of the time they felt lack of confidence due to the over protection of their parents.
- “To what extent your parents impose restrictions on you?”

46% of the respondents indicated that the restriction their parents impose on them are minimal 43% of the respondents indicated that the restriction their parents impose on them are to some extent and 11% of the respondents indicated that they are highly restricted by their parents.

- “Would your parents allow you for love marriage?”
Majority of 81% of the respondents indicated that their parents do not allow them for love marriage. From this and the above result we conclude that though daughters are not restricted by their parents but still they are not allowed to get love marriage

5.2 The extent to which the daughters share their personal matters with their parents:

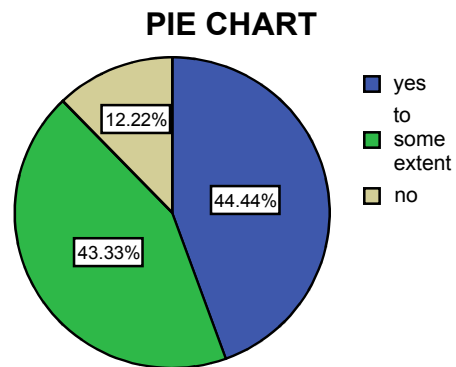
Analysis of the data yields the following information:

- “Do you have a sharing relation with your parents?”
Majority of 87% of the respondents indicated that they have sharing relation with their parents. This result also shows a strong bond between parents and their daughters

Options	Percentage of Respondents
To some extent	36%
no	13%

- “Do you talk about your college activities with your parents? “
56% of the respondents talk about their college activities to their parents, 30% of the respondents talk about their college activities to their parents but to some extent and 14% of the respondents do not talk about their college activities to their parents.

- “If you ever faced any kind of harassment would you prefer to share with your parents?”
The pie chart shows that 88% of the respondents would not feel hesitation in sharing harassment that they have faced, with their parents. Only few daughters hesitate in sharing these matters with their parents



“If you ever faced any kind of harassment would you prefer to share with your parents?”

- “Would you share your opinion regarding your liking/involving in some one with your parents?”
Majority of 72% of the respondents have indicated that they do not share their liking/involving in some one with their parents and only few respondents have that much strong relation that they do share this matter also with their parents]

The Spearman’s Rank Correlation Coefficient has turned out to be highly significant, and indicates a positive association between the sharing relation of daughters with their parents and sharing of college activities with their parents

Considering the p-value, of Pearson test, and the p-value, of spear man’s rho test are significant, being less then level of significance There fore we conclude that daughters who have sharing relation with their parents also talk about their college activities with them and they also share any kind of harassment they have faced

5.3 To what extent the college going girls follow their parent’s advice:

- “What would be your reaction if your parents do not allow you for hang?”
The **51%** of the respondents indicated that they would try to convince their parents to if they are not allowed to hang out, **41%** of the respondents indicated that they would not go if they were not allowed to hang out and only **8%** of the respondents indicated that they would go
- “If your parents do not allow you for love marriage what would be your reaction?”
From the results we conclude that majority of the respondents would try to adjust which means they follow their parents advice and that shows quite strong relation between parents and their daughters.

Options	Percentage of Respondents
You would try to adjust	57%
You would try to convince them	33%
You would go against them	10%

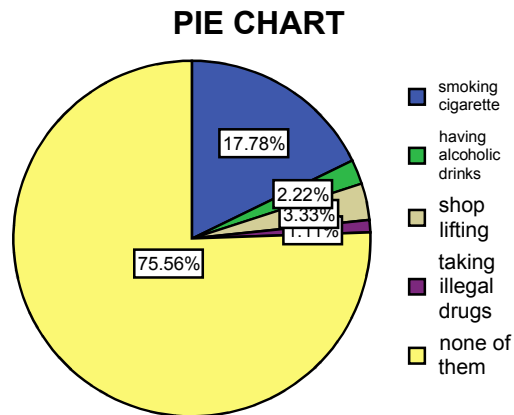
- “How frequently you get angry at your parents ?”
70% of the respondents get angry at their parents but to some extent **24%** of the respondents get angry at their parents, and only **6%** of the respondents who always get angry at their parents.

5.4 To observe the impact of mother’s occupation on parent daughter relationship:

- “What is your mother’s job?”
74% of the respondents mothers have no job, **15%** of the respondents indicated their mother’s full time job, **10%** of the respondents indicated their mother’s part time job and only **1%** of the respondents indicated their mother’ 2 to 4 hours job timings

- “Have you ever indulged in any bad activity?”
Majority of **76%** of the respondents have never indulged in any bad activity. This indicates that mother’s occupation has a positive impact on their daughters.

“Have you ever indulged in any bad activity?”



- “with whom you are more attached ?”
 .39% of the respondents are more attached with their mother, 7% of the respondents are more attached with their father, 33% of the respondents are more attached with both mother and father, 13% of the respondents are more attached with their siblings and 8% of the respondents are more attached with their friends.

6. COMPARATIVE STUDY

As indicated in the references, a study on parent - daughter relationship was carried out at Kinnaird College For Women, Lahore in 1987 – 88. Some comparative results are presented in Table 6.1:

Table 6.1
Parent - Daughter Relationship: 1988 versus 2008

I. Background of the Respondent

S#	Variable	1988	2008
1	Parent's marital status	94% were married	Only 33% are married
2	Father's education	Majority of 51% had done masters	Only 29% had done masters and majority is graduate
3	Mother's education	Majority of 39% were graduate	Only 8% were graduate and majority is intermediate
4	Mother's occupation	75% were house wives	78% are house wives

II. Quality of Parent - Daughter Relationship

S#	Variable	1988	2008
1	Restrictions imposed on daughters by their parents	Majority of 94% indicated that minimal restrictions were imposed	Majority of 89% indicated that minimal restriction are imposed
2	What would you do if your are not allowed to hand out?	50% try to convince them	51% try to convince them
2	Do you feel lack of confidence due to the over protection of your parents?	Majority of 73% indicated that they did not feel lack of confidence due to the over protection of their parents	Majority of 70% indicated that they do not feel lack of confidence due to the over protection of their parents
3	With whom you are more attached?	53% were attached with their mother	Only 39% are attached with their mother

7. CONCLUSION

The comparison indicates that parents were more educated in the last two decades and daughter's attachment has been seen more with their mother in the past study. Hence we conclude that no prominent difference, other than those mentioned above is observed.

8. CONCLUSION AND RECOMMENDATION

From the above results we conclude that today parents are not highly educated, mostly fathers are graduate and mothers are intermediate. We have examined that majority daughters perception is that their parents do not understand them besides being supportive and not self centered. The study also pointed that there are no restrictions on daughters that's why they are not indulged in any illegal activities. majority of the daughters get angry at their parents. We have observed that mostly daughters are attached with their mother and they have sharing relation with them they do share harassment they faced but do not share their involvements in some one. Majority of the daughters prefer love marriage but their parents are against of it. Majority of the daughters admires their parents and would like to be more like their parents. It is important for parents to listen to understand their daughters and daughters should not get angry at their parents and parents should listen to their daughter, they are more apt to listen to them and trust them when they impose restrictions.

9. REFERENCES

1. Mother-daughter relation. <http://www.comfsm.fm/anthology/leilaniilai.htm>
2. *Mother-daughter relation*. <http://health.discovery.com/centers/womens/daughter/daughter.html>
3. *Father-daughter relation*. <http://www.dr-jane.com/famrel.htm>
4. Rosalind C. *Adult Daughter-Parent Relationships and Their Associations with Daughters*. <http://www.jstor.org/pss/353131>
5. Tenn. Nashville. *Father-daughter relationship crucial to when girls enter puberty*. <http://www.vanderbilt.edu/News>
6. Goetz Donna. *Mother-daughter relationship in the USA, Germany and Austria and among Pakistani immigrants to the U.S*-<http://www.elmhurst.edu/~earls/fdc/grantaps/fdcgoetz.pdf>
7. Chowdhury Afra. *Analyzing the importance of parent-daughter relationship quality*. <http://iussp2005.princeton.edu/download.aspx?submissionId=52435>
8. Texas Austin. *Strong relationship with father may delay daughter's sexual activity*. <http://www.utexas.edu/news/2006/02/20/sociology/>
9. Dradomir Janelle. *Yom mother-daughter relationship in Nepal*. <http://www.hichumanities.org/AHProceedings/Jaelle%20Dragomir.pdf>
10. Lafayette West. *Aging improves parent, child relationships*. Lafayette West. <http://news.uns.purdue.edu/x/2007b/071126FingermanAge.html>
11. Dixson Marcia D. *Parent-child relations inventory*. <http://speech.ipfw.edu/research/prci.pdf>
12. Habibullah, S.N. (1991). *A Survey on Parent-Daughter Relationship in Pakistan. Proceedings of the Sixth International Conference on Gender and Science and Technology (GASAT 6)*, Melbourne, Australia.

PROCESS CAPABILITY INDICES A SIMULATION BASED STUDY

Suboohi Safdar

Department of Statistics, University of Karachi, Karachi.

Email: suboohisafdar@yahoo.com

ABSTRACT

A process is a set of inputs which may include materials, people, information, action, methods and operations into desired outputs in the form of the products, services or generally results. The out put of the process is that which is transformed to somewhere or to some one-the customer. To monitoring and controlling the input results necessary to get better outputs. Control charts could be used effectively to identify assignable causes creating out of control results. Designing better results ideal but an important question needs to be assumed for "Is our process capable to produce desired results?" process parameters estimate could be used to determine the process capability. Process capability refers to the control behavior of a process when operating in a state of statistical control. The process capability allows us to quantify how well a process can be produce acceptable product. In this paper we intend to simulate data from non normal distribution, construct the control charts and estimate the process parameters to determine the process capability.

KEY WORDS

Process Capability Measures, Non Normal Distribution, Control Charts, Process Capability Index.

INTRODUCTION

If the measurements of the quality characteristic being collected in the sample data come form a stable normal population than it is possible to draw inferences regarding the incidence of measurements beyond a certain limit such as part defective per million While such measurements can be taken directly as from normal distribution models with capability indices in order to make such inferences. How ever these estimates are not unbiased estimates if the population mean and standard deviation are substituted for the sample mean and sample standard deviation respectively (Chan, Cheng, Spiring 1988). Kane 1986 denoted only a short paragraph for capability indices from non normal distribution .

‘A variety of process results in a non normal distribution for a characteristic it is probably reasonable to expect those capability indexes are some what sensitive to departure from normality. Alas it is possible to estimate the percentage of parts outside the specification limit either directly or with a fitted distribution. This percentage can be related to an equivalent capability for a process having a normal distribution’.

When the process is not normal is presented in part II and III of Gunter (1989) series of four papers. He emphasize the difference between ‘Perfect’ (Presently Normal) and ‘Occasionally erratic’ processes.

The discussion of non normality falls into two main parts

1. Investigation of the properties of PCIs and their estimators when the distribution of X has specific non normal forms
2. Development of methods of allowing for non normality and consideration of use of new PCIs specially designed to be robust to normality

McCoy 1991 'All that is necessary are statistically generated control limits to separate residual noise from a statistical signal indicating something unexpected or undesirable is occurring. C_{pk} are dimensionless and thus become a handy tool for simultaneously looking at all characteristic relative to each other

In this paper I have discussed the construction of Control Charts and Estimation of Process Capability Index by simulation where the measurements of the quality characteristic being collected in the sample data come form a distribution which is not normal but skewed e.g. Exponential Distribution

EXPONENTIAL DISTRIBUTION

Suppose x is a random variable which is exponentially distributed with parameter λ with probability density function $f(x; \lambda) = \lambda e^{-\lambda x}, x > 0$

Parameter Estimation:

There are various methods for estimating the parameter of probability density function. In this paper Maximum Likelihood Method is used

Maximum likelihood Method MLE:

The likelihood function for λ , given an independent and identically distributed sample $x = (x_1, \dots, x_n)$ drawn from your variable, is simply the product of their pdf's

$$\begin{aligned} L(x) &= f_{X_1}(x_1) f_{X_2}(x_2) \dots f_{X_n}(x_n) \\ &= \prod_{i=1}^n f_{X_i}(x_i) \end{aligned}$$

If the distribution of x_1, x_2, \dots, x_n depends on values of parameters $\lambda_1, \lambda_2, \dots, \lambda_n (= \lambda)$, then the likelihood function L is a function of λ .

The values $\hat{\lambda}_1, \hat{\lambda}_2, \dots, \hat{\lambda}_n (= \hat{\lambda})$ that maximize L are called Maximum likelihood estimates of $\lambda_1, \lambda_2, \dots, \lambda_n$ respectively

$$\begin{aligned} L(\lambda) &= \prod_{i=1}^n \lambda \exp(-\lambda x_i) \\ &= \lambda^n \exp\left(-\lambda \sum_{i=1}^n x_i\right) \\ &= \lambda^n \exp(-\lambda n\bar{x}) \end{aligned}$$

where $\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i$ is the sample mean. The derivative of the likelihood function's logarithm is

$$\begin{aligned} \frac{d}{d\lambda} \ln L(\lambda) &= \frac{d}{d\lambda} (n \ln(\lambda) - \lambda n \bar{x}) \\ &= \frac{n}{\lambda} - n \bar{x} = 0 \end{aligned}$$

Consequently the maximum likelihood estimate for the rate parameter is $\hat{\lambda} = \frac{1}{\bar{X}}$.

While this estimate is the most likely reconstruction of the true parameter λ , it is only an estimate, and as such, one can imagine that the more data points are available the better the estimate will be. It so happens that one can compute an exact confidence interval-that is, a confidence interval that is valid for all number of samples, not just large ones.

The $100(1 - \alpha)\%$ exact confidence interval for this estimate is given by

$$\frac{1}{\hat{\lambda}} \frac{2n}{\chi_{2n, \alpha/2}^2} < \frac{1}{\lambda} < \frac{1}{\hat{\lambda}} \frac{2n}{\chi_{2n, 1-\alpha/2}^2}$$

λ is the true value of the parameter, and $\chi_{2n, \alpha}^2$ is the value of the chi squared distribution with $2n$ degrees of freedom that gives x cumulative probability (i.e. the value found in chi-squared tables, where $1 - \alpha$ gives lower tail probability and α , upper tail probability) of a Chi-Square probability curve

In this paper I have drawn the samples from the exponential distribution with different values of the parameter λ and

- a) Const Control Chart &
- b) Estimate Capability Index C_p

STATISTICAL METHODS FOR QUALITY IMPROVEMENT

In brief three statistical methods can cause for the quality improvement

- i) Statistical Process Control (*Control chart*)
- ii) Statistical Process Control (*Control chart*)
- iii) Design of Experiment (*Off Line Quality Control*)
- iv) Acceptance Sampling (*Inspection and testing of product*)

Control Charts:

If the process is in control nearly all of the sample points will fall between the control limits. Even if all the point fall inside the control limits and behave in a systematic manner or non random fashion then this could be an indication that the process is out of control and assignable causes can be found and eliminated hence process performance can be improved. Control charts provide information about process capability, the value of important process parameter and their stability over time which assist process designer for better product

1. Control chart is a test of hypotheses that the process is in a state of statistical control. Points are within the control limit fails to reject null hypotheses and plots outside reject the null hypotheses.
2. OC curve of Control Charts:
The ability of control chart to detect process shift of different magnitude can analyzed by means of control charts. The control chart will identify the presence of assignable causes. To identify and eliminate assignable causes it is important to find the “root cause” of the problem ant to attack it.
3. Estimating Device:
If the process is in statistical control, process parameter can be estimated as mean, standard deviation, fraction nonconforming / fall out. These estimates are used to determine the capability of the process to produce acceptable products

Interpretation of Control Charts

1. Increases the distance between the center line and control limit decreasing the risk of a type I error i.e. the risk of a point falling beyond the control limit indicating an out of control conditions when no assignable cause is present.
2. widening the control limit increases the risk of type II error i.e. the risk of a point falling between the control limits when the process is really out of control
3. closer the distance of control limits to the center line increases the risk of type I error and reduced type II error

Simulation from Exponential Distribution:

In this paper 100 samples of size 5 are drawn with different values of the parameter λ of the Exponential distribution with probability density function $f(x; \lambda) = \lambda e^{-\lambda x}, x > 0$

Let for each $i, i = 1, 2, 3, \dots, m, X_{ij}, j = 1, 2, 3, \dots, n$ be a random sample from Exponential distribution with the MLE estimator $\hat{\lambda} = \frac{1}{\bar{X}}$, measuring the studied characteristic of the process.

Where $\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i$ is the sample mean It is assume that the process is in Statistical Control during the time period that the subsamples are taken.

Since the moment generating function of exponential distribution for parameter λ is $(1 - \lambda t)^{-1}$

$$M_x(t) = (1 - \lambda t)^{-1}$$

$$M_{\sum_{i=1}^n X_i}(t) = (1 - \lambda t)^{-n}$$

$$M_{\bar{x}}(t) = \left(1 - \frac{\lambda t}{n}\right)^{-n}$$

$$\text{Let } y = \frac{2n\bar{x}}{\lambda}$$

$$M_y(t) = M_{\bar{x}}\left(\frac{2nt}{\lambda}\right) = \left(1 - \frac{\lambda t}{n\lambda}\right)^{-n}$$

$$M_y(t) = (1 - 2t)^{-n}$$

$$Y \sim \chi_{2n}^2$$

The $100(1 - \alpha)\%$ exact confidence interval for this estimate is given by

$$\frac{1}{\hat{\lambda}} \frac{2n}{\chi_{2n, \alpha/2}^2} < \frac{1}{\lambda} < \frac{1}{\hat{\lambda}} \frac{2n}{\chi_{2n, 1-\alpha/2}^2}$$

The sample mean for each random sample is calculated and a control chart for the estimate $\hat{\lambda} = \frac{1}{\bar{X}}$ is constructed where the control limits are;

$$LCL = \frac{1}{\hat{\lambda}} \frac{2n}{\chi_{2n, \alpha/2}^2}$$

$$UCL = \frac{1}{\hat{\lambda}} \frac{2n}{\chi_{2n, 1-\alpha/2}^2}$$

as $\hat{\lambda} = \frac{1}{\bar{X}}$ so for control limits one can estimate $\hat{\lambda}$ as $\hat{\lambda} = \frac{1}{\bar{X}}$ where $\chi_{2n, \alpha/2}^2 = 20.483$

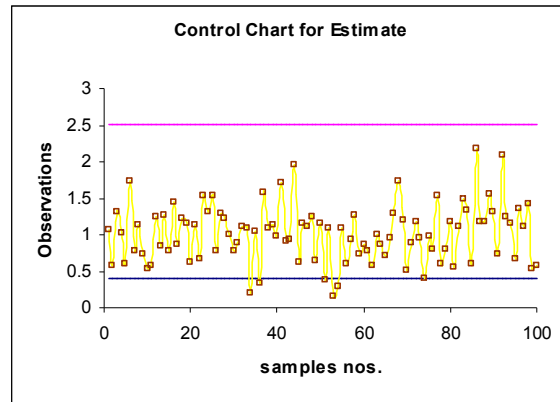
$\chi_{2n, 1-\alpha/2}^2 = 3.24696$ for $n=5$ and $\alpha = 0.05$

i. For $\lambda=1$

$$\hat{\lambda} = \frac{1}{\bar{X}} = 1.22681$$

The Control limits are

$$LCL = 0.3979 \quad UCL = 2.5104$$



The control chart shows that only few points are below the lower control limit

Process Capability:

The process capability allows us to quantify how well a process can be produce acceptable product. If the process is capable, than statistical process controls can be used to monitor the process and conventional acceptance efforts can be reduced or eliminated entirely.

Process capability indices not only yields great cost savings in eliminating non-value added inspections, but also eliminate scrap, rework and increases customer satisfaction. The benefits of performing process capability studies are certainly worth the effort in the long run.

Process capability refers to the normal behavior of a process when operating in a state of statistical control. There are two ways to thinks of this variability;

- i) The natural or inherent variability at specified time; i.e. instantaneous variability
- ii) The variability over time

If we compare process spread with specification spread, typically we have three situations

- i) *A Highly Capable Process*
- ii) *A Barely Capable Process*
- iii) *A Not Capable Process*

Why Measure Capability of a Process

- i) To quantify the defect rate
- ii) To identify the opportunities for process improvement
- iii) Assessing capability to predict its true quality level for its true for its product and services
- iv) Identify the nature of the process problem understand its spread and centering
- v) To determine whether a process given its natural violation has the potential capability to meet established customer requirements or specification

Process Capability Indices

Process capability can be expressed as percent nonconforming or in terms of the natural spread related to the specification spread. Capability indices are simplified measures to quickly describe the relationship between the variability of a process and the spread of the specification limits. These indices monitoring the expected proportion outside the specification limits

Measures of Process Capability

There are various measures of process capability indices which may distinguish as under

- i) Process Potential C_p
- ii) Process Performance C_{PU}, C_{PL}, C_{PK}

The C_p Index:

Consider a situation wherein there are lower and upper specification limits (USL, LSL) for the values of a measured characteristic X . Values of X outside these limits will be termed 'Nonconforming' NC. An indirect measure of potential ability 'Capability' to meet the requirement $LSL < X < USL$ is the process capability index.

C_p is a ratio of the tolerance width to the spread of the process. C_p does not consider the centre of the process $C_p = \frac{\text{Tolerance width}}{\text{Process Spread}} = \frac{USL - LSL}{6\sigma}$ where σ denote the standard deviation of X

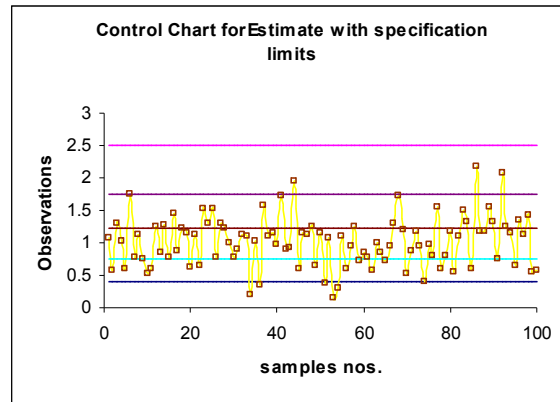
Large values of C_p are desirable and small values undesirable. Constable and Hobbs (1992) define 'Capable' as referring to percentage of outputs within the specification. Small values of C_p are bad signs! But large values of C_p do not 'guarantee' acceptability in the absence of information about the values of the process mean.

Montgomery (1985) recommended minimum values of C_p as follows

- For an existing process 1.33
- For a new process 1.5

For different values of λ , the process capability index C_p is also calculated with some other specification limits $LSL = 0.75$ $USL = 1.75$. Values of X outside these limits will be termed 'Nonconforming' NC. An indirect measure of potential ability 'Capability' to meet the requirement $LSL < X < USL$ is the process capability index

Now the C_p can be estimate $\hat{C}_p = \frac{USL - LSL}{6\hat{\sigma}}$, as the estimate of $\hat{\sigma} = 0.8073$ so $\hat{C}_p = 1.239$ The Control charts are constructed and the C_p are calculated for different values of the parameters will be present in the conference.



CONCLUSION

The C_p can be calculated for the distributions which are not normal by constructing confidence intervals of the estimate. Some other methods as Fisher Matrix Confidence Bounds for the Exponential Distribution, Likelihood Ratio Confidence Bounds for the Exponential Distribution and many more may use for the same purpose. In this paper we use the MLE estimator to construct the confidence bounds to construct the control chart and estimating the process capability Index.

BIBLIOGRAPHY

1. Ahmed, S.E. (2004). *Assessing the process capability index for non-normal processes*. Department of Mathematics and Statistics, University of Windsor, Windsor, Ont., Canada N 9B 3P4 Available online.
2. Pearn, W.L. and Chen, K.S. (1997). Capability Indices for Non-Normal Distributions with an Application in Electrolytic Capacitor Manufacturing. *Microelectron Reliability*, 37, 1853-1858
3. Carr, W.E. (1991). A New Process Capability Index,: Parts per Million. *Quality Progress*, 24(2) 152.
4. Constable, G.K. and Hobbs, J.R. (1992). Small Samples and Non Normal Capability. *46th ASQC Annual Quality Congress Transactions*, Nashville, TN, 37-43.
5. Shenton, L.R. and Bowman, K.O. (1972). Further Remarks on Maximum Likelihood Estimators for the Gamma Distribution. *Technometrics*, 14, 725-733.
6. Bissell, A.F. (1990). How Reliable is Your Capability Index? *Applied Statistics*, 39(3), 331-340.
7. Kotz, S. and Johnson, N.L. (2002). Process capability indices – a review, 1992-2000. *Journal of Quality Technology*, 34(1), 1-19.

GINI'S MEAN DIFFERENCE BASED TIME VARYING EWMA CHARTS

Muhammad Riaz¹ and Saddam Akbar Abbasi²

¹ Department of Statistics, Quaid-e-Azam University,
Islamabad. Email: riaz76qau@yahoo.com

² Pakistan Institute of Development Economics,
Islamabad. Email: saddamabbasi@yahoo.com

ABSTRACT

The concept of time varying control limits with reference to EWMA charts is briefly introduced and a proposal of time varying control limits is given, for the asymptotic control charts proposed by Riaz and Abbasi (2007b). A comparison of the proposed limits is made with those of Riaz and Abbasi (2007b) asymptotic charts and different time varying EWMA control structures based on sample range R , sample standard deviation S and Downton's estimator σ^* .

KEY WORDS

Control Charts; Downton's estimator (σ^*); EWMA Control Structures; Gini's Mean Difference (G); Location and Scale Parameters; Normality; Outliers.

1. INTRODUCTION

Statistical Process Control (SPC) is a collection of different methods that are used to examine a process and to improve the quality of its products (cf. Does, Roes and Trip (1999)). Out of these methods, the control chart is the most important and the most commonly used tool. The literature on process control provides a variety of charts to monitor dispersion and location parameters of any process. These range from Shewhart-type control charts, Cumulative Sum (CUSUM) charts (cf. Page, 1954) and Exponentially Weighted Moving Average (EWMA) charts (cf. Roberts, 1959). EWMA and CUSUM control structures address smaller shifts whereas Shewhart type control schemes address larger shifts in process parameters. This article deals with EWMA control charts.

The EWMA statistic is the weighted average of all the current and past values and is defined in general as (see Montgomery (2001)):

$$Z_t = \lambda X_t + (1-\lambda)Z_{t-1} \quad (1.1)$$

where λ (lying between 0 and 1) is the weight assigned to each observation, t refers to the time, X_t is the value of random variable X at time t . The variance of the test statistic defined in (1.1) is given as (see Montgomery (2001)):

$$\sigma_{z_t}^2 = \sigma_{x_t}^2 \left(\frac{\lambda}{2-\lambda} \right) \left[1 - (1-\lambda)^{2t} \right] \quad (1.2)$$

where $\sigma_{x_t}^2$ is the variance of the random variable X_t used in (1.1).

There are two commonly used fashions of defining EWMA type control structures, one is asymptotic and the other is time varying. Khoo (2004) proposed two asymptotic charts namely EWMAVD and EWMAMD charts for monitoring spread and location parameters respectively based on Downton's estimator. He claimed an improved performance of his proposed charts over the R - based charts proposed by Ng and Case (1989). Riaz and Abbasi (2007a) proposed EWMAVDT and EWMAMDT charts by introducing the time varying feature on the Khoo (2004) proposed EWMAVD and EWMAMD charts. They concluded that their proposed EWMAVDT and EWMAMDT charts are better than Khoo (2004) proposed charts in terms of outlier's detection especially for smaller values of λ . Ng and Case (1989) proposed EWMASR and EWMASM charts based on sample statistics R and \bar{X} for scale and location parameter respectively. Riaz and Abbasi (2007b) proposed GVA and GMA charts based on Gini's mean difference (G), using the asymptotic feature for the control limits. The similar asymptotic EWMA structures, based on the well known sample statistic S and \bar{X} , are given in Riaz and Abbasi (2007b) in the form of SdV and SdM charts for scale and location parameter respectively.

This study proposes the time varying EWMA control structures based on Gini's mean difference (G) for monitoring the scale and location parameters, following Riaz and Abbasi (2007 a & b).

2. THE PROPOSED CHARTS

In this study, a modification of Riaz and Abbasi (2007b) asymptotic limits is proposed to take into account the effect of time t . The proposed time varying control structures, namely GVT and GMT charts, for monitoring the process spread and location parameters respectively are defined as:

The control structures of the proposed GVT chart:

$$\left. \begin{aligned} UCL &= \hat{Y}_o + 3\hat{\sigma}_{\hat{Y}_t} = \left[c_4 + 3 \sqrt{(1-c_4^2) \left(\frac{\lambda(1-(1-\lambda)^{2t})}{2-\lambda} \right)} \right] \bar{K} \\ CL &= \hat{Y}_o = c_4 \bar{K} \\ LCL &= \hat{Y}_o + 3\hat{\sigma}_{\hat{Y}_t} = \left[\max \left(0, c_4 - 3 \sqrt{(1-c_4^2) \left(\frac{\lambda(1-(1-\lambda)^{2t})}{2-\lambda} \right)} \right) \right] \bar{K} \end{aligned} \right\} \quad (2.1)$$

The EWMA statistic $\hat{Y}_t = \lambda S_t + (1-\lambda) \hat{Y}_{t-1}$ is plotted against the control structure of GVT chart given in (2.1), following Khoo (2004) and Riaz and Abbasi (2007 a & b). Any \hat{Y}_t falling outside the control limits is an indication of out of control situation with respect to the scale parameter.

The control structure of the proposed GMT chart:

$$\left. \begin{aligned}
 UCL &= \hat{Z}_o + 3\hat{\sigma}_{\hat{Z}_i} = \bar{\bar{X}} + \left(\frac{3}{\sqrt{n}} \sqrt{\frac{\lambda(1-(1-\lambda)^{2t})}{2-\lambda}} \right) \bar{K} \\
 CL &= \hat{Z}_o = \bar{\bar{X}} \\
 LCL &= \hat{Z}_o - 3\hat{\sigma}_{\hat{Z}_i} = \bar{\bar{X}} - \left(\frac{3}{\sqrt{n}} \sqrt{\frac{\lambda(1-(1-\lambda)^{2t})}{2-\lambda}} \right) \bar{K}
 \end{aligned} \right\} \tag{2.2}$$

The EWMA statistic $\hat{Z}_t = \lambda \bar{X}_t + (1-\lambda)\hat{Z}_{t-1}$ is plotted against the control structure of GMT chart given in (2.2) following Khoo (2004) and Riaz and Abbasi (2007 a & b). Any \hat{Z}_t falling outside the control limits is an indication of out of control situation with respect to the location parameter.

The control limits of the time varying counterparts for the EWMA control structures based on R and \bar{X} namely EWMA_{SRT} and EWMA_{SMT}, and S and \bar{X} namely SdVT and SdMT for monitoring scale and location parameters respectively, have also been computed:

3. COMPARISON OF PROPOSED CHARTS

In this section, the comparisons of the proposed GVT and GMT control charting schemes are made with (i) the asymptotic scheme proposed by Riaz and Abbasi (2007b); (ii) the time varying EWMA control structures based on the well known sample statistics R & \bar{X} and S & \bar{X} ; iii) the time varying EWMA control scheme, based on Downton’s estimator σ^* proposed by Riaz and Abbasi (2007a). The performance of all the EWMA control structures is evaluated on similar pattern as Khoo (2004) and Riaz and Abbasi (2007 a & b) for the sample sizes $n = 5$ and 10 based on $m=10$ subgroups. The following two situations have been considered for evaluation and comparison of different EWMA control schemes:

- a) Un-contaminated distribution where all the samples are generated from the standard normal distribution i.e. $N(0, 1)$.
- b) Contaminated distributions where outliers are introduced in the data in four different combinations namely **C05N3** (95% $N(0, 1)$ 5% $N(0, 9)$), **C10N3** (90% $N(0, 1)$ 10% $N(0, 9)$), **C05N5** (95% $N(0, 1)$ 5% $N(0, 25)$) and **C10N5** (90% $N(0, 1)$ 10% $N(0, 25)$).

3.1 The proposed charts versus the proposals of Riaz and Abbasi (2007 b)

In this section, we provide the comparisons between the proposed GVT and GMT charts with the respective GVA and GMA charts proposed by Riaz and Abbasi (2007b) for the scale and location parameters respectively. For ease in comparisons we have made the

graphs of C10N3 for $n=5$ against different values of λ , for GVT and GVA charts, for the scale parameter; and C10N5 for $n=10$ against different values of λ , for GMT and GMA charts, for the location parameter. These graphs have been shown in the following Figures 3.1.1-3.1.2 for examination purposes. The other situations can be compared on similar pattern.

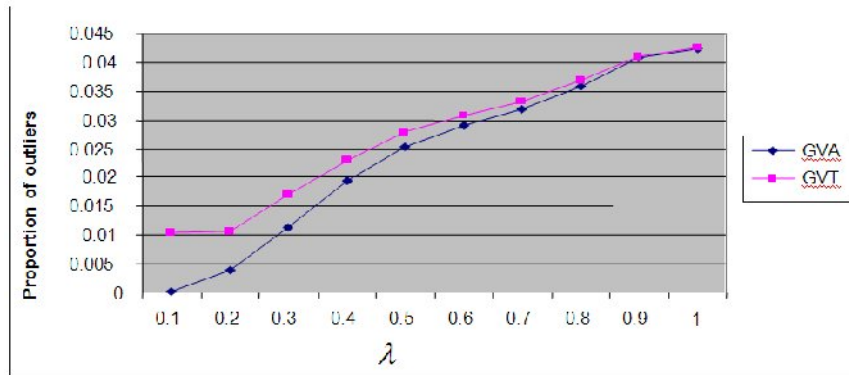


Fig 3.1.1: Proportion of outliers detected for GVA and GVT charts for monitoring process scale parameter for C10N3 and $n=5$

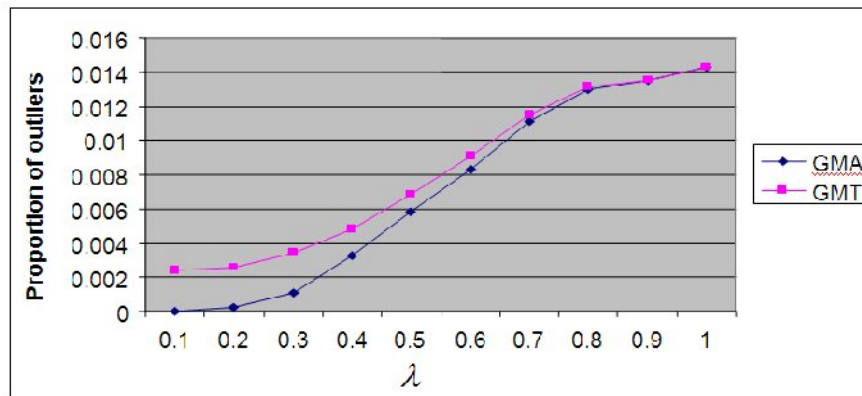


Fig 3.1.2: Proportion of outliers detected for GMA and GMT charts for monitoring process location parameter for C10N5 and $n=10$

It is clear from the above Figures 3.1.1-3.1.2 that the proposed GVT and GMT charts are superior, in terms of ability to detect outliers, as compared to the respective GVA and GMA charts proposed by Riaz and Abbasi (2007b) particularly for smaller values of λ , with an increase in λ , the performance of GVT and GMT charts, starts coinciding with those of GVA and GMA charts and for $\lambda=1$ their performances are exactly same.

3.2 The proposed charts versus different time varying EWMA control structures based on R , S , and σ^*

In this section, we provide the comparisons of the proposed GVT and GMT charts with different time varying respective EWMA control structures based on the well known

sample statistics $R & \bar{X}$ and $S & \bar{X}$ and the time varying control structures proposed by Riaz and Abbasi (2007a) for the scale and location parameters. The time varying control limits for all the EWMA control structures under discussion are computed and the proportions of subgroups, which are plotted outside their respective control limits, are calculated. The results are obtained on similar pattern as Khoo (2004) and Riaz and Abbasi (2007 a & b) for the process scale and location parameters respectively.

For ease in comparisons we have made the graphs of $C10N3$ for $n=5$ against different values of λ , for different time varying EWMA control structures under discussion for the scale parameter and $C10N3$ for $n=10$ against different values of λ , for different time varying EWMA control structures under discussion for the location parameter. These graphs have shown in the following Figures 3.2.1-3.2.2 for examination purposes. The bars, in these figures, represent the proportion of outliers detected using different EWMA control schemes. The other situations can be compared on similar pattern.

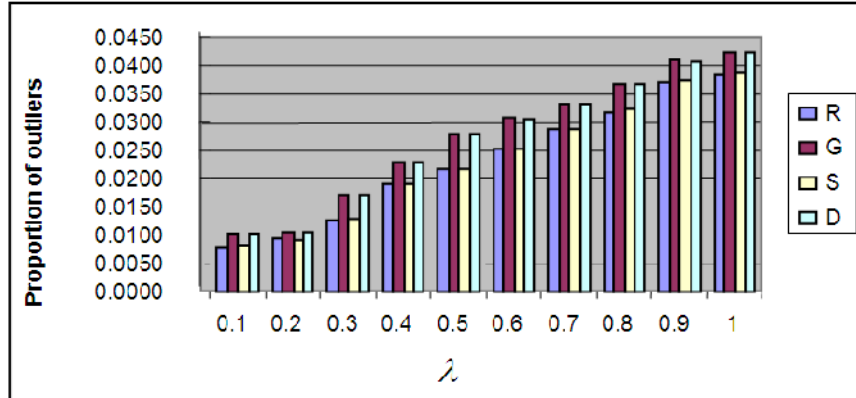


Fig. 3.2.1: Proportion of outliers detected by EWMA SRT, GVT, SdVT and EWMA VDT Charts for the process scale parameter using C10N3 & n=5

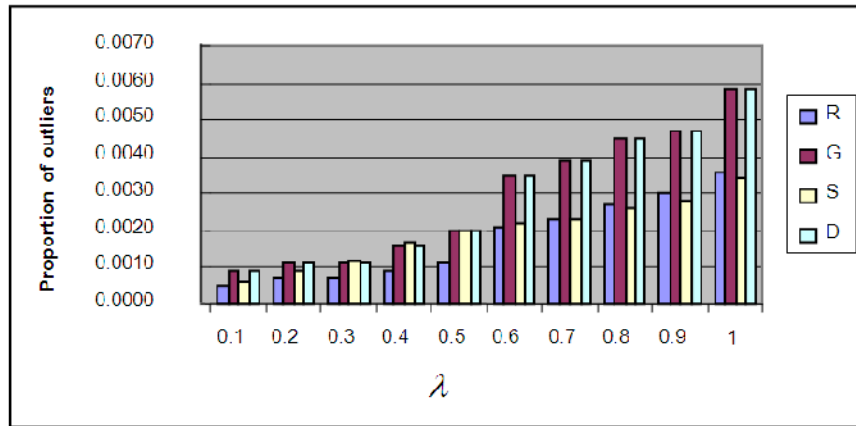


Fig 3.2.2: Proportion of outliers detected by EWMA SMT, GMT, SdMT and EWMA MDT Charts for the process location parameter using C10N3 & n=10

The bars referred to as R, G, S and D respectively represent the proportion of outliers detected by EWMA_{SRT}, GVT, SdVT and EWMA_{VDT} charts for the scale parameter (see in Figure 3.2.1) and EWMA_{SMT}, GMT, SdMT and EWMA_{MDT} charts for the location parameter (see in Figure 3.2.3).

From the above Figures 3.2.1-3.2.2, it is obvious that the proportions of outliers detected by the proposed GVT and GMT charts are greater than their respective counterparts based on R, S and are almost equal to the EWMA schemes proposed by Riaz and Abbasi (2007a). All this is due to the fact that the limits of the newly proposed charts based on G are less disturbed by the presence of outliers, and hence making their detection quick.

4. CONCLUSION

The newly proposed GVT and GMT charts, used for monitoring the scale and location parameters respectively, show superiority over the asymptotic GVA and GMA charts proposed by Riaz and Abbasi (2007b), especially for smaller values of λ . The proposed charts are also more efficient than the time varying R, S based EWMA design structures and equally efficient to the time varying EWMA control charts proposed by Riaz and Abbasi (2007a) for the scale and location parameters.

REFERENCES

1. Does, R.J.M.M., Roes, K.C.B. and Trip, A. (1999). *Statistical process control in industry*. Kluwer Academic, Dordrecht, The Netherlands.
2. Khoo, M.B.C. (2004). Some Control Charts for the Process Mean and Variance based on Downon's Estimator. *International Engineering Management Conference 2004*.
3. Montgomery, D.C. (2001). *Introduction to Statistical Quality Control*. 4th edition, Wiley, New York.
4. Ng, C.H. and Case, K.E. (1989). Development and evaluation of control chart using exponentially weighted moving averages. *Journal of Quality Technology*, 21, 242-250.
5. Page, E.S. (1954). Continuous inspection schemes, *Biometrika*, 41, 100-115.
6. Riaz, M. and Abbasi, S.A. (2007a). On Effect Of Time Varying Control Limits. *Interstat*, September 2007 #1.
7. Riaz, M. and Abbasi, S.A. (2007b). Gini Mean Difference and EWMA Charts. *Interstat*, December 2007 #3.
8. Roberts, S.W. (1959). Control charts tests based on geometric moving averages, *Technometrics*, 1, 239-250.

ERUPTION TIME OF PERMANENT TEETH IN SCHOOLCHILDREN OF KARACHI

Nazeer Khan

Dow University of Health Sciences, Karachi.

Email: n.khan@duhs.edu.pk

ABSTRACT

The objectives of the this study were to determine the mean eruption time of permanent teeth, sequence of eruption and the relationship of eruption time with height, weight and Body Mass Index (BMI) in schoolchildren of Karachi city. About twenty thousand children from 103 schools of age 5 to 14 years were screened 'free of charge' from all the 18 towns of Karachi. The number of private and public schools were 77 and 26, respectively. 4300 children showed at least one tooth 'just erupted' at the time of screening. Three dentists and one assistant were involved in this study. The dentists were calibrated by clinical pictures. This study was funded by Higher Education Commission, Islamabad and was the first cross-sectional study conducted in Pakistan.

INTRODUCTION

Eruption of teeth is a normal physiologic phenomenon which starts with the eruption of primary teeth, and then followed by permanent dentition. Most of the parents consider tooth eruption as an important event in the child's development, and they have often shown their concern about the timing and sequence of eruption of teeth as well as about the replacement of primary with permanent teeth. An adequate knowledge and timing of emergence is essential for the guidance of the development of the dentition and for the diagnosis of developmental disturbances¹. Furthermore, the information about the timing of permanent tooth emergence is essential for diagnosis and treatment planning in Pediatric Dentistry and Orthodontics.² Moreover, the information on tooth emergence is also used to supplement other maturity indicators in the diagnosis of certain growth disturbances, and in forensic dentistry to estimate the chronological age of children with unknown birth records.^{1,3-5} Therefore, the specific standards on the timing and sequence of eruption of the permanent teeth provides an important information for the specialists and general dental practitioners involved in managing dental problems in growing children.⁶

In the literature, the eruption time of permanent teeth has been studied among different populations and ethnic groups^{1-4,6-24}. The results of these studies showed that variation exists in times of permanent teeth may be attributed to numerous racial differences^{5,8,11,13}, sexual maturity, genetic and hormonal factors^{19,22,23}, geographical, tribal, gender, as well as socioeconomic status, nutrition and growth parameters^{5,8,11}. Few studies have also reported a relationship between the eruption time, with the height and weight of children^{8,15}. Literature shows that among Pakistani children only two studies were reported for primary teeth^{21,24} and one was reported for permanent teeth.²² The study of the permanent teeth was conducted before partition of subcontinent. Major changes have occurred in eating habits and living styles during the last 60 years. Therefore, the present study was conducted on Pakistani schoolchildren to find out the eruption time of all the permanent teeth, except the

third molars. The objectives of the present study were to determine the mean eruption time of permanent all the permanent teeth except the third molars; and the relationship of the eruption time of these teeth with height, weight and BMI of Pakistani schoolchildren.

SUBJECTS AND METHODS

The population used for this cross-sectional study comprised of schoolchildren of pre-school (Nursery) to grade 8 of schools of Karachi, Pakistan. Number of private and public schools registered in education section of the City Government in 18 towns of Karachi urban area are 2,560 and 3, 948, respectively. However, one government school building registered many government schools of different levels such as primary, intermediate and secondary. Contrary, many private schools run more than one campuses under one registration. After adjusting these opposing trends, the ratio of public and private schools were 3:1. Therefore, 75 private and 26 government schools were randomly selected from the list of the schools of 18 towns of Karachi according to the proportion of schools for the survey. Prior to the commencement of the study, consent was taken from the selected schools. Letters were sent to the respective head of the schools stating the aims and objectives of the study. Examiners were trained and calibrated for the clinical examination of just erupted teeth by showing them clinical pictures. The sampling employed for this study was stratified cluster random sampling. All the children from the selected schools were screened and the students who had at least one tooth 'just erupted' were subjected to further examination. The criterion for 'just erupted' tooth was defined as; a tooth deemed to have emerged if any part of it (Incisal edge or cusp of permanent tooth) was visible in the oral cavity⁷. Therefore, if the child does not have any tooth 'just erupted' will be excluded from the study. About 30,000 children were examined and only 4,400 of them fulfilled the criteria mentioned above. The data were collected within six months (September 2007 to March 2008).

The clinical dental examination was carried out by three investigators (dentists) under natural light by direct visual inspection and manual palpation by using gloves. Sometimes a dental mirror was also used. Two investigators recorded all the information on specially designed form for the study. The teeth extracted due to caries or for orthodontic reason were recorded as having emerged. No radiographs were taken in this study. Height and weight of the selected sample were recorded after the clinical examination. The height and weight of the children were measured using a commercial digital scale and a wall-mounted tailor tape. The basic demographic information about the children: educational level; place of birth; race; dietary habits, such as consumption of milk, vegetable, rice and meat; any systemic disease were recorded. Schools were requested to provide the date of birth of the selected cases.

Descriptive statistics (minimum, maximum, mean, standard deviation, median and range) of eruption time was computed for each tooth. Independent two-samples 't' test was used to find the significant difference in the mean eruption time of each antagonistic tooth between maxillary and mandibular jaws; and contralateral tooth of right with left quadrants; children of private and public schools and males and females. Pearson correlations were determined between eruption time with height, weight and BMI. In addition, partial correlations were also calculated between eruption time with height and weight. BMI was calculated using the following formula:

$$BMI = \frac{Weight(kg)}{(Height(m))^2}$$

RESULTS

The mean age of 4400 schoolchildren was 9.31 ± 2.27 years (R: 2.5–18.5 years). The descriptive statistics (number of cases, mean and standard deviation) for male and female children and total subjects with p-values for comparison of time of eruption for study teeth is discussed in Table 1. First molars showed the lowest mean values of 6.6, 6.7, 6.6 and 6.5 years for tooth number 16, 26, 36 and 46, respectively. Central incisors followed the first molars with mean values of 7.5, 7.5, 7.0 and 6.9 years for the tooth numbers 11, 21, 31 and 41, respectively. Mean eruption time for lateral incisors followed the central incisors. The last teeth to be erupted were the second molars with mean values of 11.8, 11.8, 11.4 and 11.3 years for tooth numbers 17, 27, 37 and 47, respectively. There was no significant difference between the mean eruption times of male and female children, except the maxillary 2nd premolars, where females showed significantly late eruption than males; and mandibular canines, where males showed late eruption than females. There was no significant difference between contralateral teeth of left and right quadrants. Figure 1 compares the mean values of antagonistic teeth of maxillary with mandibular jaws. Mean eruption time of maxillary central and lateral incisors, canines and 2nd molars were significantly higher than mandible counterparts. Table 2 demonstrates the Pearson correlations of eruption time with height, weight and BMI; and partial correlations of eruption time with height and weight. Eruption time was significantly positive correlated, linear as well as partial, with height of the children in all the teeth, except left mandibular central incisor and 2nd premolar. Eruption time was significantly positive linear correlated with weight in about 50% of the teeth. However, it was statistically significant with weight for partial correlation, controlling for height, only in 5 teeth. There was no statistical significance correlation between eruption time and BMI ($p > 0.05$), except in 2 teeth.

ACKNOWLEDGEMENT

This study was approved and supported by Higher Education Commission with a grant, Letter No. 1-28/HEC/HRD/2006/475, dated 6 February 2007.

REFERENCES

1. Mugonzibwa EA, Kuijpers-Jagtman AM, and Laine-Alava MT, van't Hof MA. (2002). Emergence of permanent teeth in Tanzanian children. *Community Dent Oral Epidemiol*; 30: 455-62.
2. Leroy R, Bogaerts K, Leasffre E, and Declerck D. (2003). The emergence of permanent teeth in Flemish children. *Community Dent Oral Epidemiol*; 31: 30-9.
3. Savara BS, and Steen JC. (1978). Timing and sequence of eruption of permanent teeth in a longitudinal sample of children from Oregon. *JADA*; 97: 209-14.
4. Elmes A, and Dykes E. (1997). A pilot study to determine the order of emergence of permanent central incisors and permanent first molars of children in the Colchester area of the U.K. *J Forensic Odontostomatol*; 15: 1-4.
5. Garn SM, Sandusky ST, Nagy JM, and Trowbridge FL. (1973). Negre-Caucasoid difference in permanent tooth emergence at a constant income level. *Arch Oral Biol*; 18: 606-15.
6. Diamanti J, and Townsend GC. (2003). New standards for permanent tooth emergence in Australian children. *Aust. Dent. J.*; 48: 39-42.

7. Houtp MI, Adu-Aryee S, and Grainger RM. (1967). Eruption times of permanent teeth in the Brong Ahafo region of Ghana. *Am. J. Orthodont*; 53: 95-9.
8. Billewicz WZ, and McGregor IA. (1975). Eruption of permanent teeth in West African (Gambian) children in relation to age, sex and physique. *Ann. of Hum. Biol*; 2: 17-28.
9. Pahkala R, Pahkala A, and Laine T. (1991). Eruption pattern of permanent teeth in a rural community in northeastern Finland. *Acta Odontol Scand*; 49: 341-9.
10. Akpata ES. (1971). Eruption times of permanent teeth in southern Nigerians. *J. Nigerian Med. Assoc*; 1: 34-5.
11. Lee MMC, Low WD, and Chang SFS. (1965). Eruption of the permanent dentition of Southern Chinese children in Hong Kong. *Arch. Oral Biol*; 10: 849-61.
12. Moslemi M. (2004). An epidemiological survey of the time and sequence of eruption of permanent teeth in 4-15 year-olds in Tehran, Iran. *Int. J. Paediatr. Dent.*; 14: 432-8.
13. Blankenstein R, Cleaton-Jones PE, Maistry PK, Luk KM, and Fatti LP. (1990). The onset of eruption of permanent teeth amongst South African Indian children. *Ann. Hum. Biol.*; 17: 515-21.
14. Wedl JS, Schoder V, Blake FA, Schmelzle R, and Friedrich RE. (2004). Eruption times of permanent teeth in teenage boys and girls in Izmir (Turkey). *J. Clin. Forensic Med.*; 11: 299-302.
15. Agarwal KN, Gupta R, Faridi MM, and Arora NK. (2004). Permanent dentition in Delhi boys of age 5-14 years. *Indian Pediatr*; 41: 1031-5.
16. Niswander JD, and Sujaku C. (1960). Dental eruption, stature, and weight of Hiroshima children. *J. Dent. Res.*; 39: 959-63.
17. Hoffding J, Maeda M, Yamaguchi K, and Tsuji H et al. (1984). Emergence of permanent teeth and onset of dental stages in Japanese children. *Comm. Dent. Oral Epidemiol.*; 12: 55-8.
18. Clements EM, Davies-Thomas E, and Pickett KG. (1953). Time of eruption of permanent teeth in British children in 1947-8. *Br. Med. J.*; 1: 1421-4.
19. Khan NB, Chohan AN, AlMograbi B, AlDeyab S, Zahid T, and AlMoutairi M. (2006). Eruption time of permanent first molars and incisors among a sample of Saudi male school children. *Saudi Dent. J.*; 18: 18-24.
20. Chohan AN, Khan NB, Al Nahedh L, Bin Hassan M, and Al Sufyani N. (2007). Eruption time of permanent first molars and incisors among female primary school children of Riyadh. *J. Dow. Univ. Health. Sciences.*; 1(2): 53-8.
21. Saleemi MA, Hägg U, Jalil F, and Zaman S. (1994). Timing of emergence of individual primary teeth. A prospective longitudinal study of Pakistani children. *Swed. Dent. J.*; 18: 107-12.
22. Shourie KL. (1946). Eruption age of teeth in India. *Indian J. Med. Res.*; 34: 105-18.
23. Triratana T, Hemindra, and Kiatiparjuk C. (1990). Eruption of permanent teeth in malnourished children. *J. Dent. Assos. Thai.*; 40: 100-8.
24. Saleemi MA, Hägg U, Jalil F, and Zaman S. (1996). Dental development, dental age and tooth counts. A prospective longitudinal study of Pakistani children. *Swed. Dent. J.*; 20: 61-7.

Figure 1 Comparison of mean eruption time of upper and lower teeth

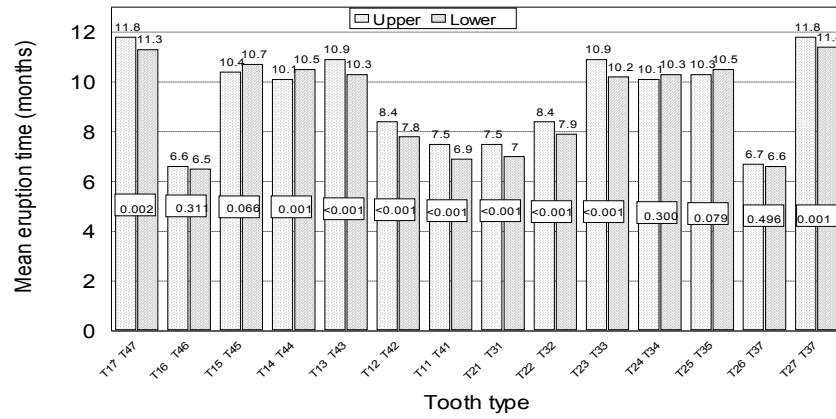


Table 1: Mean eruption time of the total sample and comparison of male and female children

Tooth Type	Male			Female			p-value	n	Mean	Median	SD
	N	Mean	SD	N	Mean	SD					
17	137	11.6	1.6	94	12.0	1.5	0.086	231	11.8	11.8	1.6
16	86	6.6	1.3	72	6.6	1.2	0.919	158	6.6	6.4	1.2
15	123	10.2	1.5	73	10.8	1.5	0.007	196	10.4	10.3	1.5
14	160	10.1	1.3	131	10.1	1.5	0.839	291	10.1	10.0	1.4
13	367	11.0	1.5	202	10.7	1.5	0.111	569	10.8	10.8	1.5
12	180	8.4	1.1	162	8.4	1.5	0.700	342	8.4	8.3	1.3
11	193	7.5	1.3	133	7.5	1.7	0.955	326	7.5	7.4	1.5
21	187	7.5	1.1	137	7.5	1.6	0.911	324	7.5	7.3	1.4
22	184	8.5	1.2	145	8.3	1.4	0.377	329	8.4	8.3	1.3
23	354	10.9	1.4	183	10.9	1.4	0.666	537	11.0	11.0	1.4
24	174	10.2	1.4	142	10.1	1.6	0.759	316	10.1	10.1	1.5
25	146	10.0	1.3	91	10.7	1.5	0.002	237	10.3	10.2	1.4
26	85	6.7	1.0	74	6.7	1.0	0.828	159	6.7	6.6	1.0
27	141	11.7	1.5	91	12.0	1.5	0.171	232	11.8	11.7	1.5
47	250	11.4	1.5	183	11.3	1.7	0.705	433	11.3	11.2	1.6
46	130	6.6	1.3	109	6.4	1.0	0.187	239	6.5	6.4	1.1
45	92	10.7	1.8	78	10.8	1.5	0.672	170	10.7	10.7	1.7
44	165	10.5	1.6	135	10.5	1.5	0.703	300	10.5	10.3	1.6
43	247	10.5	1.7	162	10.0	1.5	0.002	410	10.3	10.3	1.6
42	187	7.8	1.2	120	7.7	1.1	0.533	307	7.8	7.7	1.2
41	121	6.8	1.1	94	7.0	1.2	0.295	215	6.9	6.6	1.1
31	122	7.0	1.2	71	7.1	1.4	0.558	193	7.0	7.0	1.2
32	173	7.9	1.1	121	8.0	1.5	0.356	294	7.9	7.8	1.3
33	237	10.4	1.5	158	10.0	1.6	0.007	396	10.2	10.1	1.6
34	161	10.3	1.3	124	10.3	1.5	0.944	285	10.3	10.3	1.4
35	100	10.4	1.4	64	10.7	1.7	0.323	164	10.5	10.6	1.5
36	123	6.6	1.2	99	6.6	1.3	0.972	222	6.6	6.4	1.2
37	242	11.2	1.7	179	11.5	1.6	0.068	421	11.4	11.3	1.7

Table 2:
**Correlations of eruption time of 2nd molars, premolars and
 canines with height, weight and BMI**

Tooth Type	No. of Cases	Height				Weight				BMI	
		Pearson Correlation		Partial Correlation		Pearson Correlation		Partial Correlation		Pearson Correlation	
		r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
17	231	0.318	<0.0001	0.344	<0.0001	0.076	0.254	-0.159	0.018	-0.064	0.341
16	158	0.504	<0.0001	0.289	<0.0001	0.435	<0.0001	0.068	0.397	0.162	0.043
15	196	0.226	0.002	0.206	0.004	0.108	0.135	-0.051	0.479	-0.017	0.817
14	291	0.411	<0.0001	0.337	<0.0001	0.257	<0.0001	-0.060	0.309	0.038	0.515
13	569	0.231	<0.0001	0.226	<0.0001	0.091	0.030	-0.074	0.078	-0.031	0.468
12	342	0.243	<0.0001	0.201	<0.0001	0.139	0.010	-0.013	0.814	-0.005	0.925
11	326	0.218	<0.0001	0.224	<0.0001	0.068	0.221	-0.088	0.114	-0.072	0.195
21	324	0.206	<0.0001	0.218	<0.0001	0.053	0.339	-0.089	0.110	-0.089	0.111
22	329	0.193	<0.0001	0.193	<0.0001	0.71	0.202	-0.070	0.207	-0.065	0.244
23	537	0.170	<0.0001	0.147	0.001	0.092	0.033	-0.031	0.475	0.009	0.832
24	316	0.370	<0.0001	0.301	<0.0001	0.234	<0.0001	-0.063	0.267	0.027	0.630
25	237	0.272	<0.0001	0.222	0.001	0.164	0.012	-0.031	0.634	0.017	0.794
26	159	0.235	0.003	0.360	<0.0001	-0.038	0.663	-0.282	<0.0001	-0.250	0.002
27	232	0.234	<0.0001	0.253	<0.0001	0.058	0.379	-0.113	0.087	-0.054	0.415
47	433	0.359	<0.0001	0.331	<0.0001	0.176	<0.0001	-0.096	0.046	-0.004	0.933
46	239	0.326	<0.0001	0.260	<0.0001	0.204	0.002	0.019	0.766	-0.086	0.187
45	170	0.336	<0.0001	0.202	0.009	0.281	<0.0001	0.063	0.417	0.185	0.016
44	300	0.298	<0.0001	0.174	0.003	0.251	<0.0001	0.048	0.415	0.128	0.128
43	410	0.436	<0.0001	0.328	<0.0001	0.306	<0.0001	-0.031	0.530	0.100	0.044
42	307	0.145	0.011	0.186	0.001	-0.007	0.909	-0.117	0.041	-0.098	0.087
41	215	0.265	<0.0001	0.315	<0.0001	0.034	0.622	-0.179	0.009	-0.205	0.030
31	193	0.137	0.057	0.108	0.134	0.087	0.229	-0.021	0.771	-0.005	0.940
32	294	0.289	<0.0001	0.336	<0.0001	0.064	0.273	-0.191	0.001	-0.141	0.015
33	396	0.395	<0.0001	0.281	<0.0001	0.290	<0.0001	-0.015	0.773	0.106	0.036
34	285	0.264	<0.0001	0.238	<0.0001	0.140	0.019	-0.077	0.198	-0.008	0.897
35	164	0.158	0.045	0.080	0.310	0.144	0.066	0.044	0.577	0.081	0.303
36	222	0.374	<0.0001	0.258	<0.0001	0.296	<0.0001	0.098	0.145	-0.037	0.583
37	421	0.322	<0.0001	0.280	<0.0001	0.173	<0.0001	-0.045	0.361	0.033	0.954

FACTORS THAT MOTIVATE BUSINESS FACULTY TO CONDUCT RESEARCH

**Ansa Mahmood¹, Ammara Noshin², Muhammad Rehman³,
Rizwan Altaf Hussein⁴ and Moneeb Qamar⁵**

Gift Business School, Gift University, Gujranwala.

Emails: ¹ansa_gift@yahoo.com; ²ammaranoshin@yahoo.com; ³07210066@gift.edu.pk;
⁴07210056@gift.edu.pk and ⁵07210055@gift.edu.pk

ABSTRACT

Little empirical research exists concerning the factors that motivate business faculty to conduct research. This study examines the motivational factors that influence the research output of business faculty. Using different statistical techniques investigate both intrinsic and extrinsic factors that influence the quantity of research productivity. Our Results show that satisfying the need to creativity and curiosity, permanent position, getting an administrative assignment, achieving peer recognition, finding job at another university, getting better salary raises, getting reduce teaching load and percentage of time spending on research consistently motivate business faculty to increase their research output.

INTRODUCTION

This study explores the both intrinsic and extrinsic motivational factors that contribute to higher research productivity. For achieving different rewards faculty needs to publish more. Publications in refereed journals are required for different rewards in many business schools which earlier thoughts as teaching oriented (Hermanson, Hermanson, Ivancevich and Ivancevich 1995). Thus, an individual faculty member's compensation, promotion and job status, reputation, and teaching load, creativity or curiosity are very much related to his or her research productivity. This study adopted a survey instrument to provide a quantitative assessment of the factors that affect research productivity of business school faculty.

LITERATURE REVIEW

Research and publication are generally accepted as important in the development and reputation enhancement of any academic discipline. Little empirical research are available about the factors most contribute in research and development but most of these studies concentrated basically on association with schools which are most active in research and publication and rank such schools on this basis, but they do not try to explore the factor which increase individual ability for the research productivity (Cargile and Bublitz, 1986; Chow & Harrison. 1998 and Fox, 1985). Several studies in the past have documented a strong relation between publication and promotion (Campbell and Morgan 1987; Milne and Vent 1987). Reward structure for the promotion of faculty members at higher educational institutions can influence the research productivity of the faculty members (Fox1985). Three major factors (publication, teaching and service) are associated with promotions.

Research productivity is the most important determinant of promotion and other rewards. Several studies in the past have documented a strong relation between publication and promotion (Campbell and Morgan 1987; Milne and Vent 1987). Other researchers examined that some faculty members motivate toward research on only for external reward but for the purpose of creativity and curiosity (e.g., McKeachie, 1979). In summary, two main categories of motivational factors are identified by prior researchers: intrinsic factors and extrinsic factors which drive or motivate business faculty to be more productive in their research output. According to the Life-Cycle theory (Hu & Gill, 2000) explained that research productivity is higher in the initial stages of the faculty and after that it decline. Research productivity depends heavily on how much time an individual spends on research-related activities (Hancock et al., 1992; Lane et al., 1990). Prior Researchers have identified the following factors that motivate business faculty to be more productivity in their research output: tenure status, working time spending on the research activities, length of the tenure probationary period, teaching loads, and financial research reward (Buchheit et al., 2001; Cargile & Bublitz, 1986; Chow & Harrison, 1998).

OBJECTIVES OF THE STUDY

We aimed to verify the results of (Yining Chen, Ashok Gupta 2006) a study on factors that motivate business faculty to conduct research. Both extrinsic and intrinsic rewards that motivate business faculty to conduct research were examined. Difference between permanent versus non permanent faculty members and permanent versus visiting faculty members were also examined in this study. Difference in research productivity of public and private universities faculty members were also examined in this study. Difference by gender in research productivity was also analyzed.

METHODOLOGY

To verify the findings of a previous study by (Yining Chen, Ashok Gupta 2006) a survey was conducted in the six cities of Punjab (Islamabad, Lahore, Multan, Gujrat and Gujranwala). Both public and private universities were selected for this purpose. Twenty two universities were visited and data was collected conveniently from each university. Sample size of our respondents was 200 faculty members in which 100 faculty members from public universities and 100 from private universities. Data was collected by using a questionnaire which was developed by the previous researchers (Yining Chen, Ashok Gupta 2006). We aimed to cover the entire business faculty in each university. Only some faculty members were available at the time of the survey so we used rollover sampling to cover our target sample size. Every attempt was made to cover at least 20 faculty members from each university. Average 15 faculty members were available at the time of survey in each university. So the questionnaires were distributed to those faculty members that results in non contract-rate was 25%. Of these average 10 questionnaires were responded and returned which represent the response-rate was 66.6%. No questionnaire was rejected during the screening process which represents the incident-rate 0%. The entire respondent questionnaires were used in this study. Data were analyzed by using Statistical Programme for Social Sciences (SPSS).

ANALYSIS OF THE RESULTS

Demographical analysis

There were 70% and 30% female respondents in this study. Following were the discipline of the respondents, accounting 13.5%, finance 16.0%, MIS 11.0%, Operational management 7.0%, HRM 11.5%, OB 11.0 %, Business law 4.5%, marketing 11.0% and others 14.5%. Total number of books published or accepted for publication during 24 months and during entire career was; less than one 87.0%, 1-5 25% and 5-10 was .5%. Total books chapters published or accepted for publication was; 74% have no publication, 1-5 23.5%, 5-10 1.5% and more than 10 was 1.0%. Total number of refereed journal articles published or accepted for publication was; 68.0% have no publication, only 27.5% have publications between 1-5, 3.0% have publications between 5-10, and only 1.5% has publications more then 10. total number of conference papers published or accepted for publication was; 66.5% have no publication, only30.5% have publications between 1-5, 1.5% have publications between 5-10 and 1.5% have more than 10 publications of conference papers.

Difference by gender in research productivity

There were 140 male respondents and 60 female respondents in the data. Male respondents are significantly higher who score 1.4420 in the research productivity compare as female respondents who score 1.2333. The results may be different due to the difference in the data.

Difference in research output due to difference in job status

By using independent sample t-test we compared the means of permanent verses contract base faculty members productivity or permanent verses visiting faculty. According to results permanent faculty’s research output is higher then the contract base faculty. The permanent faculty’s average score is 1.5890 where as contract faculty’s average score is 1.2222 and the visiting faculty’s average score is 1.4054. so the results show that permanent faculty have the higher research output.

Difference in research productivity by the category of university

By using independent sample t-test we compare the difference between public and private universities research productivity. Public universities are higher in research productivity there score is 1.400 rather then private universities which score is 1.2300. Private universities are only higher in the number of conference papers (1.4200) rather the public universities (1.3400).

KMO and Bartlett’s Test the Bartlett’s test of sphericity

Table 2 KMO and Bartlett’s Test the Bartlett’s test of sphericity is significant at the level of .806 and the significant level is .000.

Table 2: KMO and Bartlett’s Test the Bartlett’s test of sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.806
Bartlett’s Test of Sphericity	Approx. Chi-Square	883.765
	df	78
	Sig.	.000

Important motivational factors that influence the research output

Table 3 Principal axis factor analysis with varimax rotation was conducted to assess the underlying structure for the thirteen items of the research motivation. Total variance explained the variance among the thirteen items. Seven items extracted which covers the 82% of the total items.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.183	32.181	32.181	4.183	32.181	32.181	2.671	20.546	20.546
2	2.162	16.633	48.814	2.162	16.633	48.814	1.749	13.454	34.000
3	1.309	10.067	58.881	1.309	10.067	58.881	1.731	13.085	47.085
4	1.057	8.130	67.011	1.057	8.130	67.111	1.532	12.017	59.102
5	.753	5.833	72.843	.758	5.833	72.343	1.055	8.115	67.217
6	.615	4.729	77.573	.615	4.729	77.573	.932	7.628	74.845
7	.567	4.361	81.934	.567	4.361	81.334	.921	7.088	81.934
8	.525	4.036	85.969						
9	.452	3.479	89.448						
10	.409	3.144	92.592						
11	.351	2.699	95.292						
12	.331	2.549	97.841						
13	.281	2.159	100.003						

Extraction Method: Principal Component Analysis.

Table 4 shows the component rotated matrix. The result shows that the seven factors are more important factors from the thirteen factors. Approximately 82% faculty members motivate by these factors. Satisfy my need to creativity and curiosity is .841% important for faculty members. Receiving or having tenure or permanent position is .898% important for faculty members. Getting an administrative assignment is .820% important for faculty members. Achieving peer recognition is .880% important for faculty members. Finding job at another university is .898% important for faculty members. Getting better salary raises is .728% important for faculty members. Getting reduce teaching load is .925% important for faculty members. The most important factor is reducing teaching load that motivate business faculty to conduct research.

Table 4: rotated component matrix

	Rotated Component Matrix ^a						
	1	2	3	4	5	6	7
Receiving or having tenure or permanent position	.069	.225	.090	.062	.060	-.020	-.020
Being full professor or receiving promotion	.180	.087	.304	.080	.057	.187	.218
Getting better salary raises	.159	.405	.016	.074	-.003	.040	.720
Getting an administrative assignment	.145	.820	.075	-.080	.128	.235	.151
Getting a chaired professorship	.056	.792	.232	.070	.175	-.101	.092
Getting a reduced teaching load	.021	.203	.112	.001	.111	.026	.036
Achieving peer recognition	.005	.033	.129	.880	.071	.104	-.099
Getting respect from students	.348	-.053	-.022	.763	-.103	-.021	.245
Satisfying my need to contribute to the field	.787	.020	.120	.370	-.025	-.028	-.084
Satisfying my need for creativity or curiosity	.041	.190	.110	.110	-.101	-.003	-.140
Having satisfying collaborations with others	.793	.040	-.030	-.034	.210	.088	.280
Satisfying my need to stay current in the field	.725	.045	.143	.099	.315	.002	.282
Finding a better job at another university	.129	.255	.101	.012	.308	.112	.002

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotating converged in 0 iterations.

Important extrinsic factors that motivate business faculty

Table 5 Principal axis factor analysis with varimax rotation was conducted to assess the underlying structure for the six items of the research motivation. Total variance explained the variance among the six items. Three items extracted which covers the 83% of the total items.

Table 5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.360	56.007	56.007	3.360	56.007	56.007	2.048	34.132	34.132
2	.985	16.409	72.417	.985	16.409	72.417	1.827	30.461	64.583
3	.607	10.110	82.526	.607	10.110	82.526	1.077	17.944	82.526
4	.407	6.789	89.315						
5	.348	5.804	95.119						
6	.293	4.881	100.000						

Extraction Method: Principal Component Analysis.

Table 6 shows the component matrix of important extrinsic factors that motivate business faculty to conduct research. The most important extrinsic factor is getting a reduced teaching load which is .903% important for faculty members for conducting research. Second important extrinsic factor that motivate faculty to conduct research is receiving a permanent status which is .864% important for faculty members. Third important factor is getting an administrative assignment which is .840% important for faculty members to motivate toward research.

Table 6: component rotated matrix

	Component		
	1	2	3
Receiving a permanent status	.864	.079	.279
Receiving promotion	.847	.295	.089
Getting better salary raises	.682	.553	-.113
Getting an administration assignment	.230	.840	.223
Getting a chaired professorship	.209	.793	.336
Getting a reduced teaching load	.148	.306	.903

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 6 iterations.

Important intrinsic factors that motivate business faculty

Table 7 Principal axis factor analysis with varimax rotation was conducted to assess the underlying structure for the seven intrinsic items of the research motivation. Total variance explained the variance among the seven items. Three items extracted which covers the 80% of the total items.

Table 7: total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.539	50.558	50.558	3.539	50.558	50.558	2.677	38.238	38.238
2	1.314	18.771	69.330	1.314	18.771	69.330	1.722	24.599	62.836
3	.734	10.483	79.813	.734	10.483	79.813	1.188	16.977	79.813
4	.440	6.283	86.096						
5	.406	5.803	91.899						
6	.306	4.368	96.268						
7	.261	3.732	100.000						

Extraction Method: Principal Component Analysis.

Table 8: Important intrinsic factors that motivate business faculty

	Component		
	1	2	3
Achieving peer recognition	.100	.925	-.011
Getting respect from students	.277	.857	.141
Satisfying my need to contribute to the field	.805	.282	-.010
Satisfying my need for creativity or curiosity	.805	.174	.096
Having satisfying collaborations with others	.782	.088	.339
Satisfying my need to stay current in the field	.792	.096	.396
Finding a better job at another university	.234	.072	.942

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 5 iterations.

Table 8 shows the component matrix of important intrinsic factors that motivate business faculty to conduct research. Results show that the most intrinsic factor that motivate business faculty to conduct research is finding the job a better job at another university which is .942% important for faculty members. The second important factor is achieving peer recognition which is .925% important for faculty. The third important motivational factor for faculty is satisfying the need to contributing in the field or satisfying the need for curiosity and creativity.

Table 9 shows the reliability statistics which is significant at the alpha level of .838.

Table 9: Reliability statistics

Cronbach's Alpha	N of Items
.838	36

DISCUSSION

The results show that the most faculty members motivated by reducing teaching load through there research productivity. According to the factor loading analysis .903% faculty members are motivated through this factor so it is important to take step by using this factor. So reducing the teaching load may result higher research productivity.

Researchers want to conduct research because through there research productivity they want to find job at another university. They are not satisfy with there current status. According to the results .942% faculty members are motivated by finding a job at another university. So we can say that better Jobs may increase the research productivity. Achieving peer recognition is also very important factor that motivate researchers to conduct research, results show that .925% faculty members are motivated by this factor.

Satisfying the need to stay current in the field is also very important factor for researcher to conduct research. According to the factor loading analysis .805% faculty members are motivated by this factor. Receiving a permanent position is also very important factor for research which motivates them to conduct research. Results show

that .864% faculty members are motivated by this factor. As faculty members got permanent status there research productivity also increases. They conduct research to find better position in there university. Getting an administrative assignment is also very important factor that motivate business faculty to conduct research. According to the factor loading analysis .840% faculty members are motivated by this factor.

CONCLUSIONS

Our results show that those faculty members who have higher motivational factors both extrinsic and intrinsic factors have more research productivity rather than those who have lower motivational factors in both extrinsic and intrinsic motivational factors. Results also show that the time spending on research and research productivity is also positively related. Male respondents have more research productivity then that of female respondents. We also compare permanent and visiting faculty in order to know there research productivity. We also compare public and private universities in order to know there research productivity. Results show that the public universities have more research productivity then that of private universities. The integration of research and teaching responsibilities must be an expectation of faculty at all ranks. Furthermore, we must devise strategies that consider faculty needs over an entire academic career and that are based on the synergetic interrelationship between faculty and an institution.

REFERENCES

1. Athey, S. and Plotnicki, J. (2000). An Evaluation of Research Productivity in Academic IT. *Communication of the Association for Information Systems*, 1-20.
2. Buchheit, S., Collins, A.B. and Collins, D.L. (2001). Intra-institutional factors that influence accounting research productivity. *The Journal of Applied Business Research*, 17(2), 17-31.
3. Cargile, B.R. and Bublitz, B. (1986). Factors contributing to published research by accounting faculties. *The Accounting Review*, 61(1), 158-178.
4. Campbell, D.R. and Morgan, R.G. (1987). Publication activity of promoted accounting faculty. *Issues in Accounting Education*, 2(1), 28-43.
5. Chow, C.W. and Harrison, P. (1998). Factors contributing to success in research and publications: Insights of "influential" accounting authors. *Journal of Accounting Education*, 16(3/4), 463-472.
6. Fox, M.F. (1985). Publication, performance, and reward in science and scholarship. In J.C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 1, 255-282). New York: Agathon Press.
7. Hu, Q. and Gill, T.G. (2000). IS faculty research productivity: Influential factors and implications. *Information Resources Management Journal*, 13(2), 15-25.
8. Hermanson, D.R., Hermanson, H.M., Ivancevich, D.M. and Ivancevich, S.H. (1995). *Perceived expectations and resources associated with new accounting faculty positions*. Paper presented at the 1995 American Accounting Association Annual Meeting, Orlando, FL.
9. McKeachie, W.J. (1979). Perspective from psychology: Financial incentives are ineffective for faculty. In D. R. Lewis & W. E. Becker (Eds.), *Academic rewards in higher education*. Cambridge, MA: Ballinger

10. McCarthy, Claffey and White (2004). The Balance between Teaching and Research: The Development of Survey Instrument to Assess Factors that Affect MIS Research. *Journal of management information system*.
11. Milne, R.A. and Vent, G.A. (1987). Publication productivity: A comparison of accounting faculty members promoted in 1981 and 1984. *Issues in Accounting Education*, 2(1), 94-102.
12. Poe, C.D. and R.E. 'Sriator (1990). AACSB Accounting Accreditation and Administrators; Attitudes toward Criteria for the Evaluation of Faculty. *Issues in Accounting Education* (spring): 59-77.

**ON THE NEED OF DEVELOPING VALID DATA
CAPACITY BUILDING IN DEVELOPING COUNTRIES**

Muhammad Tufail Jarral

Director (CM) Power, PEPCO, Wapda House, Lahore, Pakistan
Email: mtjarral@hotmail.com
(Ph.D. Research Fellow)

ABSTRACT

In this competitive age, the use of information and communication skills is becoming of imperative requirement than ever in any business activity like banking, industry, agriculture, health, crimes and environment at all management levels. Decision making for achieving set targets is required in the Organizations, at each managerial level in public as well as private sectors right from Planning to Controlling, specially at monitoring level and reliable information is the pivot for sound or unbiased decision making. This requires valid data capacity building.

An attempt has been made in this paper to identify the problems faced with respect to availability of valid information as per requirements of a particular business activity / environment and lack of access to it and measures for developing a valid data capacity building called “data power” in public as well as private organizations leading to good governance in the developing countries have been proposed.

1. INTRODUCTION

Data is the basis for logical decision making in all spheres of life from “policy planning” to “monitoring and control”, whether it is production, industry, agriculture, education, health, and environment or personnel performance appraisal systems.

Correct and reliable information is pivot for unbiased decision making by the management for achieving set targets in the organization in public / private sectors.

Data is used for exploratory / empirical studies. The investigational type data relating to medical or agriculture fields where “testing of hypothesis” on treatments, is applied, requires accuracy as the application of results of such a research may pose threat to the life of a toll of individuals. The importance of valid data becomes more critical when business forecasts for production or economic trends are estimated.

The decisions are generally taken by the non - statisticians, so if database is not valid, decision making may be biased. This makes data validity more important.

2. ANALYTICAL DISCUSSION

National Statistical Organizations (NSOs) have been established in almost all developed and developing countries for collection of data, as per individual country requirements.

No doubt, Data collection at organizational levels covering a wide variety of social, economic, industrial and demographic aspects exists in the developing countries, but without proper programmed responsibility i.e. taking into account the user needs.

It is observed that NSOs in the developing countries although collect data as per country requirement but the data are not collected as per one standardized format e.g. in Muslim states of OIC, data is not being collected as per format developed by the SESRTCIC / OIC HQ for member states covering all bench marks [6].

As referred above, most of the decisions in any activity specially in managerial activity are based on data analysis (may be descriptive or inferential). Quality of administrative or official statistics used for career personnel is also challengeable.

3. QUALITY OF DATA

The fundamental characteristics of data are that it should be purpose oriented and secondly it should be valid.

The following observations on quality of data (from data collection to data analysis / interpretation) can be made on the statistics of developing countries:

- a) Less attention is paid towards what is the targeted population, how data is collected (primary or secondary) and how much is data valid
- b) Practical difficulties in collection of factual information due to lack of knowledge / apprehensions of the subject matter by the interviewer and entry behavior of the respondents (say information on remunerations / salaries of individuals mostly incorrect as the respondents conceal such information).
- c) Data bench marks in case of primary data, are not well defined, clear and not well communicated to the respondents.
- d) Estimated figures instead of real data are generally manipulated by non statisticians.
- e) Priorities in data collection for future targets are not regularly examined for their relevance by end users and data collecting agencies.
- f) If lost data are missed, data falls into wrong hands, it is one thing and it can be used frequently but data deliberately obtained as theft is another [1].
- g) Although, use of IT technology has now shrunk the gaps of data communication, but still instant availability of data at users' end is a bit difficult.
- h) There is need to promote the view that the federal statistical agencies / other data custodians should be as concerned about providing data for their customers and about promoting use of their data as they are about protecting their respondents and ensuring security of confidential information [3].

The above observations boil down to the fact that NSOs in developing countries are not producing quality data leading to data bases with poor statistics.

The types of errors in data (sampling errors, data category inherent errors, reporting errors etc.) may therefore occur due to wrong targeted population; wrong mailing list of respondents; wrong sampling design and fictitious responses to the questions by the interviewee.

The quality of data could be improved provided data benchmarks are well defined; data is filtered through use of statistical techniques both in case of primary and secondary data; Sample and Questionnaire development are designed carefully keeping in view the targeted information and entry behavior of interviewer and respondents is of equal level.

The quality of data can further be validated if proper data capacity building is ensured by NSOs.

4. DATA CAPACITY BUILDING

Capacity building with respect to data collection, compilation, dissemination and data updation (henceforth called as Data Power) by the NSOs in the developing countries at individual levels as well as central level requires customization.

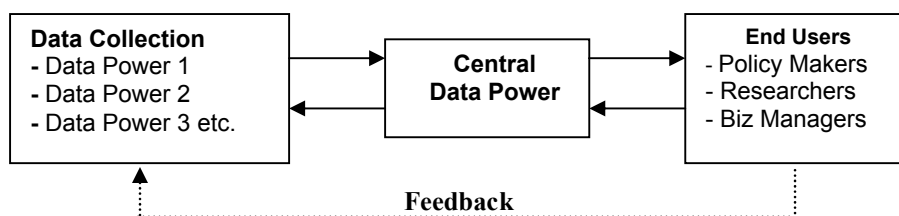
Data Power should take care of all parameters of data validity, if the Live ware (HR personnel) dealing with development and operations of data power are trained and competent.

The components of a valid Data Power could be:

- a) Standardization of data system / collection of data, support instrumentation (e.g. IT involvement) plus expert data analysts.
- b) Customization of internal environment data power with external environment for data linkage purposes, on requirement with free access to users to data for continuous appraisal and feedback on validity of data.

The following model gives an eye view of individual as well as central data powers of NSOs of developing countries.

MODEL DATA POWER



5. RECOMMENDATIONS

- a) Data Powers be developed by the NSOs of all developing countries dully customized with standardized data banks of IMF, World Bank, etc. The Central data power should develop well defined data benchmarks for individual data powers.
- b) Awareness in the masses of the importance of valid statistics be created through media and national / international seminars / conferences / symposia / workshops must be promoted by Central Data Powers in this regard.

REFERENCES

1. David Hand (2008). Privacy, data disks and Realistic risk. *Significance Journal*. Vol. 5.
2. Neil Malhotra and Jon A. Krosnick (2007). *Journal of Official Statistics*. Vol. 3. Sweden.
3. Julia Lane (2007). Optimizing the use of Micro data, An overview of the Issues. *Journal of Official Statistics*. 23(3), Sweden.
4. Hiroko, H. Dodge, Changyo Shen and Mary Ganguli (2008). Application of the Pattern – mixtures latent Trajectory Model in an Epidemiological Study with non – negative missingness. *Journal of Data Science*. 6(2) (online).
5. Jaral, M.T. (1990). *The Development and Role of Data Bank of Islamic Countries*. Paper delivered for the Second Islamic Countries Conference on Statistical Sciences (ICCS-II) at Johor Bahru, Malaysia organized by Islamic Society of Statistical Sciences (ISOSS).
6. SESRTCIC (2004). *WEB Usage in the National Statistical Organizations of the Member Countries of the Organization of the Islamic Conference*. Report of Fourth meeting of the Heads of the NSOs of the Member Countries of the OIC (11-13 Feb 2004) Lahore, Pakistan.

THE ROLE OF DISCIPLINE IN ORGANIZATIONS

Zareen Abbasi¹ and F.M. Shaikh²

¹ Department of Public Administration, University of Sindh, Jamshoro

² ZABAC-Dokri, Email: faizshaikh@hotmail.com

ABSTRACT

The conduct and discipline is one of the most important factor for maintaining regularities, responsibility and authority. The image of the organization is also built by adhering discipline rules. Those organizations are always in a state of problem where the discipline code is not properly followed. This conduct and discipline rules being observed Particularly in Pakistani organizations for study. Every organization has some rules and procedures lay out and if the members do not abide by the rules, the organization, its goals, and achievements may fall. This is concluded that if the organization wants to be successful in this competitive era, its employees as well as employers must follow Discipline policy in true manner.

Key words: Role, Discipline, Organization

INTRODUCTION

Discipline is to bring under control, order and punishment and its purpose is to enforce the rules, to tell the persons what they did wrong, to make sure that they don't repeat whatever they have done and to inflict a disciplinary punishment. The origin of the word discipline is Disciple that is a Learner. Unfortunately, many people interpret discipline as punishment but it does not always have to be punished. ~ In modern organizations, self-discipline ensures that staff will know what is required of them. In a perfect world, well-managed, well-organized staff would be well motivated and react to being held responsible by acting sensibly. The approach to manage discipline normally involves positive feedback and the encouragement of staff to do the right things. To attain these objectives, the organizations set detailed rules and need to specify how deviations from these rules will be dealt with. The threat of sanctions can be used, i.e., penalties imposed for doing the wrong things, such as breaking is an important organizational rule. In this context, organizations speak about disciplinary offences or disciplinary hearings but this is really a shorthand label. Disciplinary action is planned with the intention to improve the future behavior of the employee who has broken the rules. It can also influence the Behavior of other staff.

LITERATURE REVIEW

Discipline is the attitude of mind that regulates conformity of certain norms of good demeanor. It has the element of being directed by the requirements of society and that deemed socially good.² It is a well known fact that discipline is a procedure that corrects or punishes a subordinate because a rule or procedure has been violated.³ The proper

administrations of disciplinary procedures are necessities prior to planning.⁴ A fair and just discipline process is based on three prerequisites; rules and regulations; systems of progressive penalties; and an appeals process.⁵ The progressive discipline approach involves identify behaviors for which discipline will be applied and establishing a progressive list of punishments to be administered based on the severity of the offense and its frequency of occurrence.⁶ The other side of discipline is negative discipline in which individual's misconduct must be punished and penalty is imposed. It is important that the penalty be the minimum crucial to bring about the desired change.⁷ Dealing effectively with disciplinary problems requires a good understanding of the discipline process and skill in handling a variety of human relations problems,⁸ the strong interest is needed for the employers and employees in organizations regarding justice or fair treatment at work.⁹ The perceived fairness of workplace decisions and organizational procedures are used to make fair decision.¹⁰ It is in management's interests to resolve problems before they can develop into major difficulties for all concerned. ~ Managers believe that employees should be able to present their complaints to top management through some sort of grievance procedures.² In organizations, managers appear to view conflict as having more negative than positive impacts.¹³

PAKISTAN'S PERSPECTIVE

A variety of labor laws are vague in Pakistan, have been framed primarily because of these considerations. A majority of them, however, originate from those laws, which existed before independence in the Indo-Pak subcontinent. Indeed, all of them were adopted in Pakistan by the adoption of existing laws of 1947.¹⁸ Pakistan inherited a number of labor laws governing working conditions, wages and occupational safety and health. Nevertheless, a series of new labor laws and rules were introduced and existing ones updated/modified following, industrialization and the consequent need for ensuring workers. In Pakistan, a list of important laws or legislation enacted from time to time.

The employees find it comfortable to be part of a disciplined workforce where expectations are clear, behavior is predictable and supervisors are fair and consistent in their treatment with employees. Certainly employees' are benefited from developing a disciplined workforce. There are fewer performance and behavior problems; and the rate of discharge with its associated financial and psychological costs are reduced. The procedures for making disciplinary decisions and the rules of the organization are specified in writing. The formulation of work rules, penalties and disciplinary procedures are joint functions of line management and the human resource staff. Line managers must implement the procedures but the personnel staff may hold responsibility for publicizing the rules and training the supervisors to apply them properly. It is important to ensure that disciplinary actions will be viewed as a fair and thus worthy of being upheld by an impartial behavior. This is pragmatic that "grievance is a source of grief, ground of

Grievance thus would mean any dissatisfaction expressed through action, spoken or written words, whether justified or not, arising out of work situation and is concerned with the establishment that an employee thinks, believes or even feels is not fair, just an equitable. Complaint, condition felt as oppressive or wrongful. The term grievances have not been defined in the ordinance. The aggressive employee desires a solution to his grievances as it has also a bearing on his future relationship with the employer.

The progressive and enlightened employer in Pakistan assign due importance to proper handling of employee grievances, if any, and have devised formal procedures for their redress at the organization, the cause of grievance to an employee should not arise as prevention is better than cure. There are definite advantages if the grievance is resolved mutually between employee and the employer than to force the former to resort to litigation. The decision by court may cause complications for the employer and disturb his established practices and systems. Whenever the grievances are pointed out to the employer; they must be processed expeditiously. In case of delay, the employee feels frustrated and de-motivated. Short-term basis and are more likely to be perceived as unfair by employees. However, employees working under a system designed to educate and correct behavior on a long-term basis will view the policy as fair, which, in turn, will help to increase productivity and morale.

Progressive discipline goes hand-in-hand with policies set up to educate because the progression is aimed at rehabilitation by gradually increasing the severity of punishment with each violation of the work rules. A typical progression would include the oral warning, written warning, suspension and termination. In this regard each organization must work within this guideline to tailor a policy that meets specific company needs and also determines behaviors and violations that warrant immediate disciplinary action.

Managers also must be aware that certain behaviors demand immediate action and should not be subject to the progressive approach. Such violations include fighting, stealing and any other intolerable behaviors an organization chooses to list. Once those violations are determined, it should be communicated in the policy what disciplinary action will be taken, either suspension without pay or termination. When policy violations require immediate action and removal of employees from the premises, supervisors should always tell employees they are suspended and are to return on a specific day and time to determine the disciplinary action. Management also should reserve the right to modify the policy. However, this does not give management the right to arbitrarily use the policy.

Managers still must remain consistent when disciplining all employees. Even though progressive discipline is a positive approach to employee behavior problems, there are disadvantages to be considered. Thoroughly training supervisors about the policy and how to properly utilize it can be time consuming. Also, using a progression may lock an organization into a multi step process. Despite these disadvantages, the benefits of such a program generally counteract any negatives.

A progressive policy conveys a definite and consistent system on which employees can rely. It also allows supervisors to document the progression of disciplinary actions to justify termination, if necessary. The documentation must begin with the first oral warning given for a violation of the discipline policy. The successful discipline policy is to communicate the policy to employees both before and after implementation. There are

Two aspects of communication: informing employees of the discipline policy and creating an atmosphere that allows supervisors and employees to learn from the discipline process. Employees must be aware that a policy exists and how it will be implemented. If employees are uninformed, they will view any disciplinary action as unfair and arbitrary.

Communication also is vital when disciplining. Employees must realize that certain behavior is unacceptable and understand what behavior is expected of them. Equally important, supervisors can learn the underlying causes of certain behavior and then work with the employee to remedy the situation. Reviewing future consequences of repeated behavior can reinforce policy. Inconsistencies compromise the value of the policy and open the door to legal action by employees. Adopting a positive approach to disciplinary problems does not coincide with being a pushover. However, it does mean communicating with workforce and working together to resolve destructive behavior that will adversely affect the productivity of organization.

CONCLUSION

Organization must be consistent and fair in disciplinary procedures, the following guidelines has been adopted. With the exception of unacceptable conduct, which may be cause for more serious disciplinary action or for immediate dismissal, any employee whose employment is terminated will have gone through the following manner. In discussion the supervisor has a face-to-face conference with the employee to discuss problems with work performance or conduct and the need for correction. Assessment, if there is little or no improvement after the discussion, the next step is a written assessment. The supervisor completes a report in the employee's presence and the employee has the right to read and discuss the report and comment on the report in writing. A member of the personnel staff must be present. In suspension, the employee will be suspended for five working days without pay. The supervisor completes a written record of the suspension in the employee's presence. A member of the personnel staff must be present. A suspension may take place only with the approval of the supervisor, the department manager and the personnel manager. In termination, there is no marked improvement; the employee may be terminated.

REFERENCES

1. Dessler, G. (1994). *Human resources management*. USA: Prentice Hall Inc. 239-240.
2. Harsey, P., Kenneth, H., Blanchard and Johnson, D.E. (1996). *Management of organization: Behavior utilization of human resources*. USA: Prentice Hall, Inc. p 278.
3. Smith, S. (1999). *Create that change: Readymade tools for change management*. New Delhi; Kogan page India Private Limited. 35-59.
4. Lewis, P.V. (1983). *Managing human relations*. Boston: Kent Publishing Comp. 211-212.
5. Singer, M.G. (1990). *Human resources management*. Boston, PWS-KENT Publishing Company. 203-248.
6. *Ibid*, 246.
7. Dessler, G. Op, Cit., 599.
8. Streeten, P. and Hanry, M. (1983). *Human resource employment and development*. The McMillan Press Ltd. Hong Kong. 3-10.
9. Fryxell, G.E. and Gordon, M.E. (1989). Workplace justice and job satisfaction as predictors of satisfaction with union and management. *Academy of Management Journal*. 32, 851-66.

10. Folger, R. and Greenberg, J. (1985). Procedural justice: in Interpretive analysis of personnel systems In Rowland, K.M. and Ferris, G.R. *Research in Personnel and Human Resource Management*. 3, 141-83.
11. Greenberg, J. (1993). Looking vs. being fair: Managing impressions of organizational justice. In Staw, B.M. and Cummings, I.I. (Eds.). *Research in Organizational Behavior*. 12, 111-57. CT: Jai Press.
12. Ewing, D.W. (1977). What business thinks about employee's rights? *HBR*. 55, 81-94.
13. Baron, R.A. (1991). Positive effects of conflict: A cognitive perspective. *Employee Responsibilities and Rights Journal*. 4, 25-36.
14. Kochan, T.A., Katz, H.C. and Mckersie, R.B. (1988). *The transformation of American industrial relations*. New York: Basic Books.
15. Mayer, D. and Cooke, W. (1988). Economic and political factors in formal grievance resolution. *Industrial Relations*. 27, 318-35.
16. Lewin, D. and Peterson, R.B. (1988). *The modern grievance procedure in the United States*. New York: Quorum Books.
17. Aram, J.D. and Salipante, P.F. (1981). An evaluation of organizational due process in the resolution of employee/employer conflict. *Academy Management Review*. 6, 197-204.
18. Peterson R.B. and Lane, T. (1979). *Systematic management of HR*. USA: Addison Wesley Publishing Company, 81.

A STUDY TO ANALYZE AND FORECAST THE CUSTOMER TURN-OVER FOR A SHOPPING MALL

Ismat Fatima

Department of Statistics, Kinnaird College for Women, Lahore

ABSTRACT

The objective of this research is to analyze and forecast the daily customers' turn-over for a shopping mall. Data has been obtained from a shopping mall named "Azad Mega Mart", Mirpur (A.K) for three years from 1st January 2003 to 31st December 2005. The study aims at bringing to the surface the underlying tendencies and patterns of customer turn-over in this particular shopping mall. The information obtained is used to project the data into future time periods as forecasts.

INTRODUCTION

Azad Mega Mart (Pvt) Ltd is a shopping mall that is situated in Mirpur Azad Kashmir. It is carefully thought-out and planned mall in Azad Kashmir. Its ground area is 6400 sq. feet and it has five stories, with 37 departments. Total employees are about 250. It remains open for 24 hours and 365 days in a year.

LITERATURE REVIEW

Elizabeth Howard (January 1992) Evaluate the success of out-of-town regional shopping centers.

Charles Dennis, John Murphy, David Marsland, Tony Cockett, Tara Patel (2002) conduct a research on the Consumer Behavior; Market Research and Retail Marketing which shows that the authors investigated qualitatively, asking shoppers to describe centers in 'personality' terms and eliciting clear descriptive differences between centers.

Dennis C E, Murphy J, Marsland D, Cockett T, Patel, T (2002) conduct a research to Measuring Brand Image: Shopping Centre Case Studies.

Charles Dennis, David Marsland and Tony Cockett (May 2002) carried our a study on the topic: Central place practice: shopping centre attractiveness measures, hinterland boundaries and the UK retail hierarchy¹. This paper evaluates the authors' empirically based measurement system for attractiveness that can be applied to out-of-town as well as in-town shopping centers.

OBJECTIVE OF THE STUDY

The objective of this research is to analyze and forecast the daily customers' turn-over for a shopping mall. All the organizations operate in an atmosphere of uncertainty and that, in spite of this fact, decision must be made that affect the future of the organization. Educated guesses about the future are more valuable to organization managers than are uneducated guesses. The purpose of this particular research is to reduce the range of uncertainty within which management judgments of the shopping mall must be made by using forecasting techniques.

METHODOLOGY

In order to make forecast for any organization, the analysis must be made to explain or account for the behavior of the series. Forecasting procedures can be classified according to whether they tend to more quantitative or qualitative. This research work emphasizes the quantitative forecasting techniques because a broader understanding of these very useful procedures is needed in the effective management of Azad Mega Mart.

Quantitative forecasting techniques are used when sufficient historical data are available and when these data values are judged to be representative of the unknown future. Quantitative techniques are frequently classified into two categories: Statistical and Deterministic. Statistical techniques focus entirely on patterns, pattern change, and disturbances caused by random influences. Statistical forecasting techniques use basically two approaches. One is based on the assumption that the data can be decomposed into components such as trend, seasonality, cycle, and irregularity. A forecast is made by combining the projections for each of these individual components.

A second approach is associated with econometric time series modeling and Box-Jenkins methodology. Their theoretical foundations are based primarily in statistical concepts and do not assume that the data are represented by separate components.

This thesis is based on statistical techniques, which is one of the techniques belongs to Quantitative forecasting technique. The analysis and brief discussion with the key elements of data patterns that are important for understanding the forecasting technique is as follows:

DATA ANALYSIS

Daily customer turn over coming to the Mart in Mirpur Azad Kashmir from 2003 to 2005 are plotted in fig. 1 and 2 using statistical package Minitab, respectively.

The values from the Year 2003 to 2005 are used to develop the trend equation in Fig. 1. Number of customers is the Y or dependent variable and time t is coded as (1st January 2003 =1, and 31st December 2005 = 1096) or the independent variable.

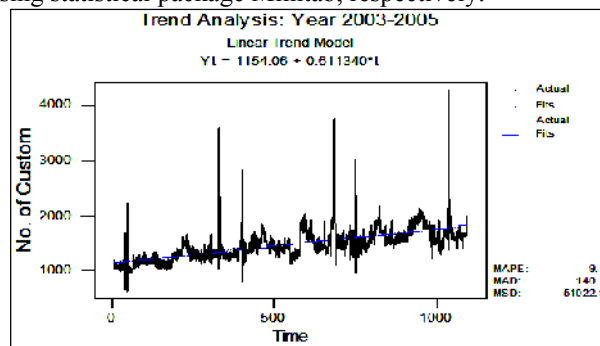


Fig. 1: Trend Analysis “Number of Customers”

The estimated coefficient, $b = 0.61134$ indicates that the number of customers are expected to increase at an average rate of 0.61134 per day or 223 per year.

The values from the Year 2003 to 2005 are used to develop the seasonal variations in Fig. 2. Number of customer is plotted along y-axis and 12 months along x-axis.

The graph showing peak values in the month of august for the year 2003, 2004 and 2005. This type of movement repeating itself year after year is called Seasonal variation.

As the data of the mart has shown both trend and seasonality. The simple forecasting technique applied to this data is “Winter’s Method (Exponential smoothing adjusted for Trend and Seasonal variations)”.

The values from 2003 to 2005 are used to develop the Winters’ Model. Number of customers is the Y or dependent variable and time is coded as t (1st January 2003 = 1, 2nd January 2003 = 2, 3rd January 2003 =3, and so on 31st December 2005 = 1096) or the independent variable.

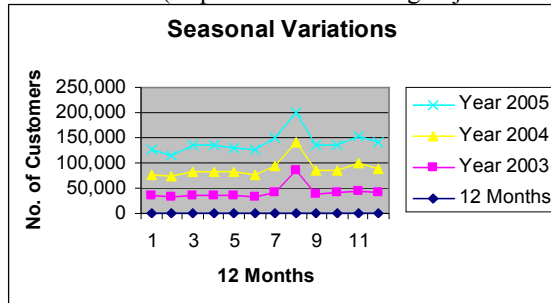


Fig. 2: Seasonal variations “Number of Customers”

Winters’ Model is known as three parameter linear and seasonal exponential smoothing model. This method is based on averaging (smoothing) past values of a series in a decreasing (exponential) manner. The observations are weighted, with more weights being given to the more recent observations. These three parameters are α , β and γ . The value for α smoothed the data to eliminate randomness. The smoothing constant β is like alpha except that it smoothed the trend in the data. The smoothing constant γ is like alpha and beta except that it smoothed the seasonality in the data. The computer program Minitab automatically selected the best smoothing constants as $\alpha = 0.2$, $\beta = 0.2$ and $\gamma = 0.2$ which decrease the MSE i.e. $MSE = 51279.6$. This method gives the forecast value for 1st January 2006 which is 1966.25 numbers of customers.

Another method of forecasting techniques is different from most methods which is called The Box- Jenkins method because it does not assume any particular pattern in the historical data of the series to be forecast. It uses an iterative approach of identifying a possible useful model from a general class of models. A general class of Box- Jenkins models for a satisfactory time series is the ARIMA, or autoregressive integrated moving-average, models. This group of models includes the AR models with only autoregressive terms, the MA models with only moving- average terms, the ARMA models with both autoregressive and moving average terms and the ARIMA models with autoregressive integrated moving average terms. The Box- Jenkins methodology allows the analyst to select the model that best fits the data. Selection of an appropriate model can be made by comparing the distribution of autocorrelation coefficient of the time series being fitted with the theoretical distribution for the various models.

The values from 2003 to 2005 are used to develop the ACF and PACF to identify the suitable ARIMA model. To began the first step in identifying a tentative model by looking at the Autocorrelation of the data for the year 2003-2005 to determine whether the series is stationary. After developing the autocorrelation plot for the original series it was observed that the series were non-stationary. The stationary series have been obtained after taking the first order differences.

By examining the ACF and PACF of the first order differenced series it was suggested that the ARIMA (0,1,2), ARIMA (1,1,0), ARIMA (1,1,2), and ARIMA(1,1,1,) models are the suitable models for the shopping mall, which can be applied one by one to identify an appropriate model with reduced MSE.

A summary of the above mentioned analysis is given in the following table:

Models	MSE	MAPE	MPE	MAD
Winters' Model	51279	9.3	-1.09054	139.4
ARIMA (0,1,2)	38056	7.059	-0.928	106.658
ARIMA (1,1,0)	42640	7.241	-0.930	108.131
ARIMA (1,1,2)	38366	7.004	-0.946	105.976
ARIMA (1,1,1)	37987	7.054	-0.9259	106.482

The table shows reveals that ARIMA (1, 1, 1) is the most adequate model for the "Number of Customers".

CONCLUSION

The objective of this study was to forecast customers turn over for the mart. Through analysis, it is observed that the customers turn over of the mart has an upward trend and contains seasonality. As the data shows both trend and seasonality, the simple forecasting technique applied to this data is "Winter's Method".

Box-Jenkins Methodology has also been applied to the data. All the ARIMA models, considered, have turned out to be better than the Winters' Method. The most adequate model using the Box-Jenkins methodology, for this data, is found to be ARIMA (1,1,1).

REFERENCES

1. Charles Dennis; John Murphy; David Marsland; Tony Cockett; and Tara Patel (2002). *Consumer Behavior; Market Research; Retail Marketing*.
2. Elizabeth Howard (1992). *Evaluating the success of out-of-town regional shopping centers*.
3. Dennis C.E., Murphy J., Marsland D., Cockett T. and Patel T. (2002). *Measuring Brand Image: Shopping Centre Case Studies*.
4. Charles Dennis, David Marsland and Tony Cockett (2002). *Central place practice: shopping centre attractiveness measures, hinterland boundaries and the UK retail hierarchy*.^{*1}
5. Hanke J.E. and Reitsch A.G.(1998). *Business Forecasting*. 6th Edition. Prentice-Hall, New Jersey.
6. David M.L., Timothy C.K. and Mark L.B. (2003). *Business Statistics (3rd edition) A first course*, Pearson' s Education, Inc.
7. Amir D.A. and Sounderpandi J. (2002). *Business Statistics (International Edition) (5th edition)* Published by McGraw-Hill/Irwin, a business unit of the McGraw-Hill companies, Inc., New York.
8. McGraw-Hill, L. Bowerman B.L. and O'Connell R.T. (2003). *Business Statistics in Practice (International Edition) (3rd edition)* Published by McGraw-Hill/Irwin, a business unit of the McGraw-Hill companies, Inc., New York.
9. www.forecasting methods.com
10. www.business forecasting.com
11. www.averaging methods.com, last referred in October 10th, 2006.
12. www.smoothing methods.com, last referred in October 12th, 2006.
13. www.Box-Jenkins methodology.com, last referred in October 12th, 2006.
14. www.seasonality in data.com, last referred in October 24th, 2006.
15. www.autocorrelation function.com, last referred in October 28th, 2006.
16. www.partial autocorrelation function.com, last referred in October 12th, 2006.
17. www.holts method.com, last referred in October 15th, 2006.
18. www.winters method.com, last referred in October 18th, 2006.

ECONOMETRIC ANALYSIS OF INCOME OF NOMADS IN IRRIGATED AREAS OF CHOLISTAN DESERT

Mariam Abbas¹, Karamat Ali¹ and Jamal Abdul Nasir²

¹ Department of Economics, The Islamia University of
Bahawalpur. Email: ma_eco@hotmail.com

² Department of Statistics, The Islamia University of
Bahawalpur. Email: njamal76@hotmail.com

ABSTRACT

Economy of any rural areas depends on different types of economic indicators. The economic indicators which affect the income of nomads in Cholistan Desert are described in this paper. Economy of the nomads of Cholistan desert can be divided in to two parts, i) economy of the nomads when they stay in the desert and ii) economy of the nomads when they are at irrigated areas. Nomads earns more income in irrigated areas as 71% earn their income in the range of Rs. 1,00,100/- to 2,00,00/-. The present study revealed about the factors which influence the income of nomads in irrigated areas of Cholistan Desert. The study was econometric and income is estimated by using Binary Logistic Regression Model on 200 sample data taken from ten different villages of Cholistan Desert.

INTRODUCTION

More than 45% people in Pakistan generate income from agriculture sector and the cultivable wasteland in Cholistan (Bahawalpur and Rahimyarkhan,) is 6.6 million acres with 1.2 million inhabitants. Since 1978, only 350000 acres were allotted to its 30000 applicants while 5784 applications are still pending. All the people who were allotted the lands are now in better economic conditions as compared to the majority of the poor landless 'Rohailas' (Cholistan). The allotment of the land is banned regardless of the promises and commitments made by the successive governments to allot the land to the landless 'Rohailas'. It seems that the government wants to bring these 'Rohailas' and people in other parts of the country to the same fate as of tenants in 'Pirowa'l and 'Okara' (Roshan, 2006).

The economy of nomads of Cholistan Desert entirely depends on fragile and meager natural resources associated with inconsistent rain pattern. Job opportunities are confined to labour in agricultural fields or other minor activities due to lack of education or skilled training. In Cholistan desert most of the nomads live below poverty line in the absence of basic human needs like clean drinking water or sufficient food, health and education for their children. Livestock breeding, improvement of performance or range management is not practiced scientifically (Sharif, 2003).

The total human population of Cholistan desert is around 120,000. The economy of the region is predominantly pastoral. People have practiced a nomadic life style for centuries. Large herds of camels, cattle's, sheep, and goats are owned by the nomads. The

area is not served by modern communication system and can be traversed by either camels or jeeps. Local people use camels as a mode of transportation. Habitations are small and extremely scattered (Ahmad, 2002).

The nomads and their herds return back to the desert around July or August with the news of first monsoon showers. Distance traveled during this migration varies 10 to 100 Km. While in the desert natural vegetation is the main source of feed for grazing livestock. Tobas serves as drinking water both for nomads and their livestock. Tobas are made in clayey that locally called dahars in catchments area to avoid heavy water percolation. Tobas belonging to the same clan are generally located to each (often 1 Km radius). At the start of the rainy season, livestock graze with in one or 2 km radius of each Toba. This distance increase about 15 km as the season progress. During October and November, when water resources become almost totally depleted, each clan moves its herds to semi-permanent centers equipped with a serious of traditional (hand-dug and unlined) wells and kunds (usually lined) (FAO 1993).

The nomads manage their mixed livestock in such a way that milking cows are moved near by the urban centers where milk is sold readily while other animals like camels, goats, sheep and bullocks are kept in the desert for grazing. Nomads attach high values to their herds. Livestock are the main source of their survival and a number of cultural norms are frequently used meat, milk and gifts. Communal ceremonies like weddings, funerals, and tribal celebrations include slaughtering and exchange of animals. A person's status in the desert nomadic life style is chiefly represented by the size of the herds he owns. (Arshad, et al. 1999).

OBJECTIVES

Keeping in view the environmental changes in the Cholistan, it is important to study the income of desert dwellers. Such a study could help in formulating the poverty reduction and up lift of Cholistan desert nomads in changed environment. Such a study could also be benefited for NGO's especially which are working for poverty alleviation and socio-economic up lift in Cholistan and build on the existing resources for community development through improvement in infrastructure, job creation and human resource development. However, the main objectives of this study are

1. Evaluate income of nomads of Cholistan Desert to find out economic status in irrigated areas of Cholistan Desert.
2. To find out different sources of income of nomads of Cholistan desert.
3. Find out the major variables effects the income of nomads in irrigated areas of Cholistan Desert.

LITERATURE REVIEW

Khan et al. (1996) examined the factors behind low crop yield in Cholistan. Both the quantitative and qualitative analysis showed how the low levels of agricultural productivity in this area may be linked to material and climatic factors. The quantitative analysis was mainly focused on physical factors. The qualitative analysis, however, emphasises that relative inefficiency of agricultural activity in Cholistan reflected the influence of physical, economic, social and, most importantly, climatic factors.

Ajmal et al. (2001) described the problems and sustainable development of Cholistan desert communities through various resources and sampled the available resources such as vegetation resources, livestock resources, soil resources and water resources.

Sharif (2003) explained that extent, nature, structure and determinants of rural poverty was a pre condition for effective public action to alleviate poverty in rural areas of Pakistan. The major concern of this study was to explore the determinants of poverty in Pakistan with a case study of Cholistan in Bahawalpur district. In this study an attempt was made to analyze the economic, social and demographic characteristics of households in poverty and a detailed poverty profile based on the household survey data of a cluster sample of Cholistan. In addition, the author performed an econometric analysis in terms of income and logistic regression models looking at the determinants of rural poverty for empirical analysis.

Ahmad (2006) described the agro pastoral systems in Cholistan and repeated that the Cholistan desert has extreme summer temperatures (50°C plus) and prolonged droughts rearing is the only age-old profession of the nomad pastoralists of this desert. Pastoral system is characterized by mass migrations of animals and people throughout the year in search of water and forage. The onset of monsoon and the distribution of rainfall mainly dictate the pattern of movement of nomadic herders. Livestock are the main source of their survival and a number of cultural norms are linked with the animals. The major constraints to the nomadic system are very poor quality of drinking water and inadequate feed, both of which are acute during summer.

ECONOMIC INDICATORS OF NOMADS OF CHOLISTAN DESERT

Economy of nomads of Cholistan Desert is influenced by a large number of economic indicators. But only seven indicators are taken in this paper.

- Sex (x1): Male-female ratio is taken there as independent variable, means who are the head of household.
- Age (x2): Age means number of years after born. Age of head of household is taken as independent variable.
- Total Cultivated Land (x3): Total cultivated land means total area used for cultivation of crops. This indicator is very important for the analysis of income because mostly nomads have land but all land is not cultivated due to unavailability of water and unfertile soil. This indicator is taken as independent variable.
- Total Number of Livestock (x4): Total number of livestock means livestock holds by respondent in irrigated areas of Cholistan Desert. It is taken as independent variable.
- Health Status (x5): Health status means health of respondent, it is measured as respondent have any disease or not. It is taken as independent variable.
- Education Status (x6): Education status means education of respondent and it is measured as respondent can read and write or not. It is taken as independent variable.
- Income in Irrigated Areas (y): Income in irrigated areas means annual income of respondent earned from different sources in irrigated areas of Cholistan Desert. It is taken as dependent variable.

MATERIALS AND METHODS

An overwhelmingly large part of study is based on the primary source of data. The present study is primary based on the household survey data as collected by the author during April-September 2007. The household survey was conducted and information recorded from two hundred household in a cluster sample of Cholistan consisting on ten villages (Chaks). A two-stage Area sampling was used, at first stage households was selected and at the second stage the male as a head of household was interviewed.

Primary data on economic conditions of nomad's pastorals of Cholistan desert was collected by interview technique by going door to door in Cholistan desert and the interview schedule was a set of Questions in a Questionnaire form which has been filled by the interviewer. In this study, major emphasis is on the analysis of economy of nomad pastorals by econometric analysis of income of nomads in irrigated areas of Cholistan Desert.

LOGISTIC REGRESSION ANALYSIS

The dependent variable in logistic regression is usually dichotomous, that is, the dependent variable can take the value 1 with a probability of success θ or the value 0 with probability of failure $1-\theta$. Consider a collection of k independent indicators, thus the general form of the Logistic regression is

$$\theta(x) = \frac{e^{(\alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k)}}{1 + e^{(\alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k)}} \quad (1)$$

where α = the constants of the equation and β = the coefficient of the predictor variables. The log odds has the linear relationship

$$\text{Logit} [\theta(x)] = \text{Log} [\theta(x)/(1-\theta(x))] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k \quad (2)$$

Logistic regression calculates the probability of success over the probability of failure, therefore, the result of the analysis are in the form of an odds ratio.

STRATEGIES IN MODEL SELECTION

As we have number of explanatory variables that should include all the important (influential) factors, but the actual subset of predictor variables that should be used in the model need to be determined. When the number of variables increases, the selection process becomes harder. Fitting all possible models is impractical when the number of dimensions exceeds three, and it helps to have guidelines.

Stepwise selection of variables has been widely used in linear regression. Most major software packages have either a separate program or an option to perform this type of analysis. At one time, stepwise regression was an extremely popular method for model building. Methodology for performing stepwise logistic regression has been available for much less time [Hosmer, wang, Lin, and Lemeshow (1978)]. Among major software

packages only BDMP offers a program for stepwise logistic regression. We feel that the procedure provides a useful and effective data analysis tool.

Any stepwise procedure for selection or deletion of variables from a model is based on a statistical algorithm which checks for the “importance” of variables, and either includes or excludes them on the basis of fixed decision rule. The “importance” of a variable is defined in terms of a measure of the statistical significance of the coefficient for the variable.

RESULTS AND DISCUSSION

The results showed that there are three major sources of income in irrigated areas of Cholistan desert i.e. crops, livestock and embroidery. Other sources included jobs in different sectors, like teaching in schools or in government institutes, labor with the farmer or in some factories etc. Sources of income along with income generated from these sources by nomads of Cholistan desert in irrigated areas are incorporated in table 1.

Table 1:
Sources and annual income (Rs.) of nomads in irrigated areas of Cholistan desert

Sr. No.	Sources of Income(Rs.)	Average Income(Rs.)	Maximum Income(Rs.)	Minimum Income(Rs.)
1	Crops	78113.6	685000	200
2	Livestock	81805.7	888000	1000
3	Embroidery	7895.01	150000	0
4	Other Sources	11739.5	100000	0

Source: Survey

Maximum average annual income is earned from livestock, crops and other sources and minimum average annual income is generated by embroidery. So far as range of average annual income is concerned, the income from livestock ranged from Rs.1000/- to Rs.8,88,000/-, from crops range of income was Rs.200/- to 6,85,000, from embroidery the annual average income was Rs.0.00 to Rs.1,50,000/- and from other sources the average annual income ranged from Rs.0.00 to Rs.1,00,000/- .

Livestock in irrigated areas include cattle, buffaloes, sheep, goats and camels. Populations of livestock in irrigated areas are described in table 2. Maximum numbers of animals (500) were recorded by sheep and goats and minimum (40) by camels, whereas population of animals recorded by cattle was 150 and buffaloes 170.

Table 2:
Number of Livestock in Irrigated areas

Sr. No.	Livestock	Maximum	Minimum	Average
1	Cattle	150	0	6
2	Buffalos	170	0	6
3	Sheep	500	0	17
4	Goats	500	0	34
5	Camels	40	0	1

Source: Survey

Nomads of Cholistan desert generate income from different products of livestock like milk, wool, goat hairs, and meat. During the drought period (environmental stress) the nomads of Cholistan desert sell almost half of their livestock for the safety of their income.

Second major source of income in irrigated areas is by crop production. Table 3 showed that major crop cultivated in irrigated area is wheat and 35% people of the area are directly involved in the production of wheat and remaining is indirectly involved. Other crops grown in the area are cotton, sugarcane and mustard. These crops are grown in different groups and 43% people of the area select different groups of crops for their income.

Table 3:
Majors crops cultivated in irrigated areas of Cholistan Desert.

Sr. No.	Group of Crops	Frequency	Percentage
1	Wheat	69	34.5
2	Mustard	5	2.5
3	Mustard, Sugarcane	7	3.5
4	Wheat, mustard, cotton, sugarcane	86	43
5	Wheat, mustard, cotton	10	11
6	Wheat, Sugarcane	4	2
7	Wheat, Cotton, Sugarcane	18	9
	Total	200	100

Source: Survey

ECONOMETRIC ANALYSIS OF INCOME

Logistic Regression Model (Backward Stepwise Regression Method)

Model	Variables	Co-efficient	S.E	p-value	OR
Income in Irrigated Areas	Total cultivated land	0.069	0.034	0.042	1.072 (1.002--1.146)
	Health Status	-1.169	0.392	0.003	0.311 (0.144--0.669)
	Education Status	1.159	0.32	0	3.187 (1.703--5.964)
	Constant	-790	4.29	0.038	0.454

OR: Odd Ratio, S.E: Standard Error, C.I: Class Interval, P-value: Level of Significance

In irrigated areas income of respondent is highly affected by three variables as shown in model, total cultivated area, health and education status of respondent remaining variables was excluded from the model by using stepwise regression method. Respondent have more cultivated area, earn more income. Similarly health and education shows positive affect on the income of respondent. Income of educated people in irrigated areas is 3.0 times more than uneducated people. Sex and age are used as independent variable in model, showing minimum effects on the income of respondent in irrigated areas.

Major indicators highly effect the income of respondent in irrigated areas are total cultivated land, more area cultivated by respondent showed more income, similarly respondent with better health and education showed high level of income.

CONCLUDING REMARKS

Economy of the nomads of Cholistan desert can be divided in to two parts, economy of the nomads when they stay in the desert and economy of the nomads when they are at irrigated areas. Sources of income in irrigated areas are more like Crops production, livestock production, embroidery, job in different sector etc. But in desert areas the nomads have only two sources of income i.e.' Khar' Production and livestock production. Livestock production is the same source of income by which the nomads benefits, either they are in irrigated areas or in desert areas. There all the income of nomads in irrigated areas is better than that of desert areas and expenditures are higher. As main source of income in irrigated areas is livestock and for free grazing of livestock nomads move towards desert, there livestock on highly nutritious grasses and shrubs. When these are at irrigated areas they fed fodder crop and become a bigger source of income and boost the economy of nomads staying at irrigated areas.

Cholistan desert is one of the most under-developed and highly degraded region of the country. The people lack even basic amenities of life. Their socio-economic profile is nomadic pastoral and livestock production is the major economic activity. Scarcity of water and lack of adequate infrastructure are among the major constraints for the development of this arid tract. Lack of roads and communication has hampered the development of this area by making its accessibility very difficult for the people and officials.

Sample population showed that male is dominant as a head of household in Cholistan desert. Male-female ratio as a head of household play an important role to earn income in desert areas as males play effective role to graze their livestock as compared to females.

Age of the household head ranged between 31 to 45 years is common in this Cholistan desert. Respondent with this age group showed better health and health plays a very important role to earn more income.

Seventy one percents nomads staying at cultivated lands, earn their income from cultivating crops along with livestock keeping which ranged between Rs. 1,00,100/- to 2,00,000/- and their expenditures are in the range of Rs20,100/- to 35,000/-.

Crop production, being the second major source of income of nomadic pastoralist after allotment of lands by government. Pastoral nomadism is not only an environmental sustainable way of managing Cholistan desert dry lands but it could support national dairy and meat consumption requirements.

RECOMMENDATIONS

Special attention should be given towards education because education will help in providing awareness among the people. Schools should be opened in each village and all facilities should be provided to attract students towards education which ultimately boost up the income of nomads of cholistan desert.

Vegetation resources available in Cholistan desert are insufficient and it is recommended that these resources should be enhanced for the healthy livestock of desert dwellers. Ultimately, it will help in increasing the income of the Cholastani people.

Expansion of national health, education, population and nutrition programs that include services to the population of Cholistan desert and a focus on primary services.

ACKNOWLEDGEMENT

It is matter of great pleasure to express my cordial gratitude and thanks to Dr. Muhammad Arshad, Deputy Director, Cholistan Institute of Desert Studies, for his extraordinary, wise and pain taking guidance that he has so generously given throughout this research work.

REFERENCES

1. Ahmad, F. (2002). *Socio-economic dimensions and ecological destruction in Cholistan*. Ph.D. Thesis, Department of Geography, University of Karachi, Pakistan.
2. Ahmed, F. (2005). Agro-Pastoral Systems in Cholistan. *Pakistan Geographical Review*, 60(2), 65-69.
3. Ahmad, F. (2006). *Agro-pastoral Systems in Cholistan*. http://www.isdehs.com/html/2006_098.html.
4. Arshad, M.; Roa, A.R. and Akbar, G. (1999). Master of disaster in cholistan desert, Pakistan: Patterns of Nomadic migration. *UNEP Desertification Control Bulletin*. 35, 33-38.
5. Khan, A. and Anania, R. (1996). Productivity Constraints of Cholistani Farmers. *The Pakistan Development Review*, 35(4).
6. Roshan, M. (2003). Corporate Agriculture Farming: Damaging interests of small farmers. *SDPI Research and News Bulletin*, 10(2).
7. Sharif, C.I. (2003). *An Empirical Analysis of the Determinants of Rural Poverty in Pakistan: A case study of Bahawalpur District with special reference to Cholistan*. Ph.D. Thesis, Bahaddun Zakriya University, Multan.

REVOLUTIONARY CHANGES GIVE SUPREMACY TO HRM IN PAKISTAN

Zareen Abbasi¹, Seema Khoja² and F.M. Shaikh³

¹ Department of Public Administration, University of Sindh,
Jamshoro. Email: zareenabbassi@hotmail.com

² Department of Economics, University of Sindh,
Jamshoro. Email: seemakhoja101@hotmail.com

³ ZABAC-Dokri, Email: faizshaikh@hotmail.com

ABSTRACT

The trade application of sovereignty is departing an impression on HRM plus HR. In the midst of competition, in the environs or worldwide, business must turn into more workable, flexible and approachable to thrive. In this milieu of change, HR can take part in the role of a strategic collaborator, an employee follower, supporter and a change agent within the business. In order to accomplish greatly, HR must enclose a methodical notion of the organization's gigantic image and be able to manipulate key judgment and procedures. HR can meet up the challenges of workplace assortment, prompt HR through gain-sharing and accomplish information scheme through appropriate improvement. Systematize and foremost scheming of HR cope HRM utility by means of change management.

Key Words: HRM, Revolutionary, supremacy

INTRODUCTION

The current century is a means of change and by change, business has become more spirited. The main linchpin of today's organizational philosophy lies in unending change i.e. change in qualities, labor, cost, productivity and abilities as well as capabilities of HR. The central aim of the HRM is to merge all HR actions into a prearranged and incorporated agenda to meet the strategic objectives of a venture. Therefore if we wish to stay alive in the epoch of rivalry we should take up tag on the HRM in civic and hush-hush business.

The concept of HRM has emerged as a tool to develop HR at work properly and methodically so that HR at work could be utilized at maximum level to attain the utmost target and purposes of business. In the current epoch, the center of today's HR manager is on tactical workforce custody plus ability improvement.

The HR manager will also promote and fight for ethics, principles, values, and holiness inside their organizations, above all in the administrative center. Jamboree or keeping first-rate populace is significant for the triumph of every business, weather condition, and turnover or nonprofit, public or private.¹ The HRM progression helps job Valuation, aim setting and compensation of presentation. It enhances their fragile input and contentment by knowing just what is projected from them in their profession.² The HR of an organization consists of all populace who act upon its actions.³ HRM can

sensibly facilitate organization and pull off a great deal of achievement by first-rate training and running high-quality natives. The charge of supervising nation in today's world of work is mostly tricky in the light of change in efficiency improvement. It is said that change management is ongoing method by which organizations appreciate, predict and communicate the crash of changes in organization makeup, progression, dealings, goods or services. Pakistan's prearranged intricate socio-cultural density is not a serious barrier rather ineffective management and organization costs Pakistan dear.⁴

The effective HR factors include those persons who are willing to chip in for its wealth and welfare. Lack of an occupational skill, poor health, paucity of opportunity to work and other miscellaneous causes may contribute in ordinarily high percentage of ineffectiveness by refusing to employ those people who could be productive. In practice HRM achieve its purpose by meeting objectives. Objectives are benchmarked against which actions are evaluated. Managers express objectives sometimes in writing to guide the HR managers to functions and to face challenges. The failure of an organization is to utilize their resources in unprincipled ways may result in destruction. HRM is not an end itself; it is only means to assist the organization with its primary objectives.

There are countless outsized organizations that distinguish their commitment to have the paramount practice in HR but sadly fall short to transport produce. Many organizations preach genuinely and honestly that they practice and care staff policy. Sadly, Pakistan's outmoded educational infrastructure has fallen through and needed to re-orientate and train youth with job-related skills. Tutoring has a second-rate correlation to future jobs. Loads of undergraduate who have no handiness but the grade results annoyance and sky-scraping brain drain. Extraordinary encouragement in salary has been provided to magnetize overseas Pakistanis reverse to the country. It departs devoid of motto that our juvenile HR can be ideal in their field through training. With these sorts of thoroughgoing measures, organizations will strive to restore nation of competitiveness and assist answering its continued prosperity in the new millennium.

The post has the spirit of socio-economic and cultural transformation in Pakistan. The parallel is drawn between the size of post and pre independence organization. Their pre-independence size is much smaller than today's establishment with operational activities. These organizations follow commencement of the process of modernizing society that in turn effect growth and modification. Gone are days when adequate, qualified candidates were not available in required numbers to fill in a vacancy in Pakistani organizations. Currently the expansion in the educational facilities during the last quarter of the century has changed the situation. HRM practices and policies translate change as employee commitment into opportunity and enabling the organization better.

In Pakistan, it would be fair to say that the multinational organizations remain in the forefront of HRM. This is primarily due to the global approach of the organization filtering to Pakistan. Functioning in HRM is satisfying and worthwhile to input the development of individual's potential and advancement is reward in itself. It is this reward that makes the job valuable. HR is the dynamic asset but government of Pakistan has unsuccessful to recognize this. This is not astonishing since opponents of literary of the general populace exist within the top echelons of Pakistan, today. Output maturity of HR depends upon job training programs. The other important factor is the workers

cultural outlook and attitudes towards work and desire for self-improvement. It is now fully realized that HR is abundantly available but incapable of providing a guaranteed economic and social progress for country than there is a need to build HR on sound lines. It is a well known fact that the real development of HR calls for a multifaceted action, in all directions like education, literacy, technical skill, health, food, housing, intellect and culture. The HR in Pakistan is the best in the world. If we motivate these human talent and potentialities in all the walks of life we can manage to identify ourselves with the modern world and we can face all the overwhelmingly challenges.

In this scenario the role of HRM will definitely signify managers to take a lead role in organization's decision-making. Change dictates modern ways of perception and new frames of references and desired skills of managers will be competent agent of change. The acute deficiency of change management and HRM tools, techniques and procedures in Pakistani organizations is creating inefficiency, ineffectiveness and loss of productivity at upper, middle and lower level management.

Pakistan is blessed with huge HR but our savings and investment level can be raised only when we are in a position to convert our unproductive and underutilized HR into potential accelerator of economic growth. Today, we are trying hard to catch up quickly with the high standards of living through industrial and technological revolution but because of short supply of trained manpower this is not possible.⁵ In Pakistan the problem is not the lack of HR but accepting the need of HR for proper HRM. HR level can be improved on the job training, attendance in regular courses, setting up of paramount training centers or sending the cadre to similar setups already working in the market.⁶ Rapid acceleration of economy is a thorny affair without proper HR improvement.

CONCLUSION

Blissful fate of a nation is directly proportional to qualified generations. It stands to reason that quality and quantity means learning. This problem goes from bad to worse as undue external pressure nepotism, favoritism posts undue and unworthy and pseudo-talent at the cost of potential candidates. To avoid applicant's adjustment in blatant defiance of external pressure on the recruitment process, organization must methodize antitrust strategy and design ways and means to minimize the adverse impact in this overly globalize age. Healthy and educated HR is a pre-requisite for sustainable economic growth in Pakistan but it is much slower as compared to the developed countries. Pakistan is blessed with high quality of HR. The people are energetic and workers are devoted. Pakistan has required value, pledge and will to hit. In this perspective, HR is amply chipping in for the transformation of Pakistan from an underdeveloped country to potentially prosperous nation. Only proper guidance and necessary assistance is required to multiply the capabilities to increase the output. Pakistan's HR has evolutionary thinking. Changed time also requires a change in thinking. A sizeable share of budget is hoped to earmark for the development of HR in Pakistan and a change will be visible in near future and country would walk on the road to progress and prosperity. Pakistan, being a labor surplus economy with a high population rate, low literacy level, poor skill and technological base has eventuated in critical imbalances in the development of HR.⁷ Pakistan needs renewed and persevering efforts for building physical infrastructure, development of HR and environment protection while maintaining macro economic stability and self-reliance.

REFERENCES

1. Decenzo, D.A. and Stephen, P.R. (1998). *Personnel/HRM*. New Delhi: Prentice Hall of India. P. 3.
2. Shirazi, Yousif H. (2001). *Human Resource Management in corporate sector*. Harvard Business Review, Dawn. , (7th-13th May) P. IV.
3. Ulrich, D. and D. Lake. (1987). *Organization's capability competing from the inside out*. New York: John Wiley & Sons.
4. Afghan, Nasir (1999). *Business organization of the future*. *Economic and Business Review*. Dawn (May-June).
5. Abbass, Anwar (1990). *A case for Human Resource Development*. *Economic and Business Review*, Dawn (13th Dec).
6. Cheema, T.B. (2004). *Human Resources Development in utilities*. *Economic and Business Review*, Dawn. (March 22nd) P. VI.
7. Iqbal, M. (2001). *Change the only constant*. *Economic and Business Review*, Dawn. (10th July) 29-32.

BIBLIOGRAPHY

1. Beardwell, I. and Len, H. (1994). *Human Resources Management: A contemporary perspective*. Singapore: Pitman Publishing.
2. Carnall, C. (1990). *Managing change in organizations*. Prentice Hall, Herts, New Jersey.
3. Certo, S.C. (1985). *Management of organization and Human Resources*. Dubuque: W.M. C., Brown Publishers.
4. Holley, W.H. and Kenneth, M.J. (1987). *Personnel/Human Resources Management*. Chicago, IL: the Dryden Press.
5. Hrosenbroc, H. (1983). *Human Resources and technology*. Manchester University, UK: McMillan Press Ltd. Hong Kong.
6. *Human Resource Development needs renewed efforts*. (1991, 22nd May). Dawn.
7. *Human Resources Development and UNDP*. Dawn. (1986, 7th Dec).
8. Jdudeja, V.D. (2000). *Human Resources Management and Development*. New Delhi: Common Wealth Publications.
9. Kanter, R. (1991). Championing change. *Harvard Business Review*. 69(1).
10. Kotter, J. and Schlesinger, L. (1979). Choosing strategies for change. *Harvard Business Review*, 57.
11. Mohammad, I. (2001). *Change the only constant element*. Dawn. (10th July).
12. Rizvi, S.R. (1992). *Human Resources Management*. Dawn. (7th March).
13. Schuler, R.S. (1996). *Managing Human Resources*. Ohio: Southwestern Publishing College.
14. Storey, J. (1989). *New perspectives on Human Resource Management*. Routledge, London.
15. Wreather, W.B. and Davis, K. (1993). *Human Resources and Personnel Management*. New York: McGraw Hills Inc. P. 10.

**ROLE OF GLOBALIZATION IN POVERTY ALLEVIATION
OF PAKISTAN BY USING CGE MODEL**

F.M. Shaikh

ZABAC, Dokri, Sindh. Email: faizshaikh@hotmail.com

ABSTRACT

Globalization the growing integration of economies and societies around the world has been one of the most hotly debated topics in international economics over the past few years. Pakistan is one of the developing countries that adopted the economic policies similar to India and other South-east countries and tries to evaluate these policies with the passage of time. Recent wave of globalization has a positive impact on the Pakistan's economy and economic growth has been increased. The main objectives of this research are to provide detailed overview of economic reforms in the last decade by using the General Equilibrium Model. It was revealed that from last decade, globalization has positively revolutionized the economy of Pakistan. The Global trade analysis Purdue (GTAP) model is used to analyze the possible impact of Globalization on Pakistan's economy in a multi-country, multi-sector applied General Equilibrium frame work. After employing the simplified static analysis framework based on simulations reveal that Globalization and FDI have influenced positively on the economy of Pakistan. The general inflation rate is decreased and living standard is increased in urban areas. Employment opportunities are also increasing due to the investment made by the FDI and as for as cultural context is concerned, Pakistani people are more reluctant to reduce the traditional cultural barriers. On the contrary side, other consumer items like leather-made and cotton-made garments will expand after the FTA and consumer surplus will increase. This perspective enables us to identify new challenges in the global economy and to identify the multiple routes through which power and resource inequalities are reproduced within it. More positively, it helps to identify new opportunities and routes to challenging these inequalities. The application of this perspective to the impact of the rapidly-growing economy in real increase in terms of trade.

Key Words: Globalization, Economy, CGE Model, Pakistan.

INTRODUCTION

Globalization is an umbrella term that describes an ongoing process of establishing various personal, cultural, and business relationships with other countries. This process embodies an increasing view of the world as a community. People and companies are interacting with others in different countries more than ever before. This includes personal communication between people that live on the other side of the world from each other. Companies are now striving to open markets in developing countries, instead of only delivering products and services domestically. (Technology is beginning to expand across nations. Information is being shared with a multitude of people throughout the world in a fraction of the time that it would take to contact someone down the hall from your office. There is a growing interdependence of one country on another. The process of globalization

appears to be accelerating and growing rapidly. As time continues to pass, it appears that we are moving to a world where the lines that divide one country from another will begin to blur and eventually fade away entirely. Globalization – the growing integration of economies and societies around the world – has been one of the most hotly-debated topics in international economics over the past few years. Rapid growth and poverty reduction in China, India, and other countries that were poor 20 years ago, has been a positive aspect of globalization. But globalization has also generated significant international opposition over concerns that it has increased inequality and environmental degradation. This site provides access to some of the most recent presentations on globalization and some of the leading research on the subject. Globalization is a term that is used to describe the changing world order in which various aspects of a nation that include the economic, social, political, cultural and environmental factors are viewed as being part of a global community and not restricted in their scope.

In the area of employment creation, extrapolation from various sources suggests a possible direct employment effect of Globalization in developing countries of around 26 million jobs in 1997. Estimates of the indirect employment effect of FDI vary widely around a multiplier of 1.6 (i.e. 1.6 indirect jobs for every one direct job). Also, foreign-invested enterprises (FIEs) do generally pay higher wages than domestic companies, and even in low-wage, labor-intensive industries, FIE jobs are often considered better than the alternatives of unemployment or underemployment. However, investments in different industries clearly have different job-creation propensities which policymakers need to take into consideration. There is also an increasing recognition that ways of harnessing FDI to support small and medium enterprise (SME) sectors in developing countries, and associated employment creation, remain under-exploited. (*Heien, D, and Wessells, C.R. et al. 1990*) regarding employment practices, a key issue is the effect of FDI on female participation in the labor force. On the one hand, greater female employment at FIEs, in addition to helping level the playing field in terms of employment opportunities, results in a direct increase in household income and a higher proportion of income expended on meeting basic family needs. On the other hand, women are often paid less than men in comparable jobs, isolated from mainstream job advancement opportunities, and subject to greater employment instability.

**Foreign Direct Investment in Different Sectors, Sector wise
Distribution of FDI in Pakistan (1990-2006).**

Country	2002-03	2003-04	2004-05	2005-06	2006-07
	% age	% age	% age	% age	% age
U.S.A.	26.51	25.1	21.4	14.7	24.5
U.K.	27.49	6.8	11.9	6.9	23.3
U.A.E.	15.00	14.2	24.1	40.5	14.1
Switzerland	-	21.6	9.0	4.8	6.2
Netherlands	-	-	2.4	-	3.0
Mauritius	-	-	-	-	2.1
Saudi Arabia	5.45	-	-	7.9	-
Norway	-	15.4	-	7.2	-
Japan	1.77	1.6	3.0	-	-
Others	23.78	15.2	28.2	18	26.8
Total	100	100	100	100	100.0

Poverty in Pakistan is an increasing social problem and represents the critical challenge to be addressed by the Government of Pakistan. It is estimated that about 32% of Pakistan's population are below the food poverty line rising from a level of 26% in 1988 (GoP, 2002), and about 44% are below the poverty line on the human poverty index (UNDP, 2002).

MODEL: The Micro simulation method proposed in this paper relationship of both a CGE model and Household model. What distinguish from this model from the work of (Janvry *et al* .1992), (Ajitha *et at* 2004-05) and (Bourguignon *et al* 2000). Is its bi directional relationship. The model line Globalization and its impact on economy of Pakistan and poverty on both household and rural spending.

DESCRIPTION OF THE MODEL

MODEL 1. Globalization Impact on Economy of Pakistan

Computable General Equilibrium Model (CGE).

To compare the impact of Globalization on rural and urban population we started with the simple model, which however integers all the standard characteristics of the CGE model of small under developed country. The demand system is derived from the Cobb Douglas utility function with two factors of Globalization and poverty relationship. Regarding the household model we have an income function consisting of rural projects of FDI and their general impact on the rural households on consumption.

$$\lambda_i, \Pr(Y_i = y_i | x_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!}, y_i = 0, 1, 2, \dots$$

$$z_i = \frac{\left[(y_i - \hat{\mu}_i)^2 - y_i \right]}{\sqrt{2\hat{\mu}_i}} \text{ on } w_j = \frac{g(\hat{\mu}_i)}{\sqrt{2\hat{\mu}_i}}; i$$

$$\text{Var}(y_i | x_i) = (1 + \alpha \exp(x'_i \beta)) \exp(x'_i \beta)$$

λ_i = Measures the i th globalization impact (%) in the food intake
for Y_i = Calories, Protein and iron.

P_n = Measures the Economic impact of Globalization

Y_i = Aggregate output (kg) for the household.

Z_i = Vector of productive resources

Var = Real food expenditure.

RESULTS ANALYSIS OF HOUSEHOLD MODEL

We only performed one simulation to illustrate the approach's contribution. Different simulation has been tested to verify weather the conclusions reached in terms of impact of Globalization on Pakistan's economy.

Model-1. Globalization and Impact on Economy of Pakistan

Variables	Base Value	Model .1-AR	Rural	Model 2 RH	Urban Poverty	Model U-C	Change
W1 Formal Wages	0.5	-0.76	-0.05	-0.5	+0.1	0.5	0.5
W2 Informal wages	0.1	NA	NA	NA	NA	NA	NA
Mps Marginal propensity to save	0.1	0.5	-0.2	0.3	+0.5	+ 0.6	0.6
FDI Foreign direct investment	20900000	0.3	-0.4	-0.6	+0.54	0.58	0.5
GDP Gross domestic Product	15265435.1	0.01	-0.2S	-0.5	+0.57	0.57	0.33
Rh Rural household consumption	1455676776	0.25	0.24	-0.25	+0.787	0.56	0.44
Uc Urban house hold consumption	324355455	0.55	0.88	-0.25	+0.75	0.88	0.55

Women's education results indicate significant positive effects on the overall household food production in Shikarpur and Sukkur. Educated women have a capacity to process and apply the information passed to them, such as better farm methods and seed selection. Overall, the primary education of the woman had a higher impact on household food production than the other variables in the case of Sukkur. Women's education affected not only household food production but also food security. Unlike the consumption side of the model, time spent on the productive activities by a woman was positive and significantly affected household food production expect for Sukkur. The impact was slightly higher for Khairpur. Despite differences in signs time spent on production activities by a rural woman affects both her household production and consumption decisions. A joint test on all women-specific variables was statistically significant (p -value < 0.088) for all districts. The elasticity with respect to the time a man spent on productive activities was highly significant. The results of labor supply from a non-separable agricultural household model are reported in Table 3. The number of significant variables varied from district to district. More than 50% of the variables were found significant for Jacobabad and Khairpur and only less than 50% for Sukkur.

Results suggest that household size was negative and significantly affected a husband's labor supply in Shikarpur. On the contrary household size was not statistically different from zero in Sukkur and Larkana, although positive. However the consumer worker ratio in the case of Jacobabad increased a husband's labor supply as expected. Results suggest that a woman's access to hired labor significantly increased a husband's labor supply in the case of Khairpur. The reverse was true for Sukkur district. In Shikarpur a woman's access to improved seeds significantly increased the husband's labor supply. In Khairpur a woman's access to credit facilities significantly increased a husband's time. This was contrary to what was observed for a woman labor supply in the same district.

POLICY IMPLICATIONS

The results provide significant implication of Globalization on the rural poverty in Pakistan. No single policy can be prescribed for reducing the rural poverty in Pakistan which is tend to be increasing even though lot more investment made by the FDI. On the

contrast urban population they are getting benefit of the FDI and huge employment and investment in the different sector provides the positive results for the urban population and there is significant change in the production and consumption of urban population.

CONCLUSION

The purpose of this paper to analysis the impact of Globalization on Economy of Pakistan by using CGE frame work. We started with the comparative exercise of Globalization and its role in reducing poverty in Pakistan. The Household Model this model limited only capture the heterogeneity element in household behavior. There are two main factors Globalization and their impact on GDP and economic growth. In the second model linear expenditure system (LES) replaces the demand of system derived from Cobb-Douglas utility function. This exercise highlighted the contribution household disaggregating in the context of CGE modeling exercise and marginal contribution of introducing the heterogeneity elements. According to the results Globalization has significant impact on the economy of Pakistan. CGE Model has been gaining importance in policy analysis of the inequalities of poverty. Globalizations policies can affect in not only improve the economic growth but also help in poverty reduction policies. The task of the policymaker is to coordinate policies affecting the two areas in such a way as to optimize the contribution of Globalization to alleviate poverty in Pakistan.

REFERENCES

1. Ali, R. and Pitkin, B. (1991). Searching for household food security in Africa, *Finance and development*, 28(4), 3-6.
2. Ajitha et al. (2004-05). *Effect of SAFTA on Srilankan Economy*.
3. Asian Development Outlook (2004). *Part 3 Foreign Direct Investment in Developing Asia*.
4. Ayres, W.S. and McCalla, A.F. (1996). *Rural development Agriculture and food security*. www.worldbank.org/fandd/English/1296/articles/021296.htm.
5. Benjamin, J.R. and Wolfe, B.L. More evidence in nutrition demand, income seems over related and women's schooling underemphasized. *Journal of development Economics*, 14, 105-128.
6. *Borenzstein Compare poverty on local levels in Vietnam*.
7. Benjamin (1992). Household Composition, labor markets, and labor demand: testing for separation in Agricultural household models. *Econometrical*, 60(2), 287-322.
8. Bezuneh, M., Deaton, B.J. and Norton, G.W. (1988). Food aid Impact in rural Kenya. *Amer. J. Agri. Econ.* 70(1), 181-191.
9. Bombay T.B. Hill, R.C. Johnson, S.R. (1984). *Advanced Econometric methods*, Springer-Verlag, New York.
10. Carl Aoran et al. (2005). *The effect of FDI on poverty allivation a case of Vietnam*.
11. Caillavet, F., Guyomarrd, Hand Lifran, R. (eds) (1994). *Agricultural Household modeling and family economics*. Elsevier, Amsterdam and Tokyo.
12. Delisle, H., Alladoumgue, M., Begin, F., Nandjingar, K. and Lasoersa, C. (1991). Household food consumption and nutritional Adequacy in Wadi zones of Chad, Central Africa; *Ecology of food and nutrition*. 25(3). 229-248.

13. Economic Survey of Pakistan 2005-06.
14. Federal Bureau of Statistics (2006-07). Various issues causes of rural poverty in Pakistan.
15. Khaleeq Kiani (2005). Factors hindering growth identified: Industrial strategy. *DAWN*, January 14, 2005.
16. Green, W.H. (1997). *Econometric analysis* (3rd ed.) Prentice Hall, New Jersey.
17. Hafiz Mirza (2004). *Regionalization, FDI and Poverty Reduction: Lessons From other ASEAN Countries*.
18. Heien. D. and Wessells, C.R. (1990). Demand System Estimation with micro data: A censored Regression Approach. *Journal of Business and Economic*.
19. Ashfaq H. Khan and Yun-Hwan Kim (1990). Foreign Direct Investment In Pakistan: Policy Issues and Operational Implications. *Economics and Development Resource Centre (EDRC) Report Series No. 66*.
20. South Asia Trade and Investment Forum, 22 – 23rd November 2006 London, UK. Pre-Conference Paper *Investment trend and sector analysis: Bangladesh, Pakistan and Sri Lanka*.
21. Jahangir Alam. *Intra-Regional Foreign Direct Investment-The South Asian Perspective*. Department of Finance and Banking, University of Chittagong, Bangladesh.
22. Zeshan Atique, Mohsin Hasnain Ahmad and Usman Azhar. *The Impact of FDI on Economic Growth under Foreign Trade Regimes: A Case Study of Pakistan*.
23. Rodrik, Dani (1996). Understanding Economic Policy Reform. *Journal of Economic Literature*, Vol. XXXIV(9-41). Soros, G (2002) On Globalization, (New York, Public Affairs).
24. Williamson. J. (1990). The Progress of Policy Reform in Latin America. *Policy Analysis in International Economics*, 28 (Washington, DC: Institute for International Economics).
25. CBTR (2002). *The Impact of Globalization on the Turkish Economy*. Ankara, Turkey.
26. Yeldan Erinç (2007). Kriz Sonrasında Türkiye ve Arjantin (Post-crisis Status of Turkey and Argentina) *Cumhuriyet Newspaper*, June 13th,p.13.
27. <http://www.sbp.org.pk/about/speech/governors/dr.shamshad/2007/Investment-Friendly-Pakistan-22-Feb-07.pdf>
28. http://www.pakboi.gov.pk/FDI/foreign_direct_and_portfolio_i.html
29. <http://www.dawn.com/2005/01/14/ebr2.htm>
30. <http://www.dawn.com/2005/01/14/ebr4.htm>
31. www.finance.gov.pk

THE ROLE OF CULTURE IN ADVERTISING EFFECTIVENESS

Yaseen Ahmed Meenai¹ and Salma Mirza²

Institute of Business Administration (IBA), Karachi, Pakistan

Email: ¹ymeenai@iba.edu.pk; ²smirza@iba.edu.pk

ABSTRACT

This research was aimed at finding out whether culture has any impact on advertising effectiveness and whether different cultural cues should be used in ads targeted towards two different age groups: 18-30 year olds, and 40-50 year olds. A sample in all was used, both males and females belonging to the middle and upper middle income group and belonging to both age groups. The research was supposed to yield significant proof for culture being an important factor in advertising effectiveness, or it had to be observed that either older age group preferred traditional ads and younger age group preferred modern ads and vice versa, or there was no significant difference on these two dimensions- individualistic/ collectivistic, and high context/ low context. Also, the results were not coherent in terms of what the respondents felt and what they actually did.

KEYWORDS

Advertising effectiveness, significant difference, individualistic & collectivistic dimensions.

BACKGROUND

Whether to standardize or localize their advertising messages for target audiences in countries around the world is a question today's marketers are faced with. Since this question is at opposite ends of a continuum, the strategy followed becomes an even more important decision. Culture is one of the fundamental determinants of human behavior and experience and its impact on communication strategies is the greatest. Advertising theorists supporting the localization of messages suggest that advertising is one of the most difficult marketing elements to standardize especially as culture is viewed as all-pervasive (Mueller, 1987). However presenting different advertisements in different countries may confuse customers. Research has shown that standardization of marketing practices is possible given consideration to the product market, and market segmentation.

Globalization is creating an environment of standardization- the phenomenon of "one mould fits all". Many multinational companies fail to adapt to the cultural values of host countries and hence fail to penetrate the market fully. Pakistan, being a country with a very rich cultural heritage and strong cultural values would make an interesting study of how culture affects advertising theme and execution.

What is more interesting is how these cultural values are being affected and "polluted" by the ever increasing influence of western society and way of life. Increasingly eastern cultural values experiencing a shift towards Westernization is commonly found in Pakistan. Traditional, conventional eastern values reflecting collectivism, high context, and family and religious values and these are being replaced by modern, contemporary, and individualistic values.

Our study aimed to find out whether cultural cues affect advertising campaign's effectiveness and which cues are considered important by the two age groups: 18-30 year olds, and 40-50 year olds. This was basically to identify whether different cultural cues should be used in ads targeted towards the two age groups.

LITERATURE REVIEW

With the onset of globalization, many companies prefer to have a standard global marketing mix to ensure consistency and save cost. However, certain variables like advertising have to be adjusted when goods and services cross national boundaries. Beside other reasons, one of the most important has been found to be cultural preferences. Advertising messages should be sensitive to culture and be coherent with local culture (Belk, Bryce and Pollay 1985; Boddewyn, Soehl and Picard 1986; Buzzel 1968; Harris 1984; Hornik 1980; Zhang and Gelb 1996). In a study by Han and Shavitt (2004), it was found that culturally congruent ads are more effective than culturally incongruent ads. Pollay and Gallagher (1990), claim that cultural values are the core of advertising messages and advertisements in turn endorse, glamourize and reinforce cultural values.

Cultural factors affect advertising in four ways, (i) the choice of advertising theme, (ii) the connotation of words and symbols, (iii) the way pictorial conventions are interpreted, and, (iv) media selection (Douglas and Dubois 1977). Cross cultural differences have been found both in terms of advertising theme and execution, where theme is "what is said" and execution is "how it is said" (Cho, Kown, Gentry, Jun and Kropp, 1999). Previously conducted studies on cross cultural advertising have taken two directions. The first took into consideration cultures that were very different in their value systems, representing the contrast between Western and Eastern cultural values (Hong, Mudderisoghu, Zinkhan 1986; Gilly 1988; Tansey, Hyman and Zinkhan 1990). The second focused on cultures with fewer differences (Dowling 1980; Weinberger and Spotts 1989). The results have shown that differences do exist in the types and levels of appeal used across cultures. In the research by Cho et al. (1999), the authors studied the content of the advertisements from the U.S., representing the West, and Korea, representing Asian values, to isolate cultural differences along four dimension; (i) Individualism/ Collectivism, (ii) Time orientation, (iii) relationship with nature, and (iv) Contextuality. Although, U.S. commercials were more centered on individualism in theme and execution, while contrary to prior expectations, Korean ads were not found to reflect greater collectivism. It was hypothesized that U.S. ads would be more future oriented while Korean would be past oriented, based on their respective cultural values, however, both were found to be present oriented. Similarly, ads for both countries did not reflect any significant difference with respect to relationship with nature, with both being in harmony with nature. The most significant difference however was noted in contextuality, where the results matched prior expectations. The U.S., having a low-context culture, the ads were hypothesized to be direct and explicit, while Korea, having a high-context Asian culture was hypothesized to have ads with subtle and implicit appeals, centering on emotions.

In high context cultures, emotional content in ads is used more when ads pertain to products or services considered important in the country's culture. A comparative study between advertisements targeted towards women in Hong Kong and Australia, conducted by So (2004), to explore the cultural impact on advertising targeted towards women, revealed that since cultural similarities existed between the two countries due to their colonial history, the information content in the ads was similar. However, since women in Hong Kong are more image-conscious, bulk of the ads were for beauty and personal care products and carried a high emotional appeal.

The study by Cho et al. (1999) purports that cultural values do affect advertising effectiveness, however, certain dimensions like individualism/collectivism and contextuality are more significant in highlighting cross-cultural differences. However cultural values in a society change over time and the content of advertising is sensitive to and subject to changes in cultural values (Tse, Belk, & Zhou, 1989). Indeed, research in consumer behavior has shown that advertising as a cultural artifact not only transmits and reflects existing values, but also plays a role in shaping new values (Pollay, 1986).

Increasingly, eastern cultural values are experiencing a shift towards Westernization. Traditional, conventional eastern values reflecting collectivism, high context, and family and religious values are being replaced by modern, contemporary, and individualistic values. Fueled by dramatic changes in cultural, economic, and advertising environments, advertising themes in Korea have changed over time to reflect an increased concern with modern-western values. Unlike in the 1960s and 1970s, the main targets of Korean mass media are the younger generations who are better educated, make more money than their parents, and have come of age in an environment of modernization and global marketing (Han & Shavitt, 2004). To explore this, Han and Shavitt (2004) conducted a longitudinal content analysis of Korean ad appeals to examine changes in the extent to which advertising content in Korea reflects its indigenous traditional eastern values- collectivism, humanism, authoritarianism, and tradition versus modern western values- individualism, materialism, equalitarianism, and modernity. Results revealed that, collapsed across time, more Korean ads emphasized modern-western values (53.3%) than traditional-eastern values (29.2%) as ad appeals.

The Pakistani society has also undergone cultural invasion due to globalization and media exposure. This has given rise to different cultural values among today's generation and their parents. Consequently, based on the literature review, these different cultural values are likely to give rise to different perceptions and evaluations of advertisements by the two age groups. This study is an attempt to explore how cultural values have changed over time in Pakistan and their impact on advertising effectiveness.

FINDINGS

HYPOTHESES	RESULTS
H1: More than 70% of the respondents regard culture as a key influencer in advertising campaigns.	Significant. Culture is regarded as a key influencer in advertising campaign.
H2: Advertisements which take into account cultural values have higher recall for both age groups.	Not tested.
H3: Respondents from older age group show greater likeness for collectivistic ads compared to respondents from younger age group who show greater likeness for individualistic ads.	Not significant. P-value= 0.318. There is no association between age and collectivistic/ individualistic dimension
H4: Respondents from older age group respond more favorably to high context ads, while respondents from younger age group respond more favorably to low context ads.	Not significant. P-value= 0.367. There is no association between age and contextual dimension.
H5: Respondents from older age group show greater likeness for ads reflecting traditional Eastern values while respondents from younger age group show greater likeness for modern Western values.	Significant. P-value= 0.001. There is an association. Older people prefer traditional ads while younger people prefer modern ads.

CONCLUSION AND RECOMMENDATIONS

Advertising¹ is one of the oldest forms of public announcement and occupies a vital position in an organization's product mix. It is of great importance in our world of competition. It is important for both seller and buyer. It helps to keep the consumers informed about whatever new products or services are available in the market at their disposal. It helps to spread awareness about products or services that are of some use to consumer and potential buyers.

Advertising should be targeted towards the prospective audience in such a way that it forms a positive impact on the customer and in the process creates brand recognition. This is where cultural cues play a vital role, not only in creating the desired ad impact but also influencing consumer choices.

Our research was aimed at analyzing these cultural cues and the effect they have on two different age groups namely 18-30 year olds and 40-50 year olds. The conclusion we can draw from this study is that even though people take cultural cues into account when they are assessing the likability of an advertisements, which cue they use is not as different as was previously thought to be. For example, the belief that older people have high regard for collectivistic/high context cultures whereas the younger generation doesn't has changed and hence, we were not able to back this claim through our findings. However, the older generation does regard traditional eastern values as a likeability factor in comparison to their younger counterparts who prefer modern western values.

However this research suggests that there is not much difference in cultural cues considered important for ad liking among the two age groups. Previous studies conducted in Hong Kong and Malaysia show that there is a significant difference in the cultural values reflected in ads of the 1990s and ads of the 1960s. The Eastern cultures have been fused with the Western culture and the individualistic, modern and low context values of the latter are being reflected in the new ads of the Eastern countries. Only in terms of traditional/ modern dimension do the two groups differ, with the older age group preferring traditional ads while younger age group preferring modern ads. However, when asked about which values are ranked higher which contribute to ad liking, both age groups showed contradictory results. Younger group showed greater preference for collectivistic and traditional values, while older age group showed greater preference for individualistic and modern values with no difference for contextual values. On the other hand, as the hypotheses above highlight, which were based on the favourite ads for the two age groups, older group like traditional ads while younger group likes modern ads, while there is no difference on the other two dimensions. This can be because firstly, the ads identified as favourite may not be favourite because of an active consideration of cultural cues; they may be because of other factors with cultural cues being a passive factor. Also, when asked about which cultural cues are considered important in ad liking, the younger group may have tilted their views toward Eastern values to appear culturally aware, while the older age group may have tilted their views toward Western values to imply that they are moving with the times and modern. Therefore future researches should be conducted to isolate the contradiction between what the two age groups feel and what they actually do.

¹ <http://www.contentwriter.in/articles/advertising-marketing/importance-advertising.htm>

As per this research, the main recommendations would be firstly, that brand managers of global brands consider the effects of cultural cues in their ad campaigns for most products as this plays a major role in generating audiences' attention, and secondly, make traditional ads for the age group 40-50, while more modern ads, both in copy and execution for age group 18-30. Also, even if Eastern values have fused with the Western values, the transition has been the same for both age groups, at least in the middle and upper middle income group of urban Karachi.

LIMITATIONS AND FUTURE RESEARCHES

No research is free from limitations and such consumer studies face this problem more than other types.

- 1) We had based our hypotheses and expectations on research done abroad and not in this part of the world; hence we did not have any benchmark to measure ourselves against.
- 2) One cannot quantify advertising effectiveness as far as cultural influence is concerned.
- 3) The sample size is not a true representative of the target market in Pakistan. Moreover, this study may not be applicable across other Socio Economic Classes as their preferences may differ.
- 4) Since we are still students, our limited experience in this field of research may lead to a study which is not very thorough and as in-depth as it should be. Hence further researches are recommended on this topic especially to measure the effect of cultural cues on ad recall. Our hypothesis 2 was to identify that culturally coherent ads have higher recall. However, this hypothesis could not be tested because of difficulty in obtaining data. When we asked people to list ads on top of mind recall, they were having a very difficult time since it was completely unaided recall. Therefore we asked them to list their favourite ads instead. Favourite ads do not necessarily yield the same results as ad recall, hence H2 was not tested.

Future researches should focus on two areas:

- a. Determining whether culturally coherent ads have higher recall than those which are not culturally coherent with the target market.
- b. Determining whether cultural values in Pakistan have been affected by the Western values and to what extent has the change penetrated amongst the older and younger age groups.

ACKNOWLEDGEMENT

We want to pay our regards to the students of IBA who helped us lot to compile the above research; names of these students are Farah Siddiqui, Saadia Wajid, Shamaila Mahmood, Syed Saad Kamran.

REFERENCES

1. An, D. (2007). Advertising visuals in global brands' local websites: a six country comparison. *International Journal of Advertising*, 26, 303-332.
2. Carr, D. (2004). *This land is whose land? 2 magazines, 2 answers*. Retrieved October 9, 2007 from <http://www.nytimes.com>

3. Cho, B., Kwon, U., Gentry, J. W., Jun, S. and Kropp, F. (1999). Cultural values reflected in theme and execution: A comparative study of U.S. and Korean television commercials. *Journal of Advertising*, 28.
4. Deloitte (2007). *Are you ready for the future of media?* Highlights from Deloitte's State of the Media Democracy Survey.
5. Deutsch, C.H. (2006). *Not getting older, just more scrutinized*. Retrieved October 10, 2007, from <http://www.nytimes.com>
6. Han, S. and Shavitt, S. (n.d.). Westernization of cultural values in Korean advertising: a longitudinal content analysis of magazine ads from 1968-1998. *Advances in Consumer Research*, 32.
7. Holton, R. (2000). Globalization's cultural consequences. *Annals of The American Academy of Political and Social Science*, 570, 140-152.
8. Kalliny, M. (n.d.). *Cultural values manifestation in the Arab world and the United States newspaper advertising*. Retrieved October 9, 2007 from EBSCO Publishing Citations database.
9. Lin, C.A. (2001). Cultural values reflected in Chinese and American television advertising. *Journal of Advertising*, 30.
10. ManSo, S.L. (2004). A comparative content analysis of women's magazine advertisements from Hong Kong and Australia on advertising expressions. *Journal of Current Issues and Research in Advertising*, 26.
11. Onkvisit, S. and Shaw, J.J. (1999). Standardized international advertising: some research issues and implications. *Journal of Advertising Research*.
12. Polegato, R. and Bjerke, R. (2006). The link between cross cultural value associations and liking: the case of Benetton and its advertising. *Journal of Advertising Research*.
13. Sandone, A. (2006). *Cultural norms and their impact on families*. Retrieved October 10, 2007, from <http://www.articlesbase.com>
14. Schaefer, A.D, Hermans, C.M. and Parker, R.S. (2005). A cross culture exploration of advertising skepticism and media effects in teenagers. *Marketing Management Journal*, 15.
15. Shao, A.T., Raymond, M.A., Taylor, C. (1999). Shifting advertising appeals in Taiwan. *Journal of Advertising Research*, 39.
16. Shavitt, S., Nelson, M.R. and Yuan, R.M.L. (1997). Exploring cross cultural differences in cognitive responding to ads. *Advances in Consumer Research*, 24.
17. Tse, D.K., Belk, R.W. and Zhou, N. (1989). Becoming a consumer society: a longitudinal and cross cultural content analysis of print ads from Hong Kong, The People's Republic of China and Taiwan. *Journal of Consumer Research*, 15.
18. Tsui, B. (2001). *Generation Next*. Retrieved October 10, 2007, from <http://www.bonnietsui.com>
19. Vinson, D.E., Scott, J.E. and Lamont, L.M. (1977). The role of personal values in marketing and consumer behaviour. *Journal of marketing*, 41.
20. Zhang, J., Shavitt and Sharon (2003). Cultural values in advertisements to the Chinese X generation. *Journal of Advertising*, 32.

**NEXUS BETWEEN SOCIAL EXCLUSION AND REPRODUCTIVE
HEALTH BEHAVIOR OF WOMEN IN PAKISTAN**

Fauzia Maqsood

Institute of Social and Cultural Studies, University of the Punjab, Lahore
Email: fauziamaqsood@gmail.com

ABSTRACT

Present paper is an attempt to examine the conceptual framework of social exclusion as a determinant of fertility level and use of contraception among rural and urban women in Pakistan. The present study is a departure from mainstream social exclusion studies which use conventional indicators that emphasize poverty and marginalization. In this study we have measured exclusion by level of women's participation in social, cultural, political and economic activities and in the process of decision making for personal and family concerns. Patriarchal structure of Pakistani society and gender discrimination are the main basis of exclusion of women from the mainstream of life. This study was conducted in five villages of Kasur district and in an urban town of Lahore district. Data were collected from 655 ever married women through administering household and individual questionnaires. The findings of the study suggest that social exclusion of women is prevalent in both rural and urban areas of Pakistan, though; the extent of exclusion is relatively low in urban areas. The study clearly predicts that exclusion of women is closely associated with their fertility levels in both urban and rural areas, whereas; social exclusion was a determinant of contraceptive use only in urban areas.

INTRODUCTION

It has long been debated that women are being excluded from social structure of Pakistani society. Experts argue that social exclusion of women is largely based on gender biases (Hooper and Hamid 2003 and Mumtaz 2003). Pakistani society is a patriarchal society and women have not been given equal opportunities to participate in different social aspects of life. Women are marginalized and kept far from main socio economic stream of life. Their access to resources and opportunities is restricted.

Exclusion is also defined as lack of access to the institutions of the civil society and to the basic levels of education, health and financial well-being necessary to make access to those institutions a reality (Burchardt 2000). Social exclusion broadly defined refers to the societal and institutional processes that exclude certain groups from full participation in social, cultural and political life of societies (Narayan, 1999). Other definitions of social exclusion include patterns and processes of generalized disadvantage in such areas as education, healthcare, housing, and financial resources(Atkinson and Davousi 2000), a lack of capabilities within a wide range of contexts including employment, healthcare, housing, education, social insurance, financial markets, facilities, political, and culture (Sen 1998); the inability to participate effectively in economic, social, political, and cultural life, alienation and distance from the mainstream society((Duffy 1995); the dynamic process of being shut out...from any of the social, economic, political and cultural systems which determine the social integration of a person in society (Walker and Walker 1997).

This study hypothesizes that social exclusion of women has been widely prevalent, particularly, in rural areas of Pakistani society because of “traditional cum patriarchal” system prevailing in society. This system impedes women’s development with respect to health, education and social participation. The study is focusing to what extent social exclusion of women in rural areas is prevailing because of patriarchal society and to what extent reproductive health behavior is being affected by this social exclusion.

OBJECTIVES OF STUDY

The following are delineated as main objectives of the research

- i. to examine the level of social exclusion among women in rural and urban area
- ii. to study how socio cultural exclusion of women affects their levels of fertility and contraceptive use

METHODS AND MATERIALS

Data for present study was collected from five villages of Kasur Tehsil and one urban community of Lahore district. Multistage simple random sampling was used to draw the sample. A household survey was conducted to draw the sample. First household was selected by applying simple random sampling method while the subsequent values were obtained by adding kth values in both rural and urban sample. All ever married women in the selected households were interviewed. Researcher was able to interview a total sample of 655 ever married women of which 332 were from rural and 323 from urban areas.

ANALYTICAL FRAMEWORK

For the purpose of analysis, following seven factors of social exclusion out of eleven were taken because of very low level of variance in some of the indicators:

- Extent of involvement in decision making in family matters
- Extent of participation in religious activities outside home
- Highest level of education attained by women
- Household income
- Distance to health facility available
- Casting vote with their own choice
- Age at first marriage

CODING PROCEDURES FOR INDEPENDENT AND DEPENDENT VARIABLES

Categorization for Exclusion Variable

- Respondents having ≤ 2 Hs = Least Excluded
- Respondents having 3-4 Hs = Moderately Excluded
- Respondents having 5+ = Highly Excluded

Categorization for Fertility (No. of Live Births)

- No. of live births: 5 or more = H
- No. of live births: 3 or 4 = M
- No. of live births: ≤ 2 = L

Categorization of Contraceptive Use

No use of contraception	= L
Use after having 3 or more live births	=M
Use after ≤ 2 live births	=H

Inferential Analysis

After reviewing the frequency distribution and bi-variate tables an attempt was made to examine the data by undertaking multivariate analysis. Chi square test was applied to find out the association between social exclusion, contraceptive use and fertility of ever married women.

Hypotheses:

- H₀: There is no association between socio-cultural exclusion of women and their fertility: Rural, Urban and Total Samples
 H₁: There is an association between socio-cultural exclusion of women and their fertility: Rural, Urban and Total Samples

For total sample the calculated value of χ^2 worked out at 4df is 13.08 which is > tabulated value of χ^2 i.e. 9.48 at .05 level of significance. This finding leads to reject our H₀ and accept the research hypothesis (H₁). The P value (.013) associated with the computed χ^2 (13.08) has rare chance of falling in the critical region, which indicates that there is an association between level of fertility and level of socio cultural exclusion of EWM in our total sample. In rural sample calculated value of χ^2 at 1df is 5.282 which is greater than table value (2.05) at 1df. Therefore, we reject H₀ and accept H₁. The p value (.023) supports that there is an association between socio-cultural exclusion and fertility level of rural EMW. It is also worth noting that in rural areas, prevalence of socio cultural exclusion was considerably high (81%); whereas urban women had a much lower level of exclusion (33%). The calculated value of χ^2 at 4df is 11.158 which is greater than tabulated value 9.48 > at .05 level of significance. The result leads to reject H₀ and accept H₁ i.e. there is an association between socio-cultural exclusion of urban EMW and fertility level. The p-value being .017 shows a remote chance of falling in critical region.

Table 1 Chi Square Test of Fertility and Social Exclusion for EMW			
Test Statistics: Chi Square			
Sample	Value	df	No of Valid Cases
Urban	11.158	4	323
Rural	5.282	1	332
Total	13.08	4	655

Hypothesis No. 2

After establishing association between socio cultural exclusion and fertility for, urban, rural and total samples, we examine association between socio cultural exclusion and use of contraception for all these three samples.

Testing of Hypothesis

- H₀: There is no association between level of socio-cultural exclusion of EMW and their use of contraception: Total, Rural and Urban Samples
 H₁: There is an association between level of socio-cultural exclusion of EMW and their use of contraception: Total, Rural and Urban samples

For total sample the value of χ^2 is 22.443 which is greater than table value (9.48) at 4 df. The value of $p < .005$ leads to accept research hypothesis (H_1) with the conclusion that there is an association between socio-cultural exclusion of total EMW and their use of contraception. The calculated value of χ^2 at 16.61 is greater than table value (9.48) at 4df. Value of p being .003 strongly leads to accept H_1 suggesting that there is an association between use of contraception and level of socio cultural exclusion among urban EMW. In rural sample the χ^2 calculated value is 3.426 is less than table value χ^2 (5.99), whereas the p value is 0.1. Therefore, H_0 is accepted with the conclusion that there is no association between exclusion and use of contraception of rural women.

Table 2			
Chi Square Social Exclusion and Contraceptive Use for EMW			
Test Statistics: Chi Square			
Sample	Value	Df	No of Valid Cases
Urban	16.61	4	323
Rural	3.426	2	332
Total	22.443	4	655

REGRESSION ANALYSIS

The regression model has therefore been applied to find the deterministic relationship of explanatory variables i.e. exclusion factors on fertility and particularly when we are concerned with the combined effect of a group of variables on dependent variable.

Table 3 presents multiple regression analysis for all three urban, rural and total samples. The p value of ANOVA for total, rural and urban samples is less than .05, which indicates that multiple linear regression models fit for all three samples. For example the value of R square is equal to .239 i.e. 23.9%

Table 3						
Multiple Regression Model fitting for Social Exclusion Factors and Fertility						
ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Total	Regression	1015.328	7	145.047	29.033	.000(a)
	Residual	3232.391	647	4.996		
	Total	4247.719	654			
Rural	Regression	687.899	7	98.271	16.572	.000(a)
	Residual	3232.391	324	5.93		
	Total	4247.719	331			
Urban	Regression	322.01	7	46.001	12.374	.000(a)
	Residual	1171.037	315	3.718		
	Total	1493.046	322			

variation in fertility is explained by the predictors of the model for the total sample. Similarly the values of R square (.216 and .264) explain variation in fertility by all the predictors for the urban and rural samples respectively. This analysis of multiple regressions fitting the seven predictors of fertility corroborates our general findings emanating from chi square analysis as well. In other words fertility is influenced by the social exclusion which in turn is determined by socio-cultural factors.

Table 4
Multiple Regression Analysis of Social Exclusion and Fertility

Exclusion Factors	Urban Sample			Rural Sample			Total Sample		
	Regression Coefficient	t	P-value	Regression Coefficient	t	P-value	Regression Coefficient	t	P-value
House Hold Income	6.395	7.377	0.000	6.761	7.4	0.000	6.712	10.868	0.000
Distance to Health Services	0.262	2.791	0.006	0.364	2.158	0.032	0.277	3.194	0.001
Age at Marriage	-0.102	-0.87	0.385	0.063	0.363	0.717	-0.035	-0.348	0.728
Highest level of education completed	-0.933	-6.532	0.000	-0.805	-4.517	0.000	-0.863	-7.453	0.000
Frequency of consultation	-0.154	-3.368	0.001	-0.471	-6.842	0.000	-0.301	-8.68	0.000
Frequency of Participation in Religious Activities	-0.079	-0.323	0.747	0.157	0.82	0.413	0.045	0.305	0.761
Vote Casting with own Choice	0.045	0.324	0.746	0.194	1.364	0.173	0.13	1.3	0.194
(Constant)	-0.206	-2.483	0.014	-0.534	-4.964	0.000	-0.335	-4.997	0.000

The table 4 shows that only age at marriage and household income have significant effect on fertility of women in total as well as in urban sample. Whereas, in rural sample vote casting with own choice, level of education completed, age at marriage and household income all do show significant effects on fertility of women.

Table 5
Logistic Regression of Contraceptive Use and Social Exclusion

Exclusion Factors	Urban Sample				Rural Sample				Total Sample			
	Regression Coefficient	Wald Statistic	df	p-value	Regression Coefficient	Wald Statistic	df	p-value	Regression Coefficient	Wald statistic	df	p-value
Household Income	-0.012	0.015	1	0.902	-0.569	12.602	1	0	-0.246	8.45	1	0.004
Distance to Health Services	0.384	8.867	1	0.003	0.078	0.181	1	0.671	0.373	13.871	1	0
Age at Marriage	0.632	14.289	1	0	0.536	6.864	1	0.009	0.541	18.707	1	0
Highest level of education completed	-0.055	1.242	1	0.265	0.055	0.511	1	0.475	-0.113	10.879	1	0.001
Frequency of consultation	0.241	0.842	1	0.359	-0.26	1.66	1	0.198	-0.153	1.056	1	0.304
Frequency of Participation in Religious Activities	-0.111	0.555	1	0.456	-0.281	3.818	1	0.051	-0.249	6.282	1	0.012
Vote Casting with own Choice	0.088	0.961	1	0.327	0.112	0.985	1	0.321	0.153	5.196	1	0.023
Constant	-2.562	7.284	1	0.007	1.536	2.716	1	0.099	-0.213	0.12	1	0.729

While describing association between seven factors of exclusion and contraceptive use results of logistic regression in Table 5 indicate that distance to health services and age at marriage have significant effect on contraceptive use of urban women. In rural areas household income and age at marriage significantly contribute to contraceptive use; whereas, in total sample all factors except frequency of consultation in household affairs show significant effect on contraceptive use.

RESULTS AND DISCUSSIONS

The overall findings of the study confirm common perceptions that exclusionary practices are widely prevalent in Pakistan, especially in rural areas where exclusion of women is 81%. Findings also suggest that social exclusion of women has significant effect on fertility in both rural and urban areas of Pakistan, whereas, contraceptive use of women was affected by their level of social exclusion only in urban area

Results of multiple and logistic regression indicate that age at marriage, household income and education are significant in determining fertility and contraceptive use. These findings basically confirm earlier well established association between socio economic status and fertility level and contraceptive use. As such there are no surprises even though the study used different analytical framework i.e. social exclusion instead of simple demographic and socio economic variables used in earlier fertility studies in Pakistan.

LIMITATIONS OF STUDY

The study of social exclusion and its impact on reproductive behavior is a new attempt in Pakistan. Literature on this issue was quite meager, and was not readily available. Besides, in the absence of research tradition in this field, in Pakistan, richness of data and analysis may not have covered many aspects of exclusion resulting in unexplained variance in some of the models tested.

Survey methodology for measuring socio- cultural exclusion of women as an analytical framework for examining its effects on fertility and contraceptive use may not have been most robust approach. But due to time and resource constraints researcher had to rely on survey methodology. In-depth interviews and participant observation could have yielded more reliable and possibly more valid measures for social exclusion.

REFERENCES

1. Atkinson, R. and Davousi, S. (2000). The Concept of Social Exclusion in the European Union: Context, Development and Possibilities. *Journal of Common Market Studies*. 38, 427-428.
2. Burchardt, T. (2000). *Social Exclusion: Concepts and Evidence*. Bristol: Policy Press.
3. Hooper, E. and Hamid I. (2003). *Scoping Study on Social Exclusion in Pakistan*. Department for International Development (DFID), UK.
4. Mumtaz, K. (2003). Gender and Social Exclusion in Pakistan. Shirkat Gah, Lahore.
5. Narayan, D. (1999). *Complementarily and Substitution: The Role of Social Capital*. Civic Engagement and the State in Poverty Reduction. New York: World Bank.
6. Sen, A. (1998). Social Exclusion and Economic Measurement. Paper presented at the 25th General Conference of the International Association for Research in Income and Wealth, Cambridge, UK.
7. Walker, A. and Walker, C. (1997). *Britain Divided: The Growth of Social Exclusion in the 1980s and 1990s*. London: Policy Press.

AN INTEGRATED FRAMEWORK FOR VISUALIZING INTELLECTUAL CAPITAL TO MEET STRATEGIC MANAGEMENT CHALLENGES

Mumtaz Muhammad Khan¹ and Suleman A. Lodhi²

¹National College of Business Administration & Economics,
Lahore. Email: mumtazmkpk@yahoo.com

²University of Lahore, Lahore. Email: sulemanlodhi@yahoo.com

ABSTRACT

Intellectual Capital (IC) comprising of intangible assets contributing towards organizations out put is of vital importance. Its management, measurement and reporting is posing challenges to the enterprise. The different measuring techniques could not bring about a consensus on measuring intellectual capital. This paper improves the techniques and consulting methods developed and deployed by an Australian Project Team during an investigation of a client organization's intellectual capital management, measurement and reporting (ICMMR) practices. It introduces the benefits of adopting an integral approach to investigating, measuring, reporting intellectual capital (IC) and views it in terms of strategic management challenges (SMC). The integrated framework provides in depth analysis of firms IC, with gaps highlighting weaknesses in ICMMR practices in order to provide a comprehensive approach to meet strategic management challenges.

INTRODUCTION

Intellectual Capital (IC), comprising of intangible assets such as development of brands, stake holder's relationships, reputation, culture and processes of organizations is providing sustainable sources of business advantage. Intellectual Capital can be defined as intellectual resources that have been "formalized, captured and leveraged" to create assets of higher value (Prusak, 1998). Intangible assets are difficult to measure, manage, report and fit into strategic management challenges owing to complex nature of these assets. Simple financial measures fail to take cognizance of this complexity. IC is classified as human capital, internal capital and external capital. Human Capital refers to the accumulated value of investments in employee's training, competence and future. It focuses on the value the individual can produce and thus encompasses individual value in an economic sense (Becker, 1992). Human Capital can further be sub classified as the employee's competence, relationship ability and values. Internal Capital is the supportive infrastructure that enables human capital to function. Edvinsson and Malone (1997) further classify internal capital into organizational process and innovation capital. Internal Capital includes the organization's philosophy and system for leveraging the organization's capability. It also includes the techniques, procedures and programmes that implement and enhance the delivery of goods and services. It includes intellectual properties and intangible assets. An organization's policy and procedures, customized software applications, research and development programmes, training courses and patents are examples of internal capital. External capital is defined as the combined value of the relationships with the customers, suppliers, industry associations, markets and

Government functionaries. Customer capital refers to issues such as trust and understanding and the strength and loyalty of customer relations. Customer satisfaction, repeat business, financial well being, price sensitivity and corporate social philanthropy can be used as indicators of customer capital.

As focus of strategic management has shifted toward resource- and knowledge-based views of the firm, researchers have increasingly looked inward for sources of competitive advantage and value creation. Arguably, the most distinctive and inimitable resource available to firms is intangible that enables them to effectively employ, manipulate, and transform various organizational resources (Grant, 1996; Kogut & Zander, 1992; Nonaka, 1991). While organizational knowledge is embedded in a variety of entities, such as tools, tasks, technologies, and people, people-embodied intangible are the foundation of a firm's core capabilities and is fundamental to the development of its value proposition (Argote & Ingram, 2000).

In the context of strategic action, Dierick and Cool (1989) note that a firm's accumulated skills, expertise, and wisdom can be viewed as IC. In contrast, the streams of new knowledge that are obtained, transferred and integrated to enrich and change a firm's intangible resources can be viewed as knowledge flows. IC includes exchanging new knowledge across organizational boundaries, as well as transferring underutilized yet potentially, valuable knowledge resources within organizational boundaries (Argote & Ingram, 2000). While knowledge stocks provide the foundation for a firm's core competencies (Grant, 1996), intangible resources are necessary for facilitating organizational learning by enabling a firm to expand, refine and modify, thereby creating the firm's dynamic capabilities (Teece, Pisano, & Shuen, 1997). This distinction can be important because, as Leonard-Barton (1995) has pointed out, without continual intangible resources to enhance and renew their strategic value, IC can sometimes cause core rigidity.

There is a growing interest in IC driven by a broader range of socio-economic changes particularly, to service based industries owing to the emergence of the network society. The challenges are posed to manage IC resources as value drivers as a competitive advantage. The growing acknowledgement of strategic significance of IC on the one hand and its actual management, measurement, reporting on the other hand are the key challenges to the socio-economic changes with a view to visualize them as a vital competitive advantage. To achieve this end, it is essential to "gain a better conceptual and operational appreciation of what it means to strategically manage knowledge for sustained competitive advantage" (McCann and Buckner, 2004. An Australian Project Team investigated a client organization (ICMMR) practices (Boedker, Guthrie and Cuganesan, 2005). Boedker., gave an integrated framework for visualizing intellectual capital, further labeled as the intellectual capital value creation (ICVC) framework as an analytical model for extending the breadth and depth of existing management, consulting and research practices. This paper measures intellectual capital in a broader framework highlighting more gaps (weaknesses) so as to examine maximum functional aspects of intellectual capital from a strategic point of view.

LITERATURE REVIEW

IC has become increasingly important to organizations for value creation and competitive advantage. The organizations are keen to know the way to report knowledge resources and use KM activities for their strategic decision.

In Scandinavia, the Danish Ministry of Science, Technology and Innovation has published IC reporting guidelines making explicit to organizations the content, structure and format of IC reports (Mouritsen et al., 2003). These guidelines are based on a pilot project and over hundred organizations participated in preparing IC reports.

In the UK, the UK Department of Trade and Industry has proposed a compulsory reporting requirement to include an operating and review section in their annual reports from 2005, with the objective to provide a more strategic and forward looking perspective, highlighting the importance of intangible largely human assets (CIPD, 2004).

In Austria, the Austrian University Act, 2004 requires state universities to prepare and disclose IC reports. The IC reports give information about the development of the university and on the basis of development forecast its outcome (Schaffhauser-linzatti, 2004). It provides an inventory of the IC that exists within the university and serves as a basis for the university budgetary reimbursement. In Australia, the Government has set up the Australian Government Consultative Committee on Knowledge Capital (AGCCKC) to produce a set of comprehensive knowledge capital standards. These standards will be applicable across the public and private sector organizations for the development of competitive knowledge economy. Empirical research into IC is also on the increase in the USA, Europe and Australia. In the USA, McCann and Buckner (2004) undertook a research study into IC. The study focused 222 completed surveys and came up with explicit recommendation that intellectual capital is a competitive asset required to be used for competitive advantage. Organizations require culture to support the sharing of knowledge and provide rewards and incentives tied to knowledge creation, application and sharing (McCann and Buckner, 2004).

This brief review of trends of measuring, managing and reporting intellectual capital for value creation and competitive advantage highlights the growing need to find out a more comprehensive manageable measurement tool for organizations to use it in view of strategic management challenges.

PERSPECTIVE OF VISUALIZING INTELLECTUAL CAPITAL FRAMEWORK

Boedker, Guthrie and Cuganesan (2005) gave an integrated framework for visualizing intellectual capital of an Australian public sector organization by using the tripartite model of IC adapted from Petty and Guthrie's 2000. They established "that knowledge management is about the management of the intellectual capital controlled by a company" and that "knowledge management as a function describes the act of managing the object, intellectual capital"

The project team developed the ICVC framework (see Fig. 1) as an analytical model to facilitate the investigation of the client organization's ICMMR practices.

The ICVC framework was inspired by two existing IC models: Petty and Guthrie's (2000) tripartite model of IC; and Mouritsen et al.'s (2003) IC statement model. The ICVC framework is structured as follows:

- The y-axis elements are derived from Petty and Guthrie's (2000) tripartite model of IC, categorizing IC into: external, internal and human capital.
 - The x-axis elements are adapted from the reporting categories of Mouritsen et al.'s (2003) IC statement model. They detail the organization's strategic management challenges; knowledge resources enacted, and the knowledge management.
 - The z-axis elements detail the research methods including the semi-structured interviews and content analysis. The ICVC framework proved particularly beneficial to the project team in that it facilitated the assessment of organizational knowledge management gaps. As illustrated in Fig. 1, three knowledge management gaps were investigated:
1. Gap 1: Strategic management challenges vs knowledge management initiatives. Does the organization respond to its strategic management challenges through implementation of KM activities, including the acquisition, disposal, enactment and development of its knowledge resources?
 2. Gap 2: Knowledge management activities vs IC indicators. Does the organization measure the composition and performance of its knowledge resources and KM activities?
 3. Gap 3: Internal IC management issues and practices vs external IC reporting practices. Does the organization report to its external stakeholders its strategic management challenges, KM activities and IC indicators via its annual reports?

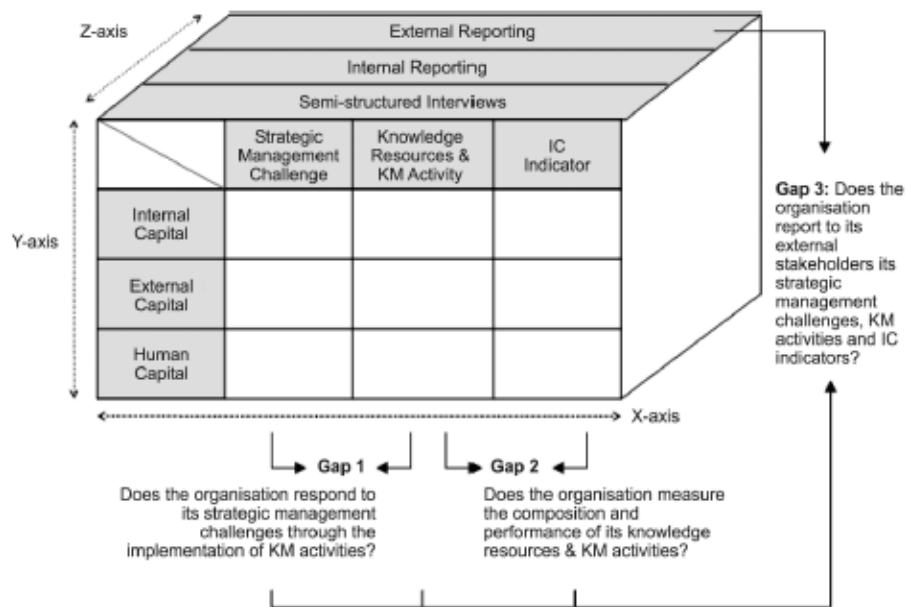


Fig. 1: Intellectual Capital Framework Adopted from Boedker et al. (2005)

ANALYSIS OF ICVC FRAMEWORK

The Z-axis in the ICVC framework included three items Internal Reporting, External Reporting and Semi Structured Interviews (SSI). SSIs were used to strengthen the data for measurement as it focused more on processes. The ICVC framework is designed to measure, manage and report the intellectual capital of an Australian Organization with organization’s interest in IC. Whereas in research studies, the organizations may not be inclined to facilitate with that much time and resources. It would be rather difficult and may prove unmanageable for researchers to conduct SSIs. Moreover, SSIs do not fit in the framework along Z-axis as they are different from internal and external reporting and therefore, their existence at Z-axis is not in harmony. SSIs are a complete process of collecting information involving top management. SSIs with top management are dependent upon the time available for interview with the top management and the interviewers. The management of such interviews itself is a long lethargic process and may do less good in providing a tool for measurement but more harm in delaying the process of measurement of intellectual capital. The world is changing and the changes are occurring at such a fast rate that a framework taking so much time may finally lose its validity. So ¹SSIs are proposed to be deleted from the framework on Z-axes (Fig. 2)

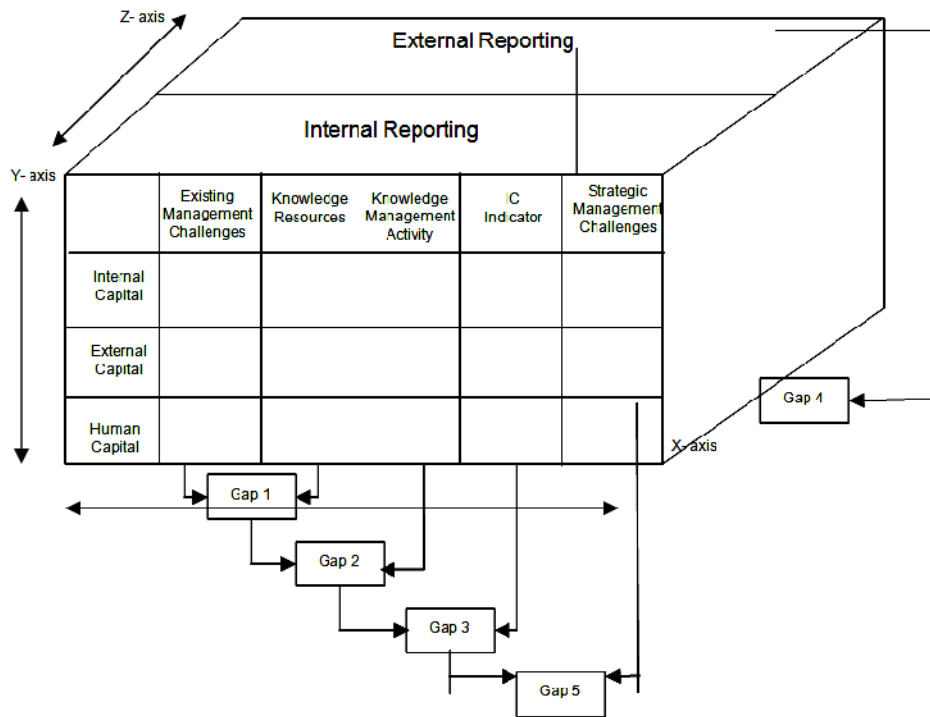


Fig. 2: Proposed framework for visualizing IC

The Y-axis elements remain the same as used by Boedker et al. However along ²X-axis existing management challenges have been introduced in order to see where the organization is and how far trying to cope with the current situation. These existing management challenges are further matched with the existing knowledge resources; ³knowledge resources and knowledge management activity have further been splitted, since the existing of Knowledge Resources is one thing and use of these Knowledge Resources i.e. Knowledge Management is another thing. The use of Knowledge Resources is knowledge management activity. Near existence of Knowledge Resources does not necessarily mean that Knowledge Management activity is taking place. This has lead to the logic of splitting the two in order to measure the gap. The gap between the two will help enabling the organization to utilize its so far untapped knowledge resources. Finally ⁴strategic management challenges have been placed in the last column on X-axis so that the organization may know itself in terms of future. Existing Management challenges can now be transformed into strategic management challenges since an analysis of organization's IC has been done. The gaps identified, the strategic decisions can be far accurately taken. This has been done advisedly:

1. to visualize more gaps in the organization between its resources and its activities.
2. to go for strategic decision in view of these gaps.
3. change the existing management challenges in view of the strategic management challenges for future.

This framework is useful as it facilitates the organization management to see the gaps illustrated in Fig. 2 and make strategic decisions accordingly.

S #	Gaps	Analysis	Benefits
1.	Gap 1 Existing Management Challenges Vs Knowledge Resources	Does the organization respond to its existing management challenges through the use of its knowledge resources?	The analysis of existing management challenges viz a viz knowledge resources will help in finding out the knowledge resources available with the organization and also determine the extent to which they are useful in meeting the existing management challenges.
2	Gap 2 Existing Management Challenges and Knowledge Resources Vs Knowledge Management Activities.	Does the organization respond to its Gap 1 (existing management challenges and knowledge resources) viz a viz knowledge management activities?	Once existing management challenges and knowledge resources have been established, they provide a basis for knowledge management activities. Organization may make decision to activate KM activities so as to utilize its knowledge resources in view of with the management challenges.
3.	Gap 3 Knowledge Management Activities Vs IC indicators.	Does the organization reflect its knowledge management activities with appropriate IC indicators?	IC indicators may not be corresponding to KM activities or KM activities might not be reflected in IC indicators. This provides an insight to integrate and co relate knowledge management activities with its indicators.

S #	Gaps	Analysis	Benefits
4.	Gap 4 Internal Reporting Vs External Reporting.	Does the organization report to its external and internal stakeholders internal reporting via its annual reports?	A possibility exists that the organization's external reporting is better than its internal reporting. An analysis of the internal reporting with the external reporting can help in understanding the gaps. Understanding of the process and gap enables organizations to opt for transparent policies.
5.	Gap 5 Strategic Management Challenges Vs KR, KM and IC Indicators.	Is the organization ready to visualize its strategic management challenges with regard to knowledge resources, knowledge management activities and IC indicators?	The final step aimed at visualizing intellectual capital for strategic management challenges will help in giving new vision to the organization and the organization may form new strategic management challenges in terms of its IC indicators.

The analyses made through tripartite model provides sufficient knowledge about the IC of the organization and helps in developing strategic management challenges to fill in the gap indicated in this model.

Its practical application will reveal whether all five gaps exist in any organization, indicating weaknesses in the utilization of its knowledge resources or not. The analysis of gaps will help to assess the extent to which the organization is responding to its existing management challenges and also provide a basis for developing strategic management challenges beneficial to the top management. Thus the framework will introduce a new perspective from which to understand and analyze the organization. It will further help in devising a series of recommendations and action plans to improve the utilization of organization's IC within minimum possible time.

FUTURE RESEARCH & LIMITATION

The new IC framework designed and developed in this paper has not been applied to any organization. It may be tested as a pilot study for measurement, management and reporting. Its pilot study and application may determine the benefits associated with development of an integrated framework for visualizing intellectual capital to meet strategic management challenges. Thus future researcher may go either for improvement of the framework or test this integrated IC framework with strategic management challenges on an organization.

REFERENCES

1. Australian Government Consultative Committee on Knowledge Capital (2004). *Draft Project Plan*, quoted with the permission of the AGCCKC.
2. Argote, L. and Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82, 150-169.
3. Boedker, C.; Guthrie, J. and Cuganesan, S. (2005). *The strategic significance of intellectual capital information in annual reporting*. MGSM Working Paper.

4. Dierick, I. and Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35, 1504-1513.
5. Guthrie, J. and Petty, R. (2000). Intellectual capital: Australian annual reporting practices, *Journal of Intellectual Capital*, 1(3), 241.51.
6. McCann, J.E. III and Buckner, M. (2004). Strategically integrating knowledge management initiatives. *Journal of Knowledge Management*, 8(1), 47.63.
7. Mouritsen, J. et al. (2003). *Intellectual Capital Statements: the New Guideline*, Danish Ministry of Science, Technology and Innovation, Copenhagen, available at: www.videnskabsministeriet.dk/cgi.bin/theme.list.cgi?theme_id_100650&-lang-uk (accessed April, 2008).
8. Petty, R. and Guthrie, J. (2000). Intellectual capital literature review: measurement, reporting and management. *Journal of Intellectual Capital*, 1(2), 155.76.
9. Schaffhauser-Linzatti, M. (2004). Intellectual capital reporting for Austrian universities-a thrilling work in progress. European Institute for Advanced Studies in Management (EIASM) *Workshop on the Process of Reform of the University Across Europe*, Certosa diPontignano, Siena, available at: www.eiasm.org/documents/abstracts/2824.doc. accessed April, 2008).
10. Teece, D.J. Pisano, G. and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18, 509-533.

QUALITY ASSURANCE (QA) IN PAKISTANI HIGHER EDUCATION INSTITUTIONS

Sumia Mumtaz

COMSAT Institute of Information Technology, Islamabad

ABSTRACT

The Higher Education Commission (HEC) has begun recently a campaign to improve the quality of education at Pakistani Institutions. It is widely believed that quality indicators used by the higher education institutions affect the education quality. The study intends to find out the perception of students, administration and faculty about the importance of education quality and indicators used by the universities to ensure quality. The study expects to find that quality indicators-institutional support; physical environment and resources; faculty and other administrative staff and organization setup are important determinant of education quality. The study also compares both public and private sector educational institutions.

1. INTRODUCTION

Globally the higher education system makes every effort to provide quality of education. The concept of quality assurance comes from manufacturing sector and now this issue becomes the core challenge for the managers of higher education institutions (HEI). In any circumstances there are two vital matters to understand quality, i.e. what is the product? and who are the customers? (Doherty, 1994). In educational system the learners are the final product and part of customers. Higher education institutions emerge as the production line with students as its final product.

In many countries the concept of quality assurance is new, (Herman, 1996), so they adopt it gradually or in phases to build a sound and strong base for quality assurance in HEI. The major emphasis of Education Sector Reform (2001-2005) is on quality included the improvement of infrastructure and human resources at primary level; improved curriculum and teaching-learning materials; improving quality of teaching-learning process; continuous professional development; measures the learner achievements.

Through quality of education we can achieve compatibilities in global market as knowledge based society. Harvey and Green (1993), Franklin, Hussey, McKillop, Raine (1995), Harvey and Knight (1996), Harvey (1998), Deden, Harman & Poole (1998), Sum (2002), Krakow (2003) identified five conceptions of quality, which are (a): Quality as exceptional product or service; (b): Quality as perfection or consistency;(c): Quality as fitness for purpose; (d): Quality as value for money; (e): Quality as transformation. Two aspects of study were researched, which are “the analysis of perception of personnel about the indicators of education quality” and “measure the variability of opinion among internal stakeholders to support the idea of quality”.

2. LITERATURE REVIEW

In an environment of global change, nations struggling to improve quality in HEIs and are making plans for the assurance of quality in all features of HEIs life. Quality is a dynamic state, which changes with time and circumstances that is associated not only with the products, services but also to the people, processes and environments, which meet or exceed current expectations, Ciampa, Goetsch and Davis (1995). Quality can only be described by the perception, which is wholly subjective to customers or consumers, Foley (1989). The policy about the quality not only contains quality mission statement, resource allocation rules, reviews, control but also the monitoring system, (Venkaiah, 1995). The HEIs quality depends on its staff skills and expertise, efficiency and weak or strong leadership, (Robinson, 1994). A product that pass through the process of quality assurance needs that first producer of the product identify and control the supply source and secondly that raw material should pass through a standard procedure of selection, thereby to achieve high quality product that meet the predefined standards, Sallis (2002). The quality in education can be achieve excellence in HEIs, value addition in educational system, fitness of educational outcome and experience for use, conformance of education output to planned goals, specifications and requirements, defect evading in education process, and meeting or exceeding customer's expectations, which is the goal of institutions, Mukhopadhyay (2004, 2001), Peters and Waterman (1982), Feigenbaum (1951), Juran and Gryna (1988), Gilmore (1974), Crosby (1979), Parasuraman et al.(1985), Reynolds(1986), Brennan et al. (1992), Tang and Zairi (1998)

The models and concepts, such as EFQM, Singapore Quality Award (SQA), School Excellence Model (SEM) and Malcolm Baldrige National Quality Award (MBNQA), are widely applied to HEIs. The framework used by Bazargan (2005), Clare (2004), West, Noden and Gosling (2000), Mýzýkacý (2000), Waks and Moti (1999), Cheng & Tam (1997), Owlia and Aspinwall's (1996), Bergquist (1995), for quality in higher education is as, Input-Process-Output (IPO), in which 'Input' refers to the entry requirements, 'Process' refers to the teaching and learning process, and 'Output' refers to the employability and academic standings. Smith (1999), Cheng (1997), Capezio and Morehouse (1995), Tenner and Detoro (1992), William and Loder (1990), highlights that with a systems approach, organization consistently meets and exceeds customer requirements. According to Harris (1994), TQM uses three approaches, first, a customer focus approach, which emphasized service to students is better be achieved by staff training and development; second, a staff focus approach, that is concerned with the contribution of all the members of staff to the effectiveness of the institution; and the third; that takes a service agreement focus. The range of indicators used can be vary, Burke & Modarresi (2000). Bell, Sallis and Hingley (1991) identified the indicators that are tangibles including physical facilities, course materials, and personal presentation of staff; understanding the clients; peer group participation; visibility of programs and institution; staff and academic credibility. The purpose of quality assurance is to achieve customer satisfaction, Naidoo (2003). Dahlgaard et al. (1995), the customer satisfaction in HEIs is achieved through continuous improvement in which all employees and students actively participate. Communicational skills of students, the ability to think critically, and the development of their intellectual independence are the important criterion that most of the universities used, Hanney et al. (1988) and, Barnett: 1992, Denison & Donald: 2001, Barzun and Ellis (1993). Students give value to their ability to get a job, Denison & Donald (2001).

Clara et al. (2001), Guolla (1999), students assume four roles in: i) as *consumers*, if they are satisfied with their program / service then they will recommend it to others; ii) as *customers*, students have their own needs when they complete the program, they will experience an improvement in their intellectual development; iii) as *producers*, as receivers of the knowledge conveyed by the professor, they learn, seek new knowledge and apply in professional life; iv) as *product* students aim not only to prepare themselves for the sake of their personal development, but also to become a good "product" for the labor market. Putting the student first is the current approach to manage quality, (Nunan and Calvert, 1991, Mills and Paul, 1993, Robinson, 1994). In any educational system, students are the most important stakeholders, (Ravisankar and Murthy, 2000). Students' perceptions thus provide important information for the improvement of quality of HEIs, (Faganel and Dolinšek, 2000). In assuring quality it is essential to assess the environment on institution, (Margo et al. 2000, James, McInnis, and Devlin, 2002). If the environment encourages students and they achieve more what they expects then HEIs will perform well, (Australian Higher Education Council, 1992).

Without faculty and administration participation and support, the successful integration of institutional effectiveness activities is unlikely to achieve, (Friedlander and McDougall, 1990, Morse and Santiago, 2000). Clara et al. (2001), Barnett (1992), the key factor that influence the quality of the university student's learning and educational process is the quality of the faculty. Stake and Schwandt (2006), the quality of an educational program is achieved through meeting its objectives, enhancing student outcomes. César, Harrison and Janez (2005), the core of quality assurance is institutional self-evaluation and development planning processes. Gough (2005), Van der Wende (1999), Woodhouse (1999), the main focus of quality assurance is on the management of the institution as a whole rather than on a specific subject area or discipline. Koslowski (2004), the quality of an institution of higher education can be determined by its definable and assessable outputs, efficient use of resources, producing uniquely educated, highly satisfied and employable graduates. Bennett and Slavin (2002), improving service quality requires developing well-running systems."

Sum (2002), the contemporary approaches of quality assurance have five dimensions of: (a) aims, (b) method, (c) process coordination, (d) output, and (e) outcomes, emerged as a result of the expansion of higher education systems. Denison & Donald (2001), the structure of institutions enhance the quality of education with the role of three key participants; students, faculty and staff.

3. RESEARCH METHODOLOGY

The broader purpose of this paper is to find out the perceptions of university personnel and students regarding quality of higher education institutions. Variance of opinion was analyzed by using ANOVA and Chi-square. Graphs were used to analyze the trend regarding the opinion among respondents. Information was collected directly from all respondents with the sample size of 125, after checking the reliability test of items with the pilot study. The variables used for research are Institutional support, Physical environment and resources, Personnel support, Organization setup and Education quality. The two hypotheses were used for test, i.e. 1st was "Perception of faculty, staff and students support the idea of quality control in HEIs" for chi-square test, and 2nd was "There is no difference in the opinion of faculty, staff and students regarding the quality indicators important to ensure the quality in HEIs" for ANOVA test.

3.1 Research findings

The variability among opinion of respondents in descriptive statistics illustrated that the means of responses of students and administrators, have greater positive opinion regarding the quality indicators to ensure institutional quality.

Using chi-square tested the perceptions about the idea of quality control. The H_0 was tested for every item by calculating the value of χ^2 for education quality. Chi-square tests of the survey items produced an observed chi-square statistic for **faculty** was 29.541 with 20 d.f. at table value 37.57 and 31.41. The test of Chi-square for the items of survey for administrative staff gave an observed chi-square statistic of 3 with 10 d.f. at table value 23.21, and 18.31. The value was 9.429 with 9 d.f. for students' Chi-square tests of the survey item had a tabulated value of 21.67 and 16.92 at alpha-value of 0.01 and 0.05. Both tabulated values of chi-square represented that a positive trend towards the item that faculty, administrative staff and students as a member of internal community support the idea of education quality in higher education institutions that institutions should have to consider the significance of education quality in their institutions.

ANOVA was calculated to find out if there were significant differences in the responses of the sampled groups about the quality indicators. The sample consisted of three groups of internal community of HEIs. Testing was done, using an alpha level of 0.05 and 0.01. Since, the sample means of each group did not give an accurate picture of significant difference, analysis of variance (ANOVA) was used "to determine whether any differences among the means were greater than would be expected by chance". The ANOVA test will provide data on the "statistical significance of a relationship," by examining the ratio of between-group variance and within-group variance that lead to a F-score. By using ANOVA, the result of F-ratio 1.605 depicted lower values than the F-critical values which were 5.05 and 11.0 at $\alpha=0.05$ and 0.01 respectively. Result illustrated the point that there was no significant difference in opinion of faculty, administration and students regarding quality important to ensure quality in higher education institutions as mentioned.

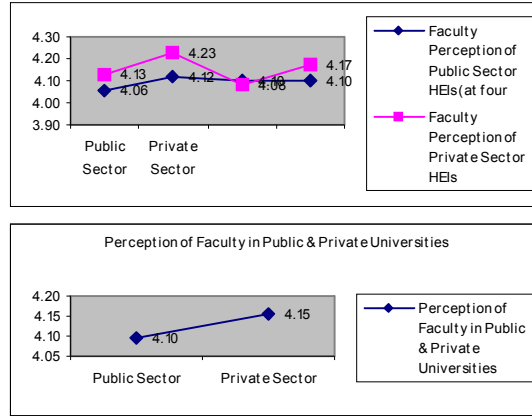
Comparisons amongst groups for ANOVA were calculated separately and the opinion of faculty members about the importance of quality in the in the higher education institutions was 1.069, which is clearly lower than the F table value of 9.28 and 29.5. The significance level was 0.369, which illustrates the point that there is no significant difference in the opinion among faculty of HEIs regarding quality, important to ensure quality in institutions. The result of F-ratio for administration was 0.210 where as the F-critical value taken from table were 19 and 99, which expressed no significance difference among the opinion of administrative staff. The 0.371 F-ratio revealed that there was no significance difference among students' perceptions regarding the quality indicators important to ensure quality in HEIs at F-critical were 161 and 4.052.

Therefore researcher failed to reject the null hypothesis based on this test, since the difference is not significant enough to say that it is based on anything but chance. Since there were no significant differences among the opinions of faculty, administration and students so there was no point in examining the data any further.

Graphical analysis of perceptions showed interesting trends in respondent's opinions. The collected data reflect visible patterns and trends, which could provide a meaningful starting point for more informative studies on this topic of quality assurance in higher education. The perception among faculty of different universities reflected a mix trend about the overall

quality of higher education institutions. The variability of data among them is lower than expected. The perception of professors, associate professors, assistant professors and lecturers in universities of public and private sectors gave insight to management about the importance of education quality who make the policies for institutions.

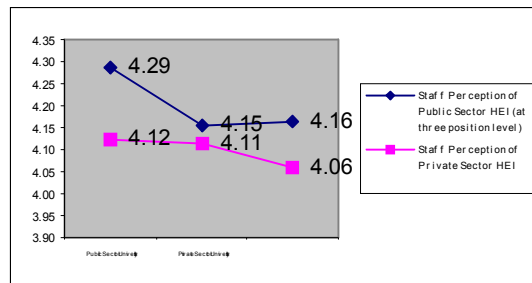
The private sector universities had more positive trend toward quality as compare to public sector universities. The private sector universities give priorities to maintain or enhance their quality to attract more qualified faculty from public sector, which attract more students for admission in these universities. The variability among perception of public and private sector universities were not much high to give any noticeable indication of difference of opinion. Figure I: Faculty Perception At four Position Levels Of Public & Private Sector Universities Figure II: Faculty Perception At Public & Private Sector Universities

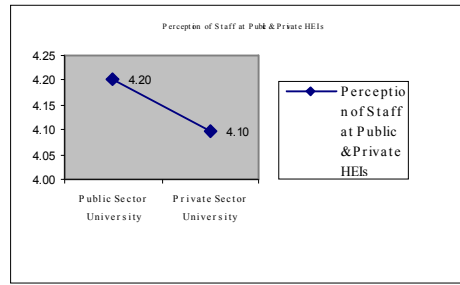


The perception of administrative staff of four public sector universities and two private sector institutions depicted an interesting trend in their responses. The upper level staff has more positive attitude and opinion regarding the quality assured at their institutions. Whereas the mid and lower carrier staff responses graph showed that they had somewhat variation in their answers about the quality indicators.

The responses of faculty of public and private sector universities as shown in graph, portrayed that public sector staff at all three levels in universities were more satisfied with the overall policies of quality adopted by these institutions.

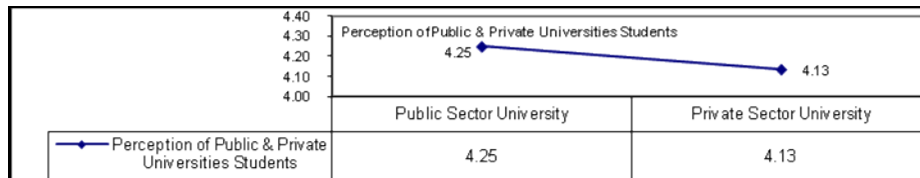
Figure III and IV: Perception of three Level Staff in Public & Private Universities





In my opinion, the overall perception among staff of public and private universities had 0.1 or 10 percent variability in the data towards the education quality. Although, staff members at all levels, play a major role in coordinating the activities that facilitate the students and faculty or management.

The perception of students was very important because they were the major source of information to analyze the quality of any institute whether they were in public sector or in private sector. Because their enrolment in any institution depicted their preference to take admission on that particular institution, which is or was depended upon the quality indicators perceived by them. The perception of students of master level students described the low variation in their answers as compare to students enrolled in other programs was described. The student's perception about the quality indicators used in public sector provide a difference of 0.12 with the private sector universities which reflect that the institutions at the public sector gave more emphases to quality in every area. Figure V: Perception of Students in Public & Private Sector Universities



4. CONCLUSION AND RECOMMENDATIONS

The study also found that faculty and administration have the view that quality should be conceptualized and defined in a way that give importance and significance to university history, culture and needs of university as an organization. The data also reveals that organization setup nurtured the quality of higher education. The study confirm this view that organizations itself do not innovate, act or implement any policy but individuals can do. Quality, like beauty, is in the eye of the beholder.

The study contributed new directions in the research of management by opening up debate on the importance of employee participation in ensuring quality in higher education institutions. This research study also open a new perspective to work on the dependability of different quality management practices on each other and also how they can affect each other as well as the quality of whole institution both in the market and with other institutions nationally and internationally.

Empirical evidence appears to support the view that management practices like institutional support can influence the education quality and customer satisfaction. Institutions interested in the education quality and high quality of teaching and learning must involve their faculty in decision-making regarding course development, monitoring and evaluation increasing the quality of education, teaching and output of the institution. Those institutions that make effective use of their resources on a wider scale can produce high results. The students, faculty and staff considered all of the indicators to be important for assessing the education quality, both in composite form and within each temporal context. The results of this study suggest foremost that we must take into account the education quality as part of institutional life. The universities should take it seriously and give priority to implement the quality assurance policy.

Our research indicating that certain indicators of education quality could influence the education quality. This study provides new directions for researchers that they can study a thorough comparison between higher education institutions. A longitudinal study can better be used to establish the causal relationship between variables of interest that will give further detailed insight about the quality of education. The research about external stake holders regarding quality of HEIs will reveals insight about HEIs standards and the utility and performance of their output in the market.

REFERENCES

1. Australia. Higher Education Council (1992). *Achieving Quality*. Higher Education Council, National Board of Employment, Education and Training. Canberra: AGPS.
2. Brennan, J., Goedegebuure, L.C.G., Shah, T., Westerheijden, D.F. and Westhop, P.M. (1992). *Towards a Methodology for Comparative Qualitative Assessment in European Higher Education*. CNAA, CHEPS, HIS, London.
3. Bergquist, W.H. (1995). *Quality Through Access, Access With Quality*. California, Jossey-Bass Publishers.
4. Bazargan Abbas (2005). *Quality Assurance in Statistics Education: From partmental. Self Evaluation to Accreditation*. University of Tehran.
5. Bell Donna. *An Evaluation of the Effectiveness of the Gap Model as a Framework for Assessing the Quality of Higher Education*.
6. Burke Joseph C. and Modarresi Shahpar (2000). To Keep or Not to Keep Performance Funding. *Journal of Higher Education*. 71(4). 432. Ohio State University Press.
7. Barzun and Ellis (1993). Total quality management in an education and training context, in Shaw, M., Roper, E. (Eds), *Quality in Education and Training*, Kogan Page, London., Vol. 25.
8. Barnett, R. (1992). *The Essence of Total Quality Management*. Prentice-Hall, Hemel Hempstead.
9. Barnett, R. (1992). *Improving Higher Education – Total Quality Care*, SRHE and Open University Press, Buckingham.
10. Bennett Leo and Slavin Lee (2002). *Continuous quality improvement*. What Every Health Care Manager Needs to Know.
11. Crosby, P.B. (1979). *Quality is Free*. McGraw-Hill, New York, NY

12. César Birzea Michela and Harrison Cecchini Cameron (2005). *Democratic Citizenship in Schools*. United Nations Educational, Scientific and Cultural Organizations. © UNESCO.
13. Clare Chua (2004). Figure: 1, input-output: ----AUQA Occasional Publication *Proceedings of the Australian Universities Quality Forum 2004*, Perception of Quality in Higher Education.
14. Cheng, Y.C. and Tam, W.M. (1997). Multi-models of quality in education, *Quality Assurance in Education*, 5(1), 22-31. <http://lysander.emeraldinsight.com>
15. Capezio, P. and Morehouse D. (1995). *Taking the Mystery out of TQM*. Career Press (1995).
16. Clara et al. (2001). Measurement and effects of teaching quality: an empirical model applied to master's programs. Clara Cardone-Riportella* Nora Lado-Cousté ** and Pilar Rivera-Torres***. *Working Paper 01-31. Business Economics Series*.
17. Ciampa, D. (1992). *Total Quality: A User's Guide for Implementation*. U.S.A., Addison-Wesley Publishing Company, Inc.
18. Doherty Geoffrey D. (1994). *Developing Quality Systems in Education*. New York. 148.
19. Deden Ann, Harman Elizabeth and Poole Millicent (1998). Article Title: Managing the Quality of Teaching in Higher Education Institutions in the 21st Century. *Australian Journal of Education*. 42(3), 271
20. Dahlgard, J.J., Kristensen, K. and Kanji, G.K. (1995). TQM and education, *Total Quality Management*, 6(5/6).
21. Denison D. Brian and Donald Janet G. (2002). Quality Assessment of University Students: Student Perceptions of Quality Criteria. *Journal of Higher Education*. 72(4), 478.
22. Government of Pakistan. *Education Sector Reforms:2001-2005*, Ministry of Education.
23. Franklin, Hussey, McKillop, and Raine (1995). Questioning quality in education: Exploring different perspectives. Kevin Franklin, Val Roche and Tony Hussey, Questioning quality in education: Exploring different perspectives. In Summers, L. (Ed), *A Focus on Learning*, 99-105.
24. Foley K. (1989). *Quality Management in Australia Managing for Change and Innovation* Lecturer
25. Feigenbaum, A.V. (1951). *Quality Control: Principles, Practice and Administration*. McGraw-Hill, New York, NY.
26. Faganel Armand and Dolinšek Slavko. *Quality Management Systems in Higher Education*. University of Primorska. Slovenia.
27. Frielander, J. and MacDougall, P.R. (1990). Responding to mandates for institutional effectiveness. *New Directions for Community Colleges*, 72(4), 93-100.
28. Goetsch, D.L. and Davis, S. (1995). *Implementing Total Quality*. New Jersey, Prentice-Hall, Inc.
29. Gilmore, H.L. (1974). Product conformance. *Quality Progress*, 7(5).
30. Guolla, M. (1999). Assessing the teaching quality to student satisfaction relationship: Applied customer satisfaction research in the classroom. *Journal of Marketing Theory and Practice*. 7(3), 87-98.
31. Gough Noel (2005). What does 'free trade' among national quality assurance agencies produce and prevent? Quality imperialism in globalising knowledge

- economies. *Annual Conference of the Australian Association for Research in Education*, Sydney, 27 November–1 December 2005.
32. Harman Grant (1996). *Quality assurance for higher education: developing and managing quality assurance for higher education systems and institutions in Asia and the pacific*. (ACEID), Bangkok.
 33. Harvey and Green (1993). Defining Quality. *Assessment and evaluation in Higher education*. 18(1): 9-34, *Higher Education in the Developing World (2002): Changing Contexts and Institutional Responses*. Greenwood Press. Westport, CT. p.216.
 34. Harvey Lee (1998). An Assessment of Past and Current Approaches to Quality in Higher Education. *Australian Journal of Education*. 42(3).
 35. Harvey, L. and Knight, P.T. (1996). *Transforming Higher Education*. SRHE and Open University Press, Buckingham.
 36. Harris, R.W. (1994). Alien or Ally? TQM, Academic Quality and the New Public Management. *Quality Assurance in Education*. 2(3), 33-9.
 37. Hanney, S.M.; Kogan, M. and Trevett, G. (1988). *The Use of Performance Indicators in Higher Education: A Critical Analysis of Developing Practice*, Jessica Kingsley, London.
 38. Juran, J.M. and Gryna, F.M. (1988). *Juran's Quality Control Handbook*, McGraw-Hill, New York, NY.
 39. James, R.; McInnis, C. and Devlin, M. (2002). *Assessing Learning in Australian Universities*.
 40. Krakow (2003). *Domains of Changes and Quality of Higher Education*. July 3-5, 2003.
 41. Koslowski Fred A. (2004). *Expectations, Challenges, and Frustrations: Faculty and Administrator Perceptions of Quality and Assessment*. koslowsf@temple.edu.
 42. Mukhopadhyay Marmar. (2004). Sudhanshu Bhusan2. *University News*. 42(07), February 16-22, 2004. Access and Quality in Higher Education: Role of Private Participation.
 43. Mukhopadhyay, M. (2001). *Total Quality Management in Education*. National Institute of Educational Planning and Administration, New Delhi.
 44. Mýzýkacý Fatma (1999). A Theory-Based Program Evaluation Model for Total Quality Management in Higher Education. fmizikac@baskent.edu.tr.
 45. Margo et al. (2000). *Promising Practices: Improving the Quality of Higher Education for Students with Disabilities*. The Ohio State University.
 46. Mills, R. and Paul, R. (1993). Putting the student first: Management for quality in distance education. In T. Evans, & D. Nation (Eds.), *Reforming open and distance education: Critical reflections from the Pacific*. London: Kogan Page.
 47. Morse, J.A. and Santiago, G., Jr. (2000). Accreditation and faculty: Working together. *Academe*, 86(1), 30-34.
 48. Nunan, T. and Calvert, J. (1991). Investigating quality and standards in distance education: An interpretation of issues. *Proceedings of the 10th Biennial Forum, Australian and South Pacific External Studies Association*.
 49. Owlia, M.S. and Aspinwall, E.M. (1996). A framework for the dimensions of quality in higher education. *Quality Assurance in Education*, 4(2), 12-20.
 50. Peters, T.J. and Waterman, R.H. (1982). *In Search of Excellence*, Harper & Row, New York.

51. Parasuraman et al. (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing*, 49(4), 41-50.
52. Reynolds, D. (1986). *Academic Standards for Universities*. CVCP, London
53. Robinson, B. (1994). Ensuring quality in the planning and development of distance learning courses. Paper presented at the 20th International Conference on Distance Learning, Bogotá, Colombia.
54. Ravisankar, K. and Murthy, C.R.K. (2000). Student participation circles: An approach to learner participation in quality improvement. *Indian Journal of Open Learning*, 9(1), 73-85.
55. Sallis (2002). Total Quality Management in Education. Contributors: Edward Sallis - author. Kogan Page. London. p.22
56. Smith, V. Jr. (1999). Total Quality Management. Corvallis, Oregon, United States of America. *Global J. of Engng. Educ.*, 3(1).
57. Sum by Cecilia Tsui Chung Bing (2002). Quality in higher education: policies and practices: a Hong Kong perspective. Introduction and research approach.
58. Sallis E. and Hingley, P. (1991). *Quality Assurance Systems*. Bristol: The Staff College.
59. Robert E. Stake and Thomas A. Schwandt (2006). On Discerning Quality In Evaluation. Discerning. Page. 1, A Chapter in *Handbook of Evaluation*.
60. Tang, K.H. and Zairi, M. (1998). Benchmarking quality implementation in a service context: a comparative analysis of financial services and institutions of higher education – Part III. *Total Quality Management*, 9(8), 666-79.
61. Tenner, A. and Detoro, I.J. (1992). *Total Quality Management: Three Steps for Continuous Improvement*, Addison-Wesley, Reading, MA.,
62. Venkaiah, V. (1995). Quality Assurance in Student Support Services. Quality Assurance in Distance Education. India: D.K. Fine Art Press (P) Ltd., 151-159.
63. Van der Wende. (1999). *Quality and Internationalization in Higher Education organization for economic co-operation and development*. Chapter 12: Quality Assurance of Internationalization and Internationalization of Quality Assurance. 12, 225-235.
64. West Anne, Noden Philip and Gosling Rosie (2000). Quality in Higher Education: An International Perspective. The views of transnational corporations. Center for Educational Research, *Clare Market Papers No. 17*, London School of Economics and Political Science.
65. Waks, S. and F. Moti (1999). Application of the total quality management principles and ISO 9000 standards in engineering education. *European Journal of Engineering Education*, 24(3), 249-259.
66. Gareth Williams and Cari P. Loder (1990). *The Importance of Quality and Quality Assurance, in Quality Assurance and Accountability in Higher Education*, ed. Cari P.J. Loder. (London: Kogan Page).
67. Woodhouse David (1999). *Quality and Internationalization in Higher Education organization for economic co-operation and development*. OECD (Chapter: 2, 29-40) a) Quality and Quality Assurance.

**EVALUATING THE EFFECTIVENESS OF TEACHERS
TRAINING PROGRAMS IN F.G. AND MODEL SCHOOLS
AND COLLEGES IN ISLAMABAD**

Mohammad Waqas Raja

COMSAT University of Technology, Islamabad.

ABSTRACT

The present study explored the variables that contribute to the effectiveness of teachers training program in Pakistan for the education sector on information and computer trainings. A sample of 111 teachers and lecturers from federal government schools and colleges in Islamabad was taken and with the help of a research questionnaire their response was recorded. On its basis the study determined that computer knowledge and skills have been imparted in the trainees but their effectiveness could have been increased if rigorous training need analysis had been done. The study also finds that factors such as support from the principals and head of departments, interest and cooperation from colleagues and availability of physical facilities in schools and colleges influenced the effectiveness of trainings. The study suggests that foreign training programs are more effective due to presence of experienced trainers and better training facilities. The study also determined that factors like duration of training programs has no effect on effectiveness of training, rather, it requires appropriate time for subject matter to be studied. The study also finds that ICT training programs do not contribute towards career growth and salary increase of teachers and lecturers; rather it affects their level of satisfaction from job. The study suggests that an increase in training budget can make these training programs more effective.

1. INTRODUCTION

The broad purpose of any training program is to change attitudes, behaviors or skills in a way that positively impacts business results. Evaluating the effectiveness of a training program in order to understand whether it meets its objectives is critical, as training and development staff is becoming more and more accountable for the effectiveness of their programs. Evaluation can be used to determine whether the training achieves its goals. Evaluation can also assess the value of the trainings, identify improvement areas, and also identify unnecessary training that can be eliminated. Systematic evaluation of training programs is also an important step in improving the overall quality of the training program and measuring its impact on the organization. It is also important to remember that effective evaluation is multifaceted. Most of the literature recognizes the importance of evaluation in terms of client orientation and economic return. In other words, most researchers in the field understand that clients, whether they are those who have hired the trainer or those who have participated in the training, must be satisfied with that training. If clients do not perceive a return on their investment, whether measured in terms of time or dollars, they may not be willing to continue to invest in training.

1.1 Purpose

The purpose of this paper is to evaluate the effectiveness of teachers training program .It reviews the potential impact of teacher's trainings on the education sector of Pakistan focusing on public sector schools and colleges in the Federal Capital Islamabad. Therefore the principle objectives of this paper were discussed below.

- To propose an effective training methodology for teachers training and describe it in terms of inputs, processes, outputs.
- To specify the internal standards that are required for an effective teachers training program.
- To propose a method or methods for establishing an external criteria that determine whether teachers training is effective or not by the help of evaluation model.

2. LITERATURE REVIEW

Asian Development Bank (ADB) Dec (2000) in financial sector firms new projects for effectiveness and impact of training in Indonesia by SEC (Security Commission) in a study of fourteen Banks and seven insurance firms focuses on model that distinguishes between training inputs, processes, and outcomes. Hashimoto (1999) found that a well structured combination of in country and overseas training produce positive results the effectiveness of fellowships in improving working effectiveness and technical skills and it does not depend on there duration and he find no correlation between technical skills and duration for a training program and finds short duration training programs to be as effective as long duration programs but the duration must be linked with the program objective. Richard Blandly, Michael Dockery & Anne Hawker (June 2000), researchers of Finland University with the assistance of Australian National Training Authority (ANTA) find that Australian insurance firms provide extensive training for their incoming employees. About half the time of incoming employees is taken up with training over the first three months of their employment compared to USA employees who take one third of the time. Michael Dockery (2000) suggest in NIVER (National Institute for Vocational Educational Research) in Britain reveals little influence of training practices or vocational educational practices on productivity levels in the capital investment firms studies. Commitment to training in the majority of hotels studied is poor and reactive rather than proactive. However these results may be confounded by an inability to maintain a constant star rating across the sample of hotels investigated. Anne Kirkpatrick's (1976, 1996) four model of training evaluation and criteria continues to be the most popular one can use this frame work to evaluate effectiveness of training programs which are usually followed by asking "effectiveness in what terms? Reaction, Learning, Behavior or Results?" Thus the objective of training determines the most appropriate criteria for accessing the effectiveness of training.

3. FRAMEWORK AND METHODOLOGY

The present study is on the evaluation of CIT (Computer Instruction Training program) for the teachers of F.G schools and colleges Islamabad; it identified the factors, which affect the outcomes of teachers training during the period 2004-2006 and this is a cross-sectional study and data will be collected only once for the research purpose. The study explains in detail the concepts, theories and research needed to evaluate of

effectiveness of teachers training programs and the type of investigation in this case is causal and the effect of different independent variables is measured on the dependent variable and the interference by the researcher in this study is minimal, as he will make no changes in the actual training program and the data will be collected from the teachers at different schools and colleges who have undergone the training program. Hence the study setting will be non-contrived and the unit of analysis is individual teacher and lecturers from various F.G and Model schools and colleges. The study uses convenience sampling method was used for data collection as information can only be accessed from the trainee only and not from all the teachers at the F.G and Model schools and colleges and only primary data is collected by the help of a research questionnaire in this study and a total of 111 questionnaires were completed and respondents were not grouped into male and female trainees. The sample is large enough to gain insight into the results of trainings. Overall the sample is reasonably balanced in term of gender 56% of the respondents are female and 44% are male teachers belonging from 37 F.G (Federal Govt) and Model schools and colleges. The extent to which the population from which this sample is drawn does not contain information on gender balance.

3.1 The Dependent Variable

Effectiveness of Training Programs

Effectiveness of training will be measured by whether the training helps in improving the required skills and knowledge, increasing the chances of employee career growth, Increase in teachers morale.

3.2 Hypothesis Developed

Following hypothesis was being tested against the objectives set in this paper.

- Increasing the budget of training programs can make them more effective.
- Choice of training method has a significant effect on the training program.
- The trainee characteristics have a significant effect on the effectiveness of training program.
- Proper and timely feedback can make the training program more effective
- Trainer's characteristics can significantly affect either positively and negatively on effectiveness of a training program.
- The more the duration of training program the more effective it can become.
- The training program can be made more effective if proper need assessment is done in the beginning of training.
- The training program can be made more effective if the training provides good training facility.
- The training program can be made more effective if the organizational setting is supportive to the new KSAs learned.

4. ANALYSIS

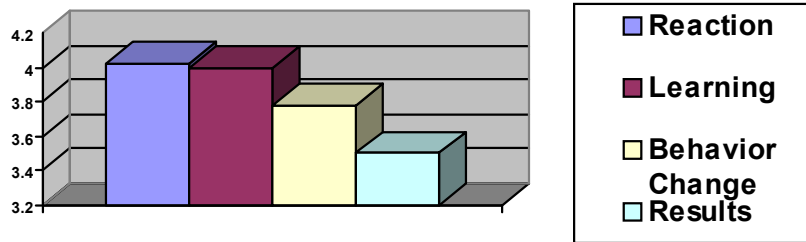
Here we presents the analysis for evaluation of the effectiveness of ICT (information and computer training) and other general training programs for teachers and lecturers in the F.G schools and colleges in the federal capital Islamabad. The paper test the hypothesis about various factors effecting the outcomes of these training programs and the results have shown that certain variables have strong effect on the effectiveness of

training. It also finds certain other variables having less or moderate effect on the success or failure of a training program and all these variables will be discussed here.

For this purpose in this paper we use two types of analysis on the data and information collected.

4.1 Descriptive Analysis

To analyze the effectiveness of ICT and other general teachers training programs the study takes a sample of teachers and lecturers from these training programs from 2004 to 2006. These training programs come under the education sector reform ESR (2002-2011) plan which is mostly funded by donor agencies like UNESCO, UNICEF, UNDP etc.



Source: Kirkpatrick, D.L., Evaluating Training Programs: The four levels, Barrett-Koehler, 1996. 523-526.

Fig. 1: Changes in Effectiveness of Training by Change in Evaluation level

4.1.1 Changes in Effectiveness of Training by Change in Evaluation level

Figure 1 shows how the effectiveness of training programs changes with the change in the evaluation criteria. The mean rating for reaction criteria is 4.02 but when we use the second level (learning from training) the mean rating for effectiveness of training decreases to 4.0 which shows that a great deal of learning takes place by the training programs, and when the third level evaluation (behavior change) is done it was found that the mean rating has further decreased to 3.78. Similarly when the fourth level (result) evaluation was taken there is again a change in mean rating to 3.5 which suggests that effectiveness of training is changed by the criteria used for training. With the help of the research questionnaire the following information is collected on various variables relating to the evaluation of ICT trainings and other general training programs.

4.2 Quantitative Analysis

For the purpose of identifying the variables that have a significant effect on the effectiveness of training program, the study uses t test with $\alpha = 0.05$. The study takes two arbitrary standards at 4.0 and 4.2 which are 75% and 80% respectively of the scale on which respondents were asked to rate whether they agree or disagree for the various variables. And the t-test determines which variables are significantly below the arbitrary standard and which are above the arbitrary standard. From table 1 the value for need analysis falls significantly below the comparison value of 4.2 but lies within significance level at comparison value of 4.0 which indicates that 75% of respondents agree that certain type of need analysis is done before training programs are offered but less than 80% believe that need analysis is done. The value for objectives of trainings falls within the significance level when the test value is taken at 4.0 but when we take the test value at 4.2 the value lies below the significance level which suggests that 75% respondents

agree that trainings meets its objectives but at 4.2 test value our hypothesis is rejected. The value for planning of trainings lies below the significance level on both the test values at 4.0 and 4.2 which suggest that less then 75% respondents agree that planning of trainings was done properly, fro these values we conclude that an improvement in the planning phase is needed.

Table-1
Significance of Agreeeness Ratings Compared to Test Values of 4.0 and 4.2

Items/Variables	Number of Respondents	Mean Agreeeness Rating (M)	Significance at test value 4.0	Significance at test value 4.2
Need Assessment	111	3.73	0.951	0.015**
Objective of Training	111	3.72	0.335	0.003**
Planning of Training	111	3.18	0.062**	0.001**
Training Methods	111	3.6	0.222	0.003**
Training Facility	111	3.48	0.004**	0,000**
Trainer Characteristics	111	3.44	0.023**	0.047**
Trainee Selection Criteria	111	2.36	0.005**	0.116**
Training Duration	111	2.86	0.004**	0.060*
Increase in KSA	111	4.05	0.000*	0.132**
Training Budget	111	4.42	0.015*	0.951*
Improvement in Teachers Morale and Way of Teaching	111	3.20	0.021**	0.051**
Reinforcement of Training	111	2.46	0.001**	0.007**
Benefits from Training	111	4.35	0.359*	0.008*
Results	111	4.22	0.009*	0.119

Students t-test comparing mean rating to test values of 4.0 and 4.2, p= 0.05

* Significantly higher then comparison value,

** Significantly lower then comparison value, Significance of Agreeeness Ratings Compared to test values of 4.0 and 4.2

The value for results on training method shows that its value lies in the significance level when we take the test value at 4.0 but at the test value of 4.2 it lies below the significance level which indicates that 75% respondents or more but less then 80% agree that training methods used in ICT trainings and other general training programs are effective but at higher level our hypothesis is rejected. The value for results on training facilities at both the test values of 4.0 and 4.2 the value lies below the significance level from this we conclude that less then 75% respondents agree that the training facility is comfortable and provide good learning environment and there is a need of improvement in the training facilities. The study also finds the values for trainer characteristics, trainee selection criteria, and change in behavior of trainee below the significance level at test values of 4.0 and 4.2, from this its was concluded that less then 75% respondents finds the trainer to be highly professional, and they do not agree with the selection criteria used, and they do not find a considerable change in behavior as a result of trainings. The value for learning from trainings is higher then the test value at 4.0 but it falls below the test value of 4.2 which suggests that 75% or more but less then 80% respondents agree that much learning has take place as a result of trainings. The Value for training budget at

both the test values at 4.0 and 4.2 is higher than the significance level which suggests that more than 80% respondents agree that if the training budget is increased the training programs can be made more effective. The value for the reinforcement of training programs falls below the significance level at both the test values of 4.0 and 4.2 which means that less than 75% respondents agree that training is reinforced after training so there is a need to reinforce training by higher management. The value for change in result is higher than the significance level for both the test values which means that from 75 to 80 % respondents agree that training is useful to them and it will improve the KSA of teachers and lecturers for which it is offered.

4.3 Ordinary Least Squares Regression Analysis

For our sample of 111 trained teachers and lecturers the study uses ordinary least square regression to determine the affect of our selected variables on the effectiveness of training programs offered these variables are used as a proxy for the dependent variable and are highlighted in the table. The results from the above table shows that the value of R is .799 which means 79.9% variation in the dependent variable is due to the influence of the independent variables considered in the study and there is a high dependence of dependent variable on the independent variables where as the R square is 78.5% and adjusted R square is 77.9% and this indicates that nearly 21.1% variation is caused by other unknown variables that are not considered in the study.

Table-2
Ordinary Least Squares Regression Analysis

R	0.799			
R-square	0.785	Mean Dependent variable	3.740	
Adjusted R-square	0.774	Standard Deviation of D.P	1.013	
F Statistics	215.88	Prob (F Statistics)	0.000	
Variables	Coefficients	Std. Error	T Statistics	Prob
C	0.298	0.335	0.890	0.003*
Need Assessment	0.701	0.249	2.194	0.042*
Training Methods	0.810	0.110	2.034	0.373*
Training Facility	0.777	0.164	2.263	0.795*
Trainer Characteristics	0.670	0.151	0.080	0.033*
Trainee Selection Criteria	0.333	0.039	2.964	0.022
Training Duration	0.203	0.178	3.510	0.094
Training Budget	0.899	0.993	2.007	0.768*
Reinforcement of Training	0.889	0.679	2.160	0.606*

* Significant at alpha = .05

N=Number of Respondents, Dependent Variable=Effectiveness of training Program

The coefficient of C is .299 and has a significant P value at alpha = 5%. The coefficient for need assessment is .701 and has a significant P value of .0424. The positive relationship between need assessment and effectiveness of training programs shows that well planned needs analysis leads to a more effective training program. For training methods the value of coefficient is .810 which shows a strong positive relationship between training methods and effectiveness of training programs it has a significant P value of .0373 at alpha .05 this means that choice of the training methods has a significant effect on the effectiveness of training. The value for trainer

characteristics is .670 which shows a positive relationship between the dependent variable and the trainer characteristics this shows that the more experienced and knowledgeable the trainers are the more will be the effectiveness of training. It has a significant P value of .0802 which confirms our hypothesis. The value of coefficient for trainee selection criteria is .333 which shows a weak positive relationship between effectiveness of training and the trainee selection criteria this means that the result of this study do not find much evidence that the trainee selection criteria has a significant affect on the effectiveness of training and the P value is also not significant at alpha at .05. The study finds a weak relationship between training duration and effectiveness of training program with coefficient value of .203 but the study finds a strong positive relationship for reinforcement of training and training budget with the effectiveness of training program and had coefficient values of .899 and .889 with a significant P values of .768 and .606 at alpha equal to .05.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In this paper we come up with important conclusions and observations, which are discussed below.

1. If rigorous training need analysis had been conducted before training starts. Such systematic analysis would have provided adequate baseline information that could have enabled decision makers to monitor the effectiveness of teachers training and help them to choose among different training strategies.
2. Factors such as support from supervisors, the interest and cooperation from colleagues and availability of physical facilities influenced the impact of training. This becomes apparent by having more favorable responses of effective training from schools and colleges that have computer labs and other related facilities.
3. To ensure effectiveness and constructive impact. Trainings need to be understood, designed and implemented as part of institutional development program. It is often assumed that such trainings automatically contribute to building institutional capabilities, so any positive change require commitment from principals and head of the departments, so an integrated institutional development strategy is needed to give better results.
4. The results from the research questionnaire shows that both trainings in Pakistan as well as abroad are an effective means to enhance the abilities and computer related knowledge of teachers and lecturers but since training institutions in Pakistan continue to suffer from various problems like shortage of well qualified and experienced trainers and physical facilities etc, so they do not provide a viable alternative to foreign trainings.
5. The study reviewed factors like duration of training programs. The results concluded that effectiveness of trainings is not dependent on the duration of training programs but rather it is dependent on subject matter which is to be studied.
6. The study suggests from the results that trainer communication and professional skills count a lot in the effectiveness of trainings.
7. The study does not find any impact of trainings in contributing to the teachers and lectures career growth and salary increases. Rather it effects the satisfaction from their job that they get from the training programs.

5.2 Recommendations

Training programs should be designed in such a way that they are integrated into a broader institutional development program. To maximize the effectiveness and impact of ICT trainings and other general training programs they should not be offered unless the following are met.

1. On the basis of analysis a comprehensive strategy should be developed which considers all the strengths and weaknesses of the schools and colleges and provide a framework for future analysis.
2. The skills and knowledge of trainees (teachers/lecturers) should be determined and assessed before trainings which reflect job requirements and current qualifications. Comparing them with anticipated responsibilities that trainees will be expected to fulfill after the training at the end of the training programs.
3. Supervisors (principals/HOD) must be trained to support trainees after the training programs are completed.
4. A clearly defined mechanism should exist for assisting returned trainees to apply the knowledge and skills that they are trained for which include supervisors support and guidance etc.
5. Information on best training institutes must be collected to assist the training managers at FDE (Federal Directorate of Education) to make a good decision when foreign trainings are offered.

REFERENCES

1. Alkin, M.C. (1992). *Encyclopedia of Educational Research*. Vol 1. New York: MacMillan, 34-41.
2. Ann P. Bartel (1997). Measuring the Employees Returns on Investment in Training. *American Business Post*, Vol 9, Lakewood Publication Britain, 23-29.
3. Bassi, L.J., and Van Buren, M.E. (1999). *ASTD State of the Industry Report*. Alexandria, VA: The American Society for Training and Development, p. 341.
4. Bee, Frances and Roland (1994). Training Needs Analysis and Evaluation, Institute of Personnel and Development. *Zonetime* 6, 67-69.
5. Kirkpatrick, D.L. (1976). Evaluation of Training, in *Training and Development Handbook*. Edited by R.L. Craig, McGraw-Hill, 451-521.
6. Eseryel, D., Schuver-van Blanken, M. and Spector, J.M. (2001). *Current Practice in Designing Training for Complex Skills*. Association for Advancement of Computing in Education: Austria, 71-89.
7. Gagné, R. and Briggs, L.J. (1974). Principles of Instructional Design: New York, Holton. *Rinehart & Winston*. Vol. 19, 56-58.
8. Pamila S. Eden's (2003). Effectiveness of Training in Organizations, *Journal of Applied Psychology*, American Psychology Association Inc, Texas, 234-245.
9. Parker, T.C. (1976). Statistical Methods for Measuring Training Results. in *Training and Development Handbook*, edited by R.L. Craig, McGraw-Hill: USA, Chapter 9.
10. Richard Blandy (2000). *Michael Dockery, Anne Hawke, Does Training Pay*, Australian National Training Authority. ISBN Printing: Australia, 17-69.
11. Tim Sullivan (2000). *Evaluating sales Training Program*. Multi Channel Service White Paper, Siebel System Inc: Australia, 4-17.
12. Wtol, A, (2000). *Glossary of UK Training and Occupational Learning Terms*. 5th edition, J. Brooks, ITOL.

ROLE OF ENTREPRENEURSHIP IN POVERTY REDUCTION IN PAKISTAN

Farid Zafar and Mohamed Nasr
COMSAT University of Technology, Islamabad.
Email: mohamed_nasr@comsats.edu.pk

ABSTRACT

Estimation of the poverty line is a very sensitive issue, and most often is treated in a subjective way. It is needed to review the methodologies adopted in former studies targeting at measuring poverty line in the developing countries specially Pakistan. This study will identify strengths and weaknesses of available studies, and attempt to evolve a new methodology with minimal biases and weaknesses. The study will hopefully contribute to the knowledge on poverty reduction, especially with the sudden wave of increasing food prices that is threatening all the developing countries with starvation.

This study is about the problem of poverty in Pakistan using the governmental statistics about spending on education and healthcare. Other measures include lack of sanitation; well about 25% of the Population of Pakistan has no access to sanitation services. They lack education as well, with females as the worst hit by poverty. The current poverty estimates from as low as 30% to as high as 40% of population.

We are going to take a quantitative approach in our research where poverty is our dependent variable. We expect to encounter an autoregressive component as it is evident in Pakistan that the poor remain poor, which means that a family that was poor last year is expected to be poor this year too. A causal model using family income as the dependent variable and other factors as the independent causal variables will be applied on different classes of Pakistanis. Other factors such as ethnic group, such as those Kashmiri, Bengali, Sindi...etc may show differences.

Our model of regressing poverty on several independent variables includes education and health-care spending by the government. We expect to find that there is a poverty multiplier, with a risk that the low average class of Pakistani may join the ranks of those below the line of poverty. We hope that government spending will be directed to areas where poverty is rampant, and to make both education and health-care an accessible part of life for all Pakistanis.

1. INTRODUCTION

Poverty has been one of the major economic issues of Pakistan. The efforts made by various governments have not made a tangible effect to the poor. But, still more than 25% of the population remains poor. Despite the fact that tons of money is being spent on the development expenditures of the country, there has been a very little trickle down effect. Recent economic issues like wheat shortage, energy crises, inflation and escalation in prices of the food items have further aggravated the situation in the country.

Pakistan is one of the richest countries in human capital. It has enormous resources, in land, weather, mountains, plains, rivers, sea ports, natural resources and picturesque resorts. Located at a most strategic place on the world map, two of its neighbors, China

and India are on the verge of an industrial revolution and high sustained growth. There are demands for reconstruction and development needs towards its other neighbor, Afghanistan. With all the opportunities knocking at the door, Pakistan is still not making the progress that it has the potential to do. There can be many reasons but the most significant is the fast growth of population and lack of technological know-how that denies the fruits of progress, trickling down to the streaming multitude below the poverty line. Culturally, Pakistanis have inherited the tradition of not letting their female to practically participate in the livelihood of their family. The historical antecedents to this situation include forbidding the female population of basic livelihood (entrepreneurial) assets—financial, human, natural, social, political, and cultural—and their exclusion from mainstream economic activity. Coupled with it is the curse of child labor for which Pakistan has been severely criticized on various economic forums.

To cope with the situation as bleak as it looks, Pakistan needs to overhaul its policies towards poverty reduction. Massive efforts are required to be focused on the bread earners and eligible people of the poor societies to make them skilled in various fields of life. This may not be easy to do but for the construction of a strong society the entire nation has to rise and design it as a national cause. A business solution to the poverty problem is possible if business will review, re-orient, strengthen, and expand its relationship with the poor sector, in innovative, entrepreneurial ways that develop and transmit entrepreneurial (livelihood) assets to the poor without compromising the commercial motive of private business. Such an entrepreneurial approach to poverty alleviation is mutually beneficial to the extent that transmitting entrepreneurial assets that sustain the capability of the poor to access resources, institutions, and basic needs fuels innovation, cost-reduction, and revenue growth in the business. Pakistan has established various institutes that issue various micro-financing schemes; but, is there a follow up? Where does the money go? Is there an infrastructure that encourages entrepreneurship? Are the entrepreneurial skills grinded and polished to make an impact? This and many other questions have been addressed in the paper. The policy implication of the paper is that poverty alleviation strategies can be effective and sustainable if they incorporate private sector approaches that foster the development of entrepreneurship within the target population.

1.1 Poverty and Causes of Poverty

When Pakistan came into existence, it was one of the poorest and most underdeveloped nations of the world. The leaders who worked on the vision of Allama Iqbal, although succeeded in the creation of a nation but did not breathe long enough to make it one of the biggest nations of the world. The mission was incomplete. The next 13 years resulted in two wars with India and the loss of one part of the country, East Pakistan. At the time of independence, Pakistan was country, mainly reliant on its agricultural activities. The literacy level was low. There was no major industrial set-up. Farming was done through medieval farming methods and there was hardly any mechanized working system anywhere. Underdevelopment persists because of so-called vicious circle of poverty. On one hand, domestic market is thin because of low incomes and on the other hand, supply of goods is scarce exactly because people are too poor to save. Despite indulging in the activities of basic needs and necessities of the poor people, the government of Pakistan could not achieve any major break-through on the poverty front. Pakistan was at the brink of bankruptcy. Saudi Arabia came to the rescue by giving free oil to cater for energy crises. Then came the events of 9/11. It turned out to be a “blessing in disguise” for Pakistan. It affected the economy in the following way:

- Foreign remittances increased,
- US imposed economic sanctions were removed,
- Foreign debts were rescheduled,
- Hard loans were converted into soft loans,
- Some Foreign debts were written-off,
- Tensions with India borders were removed and a more friendly environment was created,
- Globalization opened ways for foreign direct investment,
- Privatization of state owned enterprises brought much needed foreign exchange.
- Foreign reserves rose to \$16+ billion from a few hundred million in less than 10 years.

This gave the impetus to the government to develop adequate policies and turn the economy around. Economic Survey of Pakistan (2004-05) indicates that the government, while addressing poverty, focused on the following five points:

1. Accelerating economic growth and maintaining macroeconomic stability;
2. Investing in human capital,
3. Augmenting targeted interventions,
4. Expanding social safety nets,
5. Improving governance,

1.2 Steps Taken by the Government to eradicate Poverty

- Opening Khushai Bank in 2000 to provide finance to the youth and willing workers so that they could stand on their own feet. Microfinance plays a vital role in improving the lives of the poor people. An open example is that of Grameen Bank. Professor Muhammad Younas of Bangladesh established a bank for the poor. A bank that would give loans without collateral and on mutual trust. 97 % of the loan amount went to the female, most ignored for business in the Islamic World. The scheme proved so successful that it earned him a Nobel Prize.
- Adding others methods of micro financing schemes with similar objectives. Every year, millions of rupees worth of loans are written offered by the Zarai Taraqiati Bank of Pakistan to help small farmers. But, again, the bank continue to write off million of rupees of debt the farmers could not pay back.
- Offering joint ventures. Lt. Gen. Javed Ashraf Qazi, the former education minister, participated in the international conference at NISTE, Islamabad in September 2007. The labour minister thanked him. Today, we need skilled labour that are not available.

2. LITERATURE REVIEW

This is an interim paper about a project that will continue for several more months. Among the references that were interesting the following ones are important:

Abdelali-Martini et al. (2008) studied gender poverty gap in West Asia. They assessed the gender roles in agro-biodiversity conservation and management. They conducted surveys from 147 farms in Syria, 138 in Lebanon, 145 in Jordan and 140 in Palestine. They concluded that women were poorer than men in all those countries, and recommended that off farm income was important in sustaining the livelihoods of rural communities in the target areas. Moreover, they encouraged empowerment actions of women, through adding-value and alternative sources of income options are needed to

enhance their role in the conservation and sustainable use of this agro-biodiversity of global significance.

Cai Fang and Du Yang (2006) studied Rural China and changes in the nature of poverty there. The study concerned with the phase of poverty-alleviation program commenced by the adoption of the household responsibility system. In 2000, the total number of poor population declined by half to just 32.09 million people. In Pakistan we learn that the government financial support and micro-enterprises are integral to poverty reduction

De Silva and Indunil (2008) tried to construct a poverty profile for Sri Lanka, and examine the micro-level determinants and correlates of poverty. Their study was based on the latest Sri Lanka World Bank. They constructed an unconditional poverty profile using 3 different poverty measures (poverty headcount, average poverty gap and squared poverty gap) on basis of a multivariate analysis of poverty correlates. They used a logistic regression, with the probability of a household being in poverty as the dependent variable and a set of economic and demographic variables as correlates. Their findings showed that education of the household head, being salary employed and engaged in business had a significant positive effect on the standard of living. They found also that the probability of being poor increased with the household size, household head being female, living in a rural area, and being a casual wage earner.

Emwanu, Thomas et al. (2003) made micro level estimation of poverty and inequality in Uganda, and presented a low cost approach to arriving at small area welfare estimates for non-census years. Their approach was based on panel data and estimation of the relation between per capita consumption from the year of interest and household characteristics from the census year. The study concluded that with the exception of the North progress in rural poverty reduction was broadly shared during 1992–99. But, areas with high initial levels of poverty did not benefit from economic growth

Habibov, Nazim; Fan, Lida (2007) studied poverty in Azerbaijan. Their study examined the performance of social protection in Azerbaijan from the perspective of poverty reduction. Empirical evidence suggested that social protection programs had an important impact on poverty alleviation. They demonstrated that the current system of social protection had several limitations including absence of a social protection system for the poor mass of population, and that the poor typically received a smaller share of total benefits than the non-poor. Moreover, they found that most social transfers were too small to lift households out of poverty. They recommended more assistance programs from the government to help reduce poverty in Azerbaijan.

Hayati, Dariush et al. (2006) studied poverty in Rural Iran. They provided both qualitative and quantitative analysis of data collected about rural Iran. Their paper constructed a poverty index and validated in a six-stage process. On basis of the findings, they recommended cooperation of the government and small entrepreneurs to get the appropriate approaches in poverty reduction

Makita, Rie (2007) studied the role of private enterprises in Bangladesh. She found that while micro-credit has opened up new opportunities for the poor to start enterprises, some of them have not benefited from micro-credit schemes. Her paper proposed the creation of a partnership enterprise between a sponsor and poor producers. The paper developed a conceptual relationship in a real rural setting through the observation of an income-generating program implemented by a Bangladeshi NGO in the field of poultry-

rearing. The paper concluded that opportunities for the poor to enter into a previously inaccessible market and gain a regular income source would enable them build the foundation of their household economy beyond subsistence.

Naurath, Nicole (2007) studied poverty in Vietnam. The study found that 75% of people had improved standard of living. The article examined the economic condition of Vietnam for 2007 and found that GDP had a growth rate of 7%. Moreover, the number of Vietnamese living in poverty has been reduced by 50%. This is very interesting for us in Pakistan since the Vietnamese Government plans further poverty reduction which aims at much more reduction of the number of impoverished Vietnamese by 2010.

Narain, Urvashi et al. (2007) studied poverty in India. They found that the poorest and richest households depend more on resources than households with intermediate incomes. The poorest and richest households were also found to be least likely to collect, however, indicating that resource use at the income extremes is bimodal—either zero or above average. Moreover, they observed that trends for resources as a whole were not mirrored in those for individual resources. They found that common-pool resources were a productive source of income for the poor and the rich. They concluded that improvements in these resources could form the basis of poverty reduction efforts in the India.

Varis, Olli and Keskinen, Marko studied poverty in Cambodia. They provided a Bayesian Model for their interesting study. The study specified 3 development goals for the country: economic growth, poverty reduction and environmental sustainability. The paper used a Bayesian network model to analyze sector policies and test if they conflicted with each other. The study results indicated that a compromise policy was possible, being more balanced and acceptable than other policies targeted only one of the three goals.

Warr, Peter (2007) studied poverty in Thailand. The country had a remarkable economic development plan reflected in the very significant improvement in indicators of well-being, such as life expectancy, infant and maternal mortality, and literacy. The study found that poverty incidence has declined dramatically, but economic inequality has increased. Environmental problems and institutional failures in resource management were ongoing. The author recommended a reform in political and corporate governance, trade policy, regulation of industry and the education and health systems.

3. RESEARCH METHODOLOGY AND HYPOTHESES:

This study is important since it discusses the most important issue in Pakistan; that is poverty and how to combat it. We are going to use a multiple regression model as follows:

$$Y_{i+1} = \alpha + \sum_{i=1}^k \beta_i \cdot y_i + \sum_{j=i+1}^n \gamma_j \cdot x_j + \cdot \varepsilon_j$$

where: y_i is the household income in time i used as proxy for poverty.

X_i are explanatory variables such as inflation, education level, health services, Gross Domestic Product...etc.

3.1 Study Hypotheses

The following assumptions are our initial set of assumptions to be test during course of this research project:

H₁₀ Poverty is uncorrelated with previous years' poverty which means a vicious circle.

VS

H₁₁ Poverty is correlated with previous years' poverty which means a vicious circle.

H₂₀ Poverty is uncorrelated with Inflation reflected in the CPI

VS

H₂₁ Poverty is correlated with Inflation reflected in the CPI

H₃₀ Poverty is uncorrelated with increasing production output reflected in the GDP

VS

H₃₁ Poverty is correlated with increasing production output reflected in the GDP

H₄₀ Poverty is uncorrelated with Government spending on the country's infrastructure

VS

H₄₁ Poverty is correlated with Government spending on the country's infrastructure

H₅₀ Poverty is uncorrelated with the increasing number of population

VS

H₅₁ Poverty is correlated with the increasing number of population

3.2 Importance of the Study

This study touches an important social issue in Pakistan; that is poverty reduction. It will provide the policy makers with means to use for poverty alleviation and we try to check cases of success around us in Asia and also in Africa and Latin America.

4. DATA ANALYSIS

We are providing both descriptive and analytic statistics for the collected data from secondary sources in Pakistan and other countries.

4.1 Descriptive Statistics:

The following tables show the poverty measures during the period from 2000- 2004:

Table-1

Economic Status	2001	2004 – 05
Extremely Poor	1.1%	1%
Ultra Poor	10.8%	6.5%
Poor	22.5%	16.4%
Vulnerable	22.5%	20.5%
Quasi Non-Poor	30.1%	35%
Non-Poor	13%	20.5%
Total of Population	100%	100%

Source: Pakistan Economic Survey 2006

The Economic Survey of Pakistan (2004 – 05) claims that, this strategy has paid dividends. The long term growth trajectory of 6% per annum that has reduced poverty over a longer period has already been achieved during the last fiscal year. More importantly, the real GDP grew by 8.4% during the current fiscal year which seems to have improved the living standards of the people and thus, may help reduce poverty

among the lowest segment of population. The following table shows the Employment Size during 1979-2000:

Table-2

Employment Size	Total	Up to 1979	1980-89	1990-95	1996-98	1999	2000-03
1	1195559	47878	102505	272592	337020	161901	272663
2	1108037	42045	116518	296347	314933	135891	202303
3-4	490621	26593	69684	143992	127626	51559	71167
5-9	130470	9055	22641	40084	30793	11361	16536
10-19	24853	2243	4642	7355	5718	2128	2767
20-49	7108	1140	1712	1947	1195	506	608
50-99	1088	226	305	271	159	54	73
100-199	342	88	105	73	43	11	22
200-499	143	51	50	20	13	1	8
500-999	68	32	18	5	6	2	5
1000 & >	32	18	8	3	2	1	0
Total	2958321	129369	318188	762689	817508	363415	567152

Source: Pakistan Economic Survey 2006

4.2 Analytic Statistics

The following analysis shows that there are differences in poverty levels over the survey years as well as between the economic classes in Pakistan which is obvious. We expect to apply the regression model and find more interesting result than the following ANOVA:

ANOVA

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Years	8.33E-08	1	8.33E-08	5.95E-06	0.997993	4.964603
Between Groups	0.118308	5	0.023662	16.92561*	0.001072*	4.387374
Residual	0.006999	5	0.001398			
Total	0.125307	11				

* Significant at $\alpha = 0.01$

The ANOVA table provided shows a significant difference between the classes in the Pakistani society due to the governmental development plan. However, that change is not significant over the period of 2000 – 2005.

4. CONCLUSION AND RECOMMENDATIONS

From the analysis we conclude that poverty continues despite the governmental efforts to combat it. Also, we find that rural areas suffer more from poverty and that women are at the disadvantaged end when it comes to poverty reduction.

To help reduce poverty we need to combat illiteracy, educate women, and extend governmental services to both rural and urban regions of the country. We need also to increase the GDP of Pakistan through acquisition of high technology and capital intensive projects that employ skilled labour. It is possible by making vocational education compulsory in the government's schools. This activity will contribute to breaking the vicious circle of poverty and the autoregressive impact of past on present and future poverty.

REFERENCES

1. Abdelali-Martini et al. (2008). Gender dimension in the conservation and sustainable use of agro-biodiversity in West Asia. *Journal of Socio-Economics*, Vol. 37, 365-383.
2. Agenor et al. (2008). Roads out of poverty? Assessing the links between aid, public investment, growth, and poverty reduction. *Journal of Development Economics*, 86(2), 277-295.
3. Cai Fang and Du Yang (2006). The changing nature of rural poverty and new policy orientations. *Journal of Chinese Economy*, 39(4), 10-24.
4. Crawford, Gordon (2008). Decentralization and the Limits to Poverty Reduction: Findings from Ghana. *Oxford Development Studies*, 36(2), 235-258.
5. De Silva, Indunil (2008). Micro-level determinants of poverty reduction. *International Journal of Social Economics*, 35(3), 140-158.
6. Emwanu, Thomas et al. (2006). Updating poverty maps with panel data. *World Development*, 34(12), 2076-2088.
7. Habibov, Nazim and Fan, Lida (2007). Social protection and poverty in Azerbaijan, a low-income country in transition: Implications of a household survey. *International Social Security Review*, 60(4), 47-68.
8. Hayati, Dariush et al. (2006). Combining Qualitative and Quantitative Methods in the Measurement of Rural Poverty: The Case of Iran. *Social Indicators Research*, 75(3), 361-394.
9. Kijima, Yoko et al. (2008). Assessing the impact of NERICA on income and poverty in Uganda. *Journal of Agricultural Economics*, 38(3), 327-337.
10. Makita, Rie (2007). Exploring partnership enterprises for the rural poor through an experimental poultry program in Bangladesh. *Journal of Developmental Entrepreneurship*, 12(2), 217-237.
11. May, Julian and Roberts, Benjamin (2005). Poverty Diagnostics Using Poor Data: Strengthening the Evidence Base for Pro-Poor Policy Making in Lesotho. *Social Indicators Research*, 74(3), 477-510.
12. Narain, Urvashi et al. (2008). Poverty and resource dependence in rural India. *Ecological Economics*, 66(1), 161-176.
13. Nassar, Heba (2010). Job Creation and Restructuring for Poverty Alleviation in Egypt. *J. of Community Development*, Cairo University, 7-39.
14. Naurath, Nicole. Gallup Poll Briefing (2007). Vietnamese upbeat on economy but wellbeing lags. *Gallup Poll Briefing*, 1-2.
15. Nissanke, Machiko and Thorbecke, Erik (2008). Globalization–Poverty Channels and Case Studies from Sub-Saharan Africa. *African Development Review*, 20(1), 1-19.
16. Nordtveit, Bjorn Harald (2008). Poverty alleviation and integrated service delivery. *International Journal of Educational Development*, 28(4), 405-418.
17. Varis, Olli; and Keskinen, Marko (2006). Policy analysis for Tonle Sap Lake, Cambodia; a Bayesian Network Model Approach. *International Journal of Water Resources Development*, 22(3), 417-431.
18. Warr, Peter (2007). Long term economic performance in Thailand. *ASEAN Economic Bulletin*, 24(1), 138-163.

THE IMPACT OF BONUS ISSUES ON STOCK PRICES

Usman Ayub and Mohamed Nasr
COMSAT University of Technology, Islamabad.
Email: mohamed_nasr@comsats.edu.pk

ABSTRACT

The present crisis in the American real estate market has affected other stocks on the American as well as other stock markets all over the world. Among the countries affected is Pakistan. However, the policy of offering stock bonuses in many traded companies on Karachi Stock Exchange (KSE) has mitigated that effect. This paper examines the relationship of bonus issue on the stock prices of their respective firms and effect on these issues on the stock prices of other firms also in the index based on KSE. Karachi stock exchange is one of the fastest growing security markets in the developing countries especially that of the Asian Region which is an emerging market. Previous studies have been carried out in China and India. The event window is of seven days prior and post of the bonus announcement. Descriptive statistics will be supported by ARIMA Analysis. A sample of 100 firms will be taken from the index of KSE 100 in order to study the impact of bonus issues on the issuing firm's stock price, and eventually on other firms in the index has been analyzed.

Prior studies have been conducted about this specific issue; worth noting is the event study analysis applied to investigate stock price reaction to the announcement of bonus issues for the markets of China. Results show that the issues with a high bonus usually attract positive returns for both Chinese and foreign residents. But China is regarded as the semi-strong form market which is at odds with the stock markets in Pakistan. The study is based on a 5–10 years data taken from the KSE-100 of the top 100 firms in Karachi Stock Index.

1. INTRODUCTION

Karachi Stock Exchange (KSE) is one of the most promising stock exchanges over the last five years with index crossing 15000 points from once that was around 5000 points. With increasing foreign investment in the KSE, and the security market works on information, very little research has been done on KSE; rather KSE was virtually unknown in eighties and early nineties in the international arena.

The question arises whether KSE is to be taken as one of the form of efficient market hypothesis or it's a violation of it. According Hameed and Ashraf, they concluded that results point out that Weak-form efficiency hypothesis is rejected as it is found that past information helps in predicting future prices (Hameed and Ashraf, PIDE). However answer to this question is not the subject of this paper, rather an attempt has been made in order to provide information about the KSE, taken as an emerging market in which the relationship of bonus issue and the stock prices of the issuing firm and consequently its impact on the KSE-100 index are analyzed.

2. LITERATURE REVIEW

By the start of the twenty-first century, the intellectual dominance of the Efficient Market Hypothesis had become far less universal. Many financial economists and statisticians began to believe that stock prices are at least partially predictable (Malkiel; 2003).

Efficient markets hypothesis (EMH) asserts that in an efficient market price fully reflect available information. It means that investor can expect to earn merely risk-adjusted return from an investment as prices move instantaneously and randomly to any new information. Efficiency is defined at three different levels, according to the level of information reflected in the prices. Three levels of EMH are expressed as follows: weak-form, semi-strong and strong form. Weak-form version of EMH asserts that prices of financial assets reflect all information contained in the past prices. Semi-strong version postulates that prices reflect all the publicly available information. Lastly, strong-form posits that prices of financial assets reflect, in addition to information on past prices and publicly available information, inside info (Fama, 1970, 1991).

This means that all the information is reflected in the share price of the security and primarily, technical and fundamental analysis has no role in predicting the future stock prices- implying that bonus issues do not yield abnormal returns and the stock prices are fairly priced.

However contra evidences are there for every level of efficiency. People do overreact to unexpected and dramatic news event. As a result the “loser” portfolios outperform the market after their formation (DeBondt & Thaler, 1985). Returns unusually high in seasonal & day-of-the-week effects (Haugen & Lakonishok, 1988, Kiem & Hawawini, 1995). One of the strongest effects is the size-effect where smaller-company stocks generate larger returns than those of larger-company stocks (Fama & French, 1993).

In view of the anomalies in the EMH, Fama refers to a “weaker and economically more sensible version of the efficiency hypothesis” (Fama, 1991) which deals with prices reflecting information to the extent that it is not financially worth while to act on any information. While on the other hand, it was stressed that EMH still holds true but the markets are economically efficient not statistically efficient (Malkiel; 2003).

But this is beside the point that whether the markets are efficient or not or whether there can be abnormal profits or not, the point for an emerging market like KSE is that how would the market reacts to the information like bonus issues, in other words what is the behavior of the stock prices-the signaling effect.

An announcement of a stock dividend reveals bad as well as good news for shareholders. The bad news is that the share capital increases, which improves security for debt holders and other claim holders at the expense of the shareholders. However, this appears to be a necessary step for these firms in order to finance steady growth by debt (at an unchanged debt to equity ratio) and retained earnings alone. The good news is that stock dividends are associated with a future increase in total cash dividends. The case where cash dividends are expected to grow, but by less than proportionally to the growth in share capital, suggests that a stock dividend on its own in these cases is considered to be negative news by the stock market (Bechmann & Raaballe).

Stock prices, on average, react positively to stock dividend and stock split announcements that are uncontaminated by other contemporaneous firm-specific announcements. In addition, it documents significantly positive excess returns on and around the ex-dates of stock dividends and splits. Both announcement and ex-date returns were found to be larger for stock dividends than for stock splits (Grinblatt, Masulis, & Titman, 1984)

The event study methodology employed to investigate the stock price behaviour in response to the bonus issues for the new emerging stock markets of China. Empirical studies were conducted on the abnormal returns triggered by the announcements of bonus issues' proposals and approvals for the A-shares and approvals for the B-shares respectively. In total, eleven portfolios were constructed according to the size of the bonus ratio for each issue. A parametric test was performed on the abnormal returns not only on the event dates but also on the intervals before, after and surrounding the event date. Empirical results show that the direction and magnitude of the stock price reaction to the announcement of bonus issues depend upon the specified bonus schemes (Barnes and Shiguang Ma, May 2001).

Another paper that investigated the operating performance of Bombay Stock Exchange listed firms subsequent to equity Bonus payments states that firms exhibit superior performance compared to control firms matched on the basis of industry and size and to another set of control firms based on industry and pre-event performance (Lukose & Rao).

3. RESEARCH METHODOLOGY AND SAMPLE DATA

Our data are secondary collected from Karachi Stock Exchange about the Bonus issues by companies listed with them. It was difficult to get the data, and now the easiest way of analysis is to include just descriptive statistics, to be later supported by ARIMA Analysis. We expect that the bonus shares will be affected by several factors not only the autoregressive component which would form a random walk if used alone; i.e. the bonus shares of this month are affected only by the bonus shares paid during the former months. There are many other factors that would affect the payout of bonus shares such as the trend of the market for the specific company (Bull VS Bear Market), gross and net profit of the company, the inflation level as reflected by the CPI, and other socio-economic factors that we plan to include in a follow up when all data are available.

$$Y_i = Y_{i-1} + \sum_{i-1}^n \beta_i X_i + \varepsilon_i$$

where Y_i denotes this period's paid out bonus shares
 Y_{i-1} denotes last period's paid out bonus shares
 X_i denote the factor affecting the bonus shares payout
 β_i denote those factor's affecting coefficients
 ε_i denotes other factor's affecting coefficients

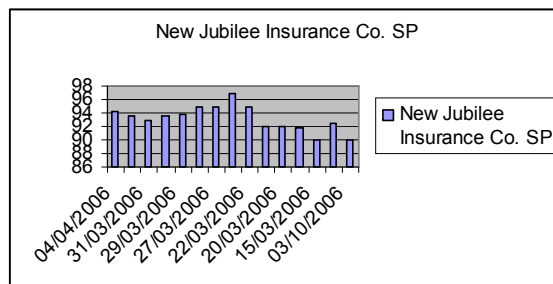
4. DATA ANALYSIS AND PRESENTATION

4.1 Descriptive Data Presentation:

The following tables and graphs are excerpts of 100+ companies we are going to analyze in our study:

Table 1: New Jubilee Insurance Co.

DATE	SP	KSE-100	DATE	SP	KSE-100
04/04/2006	94.3	11,664.97	22/03/2006	95	11,278.45
04/03/2006	93.5	11,573.94	21/03/2006	92	11,130.13
31/03/2006	93	11,485.90	20/03/2006	92	11,082.22
30/03/2006	93.5	11,568.69	16/03/2006	91.8	10,689.36
29/03/2006	93.85	11,414.34	15/03/2006	90	10,393.87
28/03/2006	94.8	11,449.52	13/03/2006	92.5	10,094.81
27/03/2006	95	11,402.22	03/10/2006	90	10,474.20
24/03/2006	97	11,458.58			

**Fig. 1****Table 2: Askari General Insurance Ltd.**

DATE	SP	KSE-100	DATE	SP	KSE-100
04/03/2006	30	11,573.94	21/3/2006	28	11,130.13
31/3/2006	29.7	11,485.90	20/3/2006	26.9	11,082.22
30/3/2006	30	11,568.69	17/3/2006	26	10,951.08
29/3/2006	30.7	11,414.34	16/3/2006	25.2	10,689.36
28/3/2006	30.35	11,449.52	15/3/2006	24	10,393.87
27/3/32006	30.9	11,402.22	13/3/2006	25	10,094.81
24/3/2006	30.85	11,458.58	03/10/2006	26.15	10,474.20
22/3/2006	29.4	11,278.45			

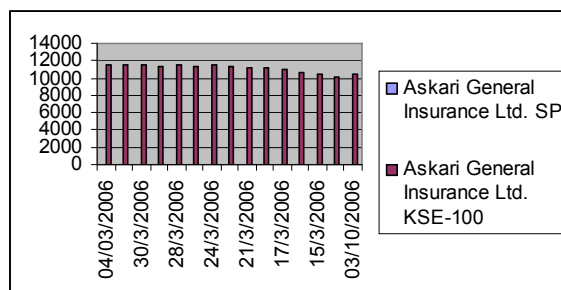
**Fig. 2**

Table 3: Bank Al-Falah Limited

DATE	SP	KSE-100	DATE	SP	KSE-100
03/08/2007	41.88	11,283.24	26/02/2007	39.69	11,393.69
03/07/2007	40.96	11,146.35	23/02/2007	41.77	11,607.84
03/06/2007	39.42	10,923.91	22/02/2007	41.5	11,542.99
03/05/2007	38.08	10,900.22	21/02/2007	41.08	11,521.49
03/02/2007	39.15	11,133.35	20/02/2007	42.27	11,463.18
03/01/2007	39.31	11,207.64	19/02/2007	40.38	11,577.71
28/02/2007	39.77	11,180.02	16/02/2007	39.54	11,379.40
27/02/2007	41.08	11,375.00			

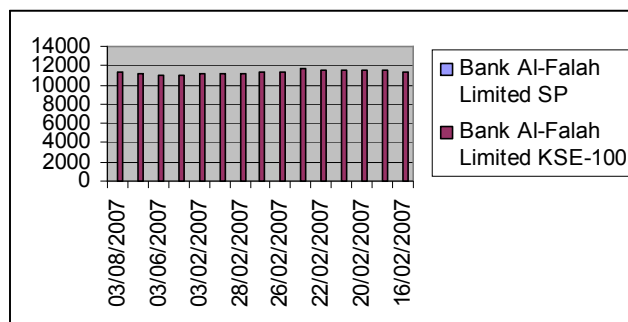
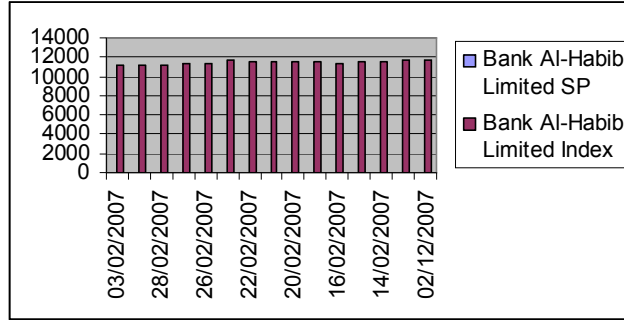


Fig. 3

Table 4: Bank Al-Habib Limited

Date	SP	Index	Date	SP	Index
03/02/2007	77	11,133.35	20/02/2007	70.3	11,463.18
03/01/2007	77.15	11,207.64	19/02/2007	72	11,577.71
28/02/2007	78	11,180.02	16/02/2007	70	11,379.40
27/02/2007	78	11,375.00	15/02/2007	69.85	11,467.77
26/02/2007	78	11,393.69	14/02/2007	71.9	11,454.77
23/02/2007	76.8	11,607.84	13/02/2007	72	11,643.76
22/02/2007	75	11,542.99	02/12/2007	71.85	11,629.75
21/02/2007	72.5	11,521.49			

**Fig. 4****Table 5: MCB Bank Limited**

Date	SP	Index	Date	SP	Index
03/06/2007	252.04	10,923.91	22/02/2007	269.43	11,542.99
03/05/2007	247.8	10,900.22	21/02/2007	261.17	11,521.49
03/02/2007	254.55	11,133.35	20/02/2007	248.75	11,463.18
03/01/2007	258.7	11,207.64	19/02/2007	254.12	11,577.71
28/02/2007	253.51	11,180.02	16/02/2007	249.88	11,379.40
27/02/2007	257.75	11,375.00	15/02/2007	256.33	11,467.77
26/02/2007	263.03	11,393.69	14/02/2007	256.97	11,454.77
23/02/2007	270.82	11,607.84			

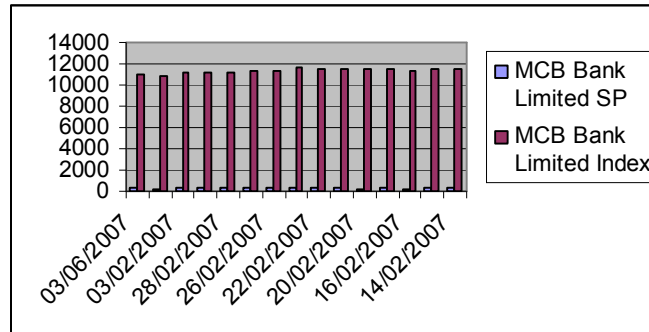
**Fig. 5**

Table 6: Abbott (Lab) Pakistan Ltd.

DATE	SP	kse 100	DATE	SP	kse 100
20/02/2006	229	11,403.92	02/06/2006	224	10,801.09
17/02/2006	229	11,352.63	02/03/2006	222	10,726.46
16/02/2006	231	11,177.91	02/02/2006	224	10,465.56
15/02/2006	235	11,254.32	02/01/2006	223	10,497.07
14/02/2006	230	10,920.09	31/01/2006	226	10,523.37
13/02/2006	230.5	11,218.61	30/01/2006	225	10,527.84
02/10/2006	235.5	11,052.86	27/01/2006	217.5	10,447.56
07.02.2006	235.2	10,914.58			

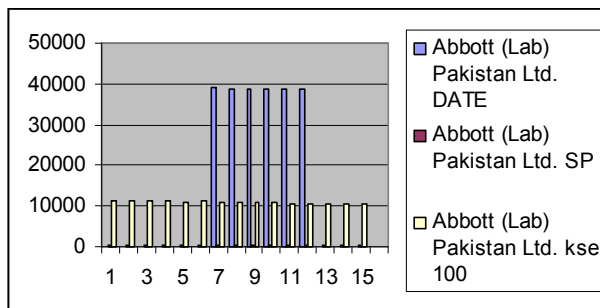


Fig. 6

Table 7: Ghani Glass Limited

DATE	SP	KSE-100	DATE	SP	KSE-100
10/09/2006	84.6	10,942.92	27/09/2006	78	10,386.52
10/06/2006	84.9	10,927.05	26/09/2006	77.5	10,305.63
10/05/2006	85.3	10,855.88	25/09/2006	78	10,253.24
10/04/2006	84.65	10,744.67	22/09/2006	78.5	10,306.75
10/03/2006	84.9	10,592.72	21/09/2006	78.5	10,157.95
10/02/2006	83	10,616.24	20/09/2006	78	10,032.69
29/09/2006	85.95	10,512.52	19/09/2006	75.5	9,908.97
28/09/2006	81.9	10,528.82			

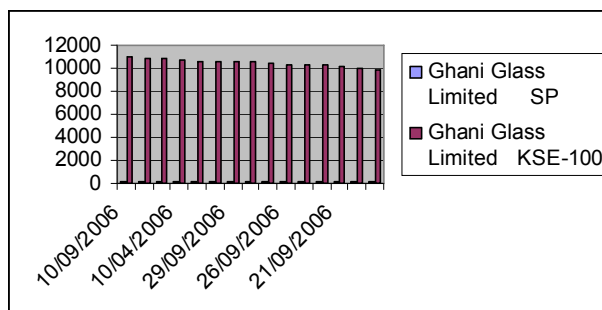


Fig. 7

Table 8: Sample Companies

Jubilee	Askari	Alfalah	Al-Habib	MCB Bank	Abbot Lab	Ghani Glass
SP	SP	SP	SP	SP	SP	SP
94.3	30	41.88	77	252.04	229	84.6
93.5	29.7	40.96	77.15	247.8	229	84.9
93	30	39.42	78	254.55	231	85.3
93.5	30.7	38.08	78	258.7	235	84.65
93.85	30.35	39.15	78	253.51	230	84.9
94.8	30.9	39.31	76.8	257.75	230.5	83
95	30.85	39.77	75	263.03	235.5	85.95
97	29.4	41.08	72.5	270.82	235.2	81.9
95	28	39.69	70.3	269.43	224	78
92	26.9	41.77	72	261.17	222	77.5
92	26	41.5	70	248.75	224	78
91.8	25.2	41.08	69.85	254.12	223	78.5
90	24	42.27	71.9	249.88	226	78.5
92.5	25	40.38	72	256.33	225	78
90	26.15	39.54	71.85	256.97	217.5	75.5

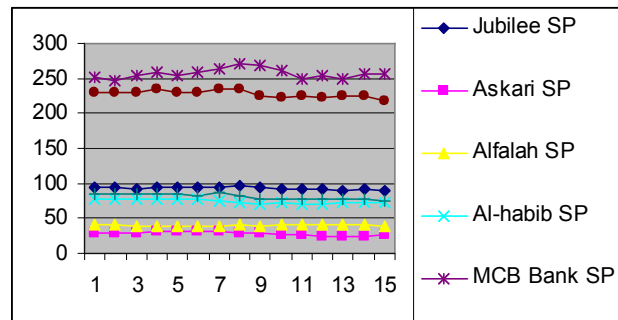


Fig. 8

Descriptive Statistics n = 15

MCB Bank Ltd.		Abbott Lab Pak Ltd.		Ghani Glass Ltd.	
Mean	256.99	Mean	227.78	Mean	81.28
Standard Error	1.769616	Standard Error	1.369505	Standard Error	0.939425
Median	256.33	Median	229	Median	81.9
Mode	#N/A	Mode	229	Mode	78
Standard Deviation	6.853692	Standard Deviation	5.304069	Standard Deviation	3.638377
Sample Var	46.9731	Sample Var	28.13314	Sample Var	13.23779
Kurtosis	0.081902	Kurtosis	-0.607	Kurtosis	-1.8086
Skewness	0.760911	Skewness	-0.11641	Skewness	-0.09251
Range	23.02	Range	18	Range	10.45
Minimum	247.8	Minimum	217.5	Minimum	75.5
Maximum	270.82	Maximum	235.5	Maximum	85.95
Sum	3854.85	Sum	3416.7	Sum	1219.2
$t(v=14, \alpha=.05)$	3.795448*	$t(v=14, \alpha=.05)$	2.937295*	$t(v=14, \alpha=.05)$	2.014866*

* Significant at $\alpha = 5\%$

4.2 Regression Model and Data Analysis

We plan to use the ARIMA model for data analysis. However, as we see here, we still are able to confirm the initial assumption of ± 7 days about the bonus share issue as we can see on figure 6. There is a curve around day 7 showing a change in the stock price before and after the date of bonus share issue. We expect to corroborate this finding through ARIMA analysis of our 100+ companies' data.

ANOVA - Averages

Groups	df	Sum	Average	Variance
Jubilee Insurance Co.	14	1303.95	93.13929	3.836992
Askari Insurance	14	393.15	28.08214	6.121003
Bank Alfalah Ltd.	14	564	40.28571	1.413365
Bank Al-Habib Ltd.	14	1033.35	73.81071	10.18891
MCB Bank Ltd.	14	3602.81	257.3436	48.56698
Abbott Lab Pal Ltd.	14	3187.7	227.6929	30.17456
Ghani Glass Ltd.	14	1134.6	81.04286	13.34764

ANOVA

Source of Variation	SS	df	MS	F	P-value	F critical
Between Groups	691935.9	6	115322.6	7103.057*	3.1E-119*	2.199905
Residual	1477.443	91	16.23564			
Total	693413.3	97				

*Significant at 1% level

The results on ANOVA table shown above tells us that there is a significant difference between those companies which we interpret as going in favor of companies that have issued bonus shares more frequently causing the share prices to change.

5. CONCLUSIONS AND RECOMMENDATIONS:

We conclude from this study at its initial stage that bonus share issues play important role in signaling for prospective investors who rush to buy stock of companies that have just declared that within a week it will issue bonus stock and it will be reflected immediately up to 7 days of the bonus stock issue. We expect that many companies will follow steps of those issuing bonus stock in order to keep their stock prices at least at the present level instead of diving in favor of competitors due to effect of speculators.

We do not recommend much at the moment except that investors should be more careful instead of being affected by the signal of ± 7 days around the bonus stock issue. We hope that use of our ARIMA model will corroborate our findings.

REFERENCES

1. Hameed, Abid and Ashraf, Hammad. *Stock Market Volatility and Weak-Form Efficiency: Evidence from an Emerging Market*, PIDE.
2. Malkiel, Burton G. (2003). The Efficient Market Hypothesis and its Critics. *Journal of Economics Perspectives*. 17(1), 59-82.
3. Kiem, Donald B. and Hawawini, G. (1995). On Prediction of Common Stock Returns: Worldwide Evidence. in *Handbook in Operations Research & Management Science*, Vol. 9, 497-544.

4. Fama, E. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *J. of Finance*, 25(2), 387-417.
5. Fama, E. (1991). Efficient Capital Markets-II. *J. of Finance*, 46(5), 1575-1617.
6. Fama and French (1993). Common Risk Factors in Return on Stocks and Bonds, *J. of Finance*, 33:1.
7. DeBondt, F.M. and Thaler R. (1985). Does Stock Market Overreact. *J. of Finance*, 793-805.
8. Haugen, Robert A. and Lakonishok, Josef (1988). *The Incredible January Effect*.
9. Barnes, Michelle L. and Ma, Shiguang (2001). Market Efficiency or Not? *The Behaviour of China's Stock Prices in Response to the Announcement of Bonus Issues*.
10. Lukose, Jijo P.J. and Rao, S. Narayan. *Does bonus issue signal superior profitability? A study of the BSE Listed Firms*, papers.ssrn.com.
11. Grinblatt, Mark, Masulis, Ronald W. and Titman, Sheridan (1984). The Valuation Effects of Stock Splits and Stock. *J. Fin. Econ.* (JFE), 13(4).
12. Bechmann, Ken L. and Raaballe, Johannes (2007). The Differences between Stock Splits and Stock Dividends: Evidence on the Retained Earnings Hypothesis, *Journal of Business Finance & Accounting*, 34(3)&(4), 574-604.

BANKING SEGMENT AND CELL PHONE INCLINATION

**Ahmed F. Siddiqi, Suneela Azeem, Maryam Mustafa,
Jamil Javaid and Hassan Sabir**

Gift Business School, Gift University, Gujranwala
Email: khurram@gift.edu.pk

ABSTRACT

This is a descriptive statistical study conducted for analyzing empirical usage pattern of cellular phones of the employees especially working in the banking sector. The purpose of this study is to investigate and explore the preferences that a customer sets in his/her mind while purchasing the cellular network like Network Coverage, Call Rates, and pattern of mobile usage like Daily outgoing calls, SMS, Weekly spending over mobile, Preferable time and Duration of the call.

As it was conducted by primary source of data in which questionnaire surveys were used to generate the data to analyze the effectiveness of different facilities provided by the telecom industry and the weight their customer gave to those facilities.

INTRODUCTION

Nothing is constant in the Universe as things in the nature continuously keep on changing. As modern era is based on technology therefore technology is improving day by day and its pace has become faster than ever before. It has changed the dimension of every thing even our way of thinking. It is difficult to forecast about the future of technology but definitely it will have significant impact on our lives as every new thing leads towards the invention of other. Cell phones can be consider as an integral part of new generation, a type of wireless mode of communication which has resolved the mobility, portability and area constraints that exist in landline phones. It has made our lives easier, enabled us to move with the pace of rest of the world. Cell phones are becoming very popular and its usage has been increased in order to keep connected with the family and friends. Asia is the fastest-growing region, accounted for one of every four phones sold in 2005, a pace that is projected to increase to one of three by 2009 (“Gartner Press Release”, 2005). It has dramatically changed the lives of the people in positive manner by increasing their social structure or in negative manner by disturbing their privacy. It has not only imposed its influence over our lives but it has also boosted up the level of competition in telecom industry. To be more successful you have to be more competitive and focused on the needs of your customers. As Customer are the vital asset of any company because this is a customer-oriented era where customers are the KING. Things have been moved from mass production to customize production and many companies target the niche markets instead of going after the large ones in which profit margin is relatively less. This study investigates and analyzes the practices of banking professionals regarding to cell phone usage, their preferences and behavior.

LITERATURE REVIEW

Mobile phone technologies are now in the hands of almost 31 percent or 2 billion people (Motorola, 2006) of the 6.47 billion people on this planet ("Population Reference bureau Statistics"). Cell phone industry is observing unprecedented growth in many parts of the world (Doxa, 2003; International Telecommunication Union, 2004). The penetration of these technologies is increasing very rapidly with around 779 million ("Gartner Press Release". 2005) mobile phones sold every year and expected to reach over 1 billion units per year sold by 2009. These staggering numbers are indicator of the growth and reach of mobile phones. The widespread use of mobile phones may affect social and geographical aspects of young adults' lives, disassociating them from or enlivening urban public spaces (Kopomaa, 2000; Katz, 2003; cooper et al., 2004).

Aoki and Downes (2002) studied these areas of interest in the context of college students in the US. Lorente (2002) suggested that as compared to USA, South East Asia and Europe are far ahead in societal penetration of cell phone usage. Massoud and Gupta (2004) emphasized the importance of mobile-commerce as a significant source of potential revenues for the companies. As with automobiles, telephones and televisions before them, cell phones have brought with them many unforeseen costs along with benefits. As society embraces the use of technology, it must also deals with its side effects. The proper use of cell phones becomes more of a concern as the number of cell phones increases. Sprint, a U.S. telecommunications company, actually employs a Cell Phone Etiquette Spokesperson who educates people about responsible cell phone use (Shalit, R. Techno-Etiquette for the Mobile Age. Mpulse, 2003).

It is seen as a fashion accessory that satisfied the need for individualization by having choices in mobile wallpaper, ring tunes, phone covers, carry bags and other accessories (Srivastava, 2005) and yet also signifies being part of the peer group (Williams and Williams, 2005) Dryer, Eisbach, and Ark (1999) discussed problems that arise with social computing, defines as "the interplay between persons' social behaviors and their interactions with computing technologies." They noted that the designs of most mobile devices do not take in to account the presence of individual s other than their users. Furthermore, information technology can interfere with positive social encounters, and devices themselves sometimes make an antisocial statement.

Researches have been involved in exploring the problems due to cell phone usage. Palen (2002) discusses how mobile phones allow individuals to maintain connectedness and expand the scope of their activities beyond what was achievable without the technology. Etiquettes and acceptability to use cell phones regarding to places is also an important discussion. Participants of focus groups in Norway (Ling, 1997) stated that cell phones should not be used in airports, stores, meetings, on trains and buses, at certain social functions and in theaters with the most serious offense involving the use of a mobile phone in a restaurant. A study by Palen, Salzman and Youngs (2000) concluded that a person's attitude towards public cell phone use changes (becomes more accepting) as they use a cell phones more. Palen (2002) predicted that as adoption of cell phones increases people will be less concerned about appropriate use but will still call for "cell-free" zones. Costabile and Addis (2002) and Vohovar et al (2004) reported the tendency of cell phone users owning more than own SIM cards. Cellular phone industry observes the adoption of cellular phones because of peer pressure (Kunz and Doris, 2003; Ling, 2001)

Weilenmann, A. and Larsson. (2001) conducted field studies of public use of mobile phones among teenagers in Sweden. Their study shed light on how the mobile phone has come to be used a tool for local social interaction, rather than merely as a device for communication with dislocated. It is now well established that cell-phone use significantly impairs driving performance (e.g., McEvoy et al., 2005; Redelmeier and Tibshirani, 1997; Strayer, Drews and Johnston, 2003; Strayer and Johnston, 2001). For example, our earlier research found that cell-phone conversations made drivers more likely to miss traffic signals and react more slowly to the signals that they did detect (Strayer and Johnston, 2001). Moreover, equivalent deficits in driving performance were obtained for users of both hand-held and hands-free cell phones (Strayer, Drews and Crouch, 2006). By contrast, listening to radio broadcasts or books on tape did not impair driving. These findings are important because they demonstrate that listening to verbal material, by itself, is not sufficient to produce the dual-task interference associated with using a cell phone while driving. The data indicate that when a driver becomes involved in a cell-phone conversation, attention is withdrawn from the processing of the information in the driving environment necessary for safe operation of the motor vehicle.

The mobile phone was originally created for adults for business use (Aoki and Downes, 2003). The growth of mobile phone technology is demonstrated by the fact that in 2002 the number of mobile phone users worldwide, surpassed those of fixed-phone users (Srivastava, 2005) it has been predicted that by the end of 2005 the number of mobile phone subscribers worldwide will reach 2 billion (Deloitte research, 2005) and in Australia will reach 19.2 million (Fisher, 2005). The diffusion velocity of cellular phone is unmatched with any other technological gadget including spread of PC and internet connection (Geser, 2006). Srivasta (2005) analyzed the influence of advancement in mobile technology on humans and society. Green and Singleton (2007) suggested that relationship between youth, gender and ethnicity with mobile phones is an areas that needs the attention of modern researchers.

International Communication Association (www.allacademic.com) states that “women use text messaging more frequently than men, and men use voice call slightly more than women. The implications of these results were discussed in terms of women’s uses of media technology. We concluded that interpersonal media such as mobile voice call and text messaging were efficient tools for maintaining interpersonal relationships and fulfilling communication motives, especially for women”. As Fox (2001) concludes from her focus group interviews, texting is a very useful way of undertaking one’s social obligations to stay in touch without spending time or energy on the encounter. Texting avoids awkward silences and having to make conversation. It enables shy or reserved young people to communicate without embarrassing emotions while encouraging candid or even cheeky text (Plant, 2000).

METHODOLOGY

The data was collected by using structured self-administered questionnaire. The survey questionnaire had closed ended questions. It was pre-tested with two Banks. It was designed to elaborate the information regarding to three major variable of segmentation i.e. Demographic, Behavioral and Psychographic. These variables were used to conduct research. Age, Gender and Work Experience have been used as Demographic variables. Behavioral variables include usage pattern related with

frequency of usage, Whereas Psychographic variables comprises perception and attitude of the respondents towards those factors which are important in their purchasing decision of that connection. Five Point Likert Scale is used to measure the Psychographic variables (i.e., rating scale: 1 = not at all important, 5 = very important). Various Private National and International Banks of Gujranwala, Gujrat and Lahore were consulted. A sample of 200 respondents was selected for conducting research including both male/females which was convenience based sampling. 30 questionnaires were discarded during selection process due to deficient data entry and Non-Incident rate is 15 percent. So this analysis was based on the data given by the 170 respondents. So n = 170.

DATA ANALYSIS AND DISCUSSION

For data analysis Statistical Program for Social Sciences (SPSS) is used. 88.2 percent respondents were male and 11.8 percent were females. 61 percent of respondents lie in 20-30 years, 23 percent lie in 31-40 years and 16 percent lie in 41-56 years. This analysis is conducted by using frequency and descriptive statistical, Pearson Correlation, Factor loading techniques and Reliability Test. As data was divided in to two parts therefore the analysis is also separately mentioned.

RELIABILITY TEST

This research work formulated a reliable tool by using existing questions on a nominal scale. Cronbach's Alpha is a numerical coefficient of reliability that ranges from 0-1 and used to describe the reliability of factors extracted from dichotomous (that is, questions with two possible answers) and/or multi-point formatted questionnaires or scales (i.e., rating scale: 1 = poor, 5 = excellent). The higher the score, the more reliable the generated scale is. Nunnaly (1978) has indicated 0.7 to be an acceptable reliability coefficient (J. Reynaldo A. Santos) which authenticates this study as its value is 0.813 that is greater than 0.7 which shows its significance.

Table 1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.813	.815	16

FACTOR LOADING TECHNIQUE

In this technique Principle Component Analysis has been used which avail the covariance matrix analysis to elaborate the relationship between two variables with itself and gave the best and strong variable from rest of the variables for carrying on the analysis.

CONSIDERATION FOR PRINCIPLE COMPONENT ANALYSIS

It is the basic step for carrying on the analysis that the variables which have been used should be normally distributed because asymmetric data affects not only the result but also the correlation. To avoid that Varimax test is used over 16 Psychographic variables to authenticate that the outcomes are normally distributed. But correlation is the important part of this analysis so the selected variables should be relevant to each other

so BARTLETT's test is conducted to evaluate it. Variable Communality is the next step as reliability of the variables is very important so we have to analyze it before proceeding further and variable having low value is not acceptable in it as it shows that it is not suitable for the analysis. Eigenvalue measures the variance in all variables means importance of that variable in that factor or contribution of that variable. If its value is less than 1 it has to be replaced with the strong variable. Due to room limitation various SPSS tables have been removed from this paper only strong variables have been discussed here.

Table 2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.7	29.6	29.608	4.7	29.6	29.608	4.1	25.7	25.736
2	2.8	17.6	47.199	2.8	17.6	47.199	2.1	13.3	39.039
3	1.3	8.019	55.218	1.3	8.019	55.218	2.1	13.1	52.105
4	1.2	7.507	62.725	1.2	7.507	62.725	1.7	10.6	62.725
5	.92	5.755	68.479						
6	.82	5.153	73.632						
7	.72	4.509	78.140						
8	.61	3.786	81.926						
9	.52	3.234	85.160						
10	.47	2.962	88.122						
11	.45	2.797	90.919						
12	.40	2.498	93.417						
13	.37	2.310	95.727						
14	.32	2.018	97.745						
15	.26	1.606	99.351						
16	.10	.649	100.0						

Extraction Method: Principal Component Analysis.

Table 2 is explaining Total Variance in which initial Eigenvalue, Extraction Sums of Squared loadings (individual and Cumulative) and Rotation Sums of Squared Loadings (where applicable). Factors that have values less than 1 have been eliminated. Four components have been extracted having 62.725 percent total variance. In rotation, the first component is showing 25.7 percent of the variance, the second one 13.3 percent, third one 13.1 percent and the fourth one 10.6 percent.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.792
Bartlett's Test of Sphericity	Approx. Chi-Square	1132.888
	Df	120
	Sig.	.000

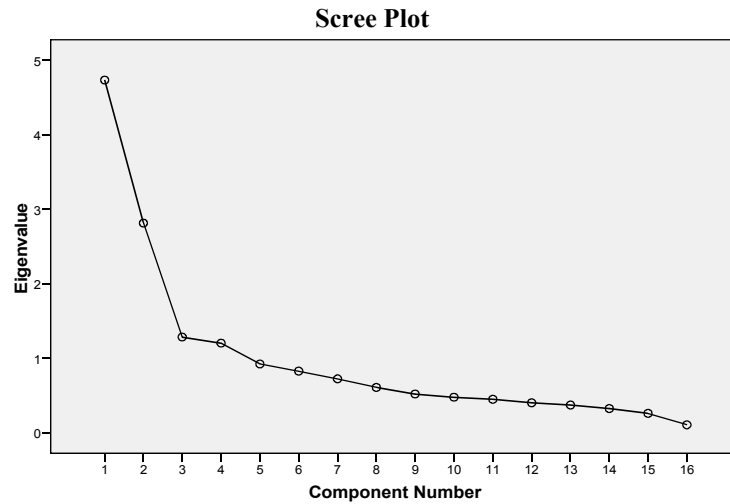


Table 3 is showing Kaiser-Meyer-Olkin measure of Sample of adequacy and Bartlett's Test of Sphericity. The outcome of KMO ranges from 0-1 and value should be greater than 0.7. The outcome is compatible as the value came after the test is showing authenticity. The values of the Bartlett's test of sphericity are also come significant as it should be less than 0.05. Scree Plot is showing the variation between the variables as after the first three variables has highest eigenvalues and after that the values of each component has been declining at almost sustainable pace. The fourth component is relatively weak variable as the Scree plot has become flattens.

Table 4: Rotated Component Matrix (a)

	Component			
	1	2	3	4
Importance of Call Rates	.084	.526	.444	.284
Importance of Network Coverage	.030	.824	.141	-.035
Importance of Network Coverage During Events	-.098	.790	.192	.132
Importance of Friends and Relatives having Same Connection	.232	-.097	.261	.627
Importance of Brand Name	-.042	.058	.706	-.059
Importance of Value Added Services	.378	.281	.148	.455
Importance of SMS rates	-.127	.234	.794	.106
Importance of MMS rates	.765	-.028	.077	.131
Importance of GPRS Services	.855	.101	.103	.065
Importance of GPRS Rates	.854	.074	.064	.103
Importance of Helpline Services	.680	.119	-.321	.349
Importance of Ring back Tune Services	.198	.085	-.276	.738
Importance of Cal Connectivity	.438	.565	.017	-.341
Importance of Low Call Rates for Special Hours	.282	.207	.642	-.020
Importance of International Roaming Facility	.821	-.047	-.066	.120
Importance of Friends and Family Services	.628	-.001	.029	.394

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

A Rotation converged in 6 iterations.

Table 4 is highlighting the variable which is mostly contributing and grouped those variables and gave a single name termed as Value Added Features.

CONCLUSION

By analyzing the given sample we configure four important variables by improving them Telecom Industry can serve this segment better which eventually leads towards concentrated market share and higher profits. Those variables can be termed as Value added features of Cell Phones like Internet usage, Network Coverage, Text messages and Ring back Tunes. As the results highlights that people in Banking sector gives much more importance to GPRS rates and Services, MMS rates, Network Coverage as they are also concerned about its availability during events, SMS rates and Ring back tune Services. Telecom industry can capture this segment efficiently and effectively by their attractive offerings regarding to these features. As there is growing trend towards GPRS and they are concerned about its rate and services so company should pay attention towards it.

REFERENCE

1. Aoki, K. and Downes, E.J. (2004). An analysis of young peoples use of and attitudes towards cell phones. *Telematics and informatics*, 20(4), 349-364.
2. Cooper, B., N. Green, R. Harper, and G. Murtagh (2004). *The mobile society: technology and social action*. Berg, London.
3. Costabile, M. and Addis, M. (2002) Comunicazione mobile in Italia; passato, presente e futuro. In *Mobile Communication: Successi di Marketing nelle Telecomunicazioni Mobili in Italia*. (eds M. Costabile and M. Addis), 23-76.
4. Deloitte Research. (2005). TMT trends: Mobile & wireless predictions 2005. Retrieved July 6, 2005 from <http://www.deloitte.com/dtt/research/0,1015,cidpercent3D70866&prepercent3DY&lidpercent3D1,00.html>
5. Doxa (2003). Junior 2002: *Indagine sui Comportamenti dei Ragazzi 5-13 Anni*.
6. Dryer, D.C., Eisbach, C. and Ark, W.S. (1999). At What Cost Pervasive? A Social Computing View of Mobile Computing Systems. *IBM Systems Journal*, 38(4), 652-676.
7. Flinchy, P. (1997). Perspectives for a sociology of the telephone. *The French Journal of Communication*, 5(2), 149-160.
8. Fisher, V. (2005). Australians embrace mobile phones. Retrieved July 6, 2005, from <http://www.cellular-news.com.au/newsstory.aspx?ClaNID=18976>
9. Fox, K. (2001). Evolution, alienation and gossip. The role of mobile telecommunications in the 21st century. Oxford: Social Issues Research Center.
10. Gartner Press Release (2005). Gartner Says Mobile Phone Sales Will Exceed One Billion in 2009. Retrieved April 11, 2006 from http://www.gartner.com/press-release/asset_132473_11.html
11. Geser Hans (2006). *Pre-teen cell phone adoption: consequences for later patterns of phone usage and involvement*. In: *Sociology in Switzerland: Sociology of the Mobile Phone*. Online Publications. Zuerich.
12. Green, Eileen and Singleton, Carrie (2007). Mobile Selves: Gender, ethnicity and mobile phones in the every day lives of young Pakistani-British women and men, Information. *Communication and Society*, 10(4), 506-526(21), Routledge, part of the Taylor and Francis Group.

13. International Telecommunication Union (2004). *Mobile cellular, subscribers per 100 people*. International Telecommunication Union, Geneva. (Available from http://www.itu.int/ITU-D/ict/statistics/at_glance/cellular04.pdf)
14. Katz, J. (ed.) (2003). *Machines that become us: the social context of personal communication technology*. Transaction Publishers, New Brunswick, NJ.
15. Kunz Heim, Doris (2003). *Sozialisationsfunktionen des Handy*. (In: Süß, Daniel et al.: Merkmale des Medienalltags, unter besonderer Berücksichtigung der Mobilkommunikation. Forschungsbericht. Zürich/Aarau; 77-106). http://www.hapzh.ch/download/F_Jugendliche_und_Medien.pdfz
16. Kopomaa, T. (2000). *The city in your pocket: birth of the mobile information society*. Gaudeamus, Helsinki.
17. Ling, R. (1997). *One Can Talk About Common Manners!: The Use of Mobile Telephones in Inappropriate Situations*. In Haddon, L. (ed.) Themes in Mobile Telephony, Final Report of the COST 248 Home and Work Group.
18. Ling, Rich (2001). The diffusion of mobile telephony among Norwegian teens. A report after the revolution. Presented at *ICUST 2001*. In Paris.
19. Lorente, Santiago (2002). *Youth and Mobile Telephones: More than a Fashion*. In: Revista de Estudios de Juventud 57, 9-24.
20. L. Srivastava, (2005). Mobile phones and the evolution of social behavior. *Behavior and Information technology*, 24(2), 111-129(19), Taylor and Francis.
21. Massoud, Samia and Gupta, Omprakash K. (2004). Consumer perception and attitude toward mobile communication, *International Journal of Mobile Communications*, 1(4), 390-408(19), Inderscience.
22. Motorola (2006). *Towards the next billion subscribers: Motorola delivers on seamless mobility vision*. Retrieved April 11, 2006 from http://www.motorola.com/meriacenter/news/detail/0,6405_6355_23,00.html#fn1
23. Palen, L. (2002). Mobile Telephony in a Connected Life. *Communications of the ACM*, 45(3), 78-82.
24. Palen, L., Salzman, M. and Youngs, E. (2000). Going Wireless: Behavior and Practice of New Mobile Phone Users. *Proceedings of the Conference on Computer Supported Cooperative Work (CSCW'00)*, 201-210.
25. Plant, S. (2000). *On the mobile. The effects of mobile telephones on social and individual life*. Retrieved from www.Motorola.com/mot/document/0,1028,333,00.pdf
26. Population Reference Bureau (2006). *Population Reference Bureau Country Statistics*. Washington DC. Retrieved 4/11/2006.
27. Shalit, R. (2003). *Techno-Etiquette for the Mobile Age*. mpulse, available at www.cooltown.com/mpulse/1203-etiquette.asp.
28. Srivastava. L. (2005). Mobile phones and the evolution of social behaviour. *Behaviour and Information Technology*, 24, 111-129.
29. Weilenmann, A. and Larsson, C. (2001). *Local Use and sharing of Mobile Phones*. In B. Brown, N. Green and R. Harper (Editors.) *Wireless World: Social and Interactional Aspect of the Mobile Age*. Godalming and Hiedleburg: Springer Verlag, 99-115.
30. Williams, S. and Williams, L. (2005). Space invaders: The negotiations of teenage boundaries through the mobile phone. *The Sociological Review*, 53, 314-331.

A PRIME ON SAS AND TIME SERIES FORECASTING

Sara Azher, Sana Riaz and Zakia Hassan
Department of Statistics, University of Karachi

ABSTRACT

The aim of our study is to analyze the large set of data by using statistical software SAS.

In this paper we provide an introduction to SAS and that how we can change our data set to SAS data. We also discussed some statistical analysis and different forecasting model and fitting of these models to our data "US Indices of Industrial production: 1947-1993 (Monthly) data has been used."

This paper provides a guide for all those ones that don't have any familiarity with this software.

This paper is basically divided into three parts:

1. Key Concept
2. Forecasting By SAS Programming
3. Click and Point Forecasting

1.1 What is SAS?

SAS stands for Statistical Analysis System. It is a statistical and information system that performs sophisticated data management and statistical analysis. SAS is available in multiple computing environments. We will focus on SAS 9.1 for Windows, which is a complete data analysis program with capabilities comparable to, and, in some aspects, surpassing, and its counterparts SPSS, S-Plus and Stata. SAS for Windows will do every task that other editions of SAS do, plus it is easy to use and its graphic user interface can do a lot more in graphical analyses than the retired mainframe or current UNIX versions.

1.2 The data step

Having created the file containing the raw data, we must instruct SAS to accept the data as prelude to analysis. This is done by means of a programming step called a **DATA STEP**.

The DATASTEP reads the data and transfers a copy to temporary SAS work file. In the process, SAS names are given to each of the variables, delete unwanted variables or observations, assign labels to values of a variable, consider the following:

```
Data INDUSTRIAL;  
INFILE "d:\industrial1.txt";  
Input YR MN IP MFG MFGD MFGN;  
Run;
```

Note that the DATA step comprises a sequence of instructions or statement, each terminated with a semi-colon, so that lengthy statements may extend over many lines. Failure to include the semi-colon at the end of a statement is the most common error made.

1.3 THE PROC step

Once the data has been read from the raw data file into the SAS work file, analysis can begin in earnest. Statistical analysis is performed by means of a programming code called a PROC step. Typically, a SAS program will comprise a single DATA step followed by one or more PROC step.

A PROC step takes the temporary SAS work file (not the raw data), processes it and produces results in the form of out put on the screen or printer.

The following is an example of a SAS procedure:

```
Proc means data=industrial
Var MFGD MFGN;
RUN;
```

This produce means and other summery statistics for the variables MFGD and MFGN. The results will be appearing in the out put window.

1.4 Executing a program

A SAS program must be submitted for execution. After execution, it will remain in the EDITOR window for editing and re-submission, if things go awry.

Quite a number of action are taken when submit a program for execution. First, a log of progress of the program will appear in the LOG window. We should take note of any errors, shown in red text as this indicates a fatal problem with our program. Warnings should also be heeded, as they indicate that the syntax is correct, but the analysis itself may have problems.

Second, a library called WORK will contain a SAS work file named, in this case, INDUSTRIAL This is the name that we provided in the data step. Under SAS filename conventions, we can refer to this work file explicitly as WORK.DOW, but this is seldom necessary.

We can peruse the data at this point to see if it has been read intended.

The output of the analysis, if any appears in the OUTPUT window

1.5 Listing data:

Having read the data into SAS we might wish to list it to the screen to see that it was read correctly. We use the procedure print.

```
PROC PRINT DATA =INDUSTRIAL(OBS=1);
VAR YR MN IP MFG MFGD;
RUN;
```

1.6 Descriptive Statistic

Descriptive statistics are a useful place to start an analysis. They can be obtained by using

```
PROC MEANS DATA=INDUSTRIAL N
MIN MAX MEAN STD STDERR CV;
VAR MFGD MFGN ;
RUN;
```

More detailed statistical summaries can be provided by PROC UNIVARIATE, which yields modes, medians, percentiles and diagnostic statistic such as tests of normality in addition to what is provided by PROC MEANS.

```
PROC UNIVARIATE DATA=industrial
VAR MFGD MFGN;
RUN;
```

2.1 Plotting time series

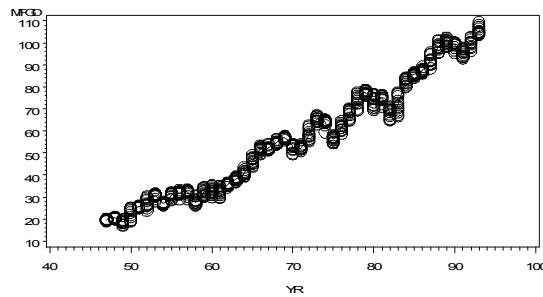
Using PROC GPLOT

The following statements use the GPLOT procedure to plot OPEN in the DOW data set against DATE.

The SYMBOL statement is used to draw a smooth line between the plotted points and to specify the plotting character.

```
Proc gplot data=industrial;
Symbol i=spline v=circle h=2;
Plot open * date;
Run;
```

2.2 The ARIMA procedure with SAS



Now we want to forecast the MFGD series in the INDUSTRIAL data set .

2.2.1 Using IDENTIFY Statement

We first specify the input data set in the PROC ARIMA statement. Then, we use an IDENTIFY statement to read in the INDUSTRIAL series and plot its autocorrelation function. We do this using the following statements:

This step produces descriptive statistics auto correlation plots and white noise test.

- **Descriptive Statistics**

The IDENTIFY statement first prints descriptive statistics for the MFGD series.

- **Autocorrelation Function Plots**

The IDENTIFY statement next prints three plots of the correlations of the series with its past values at different lags. These are the

1. sample autocorrelation function plot
2. sample partial autocorrelation function plot
3. sample inverse autocorrelation function plot

The NLAG= option controls the number of lags for which autocorrelations are shown. By default, the autocorrelation functions are plotted to lag 24. By examining these

plots, we can judge whether the series is *stationary* or non stationary. In this case, a visual inspection of the autocorrelation function plot indicates that the MFGD series is non stationary.

- **White Noise TEST**

The last part of the default IDENTIFY statement output is the check for white noise. This is an approximate statistical test of the hypothesis that none of the autocorrelations of the series up to a given lag are significantly different from 0. If this is true for all lags, then there is no information in the series to model, and no ARIMA model is needed for the series.

The autocorrelations are checked in groups of 18, and the number of lags checked depends on the NLAG = option.

2.2.2 Identification of the Differenced Series

Since the series is non stationary, the next step is to transform it to a stationary series by differencing. That is, instead of modeling the MFGD series itself, we model the change in MFGD from one period to the next. To difference the MFGD series, we use another IDENTIFY statement and specify that the first difference of MFGD be analyzed, as shown in the following statements:

```
Proc arima data=industrial;
I Identify var=MFGD(1) nlag=8;
Run;
```

The second IDENTIFY statement produces the same information as the first but for the change in MFGD from one period to the next rather than for the total MFGD in each period.

2.3 Estimating model parameter

2.3.1. Estimating an ARMA (1,3) Model

To estimate a mixed autoregressive moving average model, we specify the order of the moving average part of the model with the Q= option on an ESTIMATE statement in addition to specifying the order of the autoregressive part with the P= option. The following statements fit an ARMA (1, 3) model to the differenced MFGD series:

```
Proc arima data=industrial;
Identify var=MFGD(1) nlag=8;
Estimate q=3 p=1;
Run;
```

The parameter estimates table and goodness-of-fit statistics for this model are shown below.

Conditional Least Squares Estimation

Parameter	Standard		Approx		
	Estimate	Error	t Value	Pr > t	Lag
MU	0.16261	0.05365	3.03	0.0026	0
MA1,1	0.18740	0.22202	0.84	0.3990	1
MA1,2	-0.04913	0.06958	-0.71	0.4804	2
MA1,3	-0.08502	0.05998	-1.42	0.1569	3
AR1,1	0.45117	0.22133	2.04	0.0420	1

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr >ChiSq	-- Autocorrelations --	
6	0.82	2	0.6643	0.001	-0.002
12	11.52	8	0.1741	-0.015	0.056
18	17.63	14	0.2242	0.005	-0.077
24	30.13	20	0.0678	0.043	-0.044
30	37.40	26	0.0688	-0.093	0.018
36	41.85	32	0.1140	0.003	0.025
42	46.55	38	0.1608	-0.016	-0.024
48	51.70	44	0.1984	0.007	-0.036

The check for white noise residuals is shown below. The χ^2 tests show that we cannot reject the hypothesis that the residuals are uncorrelated. Thus, we conclude that the ARMA(1,3) model is adequate for the change in MFGD series.

The output showing the form of the estimated ARIMA(1,1,3) model for MFGD is shown below.

<p>The ARIMA Procedure Autoregressive Factors Factor 1: 1 - 0.45117 B**(1) Moving Average Factors Factor 1: 1 - 0.1874 B**(1) + 0.04913 B**(2) + 0.08502 B**(3)</p>
--

2.3.2 Forecasting Stage

To produce the forecast, we use a FORECAST statement after the ESTIMATE statement for the model we decide is best.

We know that the MFGD series is monthly, that we wish to forecast 20 months ahead. The dates for the observations are given by a variable YR in the input data set INDUSTRIAL. We use the following FORECAST statement:

<pre>forecast lead=20 interval=month id=yr out=results; run;</pre>
--

The LEAD= option specifies how many periods ahead to forecast (20 months). The ID= option specifies the ID variable used to date the observations of the MFGD time series. The INTERVAL= option indicates that data are monthly and enables PROC ARIMA to extrapolate YR values for forecast periods. The OUT= option writes the forecasts to an output data set RESULTS.

<pre>proc arima data=industrial; identify var=MFGD(1) nlag=8; estimate q=3 p=1; forecast lead=20 interval=month id=yr out=results; run;</pre>

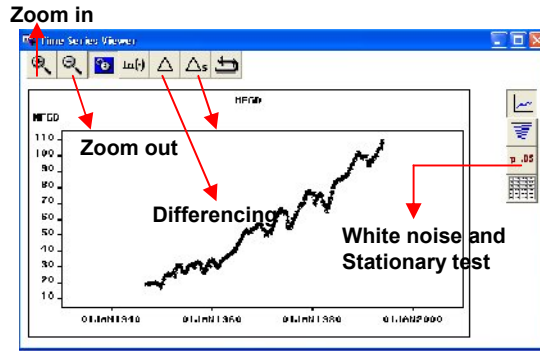
2.4 Time series viewer**2.4.1 Access to time series viewer**

We use time Series Viewer window to explore time series data using plots, transformations, statistical tests, and tables. It is available as a standalone application and

as part of the Time Series Forecasting System. To use it as a standalone application, select it from the Analysis submenu of the Solutions pull-down menu. After going to time series viewer series selection window appears and we require to specify in which library it has been located and also for which variable we are interested in doing analysis. Now we need just click on graph option and then time series viewer window appears

2.4.2 Time series viewer interface

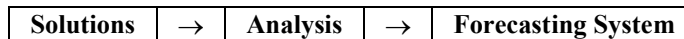
The state of the Time Series Viewer window is controlled by the current series, the current series transformation specification, and the currently selected view. We can resize this window, and we can use other windows without closing the Time Series Viewer window. We can explore a number of series conveniently by keeping the Series Selection window open. Each time we make a selection, the viewer window is updated to show the selected series. Keep both windows visible, or switch between them using the Next Viewer tool bar icon or the F12 function key.



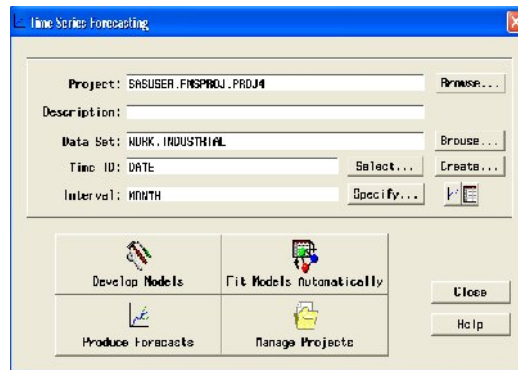
3.1 Point & Click Forecasting with the Time Series Forecasting System

3.1.1 Access to TSFS

The Time Series Forecasting System (TSFS) is a component of SAS/ETS® that provides a menu-based front-end for forecasting activities. The tasks of creating a date variable, graphing a data series and quickly seeing the results of differencing and/or applying a log transformation, testing for unit roots, examining autocorrelation and partial autocorrelation plots, performing seasonality tests, and, finally, estimating models and producing forecasts are just a mouse click away.



After clicking on TSFS, its window appears.



3.1.2 Automatic Model Fitting

Before we can produce forecasts, we must fit forecasting models to the time series. Select the Fit Models

Automatically button. This brings up the Automatic Model Fitting window, as shown below. The Series to Process field shows the number and lists the names of the variables in the input data set to which the Automatic Model Fitting process will be applied. By default, all numeric variables (except the time ID variable) are processed. However, we can specify that models be generated for only a select subset of these variables.



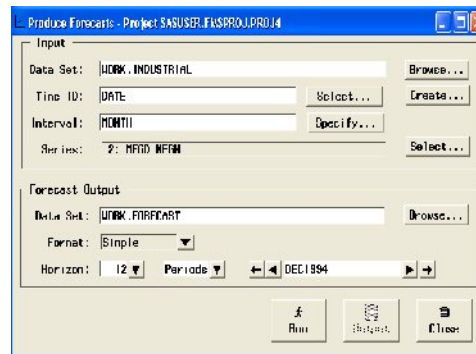
The Selection Criterion field shows the goodness-of-fit measure that the Forecasting System will use to select the best fitting model for each series. By default, the selection criterion is the root mean square error.

After selecting the RUN button models automatically will be fitted to the given series.

3.2 Produce Forecasts

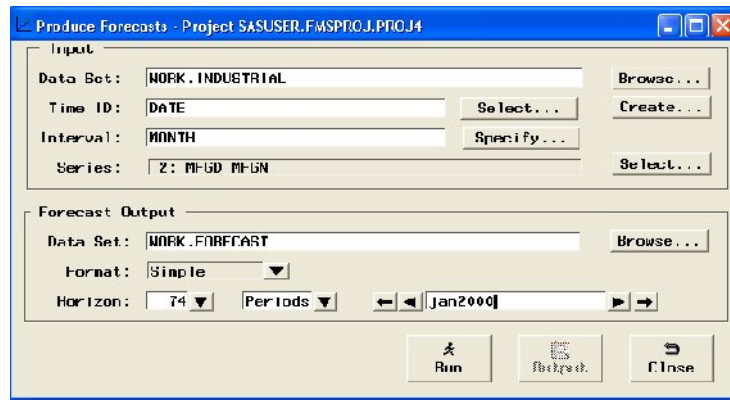
Now that we have forecasting models for these two series, we are ready to produce forecasts. Select the Produce Forecasts button. This brings up the Produce Forecasts window, as shown

The Produce Forecasts window shows the input data set information and indicates the input data set for which forecasting models exist. Forecasts will be produced for these series. If we want to produce forecasts for only some of these series, use the control arrow at the right of the Series field to select the series to forecast.



The Data Set field in the Forecast Output box contains the name of the SAS data set in which the system will store the forecasts. The default output data set is WORK.FORECAST.

We can set the forecast horizon using the controls on the line labeled Horizon. The default horizon is 12 periods. We can change it using number of periods, number of years, or the date of the last forecast period. Position the cursor in the date field and change the forecast ending date to 1 January 2000 by typing jan2000 and pressing the ENTER key. The window now appears as shown



Now select the Run button to produce the forecasts.

CONCLUSION

While working with SAS it is easily can be found that it has lots advantages as compared to other packages it gives an opportunity to unprofessional forecaster to forecast by the help of its automatic forecasting package. It enables us to select any part of data and do forecasting for that specific region. It can handle a huge number of observation that other exhausted software can't do

REFERENCES

1. Brockwell, Petter J. and Davis Richard A. (1991). *Time Series Theory and Methods*. Springer.
2. Box, GE. P, Jenkins, G.M. and Reinsel, G.C. (1994). *Time Series Analysis, Forecasting and Control*.
3. Lorn Cody. *Learning SAS by Examples*.
4. *Chair of Statistics*. University of Würzburg, September 18, 2006.
5. *A First Course on Time Series Analysis*.
6. ChatField, C. (1996). *The Analysis of Time Series*. 5th Edition, Chapman and Hall, New York, NY.
7. T Say, Ruey S. (2002). *Analysis of Financial Statistics*. John Wiley and S.
8. Delungio, Stephen A. (1998). *Forecasting Principals and Applications*. McGraw Hill.

**RELATIONSHIP BETWEEN EXCHANGE RATE, EXPORTS AND IMPORTS:
ANALYSIS IN THE FORM OF CO-INTEGRATION AND BI-VARIATE
CAUSALITY. EMPIRICAL EVIDENCE FROM PAKISTAN**

Qazi Muhammad Adnan Hye, Uzma Iram and Muhammad S. Butt
Applied Economics Research Centre, University of Karachi, Karachi.
Email: adnan.economist@yahoo.com

ABSTRACT

This paper investigate the directional of causality between exchange rate, exports and imports for developing country like Pakistan, utilizing the monthly time series data covering the period 1995-2006. For long run analysis JJ-co integration techniques applied and for short run dynamics VEC utilized. For the determination of the direction of causality, we employed standard Granger Causality and Error Correction based Granger Causality test. The results indicate that there is one co integrating vector between exchange rate exports and imports. But the important finding is that there is strong and stable relationship between exports and imports and direction of Causality is bi-directional among exports and imports. The impulse response function also supports these results. This study also reject the previous findings about negative effect of exchange rate volatility on trade volume for Pakistan, this paper founds that exchange rates cannot determine the variation in exports and imports in a developing economy like Pakistan.

KEY WORDS

Volume of trade, Exchange rate, Co-integration, Bi-variate Causality and Decomposition of Variance:

JEL Classifications: C22, C50, F13, F31

1. INTRODUCTION

The present endeavor readdressed currently debated issue, on the relationship between exchange rate, exports, and imports for a developing economy like Pakistan. Relevant literature has observed the substantial but contradictory evidence about the impact of exchange rate volatility on international trade. Those support the hypothesis that volatility of the exchange rate is negatively related with the volume of trade are included Ethier (1973), Hooper and Kohlhagen (1978), Akhtar and Hilton (1984); Cushman (1983, 1986, 1988); Kenen and Rodrick (1986); Pere and Steinherr (1986); Thursby and Thursby (1987); De Grauwe (1988); Koray and Lastrapes (1989); and Arize (1995) Kumar and Dhawan (1991), Gagnon (1993), Broll (1994), Caporale and Dorodioon (1994), Wolf (1995), Dell'Araccia (1998), Rose (2000), and Vergil (2002). While they support the idea behind the intuition of exchange rate volatility decreases trade volume is that exchange rate volatility increases uncertainty, which in turn decreases trade volume. Whereas some studies found inconclusive impact of exchange

rate volatility on export's growth for developing countries as they have explained variation in exchange rate policies and the level of growth [Bahmani-Oskooee (1984, 1986); and Rana (1983)]. Such evidence further support the view that there is an ambiguity in the role of exchange rate volatility on trade volume. Bahmani-Oskooee (1984,1986) found that exchange rate has a significant impact on trade flows of selected developing countries even in periods when most of them had pegged exchange rates.

However it is also found that, exchange rate volatility or risk may actually stimulate trade flows since uncertainty is considered as an option held by firms, which increases profitability De Grauwe, 1988; and Giovannini, 1988; Franke, 1991; Grobar, 1993; McKenzie and Brooks, 1997; Dewlin et al. 2001. Kroner and Lastrapes, 1993; McKenzie et al. 1998; Aristotelous, 2001; and Asseery and Peel, 1991; found no evidence about the impact of exchange rate volatility on trade. Moccero and Winograd (2006) investigated the effect of exchange rate volatility by examining the intra and extra regional exports and they concluded that, reducing volatility has a positive impact on exports in Brazil, but a detrimental effect on exports to the rest of the world. There are a few studies which examine separately the negative effect of exchange rate volatility on imports, for example, Rana (1983) estimated import demand function for various countries and concluded that the increase in exchange rate risk has a significant negative impact on import volumes. Gotur (1985) and Cushman (1986) investigated the effect of exchange rate volatility on imports.

For Pakistan impact of exchange rate volatility on the volume of trade has been studied since the late 1970's when the exchange rate moved from fixed to flexible exchange regime. That high degree of volatility and uncertainty of exchange rate movements since the beginning of the generalized floating in 1973 have led policy makers and researchers to investigate the nature and extent of the impact of such movements on the volume of trade. But a few empirical studies are available in the context of Pakistan. Kumar and Dhawan (1991) estimated the exchange rate volatility on Pakistan exports to the developed world from 1974 to 1985. They found that, volatility of exchange rate adversely effect on export demand. Khalid and Nishat (2004) investigated the behaviour of exchange rate volatility on exports growth and found that, the volatility of exchange rate has negative and significant effects both in the long run and short run with major trade partners namely UK and US. Similar pattern was observed in case of Australia, Bangladesh, and Singapore, where the volume of trade with Pakistan is comparatively consistent and less volatile. The relationship between exports growth and exchange rate volatility for India and Pakistan is observed only in long run perspective.

The present study has focused on the relationship between exchange rate, exports, and imports rather than the effect of exchange rate. The aim of this study to explores the direction of causality between exchange rate, exports, and imports by employing relatively most recent robust techniques. The rest of the paper will be as followed: section 1.2 Data and section 2 empirical results and section 3 conclusions.

DATA

The empirical analysis is based on Monthly time series data from 1995 - 2006. The data of X (Exports), M (Imports) and ER (Nominal Exchange rate) used in this study is taken from the International Financial Statistics (IFS). Exports and Imports are measured in million of rupees at current prices.

2. EMPIRICAL RESULTS

Unit root tests for stationarity are performed on the levels of all the three (X, M and ER) variables and on the first difference for all the variables. Determining the optimal lag length of the model is crucial in unit-root tests since these tests are sensitive to the lag length. Various statistical model selection criteria like the Akaike information criterion (Akaike, 1973,1974), Schwarz Bayesian Criterion (Schwarz, 1978) and Hannan-Quin Criterion (Hannan-Quin, 1979) are used to determine the order of lag length. Among these three model selection criteria, the Schwarz Bayesian Criteria (SBC) selects the most parsimonious model (Pesaran and Pearan, 1997).

Table-1 shows the results of ADF and PP Tests for unit roots in the level from and first difference. The results indicate the existence of unit roots, and therefore non-stationary, in the levels of the of the three variables, X, M and ER. However, the first difference of these variables are stationary under these test. Hence we conclude that these

three variables are integrated of order 1. One the basis of the above unit-root tests, we apply the producer of Johansen (1988, 1991) and Johansen and Juselius test (1990, 1992, 1995) to determine whether any combinations of these variables are co-integrated or not. Before undertaking the co integration tests, we first specify the relevant order of lags (p) of the VAR model. After finding the order of integration, we employ the JJ approach for the investigation of the long run relationship among the variables. Two tests are used to determine the number of co-integrating vectors (Denoted by r): the maximum eigenvalue test and the trace test. In the maximum eigenvalue test the null hypothesis $r = 0$ is tested against the specific alternative test that $r = 1$; $r \leq 1$ against the alternative $r = 2$ etc. In the trace the null hypothesis is that the number of co integration vectors is less than or equal to r where r is 0, 1 or 2. In each case the null hypothesis is test against a general alternative. If there is any divergence of the results between these two tests, it is advisable to rely on the evidence from the maximum eigenvalue test since the results of the latter test are more reliable in the small samples (Banerjee et al. 1993)

The results obtained from the JJ co-integration tests are presented in the table 2: starting with the null hypothesis of no co integration ($r = 0$) among the variables the Max-Eigen statistic is (27.62745) which above the critical value of (21.13162). Hence it rejects the null hypothesis $r = 0$ at 5% level of significance in the favor of the specific alternative that there is one co integrating vector $r = 1$. As is evident in table: 2 the null hypothesis of $r \leq 1$ and $r \leq 2$ can not be rejected at a 5% level of significance. Hence we conclude that there is only one co integrating relationship among the three variables of Exports, Imports and Exchange rate Turning to the trace test the null hypothesis of no co-integration ($r = 0$) is rejected at the 5% level of significance in favour of the general

Table-1: ADF and PP Unit Root Tests (1995-2006)

Variable	Augment Dickey Fuller Test		Phillips-Perron Test	
	Level	1 st Difference	Level	1 st Difference
X	-0.2096(4)	-8.21(4)	-0.5344(3)	-26.8 (3)
M	0.862 (3)	-6.93 (3)	1.582(4)	-7.299(4)
ER	-2.179 (1)	-8.626 (1)	-2.294 (4)	-9.514 (4)
Note: The Mackinnon critical values for ADF and PP test statistics are -3.48, -2.89 and -2.58 at 1, 5 and 10 percent level of significance, respectively.				

Table-2: Johansen Maximum Likelihood Test for Co-integration				
Max-Eigen Statistic				
I Hypothesis	Alternative Hypothesis	Max-Eigen Statistic	5 % critical value	Prob.
r =0	r =1	27.62745*	21.13162	0.0109
r ≤1	r=2	7.534393	14.26460	0.5162
r ≤ 2	r=3	0.002088	3.841466	0.9600
Trace statistic test				
Null Hypothesis	Alternative Hypothesis	Trace - statistic	5 % critical value	Prob.
r =0	r ≥ 1	35.16393*	29.79707	0.0053
r ≤ 1	r ≥ 2	7.536480	15.49471	0.4280
r ≤ 2	r ≥ 3	0.002088	3.841466	0.9600
Note: *: Significant at the 5% level. Lag length selected through Schwartz Criterion				

alternative $r \geq 1$. This is because the trace statistic is (35.16393) which is well above the critical value of (29.79707) at the 5% level of significance. But the test fails to reject the null hypothesis of $r \leq 1$ and $r \leq 2$ at 5% level of significance. The conclusion is that there is one co integrating relationship amongst the three I(1) variables.

Result of Vector Error Correction Models:

Table-3 presents the results of the ECM which contains three equations and each equation includes adjustment coefficient. The adjustment coefficient in the three equations is negative. Negative coefficient means there is a tendency from short term fluctuations to long term equilibrium condition if it is significant. But the only Equation 1 exports (X) has a coefficient significant. Thus, "no co integrating hypothesis" can be rejected and alternative hypothesis is accepted.

Table-3: Result of Vector Error Correction			
	D(X)	D(M)	D(ER)
Adj. coefficient	-0.573216	-0.178772	-5.27E-06
Standard Dev.	(0.11939)	(0.16321)	(4.1E-05)
t-statistic	-4.80114*	-1.09536	-0.12804
Note: *: Significant at 1%			

The Results of Variance Decomposition and Impulse Response Function:

Variance decomposition gives information about the proportion of the movements in the dependent variables that are due to their own shocks, versus shocks to the other variables. A shock to any variable, for example a shock to exports, will directly affect that variable (exports), but this shock will also be transmitted to all of the other variables in the system (here imports and exchange rate) through the dynamic structure of the Vector Auto-regression (VAR).

The first part of the table-4 shows the variance decomposition of exports. In the first round, the entire change in export is explained only by a shock to the export innovation. This shock also causes an immediate change in import and exchange rate, but the resulting changes in these variables have no effect on export at this time, since current imports and exchange rate have no effect on current exports. In round two, exchange rate variables accounts for 0.809% of the change in exports, however, import accounts for 5.72% of the change in exports. When the entire 10-year period is taken into account, the effect of exchange rate on export, following the initial shock to the export innovation, is 8.65%, but the effect of imports on exports is 38.497% after the 10-year period.

Table-4: Results of Variance Decomposition			
Variance Decomposition of X:			
Period	X	M	ER
1	100.0000	0.000000	0.000000
2	93.47143	5.719588	0.808986
3	84.57524	13.40185	2.022909
4	76.58780	20.16888	3.243320
5	70.15934	25.48310	4.357564
6	65.08916	29.54942	5.361415
7	61.05601	32.66923	6.274768
8	57.79322	35.08917	7.117612
9	55.10570	36.98893	7.905378
10	52.85464	38.49618	8.649177
Variance Decomposition of M:			
Period	X	M	ER
1	43.10378	56.89622	0.000000
2	35.32174	64.54693	0.131332
3	30.86398	68.81713	0.318881
4	28.14384	71.32868	0.527475
5	26.37641	72.87371	0.749880
6	25.16244	73.85236	0.985198
7	24.28799	74.47850	1.233505
8	23.63221	74.87313	1.494660
9	23.12338	75.10846	1.768157
10	22.71700	75.22981	2.053192
Variance Decomposition of ER:			
Period	X	M	ER
1	1.831917	0.006873	98.16121
2	1.817773	0.063739	98.11849
3	1.852644	0.148774	97.99858
4	1.913900	0.255325	97.83078
5	1.990017	0.379969	97.63001
6	2.074703	0.520331	97.40497
7	2.164320	0.674414	97.16127
8	2.256654	0.840399	96.90295
9	2.350290	1.016590	96.63312
10	2.444278	1.201409	96.35431

The second part of the table 4, which traces the variance decomposition of imports. Because of the ordering exports-imports-exchange rates, a shock to import innovations has an immediate effect on imports and current export. In round one, a shock to the import innovation accounts for 56.89% of the variation in the import variable, while export accounts for the rest of the variation. In round two, export accounts for 35.33 % of the variation in imports and imports itself account for 64.55% of its own variation. The influence of exports on imports decrease in time and by the end of the 10-year period it is accounting for 22.72 % of the total variation in imports. Imports accounts for 75.23 % of its own variation in the round 10.

The third part of the table 4 shows the variance decomposition of exchange rate. In the first round, a shock to the exchange rate innovation accounts for almost the entire change in exchange rate variation (98.17%). This situation is almost the same for all period, for example, at the end of the 10-year period, the variation in exchange rate because of the initial shock is accounted by exchange rate itself (96.36%).

The variance decomposition results indicate that exchange rate are the most exogenous variables as a high proportion of their shocks are explained by their own innovations compared with the contributions of own shocks to innovations for exports and import. As stated above, at the end of 10 years, the forecast error variance for imports, exports and exchange rate explained by their own innovations are 75.23%, 52.86% and 96.36% respectively.

Another way of obtaining information regarding the relationship between the variables, where exports, imports, and exchange rate, is impulse response functions.

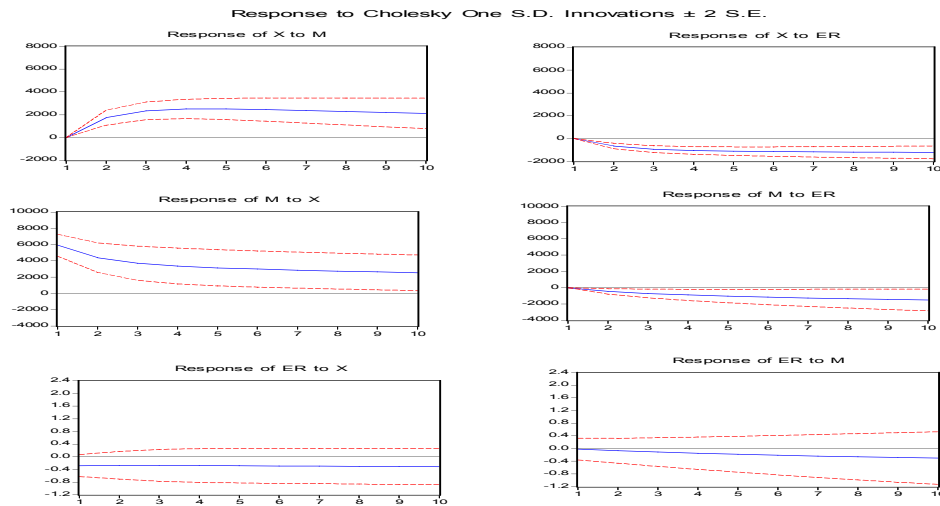


Fig. 1: Impulse Response Function

The Direction of the Causality: Results from the Standard Granger-Causality and the Bi-variate Causality Test: The results of the Standard Granger-causality test (SGC) are presented in the table-5 and Bi-variate Causality is representing in table-6. The SGC test results show that the null hypothesis of imports does not Granger cause exports is rejected at 1% level. Also, there is “reverse causation” from X to M, since the *F* value is statistically significant. This conclusion also supports the variance decomposition results.

Direction of causality		F-Statistic	Probability
M	→ X	3.44441	0.00136
X	→ M	2.26573	0.02743
ER	→ X	0.50424	0.85104
X	→ ER	0.56798	0.80227
ER	→ M	0.70112	0.68997
M	→ ER	0.43608	0.89722

Note: → shows the direction of causality

S#	Equation	F-Statistics D(X)	F-Statistics D(M)	F-Statistics D(ER)	EC _{t-1}	R ²	DW
1	X=f(M)	42.38*	-	-	-0.218* (0.0008) ^a	0.55	2.15
2	M=f(X)	-	45.22*	-	-0.088** (0.06)	0.53	2.19
3	X=f(ER)	1.008	-	-	-0.07 (0.14)	0.27	2.29
4	ER=f(X)	-	-	1.03	-0.02 (0.12)	0.11	1.92
5	M=f(ER)	-	0.883	-	-0.018 (0.56)	0.22	2.32
6	ER=f(M)	-	-	1.05	-0.03 (0.11)	0.11	1.92

Note: a; Probability Values

On the other hand, as stated before, there is no any association between exchange rate and Exports and imports, the null hypothesis of exchange rate does not Granger cause export and imports cannot be rejected. In the table 5, there is a relationship between exchange rate (ER) and exports (X), but the null hypothesis of ER does not Granger cause X cannot be rejected since the F value is not statistically significant. The table-6 Shows the result of the bi-variate Engle Granger ECM. The result shows that, there is Bi-directional causality between X (exports) and M (imports). Same as the standard Granger causality test. These results also support the variance decomposition results.

3. CONCLUSION AND POLICY IMPLICATIONS

The present study investigates the query to direction of causality between exchange rate, exports and imports, using Pakistan monthly time series data for 1995.-2006 periods. The results indicate that exports (X) are co integrated with imports (M). It is thought that negative trade balance can be reversed in the long-run by increasing exports if imported goods bring new technology and a different entrepreneur skill to home country. Therefore, exports and imports are co integrated. This result is supported by co integration test results (Johansen co integration test has concluded that there is exactly one co integrated vector). Also the variance decomposition result presented a relationship between exports and imports since a shock to exports or imports can be explained by exports and imports. There is bi-directional causality has been found between Exports and imports. Another result from this empirical investigation is that there is no relationship between exchange rate and trade at current prices. The variance decomposition test states that the power of exchange rate to explain the change in exports and imports is 8.65% and 2.054% respectively after 9-year period not. When there is a shock to exchange rate innovations than Exchange rate accounts for the change in itself only.

REFERENCES

1. Afzal, M. (2006). Causality between exports, world income, and economic growth in Pakistan. *International Economic Journal*, 20(1), 63-77.
2. Ahmed, M., Haque, N. and Talukder, S.I. (1993). Estimating Export Demand Function for Bangladesh: An Application of Co-integration and Error Correction Modeling. *The Bangladesh Development Studies*, 21, 89-104.
3. Ahmed, M., Haque, N. and Talukder, S.I. (1993). Estimating Export Demand Function for Bangladesh: An Application of Co-integration and Error Correction Modeling. *The Bangladesh Development Studies*, 21, 89-104.
4. Akhtar, M. and Hilton, R.S. (1984). Effects of Exchange Rate Uncertainty on German and U.S. Trade. *Federal Reserve Bank of New York Quarterly Review*, 9, 7-16.
5. Aristotelous, K. (2001). Exchange rate volatility, exchange rate regime, and trade volume: evidence from the UK-US export function (1889-1999). *Economics Letters*, 72, 87-94.
6. Arize, A. (1995). The Effects of Exchange Rate Volatility on U.S. Exports: An Empirical Investigation. *Southern Economic Journal*, 62, 34-43.
7. Asseery, A. and Peel, D.A. (1991). The Effects of Exchange Rate Volatility on Exports. *Economic Letters*, 37, 173-177.

8. Baak, S., Al-Mahmood, A. and Vixathep, S. (2002). *Exchange Rate Volatility and Exports from East Asian Countries to Japan and U.S.* (Manuscript). University of Japan.
9. Bahmani-Oskooee, M. (1984). On the Effects of Effective Exchange Rates on Trade Flows, *Indian Journal of Economics*, 256, 57-67.
10. Bahmani-Oskooee, M. (1986). The Determinants of Trade Flows: The Case of Development Countries. *Journal of Development Economics*, 20, 107-123.
11. Bailey, M.J. Tavlas, G.S. and Ulan, M. (1987). The Impact of Exchange Rate Volatility on Export Growth: Some Theoretical Consideration and Empirical Results. *Journal of Policy Modeling*, 9, 225-243.
12. Baldwin, R. and Krugman, P. (1989). Persistent Trade Effects of Large Exchange Rate Shocks. *Quarterly Journal of Economics*, 104, 635-665.
13. Baum, C.F., Mustafa, C. and Ozkan, N. (2001). *Exchange Rate Effects on the Volume of Trade Flows, An Empirical Analysis Employing High-Frequency Data*, (Manuscript). Boston College.
14. Bayes. A.M., Hossain. I. and Rahman, M. (1995). *Independent Review of Bangladesh's Development External Sector*. Centre for Policy Dialogue, Dhaka, Bangladesh.
15. Caporale, T. and K. Doroodian (1994). Exchange rate variability and flow of international trade. *Economics Letters*, 46, 49-54.
16. De Grauwe, P. (1988). Exchange rate variability and the slowdown in the growth of international trade. *IMF Staff Papers*, 35, 63-84.
17. Chowdhury, A.R. (1993). Does Exchange Rate Volatility Depress Trade Flows? Evidence from Error-Correction Models. *The Review of Economics and Statistics*. 75, 700-706.
18. Coes, D. (1981). *The Crawling Peg and Exchange Rate Uncertainty*, in J. Williamson (ed) New York: SDT. Martin's Press, 113-136.
19. Cushman, D.O. (1983). The Effects of Real Exchange Rate Risk on International Trade. *Journal of International Economics*, 15, 45-63.
20. Cushman, D.O. (1986). Has Exchange Risk Depressed International Trade? The Impact of Third Country Exchange Risk. *Journal of International Money and Finance*, 5, 361-379.
21. Cushman, D.O. (1988). US Bilateral Trade Flows and Exchange Rate Risk During the Floating Period. *Journal of International Economics*, 25, 317-330.
22. Dell' Ariccia, G. (1998). Exchange rate fluctuations and trade flows: evidence from the European Union, *IMF Research Paper* (107).
23. Dewlin, R., Estevadeordal, A., Monteagudo, J. and S. Raul (2001). Macroeconomic Stability. *Trade and integration, Integration and Trade*, 13.

**PERCEIVED SUPERVISOR SUPPORT AND EMPLOYEES MOTIVATION
IN TEXTILE SECTOR OF PAKISTAN**

Ahmad Qammar¹, Faheem Ghazanfar² and Muhammad Siddique³

Institute of Administrative Sciences, University of the Punjab, Lahore.

Email: ¹ahmadqm@yahoo.com; ²faheemghazanfar@yahoo.com;

³muhammadsiddique@hotmail.com

ABSTRACT

Employees exchange their loyalties and efforts with organizations for rewards. They form a general perception about the organizational support in various organizational and personal matters. The employees spend substantial part of their organizational time with their supervisors. Supervisors, who encourage employees in taking initiatives, assist them and extend help in moments of stress which creates a positive perception of employees about the supervisor and organization. In response to the support, employees exhibit high level of motivation, take more initiatives and remain more regular.

The current research paper examines the impact of perceived supervisors' support (PSS) on employees' motivation. The study was conducted in Lahore cluster of textile companies in Pakistan. The managerial cadre employees were studied through questionnaire. The results indicate that supervisor support is related with motivation. PSS was also found related with various dimensions of motivation like initiative, job loyalty, acceptance of greater responsibility and interest in work.

INTRODUCTION

Since the ancient times, human beings have recognized that exchange as important social norm in their day-to-day affairs. A person extending a favor to other expects him to respond some way. Although this practice exists from centuries and some philosophers of that time expressed the importance of social exchange in their writings, it has been extensively discussed in social science literature in second half of 20th century.

Blau (1964) was of the view that individuals offer help and care to another person and expect some benefit in return, and this way they enter in a social exchange process. He further suggested that this exchange is not limited to the monetary and economic benefits only; rather the exchange process entails socio emotional benefits as well. Gouldner (1960) expressed that people are uphold the norms of reciprocity and if someone hold out a favor to them they try to reciprocate that. Extending the work of these social theorists, other writers have alluded to employment as the exchange of efforts and commitment for tangible benefits and social rewards [Bateman and Organ (1983), Brief and Motowidlo (1986), Etzioni (1961), Gould (1979), Levinson (1965), March and Simon (1958), Mowday et al. (1982), Organ and Konovsky (1989) and Steers (1977)].

Eisenberger, Huntington, Hutchison and Sowa (1986) talked about the social exchange perspective of the employer-employee relationship to put together two sides of

the pictures i.e. employees' beliefs about how they were treated by the organization and their commitment to the organizational.

The Social exchange theory (Blau, 1964) and the norm of reciprocity (Gouldner, 1960) have been applied to the organization to describe the motivational basis behind employee attitudes and behaviors [Mowday, Steers and Porter (1979), Settoon, Bennett, and Liden (1996), Meyer and Allen (1997), Wayne, Shore, Bommer and Tetrick (2002)]. Based on the work of earlier social exchange theorists, Eisenberger et al. (1986) talked about the social exchange perspective of the employer-employee relationship to put together two sides of the pictures i.e. employees' beliefs about how they were treated by the organization and their commitment to the organizational. Eisenberger and colleagues argued, when employees believed that the organization was committed to them, they would be committed to the organization [Eisenberger et al. (1986), Shore and Tetrick (1991), Rhoades and Eisenberger (2002), Vandenberghe, Bentein, Michon, Chebat, Tremblay and Fils (2007)].

An important dimension of the organizational support is the supervisor support or the leader support. Some researchers have referred it to Leader-Member Exchange (LXM) (Graen and Scandura, 1987) and argued that supervisor and his/her subordinates are in the exchange process where they trade support with loyalty and commitment [Settoon, Bennett and Liden (1996), Wayne, Shore and Liden (1997), Wayne, Shore, Bommer and Tetrick (2002)].

The current study focuses on the perceived supervisor's support and employees' motivation in textile sector of Pakistan. The study explores the link among perceived supervisors' support and various dimensions of the motivation including job loyalty, interest in work, acceptance of responsibility and initiative.

This study has examined relationship of perceived supervisors' support with employee motivation in export-oriented textile manufacturing sector in Lahore Cluster Pakistan.

Objectives of the Study

In this study, an attempt is made to:

- To measure perceived supervisor support (PSS) and employees' motivation.
- To see relationship between perceived supervisors' support and employees' motivation.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Different antecedents of the perceived organizational support have been identified in the literature. An important antecedent identified in the research is the help given by coworkers and supervisors [Shore and Wayne (1993), Wayne et al. (1997) and Witt (1991)].

In a meta analysis, Rhoades and Eisenberger (2002) classified perceived organizational support in three general categories that included fairness, supervisor support, and organizational rewards and job conditions. The study, after systematically

reviewing literature, suggested that important antecedents of the POS fall in one of the three above mentioned categories.

Supervisor's support is found to be related with the employees' favorable perception about the organization. Because supervisors and managers act as organizational agents to evaluate employees' contribution to the organization and to reward them accordingly (Eisenberger et al. 1986), the employee's receipt of favorable treatment from a supervisor should contribute to POS (Wayne et al. 1997).

The level of employee-organization exchange or supervisory support bears a positive relationship to POS (e.g., Rhoades & Eisenberger, 2002; Rhoades et al., 2001; Wayne et al., 1997). The strength of this relationship depends on the degree to which employees identify the supervisor with the organization, as opposed to viewing the supervisor's actions as idiosyncratic (Eisenberger, Stinglhamber, Vandenberghe, Sucharski and Rhoades (2002).

Kottke and Sharafinski (1988) studied the distinctiveness of POS and perceived supervisor support. "Perceived supervisor support is defined as employees' general views concerning the degree to which supervisors value their contributions and care about their well-being". They explored in the study that employees differentiate support offered by the organization from support offered by supervisors. Hutchinson (1997) extended this study and found that employees distinguish between perceptions of support from their supervisor, the management of the organization and the organization itself.

POS was found positively related to the high-quality employee-supervisor relationships, and promotions (Wayne, Shore and Liden 1997). Perceived supervisor support, refers to employees' beliefs that their supervisors care about them and value their contributions (Kottke and Sharafinski, 1988). Supervisors act as representatives of the organization and are frequently charged with evaluating employees and communicating the organization's goals and values to employees. As such, employees have been found to identify treatment by their supervisor as indicative of organizational support (Eisenberger et al., 2002b).

As the supervisor is the immediate boss of an employee and employee has most of the interaction with his supervisor, the support of the supervisor is vital to secure positive perception of organizational support from employee. Support of the supervisor in daily working, difficult situations and unfavourable incidents form a perception among his subordinates that their supervisor protect, facilitate and encourage them.

Hypothesis

Supervisor's support in daily working enhances employee's perception to organizational support and leads to higher motivation among employees.

RESEARCH DESIGN

For the purpose of this research, survey was used to test the relationship of perceived supervisors' support with employees' motivation. Primary data were collected from respondents through survey. The current paper represents is portion of a broader study in

on perceived organizational support (POS) and employees motivation in which perceived supervisors' support was taken as dimension of the overall POS.

In this survey data were collected from managerial cadre employees of the target group. Survey research was suitable for this research because the study attempted to find perception of employees regarding organizational support and their own motivation. The managerial cadre employees working in Lahore cluster of the textile companies are part of the population. All Pakistan Textile Mills Association (APTMA) list of the companies having their offices/ production units in Lahore was used as population frame. The managerial cadre employees include entry-level managers, middle level managers, and senior managers. Different companies were contacted and those who showed their consent to cooperate in this research were included in the sample. At the first stage, 10 companies out of the list of 105 companies were selected based on the willing to cooperate for this research. The sample size for this study is 200 managerial cadre employees. A disproportionate sample of 20 employees each organization was drawn so that the total sample reaches to 200.

Instrument for Data Collection

For the purpose of this study, the basic idea was borrowed from the Eisenberger 36 point questionnaire. However, due to the difference in the cultural settings, it was largely modified and new questions were added. The questionnaire contained questions which were responded on 5 item Likert scale. The reliability of the scale and internal consistency were checked by applying different statistical tools. "Reliability is usually defined in terms of consistency of the scores that are obtained on the observed values". (Hatcher, 1994). One of very important measure of reliability is Cronbach Coefficient Alfa (Cronbach, 1951). Cronbach alfa was 0.91, that shows high reliability of the instrument.

Data Analysis

Data analysis is based on 102 responses received from 10 textile companies. Respondents included both male and females and in terms of qualification they were mostly MBAs, Textile Engineers, undergraduates. The hypothesis is tested by using Chi Square. As the data is categorical, chi square is appropriate for hypothesis testing. Further to counter check the results, correlation analysis is also used.

Table 1:
Perceived Supervisor's Support and Employees Motivation Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.548(a)	2	.008
Likelihood Ratio	12.372	2	.002
N of Valid Cases	102		

a1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.31.

Asymp. Significance of .008 in Pearson Chi-Square in table 1 indicates that the results are significant. The value of Pearson Chi-Square calculated is 9.548. χ^2 (4, n = 102) = 34.9.548, p>.05.

CONCLUSION OF CHI SQUARE TEST

Since the chi square value is significant, there is sufficient evidence to reject null hypothesis (Ho) and to conclude alternative hypothesis (Ha).

So the alternative hypothesis “Supervisor’s support in daily working enhances employee’s perception to organizational support and leads to higher motivation among employees.” is concluded. The results show that there is a relationship between perceived supervisor support and employees’ motivation. As the level of perceived supervisor support increases, employees’ motivation also increases.

**Table 2:
Correlations**

		Supervisor's ***Support	Employees' Motivation
Supervisor's Support	Pearson Correlation	1	.471(**)
Employees' Motivation	Pearson Correlation	.471(**)	1
Job Loyalty	Pearson Correlation	.541(**)	.678(**)
Acceptability of Greater Responsibility	Pearson Correlation	.288(**)	.394(**)
Interest in Work	Pearson Correlation	.195(*)	.562(**)
Initiative	Pearson Correlation	.427(**)	.530(**)

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

*** Total sample size is 102

Correlation statistics were also used to determine the relationship between perceived supervisors’ support and employees’ motivation. The correlation analysis (table 2) of independent variable (perceived supervisor support) with the dependent variable (employees’ motivation) and its dimensions indicates that POS has a moderate positive relationship (0.427) with the employees’ motivation. Although relationship is very strong if the value of the test is very close to 1, however at the same time, if the correlation is very high, it may create a doubt, whether or not correlated variables are two different variables (Sekaran, 2003).

The analysis of the table 2 reveals that the correlation between POS and job loyalty is significant at .01 level ($P < .01$). The correlation coefficient value .541 indicates there is moderately strong positive relationship between POS and job loyalty. The results are in harmony with earlier studies of Rousseau 1990, 1995; Levinson, 1965; March and Simon. Looking at the Pakistani textile sector, this seems quite logical. The results show that employees in Pakistani textile sector would have higher loyalty if they are provided high organizational support even if they are paid slightly lower salaries in the organizations (Qammar, 2007).

The correlation between PSS and interest in work is significant at .05 level ($P < .05$). However, the correlation value .195 indicates, there is positive but weak correlation between PSS and interest in work. Looking at the job market situation in Pakistan, where unemployment rate is quite high, many employees are engaged in the jobs which may not

be very interesting to them, so even if the supervisor is supportive and caring, it could not create much interest in the work. Looking at the Pakistani culture, employees may have a great regard for such supervisor but still the work may not attract them.

The correlation between PSS and initiative is significant at .05 level ($P < .05$). The correlation value .427 indicates there is moderate positive relationship between PSS and initiative. As initiatives require resources, funds and moral support, employees normally hesitate to take initiatives unless encouragement and support from the organization and supervisor are there. The employees in textile sector of Pakistan being may be hesitant to take risk because of the overall risk evasion culture (Hofstede, 2001). However, this risk avoidance tendency will be largely influenced by the supervisor support. When supervisor support is there in different initiatives, that signifies that supervisor is sharing risk with you. The moderate correlation in this case indicates that despite operating in the risk avoidance culture, people may be encouraged to take initiatives if supervisor support is there.

The correlation between PSS and acceptance of greater responsibility is significant at .05 level ($P < .05$). However, the correlation value 0.288 indicates, there is positive but weak correlation between POS and acceptance of greater responsibility. The reason for low value of correlation is that although supervisors are cooperative and supportive to the employees, employees have fear that greater responsibility could disturb their existing performance, so they hesitate to take more responsibilities.

To conclude the results, Perceived supervisors' support is vital in motivating employees and it has been found related with employees' motivation in this study. Further, all four dimensions of motivation used in this study are found to have relationship with PSS.

There is potential for the future research, in which different demographic variables like age, gender, qualifications and experience could be taken as control variables to see the strength of relationship in different groups.

REFERENCES

1. Bateman, T.S. and Organ, D.W. (1983). Job satisfaction and the good soldier: The relationship between affect and employee citizenship. *Academy of Management Journal*, 26, 587-595.
2. Blau, P.M. (1964). *Exchange and power in social life*. New York: Wiley.
3. Brief, A.P. and Motowidlo, S.J. (1986). Prosocial organizational behaviors. *Academy of Management Review*, 11, 710-725.
4. Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*. 16, 297-334.
5. Eisenberger, R., Huntington, R., Hutchison, S. and Sowa, D. (1986). Perceived organizational support. *Journal of Applied Psychology*, 71: 500-507.
6. Eisenberger, R., Stinglhamber, F., Vandenberghe, C. Sucharski, I. and Rhoades, L. (2002b). Perceived supervisor support: contributions to perceived organizational support and employee retention. *Journal of Applied Psychology*, 87, 565-573.
7. Etzioni, A. (1961). *A comparative analysis of complex organizations*. New York: Free Press.

8. Gould, S. (1979). An equity-exchange model of organizational involvement. *Academy of Management Review*, 4, 53-62.
9. Gouldner, A.W. (1960). The norm of reciprocity: A preliminary statement. *American Sociological Review*, 25:161-178.
10. Hatcher, L. (1994). *A step-by-step approach to using the SAS(R) system for factor analysis and structural equation modeling*. Cary, NC: SAS Institute.
11. Hofstede, *Culture's Consequences*, (2001), Thousand Oak, CA: Sage,
12. Hutchinson, S. (1997). A path model of perceived organizational support. *Journal of Social Behavior and Personality*, 12, 159-174.
13. Kottke, J.L. and Sharafinski C.E. (1988) Measuring Perceived Supervisory and Organizational Support. *Educational and Psychological Measurement*, 48(4), 1075-1079.
14. Levinson, H. (1965). Reciprocation: the relationship between man and organization. *Administrative Science Quarterly*, 9, 370-390.
15. March, J.G. and Simon, H.A. (1958). *Organizations*. New York: Wiley.
16. Meyer, J.P. and Allen, N.J. (1997). *Commitment in the workplace: Theory, research and application*. Thousand Oaks: Sage.
17. Mowday, R.T., Steers, R.M. and Porter, L.W. (1979). The measurement of organizational commitment. *Journal of Vocational Behavior*, 14, 224-247.
18. Organ, D.W. and Konovsky, M. (1989). Cognitive versus affective determinants of organizational citizenship behavior. *Journal of Applied Psychology*, 74, 157-164.
19. Qammar, A. *Perceived Organizational Support and Employees Motivation*. Unpublished MS thesis, University of the Punjab, Pakistan
20. Rhoades, L. and Eisenberger, R. (2002). Perceived Organizational Support: A Review of the Literature. *Journal of Applied Psychology*. 87(4), 698-714.
21. Rousseau, D.M. (1990). New hire perceptions of their own and their employer's obligations: A study of psychological contracts. *Journal of Organizational Behavior*, 11, 389-400.
22. Rousseau, D.M. (1995). *Psychological contracts in organizations*. Thousand Oaks, CA: Sage.
23. Sekaran U. (2003). *Research Methods for Business a skill building approach*. John Wiley and Sons, Inc.
24. Settoon, R.P., Bennett, N. and Liden, R.C. (1996). Social exchange in organizations: Perceived organizational support, leader-member exchange, and employee reciprocity. *Journal of Applied Psychology*, 81: 219-227.
25. Shore, L.M. and Tetrick, L.E. (1991). A construct validity study of the survey of perceived organizational support. *Journal of Applied Psychology*, 76: 637-643.
26. Shore, L.M. and Wayne, S.J. (1993). Commitment and employee behavior: Comparison of affective commitment and continuance commitment with perceived organizational support. *Journal of Applied Psychology*, 78: 774-780.
27. Steers, R.M. (1977). Antecedents and outcomes of organizational commitment. *Administrative Science Quarterly*, 22, 46-56.
28. Vandenberghe, C.; Bentein, K.; Michon, R.; Chebat, H.C.; Tremblay, M. and Fils J.F. (2007). An Examination of the Role of Perceived Support and Employee Commitment in Employee-Customer Encounters, *Journal of Applied Psychology* 92(4), 1177-1187.

29. Wayne, S.J.; Shore, L.M. and Liden, R.C. (1997). Perceived organizational support and leader-member exchange: A social exchange perspective. *Academy of Management Journal*, 40: 82-111.
30. Wayne, S.J.; Shore, L.M., Bommer, W.H. and Tetrick, L.E. (2002). The role of fair treatment and rewards in perceptions of organizational support and leader-member exchange. *Journal of Applied Psychology*, 87, 590-598.
31. Witt, L.A. (1991). Exchange ideology as a moderator of job-attitudes-organizational behaviors relationships. *Journal of Applied Social Psychology*, 21, 1490-1501.

ARSENIC IN THE GROUND WATER OF PAKISTAN

Khurshed Ahmed¹ and Sidra Karim²

Department of Environmental Management and Sciences
National College of Business Administration and Economics, Lahore.
Email: ¹drkhurshed@hotmail.com; ²kareemsidra@yahoo.com

ABSTRACT

Arsenic in ground water is present in mineral as arsenopyrite, Arsenic was identified in the groundwater of districts Sheikhpura, Bahawalpur, Bahawalnagar Jhelum, Sargodha, Rahim Yar Khan and Mianwali. The value of arsenic in groundwater ranged from 0.02-to 5.0 mg/l. Highest value of arsenic was investigated in village pel of Mianwali district.

Keywords: Erosion, Skin rash, mitigation, hyperkeratosis.

INTRODUCTION

Arsenic is natural element found widely in earth's crust. It may be found in some drinking water supplies including wells. There are trace amounts of arsenic in all living matter. Arsenic may enter lakes, rivers, and underground water naturally when mineral deposits or rock containing arsenic dissolve. Arsenic may also get into water through the discharge of industrial wastes by the deposit of arsenic particles in dust, or through rain or snow. Arsenic particles can also enter the environment through the burning fossil fuels (especially coal), and metal production (such as gold and metal mining), agricultural use (in pesticides and feed additives), or waste burning.

The commonly existing inorganic arsenic species in groundwater are in the form of arsenate (AsV) and Arsenic (AsIII), the later being more mobile and toxic(40 – 60 times) for living organism. Arsenic occurs in Pakistan as geological deposits at a shallow depth (usually 20 to 100 feet).

More than 20 arsenic compounds (species) are known. The main objective of the current research is to investigate. Arsenic in the groundwater of Pakistan.

HEALTH IMPACTS OF ARSENIC

Long-term exposure to arsenic via drinking water causes cancer of the skin, lungs urinary bladder and kidney, as well as other skin changes such as pigmentation changes and thickening (hyperkeratosis). Increases risks of lung and bladder cancer and of arsenic-associated skin lesions have been observed in drinking water with arsenic concentration of less than 0.05mg/l. Absorption of Arsenic through the skin is minimal and thus hand-washing, bathing, laundry, etc. with water containing arsenic do not pose human health risk. Following long- term exposure, the first changes are usually observed in the skin: pigmentation changes and then hyperkeratosis. Cancer is a late phenomenon, and usually takes 10 years to develop. The relationship between arsenic exposure and other health effects is not clear-cut. For example, some studies have reported hypertensive and cardiovascular disease, diabetes and reproductive effects.

Studies in several countries have demonstrated that arsenic causes other less severe forms of peripheral vascular disease. According to an estimate arsenic in drinking water has caused 200,000-270,000 deaths from cancer in Bangladesh alone [2].

REVIEW

- Seven of 16 districts of West Bengal have been reported to have ground water arsenic concentration above 0.05mg/l, the total population in these seven districts is over 34 million [3] and it has been estimated that the population actually using arsenic- rich water is more than 1 million (above 0.05mg/l) and is 1.3 million (above 0.01 mg/l)[4]
- According to a British Geological Survey study in 1998 on shallow tubewells in 61 of the 64 districts in Bangladesh, 46% of the samples were above 0.010mg/l and 27 % were above
- 0.050mg/l. When combined with the estimated 1999 population, it was estimated that the number of people exposed to arsenic concentrations above 0.05mg/l is 28-35 million and the number of those exposed to more than 0.01 mg/l is 46-57 million [5]

SAMPLING AND METHODOLOGY

Grab sampling procedure was used for collecting Arsenic samples from City and Towns.

The details of location is given with result and methodology.

Two techniques were used for estimating Arsenic in Drinking Waters of Pakistan, Field Technique and Laboratory Technique.

For field measurement MERCH FIELD KIT was used. Before using the kit it was standardized by arsenide solution. Field test kit can detect high level of arsenic but are typically unreliable at lower concentration of concern for human health. Reliability of field method is yet to be fully evaluated.

The laboratory technique is the standard procedure, this technique make use of Atomic Absorption Spectrophotometer using graphite furnace. The procedure was adopted from IWWA, AWWA Standars Methods. For the Examination of Water and Wastewater (6).

On comparison of both the methods, the relationship between the two comes out to be 0.0 mg/l Arsenic by graphite techniques which was equivalent to 10.0mg/l by MERCH FIELD KIT.

RESULTS AND DISCUSSION

Arsenic is introduced into groundwater through the dissolution of minerals and ores in some areas, which are elevated as a result of erosion local rocks. Inorganic arsenic can occur in the environment in several forms but in drinking water, it is mostly found as

Town and cities from samples were collected		
City/Towns	No. of Location Sampled	Sampling Source
Lahore	10	1 Handpump, 9 Tubewell
Sheikhupura	4	1 Tubewell, 3 Handpumps
Rawalpindi	5	2 Tubewell, 3 Tape Water WDS
Gujrat	3	1 Handpump, 2 Tubewell
Jhelum	3	1 Handpump, 2 Tubewell
Chakwal	4	1 Tubewell, 3 Handpumps
Sargodha	4	2 Tubewells, 2 Handpumps
Mianwali	3	1 Tubewell, 1 Handpump, 1 Deepwell
Multan	5	2 Handpumps, 3 Tubewell
Bhawalpur	5	1 Handpump, 4 Tubewell
R.Y Khan	2	2 Tubewells

trivalent arsenide (As (III)) or heptavalent arsenate (As(V)). Organic arsenic species abundant in seafood are very much less harmful to health and are readily eliminated by the body. Arsenic in the groundwaters of Pakistan is given in table 2.

The following districts of Pakistan contain arsenic

- Rahim Yar Khan (Basti Yar Muhammad)
- Mianwali (Main Bazar, Khawajabad and village Pel)
- Sargodha (Bus Stand, Satellite Town)
- Sheikhpura (Main Bazar and Bus Stand)
- Bhawalpur (Victoria Hospital & Mohajir Colony)
- Bhawalnagar (Officers Colony)
- Jhelum (Main Bazar and Pind Daddan Khan)

Table 1: Arsenic in Ground Water of different districts of Pakistan

S#	Village Town Cities	Sample Sources	No. of Times Sample Collected	Arsenic mg/l		Comments
				GAAS	Kit	
Lahore						
1	UET	T.Wells	4	0.0	10.0	It was confirmed by standardizing Arsenic kit that 10:00 were equivalent to 0.0 by GAAS Method.
2	Baghbanpura	T.Wells	6	0.0	10.0	
3	China Town	Hand Pump	10	0.0	12.0	
4	Dharampura	T.Wells	5	0.0	6.0	
5	Mughalpura	T.Wells	5	0.0	10.0	
6	Samanabad	T.Wells	10	0.0	10.0	
7	Model Town	T.Wells	7	0.0	10.0	
8	Gulberg III	T.Wells	2	0.0	10.0	
9	Zoohar Elahi Road	T.Wells	2	0.0	10.0	
10	Delhi Gate	T.Wells	8	0.0	10.0	
Sheikhpura						
11	Main Bazaar	Tube Wells	10	0.02	12.0	Some traces of arsenic were found in the Tube well of Main Bazar and Bus Stop
12	Bus Stand	Hand Pump	2	0.03	13.0	
13	Jamia Mosque	Hand pump	2	0.10	10.0	
14	Railway Station	Hand pump	2	0.0	10.0	
Multan						
15	Railway road	Hand Pump	5	0.0	10.0	Except few doubtful arsenic traces no arsenic was tied in the groundwater sample
16	Gulagasht Cly.	T.Wells	10	0.0	10.0	
17	Hussain Aghahi	Hand pump	5	0.0	10.0	
18	B.Z. University	T.Wells	2	0.0	10.0	
19	Bosan Road	T.Wells	2	0.0	10.0	
Bhawalpur						
20	Victoria Hospital	T.Wells	2	0.02	12.0	Some traces of arsenic were found in the groundwaters of Victoria Hospital Muzhar Colony
21	Muhajir Colony	T.Well	5	0.02	12.0	
22	Madina Colony	T.Well	6	0.01	11.0	
23	T.Sultan Colony	T.Well	5	0.00	10.0	
24	Sabzi Mandi	Hand Pump	2	0.0	10.0	
Bhawalnagar						
25	Officers Colony	T.Wells	5	0.03	13.0	Traces of arsenic was recorded in all samples obtain from Bhawalnagar
26	Munirabad	T.Wells	6	0.02	12.0	
27	Model Town	T.wells	6	0.02	12.0	

S#	Village Town Cities	Sample Sources	No. of Times Sample Collected	Arsenic mg/l		Comments
				GAAS	Kit	
Rawalpindi						
28	Saddar	T,Well	4	0.0	10.0	Most of the time traces were estimated. The groundwater is free from arsenic
29	Hati Cowk	Tap	4	0.0	10.0	
30	Raja Bazar	Tap	10	0.0	10.0	
31	Sir Syed Colony	Tap	12	0.0	10.0	
32	Cantonement	T.Well	5	0.0	10.0	
Gujrat						
33	Main Bazar	T.Wells	6	0.0	10.0	No arsenic was found from the groundwater of Gujrat
34	Services Shoes	T.Wells	2	0.0	10.0	
35	Bus Stand	Hand Pump	2	0.0	10.0	
Jhelum						
36	Bus Stand	T.Well	2	0.02	12.0	Arsenic was present in the groundwater of Jhelum, city Village Pind Daddan Khan shows the higher presence
37	Main Bazar	T.Well	6	0.03	13.0	
38	Pind Daddan Khan	Hand Pump	6	1.00	100.0	
Chakwal						
39	Main City	Hand Pump	6	0.00	0.0	Free from Arsenic
40	Kundian	T.Well	5	0.00	10.0	
41	Khushab	Hand Pump	3	0.00	10.0	
42	Jahurabad	Hand Pump	4	0.00	10.0	
Sargodha						
43	Bus Stop	Hand Pump	6	0.03	13.0	Asenic is Present
44	Satellite Town	T.Well	6	0.02	12.0	
45	Model Town	T.Well	8	0.00	10.0	
46	Tracter Bazar	Hand Pump	6	0.00	10.0	
Rahim Yar Khan						
47	Basti Yar Muhammad	T.Wells	25	0.4	400.0	In Basti Yar Muhammad High arsenic was present in 11 out of 41 house hold
Mianwali						
48	Main Bazar	T.Well	4	2.00	200	In Village Pel most of the sample obtain from deep well contain high arsenic compound.
49	Khawajabad	Hand Pump	10	3.00	300	
50	Pell(Village)	Deep Well	121	5.00	500	

The value for this arsenic rich water was further monitored from 2004 to August 2007. Maximum value of 5.0mg/l and 1.00 was recorded from samples taken from open Dug well at village pel, Mianwali and Pind Daddan Khan Jhelum. Particularly most of the water in district Mianwali are contaminated with arsenic. People of village pel, have become health conscious and have abandoned the use of this well, as well as surrounding wells. The village hand pumps and tube well also contain high arsenic.. Details in numbers are also provided in Table 2 and Table 3

Samples from Victoria Hospital Bhawalpur were studied in detail. Also this was discussed with senior Doctors who promised to take care.

Table 2 Arsenic in groundwater of District RahimYar Khan

Months	Rahim Yar Khan	Mianwali			Jehlum
	Basti Yar Muhammad	Main Bazar	Khawajbad	Village Pel	Pind Daddan Khan
2004 Jan	0.04	0	2.03	3.9	0.4
2004 May	0.03	0.09	2.5	4.6	0.8
2004 Sept	0.01	0.02	2.1	4.2	0.6
2004 Dec	0.02	0	1.9	3.9	0.5
2005 Jan	0.03	0.08	0.06	3.8	0.4
2005 May	0.03	0.09	2.3	4	0.7
2005 Sept	0.04	0.09	2.6	3.8	0.5
2005 Dec	0.02	0.07	2.3	3.5	0.2
2006 Jan	0.04	0.06	0	4	0.5
2006 May	0.03	1	0.05	4.6	0.9
2006 Sept	0.03	0.02	0.19	3.4	0.6
2006 Dec	0.04	0.02	2.8	3.9	0.4
2007 Jan	0.04	0.08	2.6	4	0.6
2007 May	0.04	1	3	5	1
2007 Sept	0.03	0.06	2.9	3.8	0.9

Table 3: Details of Arsenic in groundwater of Pakistan Bhawalpur, Bhawalnagar and Sargodha.

Months	Bhawalpur		Bhwalnagar	Sarghoda
	Victoria Hospital	Mohajir Colony	Officers Colony	General Bus Stop
2004 Jan	0	0.2	0.3	0.2
2004 May	0.1	0	0.2	0.2
2004 Sept	0.1	0.1	0.3	0.3
2004 Dec	0.1	0.1	0.2	0.3
2005 Jan	0	0.1	0.3	0.3
2005 May	0.2	0.2	0.3	0.3
2005 Sept	0	0	0.2	0.2
2005 Dec	0.2	0.2	0	0.2
2006 Jan	0.1	0.2	0.2	0.2
2006 May	0	0.2	0.3	0.2
2006 Sept	0	0	0.1	0.3
2006 Dec	0.2	0.2	0.2	0.2
2007 Jan	0.03	0.2	0.2	0
2007 May	0.02	0.2	0.2	0.3
2007 Sept	0.03	0.2	0.2	0.3

PREVENTION AND CONTROL

The most important remedial action is prevention of further exposure by providing safe drinking water. Control of arsenic is more complex where drinking water is obtained from many individual sources (such as Tube wells, Hand Pumps, Deep Wells) as is common in rural areas. Low arsenic water is only needed for drinking and cooking. Arsenic rich water can be used safely for laundry and bathing. Discrimination between

high-arsenic and low-arsenic source can be made by painting (e.g red and green). This will be effective and low cost means to rapidly source exposure to arsenic when accompanied by effective health education.

Water from such wells containing high arsenic should be tested from time to time.

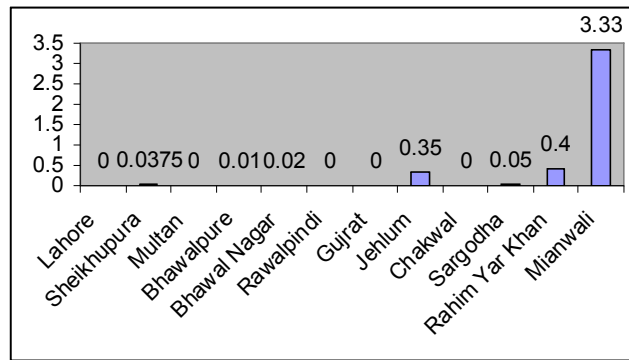


Fig 1: Bar Chart showing average values of As in Ground Water of different districts of Pakistan

CONCLUSION

From the foregone investigation, the following conclusions can be drawn.

1. Arsenic was present in the groundwater of the following districts, Bhawalnagar, Sheikhpura, Bhawalpur, Jhelum, Sargodha, Rahim Yar Khan, and Mianwali. The value ranged from 0.02 to 1.00 mg/l
2. Maximum Arsenic was identified from village pel district Mianwali and Panddadan Khan district Jhelum.
3. Those places where ground water showed higher arsenic were investigated in details from January 2004 to semptember 2007.

ACKNOWLEDGEMENT

I should like to thank Dr. Munir Ahmed, Rector and Mr Aamir Iftikhar Vice-Rector and Chairman School of Management, National College of Business Administration & Economics for their guidance throughout the investigation period.

REFERENCE

1. Editor, The Daily Star, UK (2003). *Poisonous material in the groundwater of Bangladesh*.
2. DHAR et al. (1998). *Groundwater arsenic contaminants in Bangladesh* International Conf. on arsenic. *Pollution of groundwater* Dhaka 300-312.
3. Rashid H., Rahman, M.M. and Turquist, S. (1994). *Water supply in lower water table area. Sanitation and water to all*. Proc 24 WEDC Conf. Islamabad. Pakistan 24: 300-303.
4. Rashid H. (1997). Arsenic contamination of groundwater in Bangladesh. *Annual report 02. Bangladesh Agricultural Research Institute Decca Bangladesh (BARI)* 24:308-309.
5. Khurshed, A. (2007). *J. of Env. Sci. Tech. and Eng.* 7, 9-11.
6. AWWA, APHA WPCF (2005). *Standard Methods for the Examination of Water & Waste Water*. APHA, Washington DC.
7. DCH (1997). Arsenic pollution in groundwater of Bangladesh. *Dhaka Community Hospital (DCH) Trusts* 24, 118-120.
8. WHO (1998). *Drinking water quality guidelines WHO*. CEHA, Amman Jordan.

**HOUSEHOLD CHARACTERISTICS: HOW MUCH THEY AFFECT
A WOMAN'S CONTRIBUTION IN HOUSEHOLD BUDGET?**

Rana Ejaz Ali Khan and Tasnim Khan

Department of Economics, The Islamia University of Bahawalpur.
Bahawalpur, Pakistan

ABSTRACT

The current paper highlights the determinants of contribution of a working woman (in the age group of 16-60 years) of informal sector in her household budget. Household characteristics have been focussed in the paper. Employing the OLS model on 1780 observations taken from primary data, it is found that family size and household poverty have positive effect on contribution. The burden of the loan availed by the household is shared by a woman by her contribution. It explained the phenomenon of intensive struggle by the woman for family survival in bigger households, poor households, and in the households utilizing loans. These loans either are used for consumption or investment. It means an informally employed woman always supports her family to retire the debt. A rural woman is contributing less in the household budget as compared to the urban woman. Woman living in a nuclear family contributes more to household budget. Husband's employment and education decreases the woman's contribution. Alternatively, the woman having unemployed and less-educated husbands have more contribution in their household budget. The vulnerability of the household due to unemployed and illiterate husband is smoothed out by these working women. The household per capita income, number of children (5-15 years) in the household, ownership of assets by the household and number of adult males in the household have shown negative effect on the contribution of a woman in the household budget. Poverty in different aspects like husband's unemployment, illiteracy, larger number of children, and low per-capita income force a woman to contribute in household budget. The minimum wage legislation and its implementation for informal sector woman can play an important role in welfare these households.

KEYWORDS (JEL CLASSIFICATION)

Women, Household Economics (J160), Labour Supply (J220), Female Employment (J13), Poverty (O150).

I. INTRODUCTION

The informal sector is a heterogeneous phenomenon having specific characteristics which encompasses many economic activities that are usually overlooked in economic statistics. The informal sector economic activities are carried out in the enterprises operated in small units which are established, owned and operated by one, or a few individuals; started and maintained with little capital and are unable to gain access to formal credit mechanisms; produce low-quality but relatively cheap goods and services;

are very labour-intensive and not very efficient; ill-equipped and have little infrastructure; operating in highly competitive environment with easy entry; and have limited opportunities offering better-quality goods and services because of worker's lack of knowledge and skill. The situation put the informally employed women at subsistence level.

Few studies have attempted informally employed women time allocation. The studies which touched the working women are mostly concerned with their income, wages, working conditions, marketing mechanism and working hours. Still no study exists, who have examined their contribution in household budget. The contribution of a woman in her household determines her status in household. It pulls the household out of poverty and enhances bargaining power which results into well-being of the children and household. This draws attention to analyze the determinants of women's contribution in household budget. The core of the present study is to analyze the contribution of working women (informally employed) in their household budget. We will discuss only the household characteristics which may affect the contribution.

II. DATA COLLECTION AND ESTIMATION MODEL

We have adopted the definition of informal sector devised by Federal Bureau of Statistics (FBS 2003). Primary data exclusively collected for the study by cluster sample technique has been used. A survey of 1780 urban and rural households of Bahawalpur District in March-April 2005 and October-November 2005, having at least one working woman in the age group of 16-60 years made the information valid. To capture the contribution of these women in the household budget we have estimated OLS model in which contribution of a woman was a function of several socio-economic variables related to household characteristics. The contribution of a woman in household income was defined as the ratio of the woman's earned income to the total income of the household. We have estimated contribution of women in the household income through OLS model. The function is

$$COW=f(X_1,\dots\dots\dots X_n) \quad (1)$$

Where COW is the contribution of women in household budget. $X_1,\dots\dots\dots X_n$ are the exogenous variables influencing her contribution. The definitions of dependent and explanatory variables are presented in table No.1.

**Table 1:
Definitions of Dependent and Explanatory Variables Used in the Model**

Variables and Definitions
Dependent Variable
COW (Woman's contribution in household income): Ratio of woman's earned income to the total income of the household
Independent Variables
HAGE (Husband's age): Husband's age in completed years
HEDU (Husband's education): Husband's completed years of education

HEMP (Husband's employment): 1 If husband is employed, 0 otherwise
HY (Husband's income): Husband's income (in 000 rupees)
HHPCY (Household's per capita income): Household's per capita income (in 000 Rupees) per
POVTY (Household's poverty status): 1 If household's per capita income per month is Rs.848.79 or below, 0 otherwise
HHSIZ (Household/family size): Number of household/family members
HNUC (Nuclear status of household): 1 If household is nuclear, 0 otherwise
NCHILD (Number of children in household): Number of school-age children (5-15 years) in the household
INFANT (Number of infants in household): Number of infants (up to 5 years) in the household
ADLM (Number of adult males): Number of adult males in the household
ADLF (Number of adult females): Number of adult females in the household
HSST (Household's ownership of assets): 1 if the household owns assets, 0 otherwise
HLOAN (Household's availability of loan): 1 if the household availed loan, 0 otherwise

III. RESULTS AND DISCUSSION

The OLS results are given in table-2. The majority of the results is consistent with the theoretical implications of a woman's contribution in household budget.

Table 2: OLS Results for Women' Contribution in Household Budget

Variables	Standard Coefficient Beta	T-Values	Variables	Standard Coefficient Beta	T-Values
Constant	319.465	2.9866	HNUC	2.5894	1.9755**
HAGE	1.8763	0.2876	NCHILD	-1.7649	-1.8367**
HEDU	-0.1059	-1.6589**	INFANT	-1.3668	-1.2657*
HEMP	-2.4579	-2.0148**	ADLM	-4.5647	-2.8756**
HY	-1.9422	-2.2751**	ADLF	-8.1347	-1.3986*
HHPCY	-1.6538	-1.7895**	HLOAN	4.8017	1.3941*
HPOVTY	1.0931	2.6839**	HSST	-3.5649	-2.9856**
HHSIZ	1.8215	2.2115**	LOC	-5.1365	-1.7075**
No. of Observations 1780					
R-Squared 0.6864					
Percent Correct Predictions 0.6941					

** Indicates significant at 5 percent level and * indicates significant at 10 percent level.

The following features of the results are worth noting.

1. **Husband's Educational Level and Employment Status:** The characteristics of husband play a vital role in determining a woman's contribution in household budget. We have included the life-cycle, education and employment status of the husband as explanatory variables. It is estimated that husband's education negatively affects the contribution of a woman. The results lead to the notion that contribution of a woman is economic based. An educated husband is likely to earn more income, which results into good economic status of the household and lower the contribution of woman. We have further found that a woman from unemployed husband contributes more in the household budget. The driving force behind the contribution in household budget by a woman is to supplement family income that has been eroded by unemployment of husband.
2. **Husband's Income:** Conceptually, it is argued that wife tend to earn more when the husband's income is low. Our estimation has shown that a woman from high-income husband contributes less to the household budget. The interpretation may be that the woman enjoys leisure alternatively she provides less working hours in informal labour market. She feels lower burden of household expenditures.
3. **Household per-capita Income:** The household income is the central indicator of socio-economic standing of the household. Econometric estimates have shown an inverse relationship between household per-capita income and the contribution of a woman. It implies that a woman belonging to household with lower per-capita income is more likely to contribute in her household budget.
4. **Household Poverty Status:** We have included the household poverty status as a binary variable (whether the household is living below national poverty line or not) to explain whether a working woman in informal sector living below poverty line is contributing more or less to household budget. Our analysis has shown that a woman from households living below poverty line is contributing more in household budget. It supports the view that poverty compels a woman to contribute more in household budget.
5. **Household Size and Structure:** Household size and structure are inter-related concepts. In determining a woman's contribution in household budget the household structure (nuclear family system or combined family system) becomes relevant. To detangle the effect of household size and nuclear family structure on a woman's contribution in household budget, we have included two types of explanatory variables in the model. They are (i) continuous variable, i.e. number of household members, and (ii) binary variable, i.e. whether the household is nuclear or have combined family. It is found that contribution of a woman is positively related with the household size. More precisely, it is income dilution effect, i.e. larger family size compels a woman to contribute more in the household budget. Our study further indicated that a woman from nuclear family contributes more to her household budget. It may be explained that in nuclear family the earning member may only be the husband so the ratio of the contribution of the woman in the household budget remains high.

6. **Number of School-age Children:** The volume of a woman's contribution in her household budget may be influenced by demographic characteristics of the household like the number of children, their gender and age. Even the activities of these children, i.e. child labour, schooling or home-care also determine the contribution of a woman. We have included the number of school-age (5-15 years) children in the household as an explanatory variable for the contribution of woman involved in informal sector to her household budget. It is found that school-age children in the household negatively impact the woman's contribution in household budget. It explained the phenomenon that woman contribution is substituted by children income as in such households, usually children are involved in economic activities.
7. **Number of Infants:** The number of infants in the household is speculated to influence a woman's contribution in household budget negatively. We have found that presence of infants in the household decreases the woman contribution in household budget. The explanation may be that the woman devotes more time for infants within the household so her contribution remains low. As concerned the day-care centres, they are non-existent and if rarely they exist in urban areas, the informally employed woman has no access to these centres due to cost as well as distance.
8. **The Adult Members of the Household:** The other adult members of the household may also affect the contribution of a woman in household budget in a number of ways, i.e. (i) through their characteristics like education, gender, age, employment and income status, and (ii) through their time consumption in home-care activities and production activities. The presence of adult members (males and females separately) has shown negative effect on the contribution of a woman in household budget. The phenomenon shows a substitution effect, i.e. the adult member of the household and working woman in informal sector are substitutes from their contribution point of view. One surprising aspect of the result is that both female and male adults have same type of effect, i.e. female adults also substitute the contribution of a women in the household budget.
9. **Ownership of Assets by Household:** It is an important indicator of the socio-economic standing of a household. Theoretically, the ownership of assets by household may impact the contribution of a woman by two ways. In one way, the assets make the household richer and financially stable through the un-earned income and woman is less likely to contribute household budget. In the other way, if the household owns assets, it may be easier for the woman specifically in informal sector to work at household enterprises. We have found that if the household has assets, the woman from that household contributes less in the household (see also Gonzalez 2004). The possible explanation may be that ownership of assets by the household enhance the economic status of the household and woman contributes less to the household budget.
10. **Financing Availed by the Household:** We have included in our study, a binary variable representing whether the household is availing the loan or not. The objective is to see, if the loan is obtained for investment, then whether the woman

is contributing through enterprises and if the loan is obtained for consumption, then whether the woman is contributing in the household budget to take the burden of consumption. It is concluded that a woman from the household having loan is contributing more to her household budget. The explanation may be that burden of the loan on household compresses the women to contribute more in their household income. If the loan was utilized for a small business adventure the woman is participating in the business of the household and if the loan was utilized for consumption, the woman is sharing the consumption expenditures of the household.

11. **Locality of the Household:** The contribution of a woman is determined by spatial differences (Salway, *et. al.* 2003). An urban woman is a bigger contributor in his household budget. It seemed quite strange as weaker financial background and larger family size of rural household should force the woman to contribute more in household budget. The explanation may be that most of the work done by a woman in the rural areas is still non-monetized and unpaid in agriculture sector.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

To enhance the contribution of a woman in household budget, the policy on women's employment is to be carefully planned. As poverty is the main cause of a woman's contribution, the minimum wage legislation should receive the great deal of attention.

The urban woman is contributing more in her household budget as compared to rural woman, even the informal sector is prevalent in rural areas. It is needed to support the informal sector in rural areas by providing loans, skill development programs for women, access to market and establishing the agro-based industries which are rare in Pakistan.

The more contribution of women in their household budget from low per capita households, and belonging to low-educated, illiterate, unemployed, and low-income husbands reflects the informal structure of the economy is absorbing lower strata of female labour force. It may also concluded that, the families providing the women labour force for informal sector are largely depending upon women's contribution.

REFERENCES

1. FBS (2003). *Pakistan Labour Force Survey 2001-2002*. Federal Bureau of Statistics (FBS), Government of Pakistan, Islamabad.
2. Gonzalez, L. (2004). Single Mothers and Work. *Socio-Economic Review*, 2, 285-313.
3. Salway, S., Rehman, S. and Jesmin, S. (2003). A Profile of Women's Work Participation among the Urban Poor of Dhaka. *World Development*, 31(5), 881-901.

**AN INVESTIGATION OF INFLUENCING FACTORS OF BLOOD DONATION
MOTIVATION, BLOOD DONORS A SURVEY-BASED QUESTIONNAIRE STUDY**

**Khurram Aziz Fani, Kaleem Ashraf, M. Ahmad Tauqir,
Anam Khan and Sidra Mehboob**

GIFT Business School, GIFT University, Gujranwala. Email: khurram@gift.edu.pk

ABSTRACT

Objectives: The study was conducted to find that which motivational and socio-demographic factors are important for the improvement of a long-term pledge as a voluntary, non-remunerated blood donor.

Study Design and Methods: A sample survey of active blood donors in Gujranwala, Pakistan, was conducted. Data on motivation were analyzed using factor analysis.

Results: Five dimensions of blood-donor motivation were identified with factor analysis. These were sympathy, social reasons, self-esteem, positive experiences associated with donation, and a moral responsibility to donate. Support for statements on selfless (sympathy) motives for donation was strong.

Conclusion: The major factors are of motivation of blood donors are, Feeling good when seeing a blood bank logo, Compassionate towards blood receivers, To help other people, If I don't contribute no one else will, Blood donation is important cause to me, Blood donation make me feel needed

INTRODUCTION

Socioeconomic progress of a country relies on the health of its individuals. People with poor health conditions cannot realize their true potential. Health of the masses results in increased aggregate output of an economy (Bloom, Canning & Sevilla, 2001). United Nations (2007) also emphasized the importance of health by keeping it in its millennium development goals. Both public and private expenditure on health has increased to un-matched level (WHO, 2007). The need for blood and blood components is steadily increasing and it takes more and more effort to persuade people to become blood donors. An appeal to altruism is not sufficient, and blood-donor recruitment strategies should incorporate detailed information on how active blood donors perceive blood donation, as apprehension over health risks associated with donating blood may thus be decreased (Nilsson; Sojka, 2002)

The mechanism through which donating blood reduces the risk of coronary events could be the depletion of body iron stores. Such depletion could decrease the amount of injury promoting iron in the myocardium, alter the activity of iron dependent enzymes, increase plasma anti oxidative capacity, and decrease lipid per oxidation in both the circulation and in vessel walls (Pekka; Salonen; Nyssönen, 1996) It is the basic responsibility of blood banks to ensure safety of the blood donors. Blood

donation process is one of the safest procedures provided all the standards and guidelines are strictly followed and nothing is left to individual or institutional whims and assumptions, casual approach and faulty procedures. Blood donor population's physical characteristics may also vary in different regions and countries. Therefore it is more appropriate to develop guidelines/ standards for indigenous population based on local data or data pertaining to the differences of our population from the western population where the guidelines have been made according to their data. These differences should be translated into local guidelines/standards (Salamat; 2007). Blood donation is act with high internal satisfaction and the blood donors intend to repeat their behavior in future. (Nguyen; DeVita; Hirschler; Edward; Murphy, 2007).

Motivational factors for the current donation were evaluated by the survey with a 5-point Likert scale. In all donors, altruistic motives were rated highly, followed by self-image and health concerns; that is, "Donating is good for my health". In contrast, social pressure, media appeals, reaching a targeted donation amount, and incentives were poorly rated. (Nguyen; DeVita; Hirschler; Edward; Murphy, 2007) The 'good habit' of continued blood donation seems not to be exclusively linked to a high degree of reported other regarding ('sympathy') reasons, but also to a combination of motives, including some modestly self-regarding motives. (Misje; Bosnes; bosnes; Heier, 2005) Blood donation is recognized as a noble cause all over the globe. Different people have their different perceptions and motivational level for this cause. During the past few years the demand for blood has increased due to multiple factors like increased in disease rate, increase in accident rate etc, but the blood collection level has decreased to certain level. In Australia it was reported that the blood donation level had a fall by 27% between 1977 to 1994. Similarly in USA the blood collection level had a huge decline between "1989 to 1994" similarly the decline rate was reported from Europe (Dhingra, 2002) N. The decrease in number of blood donations results from several multiple factors. It is there for important that we find and establish the factors that motivate blood donor and discover that what the perceived or actual barriers are for failed donors and non donors. Many studies have thoroughly and deeply looked donor motivation yet a few have studied the attitude to blood donation among the non donors. The objective of this research paper is to identify various factors that motivate people towards blood donation.

METHODOLOGY

A field study was conducted in Gujranwala (Pakistan) to identify the factors that motivate people toward blood donation. The population comprises of people who have donated blood in last 1 year. A purposive convenience based sample of 400 respondents was extracted by contacting various blood collection organizations including Sundus Foundation, Friends Blood Donation Society, Give Foundation, etc. The interviewers were able to reach a total of 344 respondents which constitute a non contact rate of 14 percent. The refusal rate is around 18 percent so a total of 273 questionnaires were used for data analysis. The questionnaire was developed on the basis of variables identified in a recent research (Misje *et al*, 2005) and was tailored according to objectives of the study and the local context. Due to the bilingual nature of the respondents, the questionnaire was developed both in English and local language (Urdu). Both of the questionnaires

were pre-tested (3 respondents for each language) for their structure and language. The questionnaire comprised of two sections. It started with a brief overview of the objectives of the study and response appeal. The first section dealt with demographic characteristics of the respondents including gender, age and occupation. The second part of the questionnaire contained 18 statements to accord the attitudinal evaluation of various statements related to blood donation. The questions on motives were mainly based on the volunteer functions inventory (VFI) elaborated by Clary *et al* (1992). Five point likert scale (along with “Don’t Know” option as a sixth point) was used to tap agreement of the respondents with certain blood donation motives. The surveyors remained in close proximity to assist respondents in filling the questionnaires. Statistical Program for Social Sciences (SPSS) version 10 was used for data analysis.

FINDINGS

The data analysis shows that 93.4 percent respondents were male and 6.6 percent were female. Table 1 shows that 23.8 percent of the respondents were between age 18-20, 37.7 percent were between age 21-25, 20.9 percent were between 26-30, 11percentage were between 31-35 and 6 percent were either of 36 years or above. Overall, 82.4 percent were between 18 – 30 years. Moreover 33.3 percent respondents were students, 23 percent were employed somewhere. 17.5 percent were self-employed and another 26 percent did not report their profession.

Age of Respondent	Occupation of Respondent				Total
	Student	Employee	Self-Employed	Did Not Reported	
18-20	45	5	1	14	65 (23.8%)
21-25	45	18	17	23	103 (37.7%)
26-30	1	19	17	20	57 (20.9%)
31-35	0	12	9	9	30 (11.0%)
36 and above	0	9	4	5	18 (6.0%)
Total	91 (33.3%)	63 (23.0%)	48 (17.5%)	71 (26.0%)	273 (100.0%)

Factor Analysis technique using principal component method with Varimax rotation was used to identify a subset of highly predictive variables from the larger group of variables. Factor analysis uses covariance and correlation matrix analysis to explain the relationship between variables by using less number of factors (Ozdamar, K, 1999). It results in increased parsimony (Leech, Barrett & Morgan, 2005). Principal Components Analysis (PCA) mathematically derive a relatively small number of variables to use to convey as much of the information in the observed/measured variables as possible. Precisely, PCA is simply directed toward enabling one to use fewer variables to provide the same information that one would obtain from a larger set of variables. In PCA, the analysis is performed on an ordinary correlation matrix, complete with the correlations of each item or variable with itself.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.926	21.813	21.813	3.926	21.813	21.813
2	1.552	8.620	30.433	1.552	8.620	30.433
3	1.462	8.125	38.558	1.462	8.125	38.558
4	1.272	7.068	45.625	1.272	7.068	45.625
5	1.131	6.283	51.909	1.131	6.283	51.909
6	1.045	5.803	57.712	1.045	5.803	57.712
7	.879	4.881	62.592			
8	.868	4.824	67.417			
9	.794	4.409	71.826			
10	.735	4.086	75.912			
11	.702	3.902	79.814			
12	.648	3.602	83.416			
13	.614	3.410	86.826			
14	.595	3.307	90.133			
15	.552	3.069	93.202			
16	.450	2.501	95.703			
17	.413	2.296	98.000			
18	.360	2.000	100.000			
Extraction Method: Principal Component Analysis.						

Table 2 shows the total variance explained computed using principal component analysis method of extraction. It shows that only 6 factors were extracted. It is important to mention here that only those variables with an Eigenvalue greater than 1 were selected. These 6 factors represent the 57.71 percent cumulative variance.

Factors	1	2	3	4	5	6
Blood donation an important cause to me	0.146	0.073	0.154	0.116	0.785	0.052
Donating blood makes me feel important	0.285	0.098	0.172	-0.096	0.390	-0.275
A way to make new friends	0.635	0.025	0.134	-0.049	-0.099	-0.013
Friends think it as an important activity	0.471	0.113	0.090	0.277	0.277	0.150
Feeling good when seeing a blood bank logo	0.702	0.214	-0.096	0.070	0.282	0.022
it's a habit	0.682	0.136	0.171	0.028	0.049	-0.045
Makes me feel better	0.222	0.267	0.582	-0.113	0.192	-0.152
Benefits my health	-0.044	0.611	0.161	-0.053	0.457	0.087
A moral duty	-0.041	0.120	0.628	0.223	0.418	0.282
Compassion towards bloods receivers	0.144	0.680	0.225	-0.076	-0.136	-0.258
To help other people	0.135	-0.065	0.783	0.066	0.019	-0.020
To explore my own strengths	0.268	0.668	-0.020	0.025	0.128	0.316
Makes me feel needed	0.226	0.211	0.038	0.342	0.138	0.649
Learn through important direct experience	0.288	0.340	0.140	0.452	-0.341	0.160
If I don't donate, no one will	-0.157	-0.117	-0.149	0.728	0.193	0.001
Important of who I am	0.166	0.144	0.298	0.632	-0.085	-0.088
Colleagues place high value on volunteering for donation	0.157	0.603	-0.099	0.340	0.093	-0.088
Free health check up	0.109	0.137	0.022	0.275	0.075	-0.734

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. A Rotation converged in 10 iterations.

Table 3 represents the rotated component matrix. The extracted factors includes “feeling good when seeing a blood bank logo” (0.702 loading value and 21.813percent of the variance). “Compassion towards blood receiver” (0.680 loading value and total variance explain 8.620percent) “To help other people” (0.783 loading value and total variance explains 8.125percent) “If I don’t contribute anyone will “(0.728 loading value and total variance explain 7.068percent) “Blood donation is an important cause to me” (0.785 loading value and total variance 6.283percent) and “make me feel needed” (0.649 loading value and total variance explain 5.803percent).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.765
Bartlett's Test of Sphericity	Approx. Chi-Square	872.879
	df	153
	Sig.	.000

Both KMO and Bartlett’s Test of Sphericity values are meeting acceptance norms viz KMO greater than 0.700 and Bartlett’s test of Sphericity less than 0.005

Cronbach's Alpha	N of Items
.760	18

Similarly Cronbach’s alpha (Table 5) is 0.760, is also meeting acceptable standards as it is greater than 0.7.

This concludes that our presented research data is reliable.

DISCUSSION

As per our research project is concerned we have derived different conclusions and have come to different findings. The first result that we found was the different factors that influenced the blood donors. These factors were: feeling good when seeing a blood bank logo, compaction towards blood receivers, if I don’t contribute no one else will, blood donation is an important cause to me and blood donation makes me feel needed.

Explaining the first factor it can be justified that blood bank’s collection campaigns and advertisement attract people a lot and motivate them towards donation. This point concludes that advertisement plays its role. The second factor elaborates that people donate blood because they feel the pain for the blood receivers. They have feelings in their heart for the blood receivers. This is a positive aspect of our society that people have got feelings for the blood receivers and want to help them. The third factor supports the second factor and again shows a positive emotional attachment that people donate blood to help other people. The other highlighted factor shows the importance of blood donation regarding the Pakistani donor community. As far as the research data is concerned approximately eighty three percent of the people who have donated blood are from the youth segment (less than 30 years), manly the student community. The reason is that youth(students) donate blood is that as they are young and energetic and feel fit and healthy to donate blood, their education creates awareness for them to donate blood and

most importantly that they have high emotional values and willingly want to help other people. According to the findings of this questioner based research it is concluded that people and specially students are more attracted by the emotional collection campaigns conducted by the blood banks and blood collecting organizations so on the basis of this research it is strongly recommended for the blood collection bodies that they should often arrange such campaigns so that the awareness may be created and positive results could be obtained. Another trend that resulted from this research was that it was found people more than forty years are hesitant and reluctant to donate blood the basic reason for this as discovered is, that people fear old age deceases and weaknesses. When considering rest of the globe that people above forty donate blood willingly as their youth. The main reason for this influence is their awareness and education.

CONCLUSION

From the given sample, a research concludes that the following quoted factors have a major influence on the blood donors. The major factors are: Feeling good when seeing a blood bank logo, Compassionate towards blood receivers, To help other people, If I don't contribute no one else will, Blood donation is important cause to me, Blood donation make me feel needed. More over the others factors such as moral duty, Donating blood makes me feel important and also play their important role towards motivating blood donors.

REFERENCE

1. Misje, H.; Bosnes, V.; Gåsdal, O. and Heier, H.E. *Motivation, recruitment and retention of voluntary non-remunerated blood donors: a survey-based questionnaire study.*
2. Nguyen, Dorothy D.; DeVita, Deborah A.; Hirschler, Nora V. and Murphy, Edward L. *Blood donor satisfaction and intention of future donation.*
3. Nuzhat Salamat (2007). Blood Volumes of Pakistani Male Donors: Implications for Blood Donation. *J. Ayub Med. Coll. Abbottabad.*
4. Sojka, B. Nilsson and Sojka, P. *The blood-donation experience: perceived physical, psychological and social impact of blood donation on the donor.*
5. Bloom David E.; Canning, David and Sevilla, Jaypee (2001). The Effect of Health on Economic Growth: Theory and Evidence. *NBER Working Papers 8587*, National Bureau of Economic Research, Inc, revised.
6. United Nations (2007). *The Millennium Development Goals Report 2007.*
7. World Health Organization (2007). *The world health report 2007: a safer future: global public health security in the 21st century.*
8. Misje, A.H.; Bosnes, V.; Gasdal, O. and Heier, H.E. (2005). Motivation, recruitment and retention of voluntary non-remunerated blood donors: a survey based questionnaire study. *Vox Sanguinis.* 89, 236-244.
9. Leech, Nancy L., Barrett, Karen C., Morgan, and George A. (2005). *SPSS for Intermediate Statistics, Use and Interpretation.* 2nd ed. Lawrence Erlbaum Associates, Publishers, London.
10. Özdamar, Kazim (1999). *Paket Programlar İle İstatistiksel Veri Analizi Çok Desğişkenli Analizler.* Kaan Kitabevi, Eskisehir.

**HEALTH CARE ANALYSIS AND REGIONAL DISPARITIES
IN DIFFERENT STATES OF IRAN**

Hamid Sepehrdoust

Department of Economics, Bu-Ali-Sina University, Iran
Email: hamidbasu@yahoo.com

ABSTRACT

The health of population is a distinct key issue of public policy discourse in every mature society and most often determining socio-economic status of a country. For many economists, health care policy is as much about the state's economic health, since hospitality and health care services play a vital role in communities for supplying jobs, revenues and healthy environmental opportunities. In this regard, measurement of health indicators on a regional scale level seems to be interesting because it allows us to study regional disparities and its evolution over a period of time. The main objective of the study is to describe and quantify the level of inequalities in 28 states of Iran with respect to vital health care indicators (21 variables). For this reason needed data have been collected from annual statistics published by Central Bureau of Statistics, Management and Programming Organization and Health Network Offices of Iran, including ratio of hospital beds, physicians, nurses, medical institutes, laboratories, pharmacies, Neonatal Mortality Rate (**NMR**), Infant Mortality Rate (**IMR**), Mother Mortality Rate (**MMR**), etc. on regional level. For data analysis, quantified and statistical methods such as compound indexes (**CI**), numerical taxonomy (**C_{io}**), coefficient of deprivation (**DV**) and factor analysis have been used to identify ranking position and development degree of the states. Conclusions of the study are made by extracting those principal components which are more responsible for regional disparities with respect to health care indicators. This study has shown that, despite of considerable improvements in the overall health of the country, underdeveloped regions, experience disparities in health care services and are less likely to receive routine medical procedures and have higher rates of morbidity and mortality than prosperous developed areas.

KEY WORDS

Health Care- Regional Disparities- Factor Analysis- Ranking- Iran

INTRODUCTION

A brief note shows that, Iran is a middle income country with 69555000 number of population and covering 1 648 000 km², of which less than a quarter is arable land. A country highly vulnerable to natural disasters - earthquakes, flooding and drought. The family planning was suspended after the Revolution resulting in a huge rise in fertility and population growth rates, doubling the population between 1979 and 1991. After revival of the program in 1989, fertility rates fell. Health care arrangements play a key role in determining the health status of individuals and communities such as levels of

poverty, inequality and joblessness and access to basic minimum social services. In this sense, health is not only understood as mere absence of disease but also as the indispensable basis for defining a person's sense of well being. Health care is the prevention, treatment, and management of illness and the preservation of mental and physical well being through the services offered by the medical, nursing, and allied health professions. Health care embraces all the goods and services designed to promote health, including preventive, curative and palliative interventions, whether directed to individuals or to populations (W.H.O. Report, 2006). However health planning in Iran always had to face great challenge of regional health disparities, i.e. different level of accessibility of people in different region of the country.

Though health disparity in terms of health outcomes, health status, and healthcare has been defined in several ways, but "Healthy People 2010", defines health disparity as all differences among populations in measures of health and health care. While health disparity deals with health outcomes and illness burden, healthcare disparity is related to conditions of access, treatment, and quality. That is to be mentioned that in most of the circumstances, disparities occur when resources are inequitably distributed across countries, regions, communities or societies. From this point of view, access to healthcare refers to the degree to which people are able to obtain care from the healthcare system in a timely manner (Millman, 1993).

As it is known, causes of disparities in quality of care are multiple and are the result of a variety of factors but generally speaking Socio economic inequities such as income, education, occupation, family structure, service availability, directly affect the resources required to maintain healthy regions and play a pivotal role as health indicators (Collins, 2004). That is believed that The lower quality of healthcare that is often a result of healthcare disparities has a significant impact on the individual, healthcare system, and society.

The challenges that need to be addressed in eliminating health and healthcare disparities in Iran involve multiple levels including the physical environment, the social environment, the healthcare system, and patient factors. More specifically, these factors involve lack of access to quality and timely healthcare services provided by the public sector of the economy. For example, consider the case of insurance industry in Iran which could hardly cover all groups of the nation in socio economic aspects of view, while it is well known that presence of health insurance can easily provide access to a range of healthcare services, from preventive care to management of chronic health conditions.

Iran consists of 30 provinces (Table 1 and Map1), which are governed by a local center, mostly the largest local city. Provincial authority is headed by a governor (Ostandar), who is appointed by the Minister of Interior subject to approval of the cabinet. Regional planning is directed through the budgeting system which is annually proposed by the central government and approved by the parliament. This study considers three parts of Khorasan as one State as before political partition. Therefore 28 provinces are included in data analysis and regional disparities study.

The objectives of the present study are to begin the documentation of health and healthcare disparities in different states of Iran with reference to relevant indicators collected from 28 states. That's why the study aims at examination of trends in regional

health indicators provides essential information in order to assess health and healthcare disparities among different states of Iran and provide policy makers and researchers with a framework for research and decision-making.

MATERIALS & METHODS

1. Health indicators

As it is widely known, a major challenge throughout the history of Healthy People was, how to balance a comprehensive set of health objectives with a smaller set of health priorities. For this purpose and In order to have healthy people in healthy communities, that would be necessary to improve health indicators in the country and eliminate health disparities among different regions. Since the leading health indicators which reflect the major public health concerns of the country, substantial numbers have been selected to show health status of different provinces in Iran. It is necessary to be mentioned that health indicators are those standardized measures by which we are able to compare health status and health system performance among different regions of the country and also helps to support Regional Health Authorities in monitoring the health of their population and the functioning of their local health system through quality comparative information on different aspects of human life.

These specially driven Indicators, illuminate individual behaviors, physical and social environment and important health system issues, that greatly affect the socio-economic health of the communities. Most of these indicators intend to help everyone more easily understand the importance of health promotion and disease prevention and to encourage wide participation in improving health in the next decade. Developing strategies and action plans to address one or more of these indicators can have a profound effect on increasing the quality of life and the years of healthy life and finally on eliminating health disparities.

Health Indicators publication in Iran is a series of annual reports containing the most recently available health indicators data from the ministry of Health and Medical Education. Normally, this report presents indicators measuring factors associated with the health of the nation and the health system provided by the government. The health care information consists of data showing number of Hospitals, Nursing and residential care facilities, physicians surgeons, specialists, dentists, other health practitioners, Medical and diagnostic laboratories, etc.

In order to find out health disparities among different states of Iran, we used to collect information on 21 variables named X1, X2... X21 according to table 2. The listed variables (indicators) have been operationally defined as per number of urban and rural population in each province of the country. The first 17 variables have their positive effects on the degree of regional development that is why they are directly used in the process of analysis, while those variables of 18th to 21st have been inversely used in computation because of their negative effects on regional development level.

2. Statistical Model

After collection of data related to the 21 health indicators from 28 different states of Iran, five major statistical methods have been used to analyze data. These methods are as follows:

2.1 Compound Indexing method (CI): in this method variables for each region are converted in to Z scores and then Compound Indexes are computed. Finally provinces are ranked with respect to their prosperity rate of health indicators access.

$$Z_{ij} = \frac{(x_{ij} - \bar{x}_j)}{\sqrt{\frac{\sum (x_{ij} - \bar{x}_j)^2}{n_i}}}$$

(Index) x_j (Region) A_i	x_1 x_2 ... x_j	Z_{x1} Z_{x2} Z_{xi}	CI
A_1	x_{11} $x_{12} \dots x_{1j}$	Z_{11} Z_{12} Z_{1j}	$\sum_{j=1}^n Z_{1j}$
A_2	x_{21} $x_{22} \dots x_{2j}$	Z_{21} x_{22} Z_{2j}	$\sum_{j=1}^n Z_{2j}$
A_i	x_{i1} $x_{i2} \dots x_{ij}$	Z_{i1} Z_{i2} Z_{ij}	$\sum_i^n \sum_j^n Z_{ij}$

2.2 Deprivation Score method (DV): in this method, the coefficient of deprivation is computed through deviation of real value in each region from the maximum value present, divided by the range of that variable for all regions. This method has been introduced by the Programming Sector of the United Nations to compute Human Development Index (HDI) of the countries.

$$DC_{ij} = \frac{Max(x_j) - Real(x_{ij})}{Max(x_j) - Min(x_j)} \quad (\text{Coefficient of deprivation } x_{ij})$$

$$DV_{ij} = 1 - DC_{ij} \quad (\text{Development index } x_{ij})$$

(Index) x_j (Region) A_i	x_1 x_2 ... x_j	(Converted indexes) DV_{ij}	CI
A_1	x_{11} $x_{12} \dots x_{1j}$	DV_{11} $DV_{12} \dots DV_{1j}$	$\sum V_{1j}$
A_2	x_{21} $x_{22} \dots x_{2j}$	DV_{21} $DV_{22} \dots DV_{2j}$	$\sum V_{2j}$
A_i	x_{i1} $x_{i2} \dots x_{ij}$	DV_{i1} $DV_{i2} \dots DV_{ij}$	$\sum V_{ij}$

2.3 Numerical Taxonomy Method: This method has been introduced for the first time by UNESCO to classify and determine the degree of developmental level of countries on the basis of proposed similar indicators. In this method each region is compared to the ideal point of development (CO) and the degree of developmental

level of a region is obtained (d_i). It is important to mention that only homogenous regions are included in the analysis i.e. those regions which remain within the range of lower and upper limit of $(1-\alpha)$ percent confidence level.

Mean of distances	$\bar{d} = \frac{\sum_{i=1}^n d_i}{n}$
Standard deviation of distances	$Sd = \sqrt{\frac{\sum_{i=1}^n (d_i - \bar{d})^2}{n}}$
Confidence limits of distances	$D = \bar{d} \pm 2sd$
Compound distance of region	$cio = \sqrt{\sum_{j=1}^n (Z_{ij} - Z_{oj})^2}$
	$Ci\bar{o} = \frac{\sum_{i=1}^n Cio}{n} \quad Sio = \sqrt{\frac{\sum (Cio - Ci\bar{o})^2}{n}}$
Ideal point	$co = Ci\bar{o} + 2 Sio$
Regional degree of development	$d_i = \frac{Cio}{co}$

2.4 Factor Analysis method: This method is used to study the patterns of relationship among many dependent variables, with the goal of discovering something about the nature of the independent variables that affect them, even though those independent variables were not measured directly. A typical factor analysis suggests that how many different factors are needed to explain the pattern of relationships among these variables and includes both component analysis and common factor analysis. As it is known, the central concept in Principal Component Analysis (PCA) is representation or summarization. Suppose we want to replace a large set of variables by a smaller set which best summarizes the larger set. This process could be well-defined in the mathematical sense as reducing p variables to a set of m linear functions of those variables which best summarize the original p . So it is called to be method of representation and summarization (Darlington, 1973)

RESULTS AND DISCUSSION

Through applying the above mentioned statistical methods, first of all and in order to find out the degree of homogenous among different provinces of Iran with respect to 21 health indicators, matrices of distances have been formed and then the confidence level has been computed. Fortunately all of the 28 states were homogenous and within the range of confidence level, i.e. it was not necessary to eliminate any state from comparative analysis but still there is considerable disparity among the provinces which is shown by coefficient of variance (C.V) near about 41 percent.

$D = \bar{d} \pm 2 sd_i$	Confidence limits of distances
$D = 3.562 \pm 2 \times 1.451$	
L1 = 0.66	lower limit of homogenous provinces
L2 = 6.46	upper limit of homogenous provinces
C.V = 0.41	coefficient of variance

Table 5, is the final result of statistical analysis applied to find out ranking positions of the states and their comparative developmental status with respect to the degree of accessibility to health and health care facilities in Iran. Semnan, Mazandaran, Tehran, Esfahan, Ilam, Gilan, Qom, Bushehr and kerman provinces with ranking position of 1st to 10th stands in the category of developed regions. Chahar Mahaal & Bakhtiari, Markazi, Kohkiluyeh & Buyer Ahmad, Fars, Hormozgan, Hamadan and Zanjan with ranking position of 11th to 17th, stands in the category of relatively developed regions. Kurdistan, Qazvin, East Azarbaijan, Kermanshah, Khorasan and Ardabil provinces with ranking position of 18th to 23rd stands in the category of less developed regions and the provinces Khuzestan, Sistan & Baluchistan, West Azarbaijan, Lorestan and Golestan with ranking position of 24th to 28th stands in the category of under developed regions of the country with respect to health care disparities. Comparison of coefficient of variances during the period of third five year socio economic development program of the country (1999-2004) proves that the degree of inequalities is lowered down and government anti-poverty programming could positively put its effect on regional health welfare and human development index. The goal of "Eliminating Disparities" can be better understood and embraced, since introduces a condition in which all people in the nation will be challenged with the same standards for health and safety. (kurian, 2005)

In rural areas, each village area contains a Health House which constitutes the basic building blocks for Iran's health network in rural areas, is staffed by trained or community health workers (Behvarz). In addition, Rural and urban Health Centers were put in place which include a physician, a health technician and an administrator, and deal with more complex health problems. The whole network is managed and administered through District Health Centers, working under the top supervision of Ministry of Health and Medical Education. The Chancellor of the university as executive director of the provincial health services is also in charge of all district health centers and hospitals.

As much as the Descriptive Statistics, factor analysis and extracting principal components are concerned, results in Tables 3 & 4, show that the first five reduced principal components i.e. Physicians, Specialists, Dentists, Para-Physicians and pharmacists, could describe nearly about 80 percent of Total Variance Explained for regional disparities and thereby any considerable policy action implemented by the Govt. in this regard could effectively change the environment of health and health care facilities distribution among the states specially deprived regions in Iran. Alternative methods which are suggested to show that how different indicators (factors) affect regional disparities is called the scree plot in which the successive eigenvalues are first plotted, and then look for a spot in the plot where the plot abruptly levels out. As it is shown by Figure 2, this will happen between the forth and fifth factor. (Darlington, 2007)

CONCLUSIONS

In the past three decades, Iran has adopted a policy aimed at more strongly addressing the needs of its population, and substantial progress has been achieved in Primary Health Care sector. The Ministry of Health and Medical Education could deliver primary health care (PHC) achieving remarkable developments in the health sector, such as establishing health networks and improvement in various health indicators. Under a comprehensive primary health care system, Iranian children today have a much better chance at survival than their parents did. The probability of dying before reaching the age of five (under-five mortality rate) is 3.9 %, a rate which puts the country in a relative fair position compared to other developing countries.

According to annual reports of World Health Organizations, Iran has fairly good health indicators. For instance, More than 85 per cent of the population in rural and deprived regions has access to primary health care services. Access to safe drinking water has been provided for over 90 per cent of Iran's rural and urban population. More than 80 per cent of the population has access to sanitary facilities. However, it has not been able to keep pace with the rapidly changing demographic developments. Rural areas in some parts of the country are not fully covered and health centers are inadequately equipped to meet community needs. (World's Children Report, 2005).

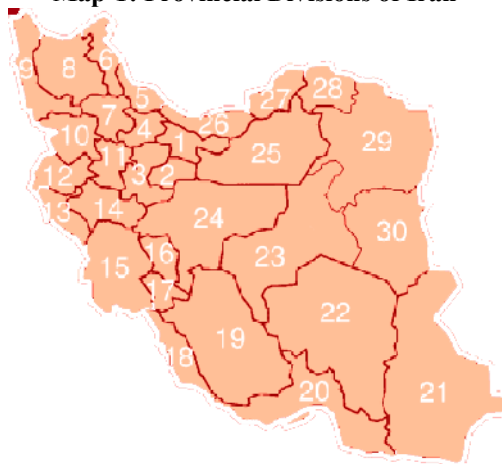
The experience of economic reforms during the past clearly indicates that one of its major victims has been balanced regional growth. Private investments have increasingly gone to relatively developed regions that have better social, economic and physical infrastructure and better governance, especially in terms of speedy decision-making processes, rather than the non-performing or poorly performing states. Drastic regional disparities make life in rural areas of the country much harsher than in urban centers and a considerable disparity still remain among the prosperous and deprived regions of the country. For instance it is reported that over 8-10 % of the population is not covered by any insurance scheme and has to pay directly.

Restricted access and low service availability in the less developed provinces like Sistan and Baluchistan, result in poor health indices compared to the rest of the country. Although infant and maternal mortality rates have decreased, malnutrition deficiencies remain a challenge in the most disadvantaged provinces of Sistan and Baluchistan, Khozestan and West Azarbaijan. In spite of the great efforts done by the Government to secure healthy life of the children and fully immunizing more than 95% of them, the figures are far lower in the disparity regions. Children in these provinces also suffer from lower rates of birth registration and from wasting, stunting and being underweight.

In order to make Public health policies more effective an comprehensive, it is necessary to step on goal programming of health disparities elimination (EHDI). The purpose of the Eliminating Health Disparities Initiative is Identifying and creating new and innovative strategies to close the gap in the health status of prosperous and deprived regions (Minnesota, 2006). This grant program is intended to promote active community involvement and build non-profit social service organizations, as they promote the health and quality of life of individuals and communities, and work toward reducing the health disparities of racial and ethnic populations. It is the responsibility of the Centre to ensure that more or less same level of public health services in all parts of the country.

REFERENCES

1. Borden, C. and Shaffer, R. (2006). *The Economic value of the Health care Industry*. Center for Community Economic Development, University of Wisconsin Extension.
2. Centers for Disease Control and Prevention (2000). *Healthy people 2010*. U.S. Department of Health and Human Services, Atlanta, GA
3. Collins, F.S. (2004). What we do and don't know about race, ethnicity, genetics and health at the dawn of the genome era, *Nat Genet*, 36 (Suppl. 11): S13-5.
4. Darlington, R.B. Weinberg, S. and Walberg, H. (1973). Canonical variants analysis and related techniques. *Review of Educational Research*, 453-454.
5. Institute of Medicine, Committee on Monitoring Access to Personal Health Care Services and M.L. Millman (1993). *Access to Health Care in America*. Washington D.C. National Academy Press. Vii, 229.
6. Kurian, N.J. (2005). *Growing Inter-State Disparities*.
7. Minnesota Department of Health (2006). *About the Eliminating Health Disparities Initiative* (EHDI).
8. Masjedi, F. (2002). Measurement of Country's Development Status. *Iranian Economic Researches*, Vol. 10.
9. North Carolina Health and Wellness Trust Fund Commission, 2006, Eliminating Health Disparities, U.S.A.
10. Richard B. Darlington (2007). *Factor Analysis*.
11. Reddy, Prashant, Ch. (2004). Regional disparities on decline in Andra Pradesh; A Case Study. *Journal of Business Line*, India.
12. Srinivasan, R. (2006). *Health Care in India, Vision 2020*. Issues and Prospects, Planning Commission, India.
13. Westert, P. and Groenewegen, P. (1999). *Regional Disparities in Health Care Supply in Eleven European Countries: Does Politics matter?* Netherlands.
14. Weinstocks, B. (2003). *Why Companies are Making Health Disparities their Business: The Business Case and Practical Strategies*, Washington Business Group on Health: Washington DC.
15. World Health Organization Report (2000). *Why Do Health Systems Matter?*
16. World Health Organization (2006). *Country Cooperation Strategy at a Glance*. Islamic Republic of Iran.

Map-1: Provincial Divisions of Iran**Table 1: Thirty Provinces of Iran as per number situated on Map-1**

1. Tehran
2. Qom
3. Markazi
4. Qazvin
5. Gilan
6. Ardabil
7. Zanjan
8. East Azerbaijan
9. West Azerbaijan
10. Kurdistan
11. Hamadan
12. Kermanshah
13. Ilam
14. Lorestan
15. Khuzestan
16. Chahar Mahal bakh.
17. Kohkiluyeh & Buyer.
18. Bushehr
19. Fars
20. Hormozgan
21. Sistan & Baluch.
22. Kerman
23. Yazd
24. Esfahan
25. Semnan
26. Mazandaran
27. Golestan
28. North Khorasan
29. Razavi hoarsen
30. South Hoarsen

Table 2: Definition of health and health care indicators in each province

Variable	Operational Definition of Variables as per population ratio
X1	Number of Physicians per 10000 population of state
X2	Number of Specialists and surgeons per 10000 population of state
X3	Number of Para-Physicians per 100000 population of state
X4	Number of Dentists per 100000 population of state
X5	Number of Pharmacists per 100000 population of state
X6	Number of Urban Public Health Centers per 10000 urban population
X7	Number of Rural Public Health Centers per 10000 rural population
X8	Number of Health & Medicare Institutes per 100000 population
X9	Number of Hospital Beds per 10000 population of state
X10	Number of Active Health House per 10000 Village area population
X11	Percentage of rural population under protection of Health House centers
X12	Number of Rural Health Workers per 10000 rural population
X13	Number of laboratories available per 100000 population
X14	Number of Rehabilitation Centers available per 100000 population
X15	Number of Radiology Centers available per 100000 population
X16	Number of Pharmacies & Drug Stores available per 100000 population
X17	Inverse rate of Mortality at birth per 100 delivery
X18	Inverse rate of under one month Neo Natal Mortality per 1000 (NMR)
X19	Inverse rate of under one year Infant Mortality per 1000 birth (IMR)
X20	Inverse rate of under five year Child Mortality per 1000 birth
X21	Inverse rate of Maternal Mortality per 100000 delivery (MMR)

	Mean	Std. Deviation
X1	1.903	0.767
X2	1.471	0.545
X3	2.820	0.817
X4	3.403	1.725
X5	1.627	0.714
X6	1.527	0.264
X7	1.139	0.307
X8	1.246	0.400
X9	16.793	5.070
X10	7.378	1.494
X11	90.905	12.641
X12	5.443	1.950
X13	6.980	2.473
X14	2.960	1.169
X15	3.008	0.827
X16	8.973	1.941
X17	0.982	0.389
X18	0.071	0.018
X19	0.051	0.012
X20	0.042	0.010
X21	0.108	0.253

Initial Eigenvalues			
Component	Total	% of Variance	Cumulative %
1	8.35	39.77	39.77
2	5.03	23.96	63.73
3	1.49	7.11	70.84
4	1.02	4.86	75.70
5	0.84	3.99	79.69
6	0.79	3.77	83.46
7	0.70	3.34	86.80
8	0.56	2.67	89.47
9	0.50	2.39	91.86
10	0.37	1.78	93.64
11	0.33	1.57	95.21
12	0.24	1.17	96.37
13	0.19	0.91	97.29
14	0.17	0.83	98.12
15	0.12	0.57	98.68
16	0.10	0.48	99.17
17	0.08	0.37	99.54
18	0.04	0.21	99.74
19	0.03	0.15	99.89
20	0.02	0.09	99.98
21	0.00	0.02	100.00

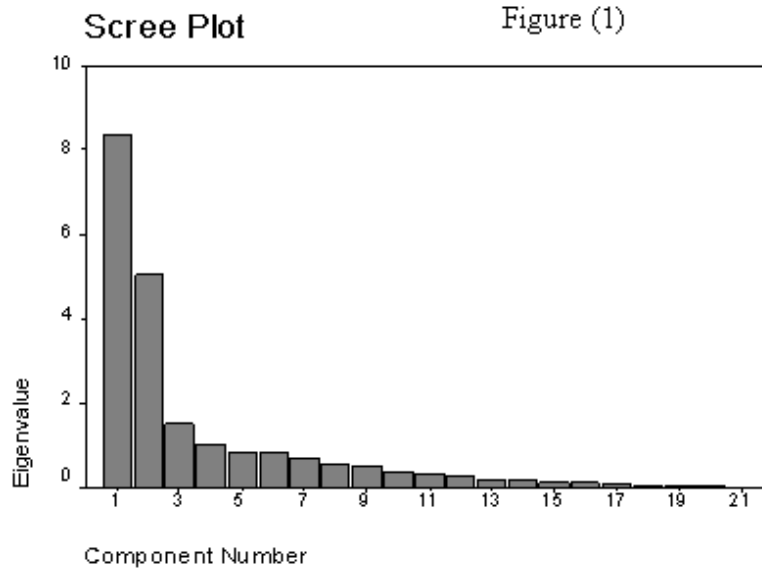


Table 5:
Ranking Position of Provinces in Iran with respect to Health Indicators

Ranking Position	Provinces	Status
1	Yazd	DEVELOPED REGIONS
2	Semnan	
3	Mazandaran	
4	Tehran	
5	Esfahan	
6	Ilam	
7	Gilan	
8	Qom	
9	Bushehr	
10	Kerman	
11	Chahar Mahaal & Bakhtiari	RELATIVELY DEVELOPED REGIONS
12	Markazi	
13	Kohkiluyeh & Buyer Ahmad	
14	Fars	
15	Hormozgan	
16	Hamadan	
17	Zanjan	
18	Kurdistan	LESS DEVELOPED REGIONS
19	Qazvin	
20	East Azerbaijan	
21	Kermanshah	
22	Khorasan	
23	Ardabil	
24	Khuzestan	UNDER DEVELOPED REGIONS
25	Sistan & Baluchistan	
26	West Azerbaijan	
27	Lorestan	
28	Golestan	

Author Index

- Abbas, Mariam 555
Abbasi, Saddam Akbar 521
Abbasi, Zareen 545, 563
Abdur-Razaq 151
Abdus Salam 73, 465
Abushaala, Ahmed M. 213
Ahmad, Munir 13, 19, 41, 227, 367, 375, 383
Ahmed, Khalil 109, 113, 119, 125
Ahmed, Khurshed 661
Ahmed, Rashid 89, 193
Ahmed, Zeeshan 1, 57, 355
Ahsan, Naveed 279
Akhtar, Munir 89, 143, 193
Akhter, Shaoib 391, 399
Akram, Adeel 109
Aleem, Muhammad 49
Ali, Karamat 555
Ali, Rana Usman 109
Amin, Atif 219
Amina Zahoor 447
Anam Khan 673
Anjum, Farah 455
Anjum, Sonia 179
Ansari, M. Rashid Kamal 321
Anwar, Masood 13
Anwar, Sumra 235
Arif, Asifa 503, 507
Arif, Maryum 219
Arshad, Hafiz Muhammad 143
Ashraf, Kaleem 673
Ashraf, Mehreen 103
Aslam, Muhammad 185
Athar, Atifa 119
Ayub, Usman 619
Azeem, Suneela 629
Azhar, Haleema 441
Batool, Tooba 113
Bokhari, S.M. Husnain 479
Burney, S.M. Aqil 201
Butt, Muhammad S. 645
Catherine, Asia 417
Chand, Muhammad Nawaz 409
Chaudhry, Kalsoom Akhtar 19, 417, 461
Cheema, Khadija Tariq 507
Dost, Muhammad Khyzer Bin 375
Ehsan, Usman 235
Ehtisham, Aisha 461
Faiza 219
Fani, Khurram Aziz 235, 673, 219
Fatima, Ismat 551
Fatima, Samreen 297
Ghanti, Sudhir Kumar 57
Ghauri, Saghir Pervaiz 489
Ghazanfar, Faheem 653
Gillani, Muhayyuddin 109
Habibullah, Saleha Naghmi 227, 441
Haider, Najeeb 303
Hanif, Muhammad 267
Hassan, Zakia 631
Hussain, Ghulam 133
Hussain, M. Arif 321
Hussein, Rizwan Altaf 533
Hye, Qazi Muhammad Adnan 645
Ikramullah 497
Ilyas, Waqas 219
Inam-ul-Haq, 69
Iqbal, Jawaid 321
Iqbal, Zafar 49, 155
Iqbal, Zahid 423
Iram, Uzma 645
Irshadullah, 73
Jarral, Muhammad Tufail 541
Javaid, Jamil 629
Jilani, Saifuddin Ahmed 333
Junejo, Mumtaz Ali 409
Kakar, Mehmood Khan 497
Kanwal, Sania 285
Nawaz, Shoaib 285
Karim, Sidra 661
Khan, Abdul Rauf 37
Khan, M. Saleem 109
Khan, M. Shuaib 293
Khan, Muhammad Shuaib 49
Khan, Mumtaz Muhammad 585
Khan, Nazeer 527
Khan, Nikhat 179
Khan, Rana Ejaz Ali 667
Khan, Tasnim 667

Khoja, Seema 563
Lodhi, Suleman Aziz 585
Mahmood, Ansa 533
Mahmood, Nadeem 201
Mahmood, Waqas Samiullah 103
Makki, M. Abdul Majid 409
Manzoor, Muhammad Mazhar 169
Maqsood, Fauzia 579
Meenai, Yaseen Ahmed 573
Mehboob, Sidra 673
Memon, Ahmad Zogo 227, 151, 155, 161
Mirza, Salma 573
Mukhtar, Bushra 455
Mumtaz, Sumia 593
Mustafa, Ghulam 475
Mustafa, Maryam 629
Muzaffar, Abdul Qayyum 37
Naeem, Asenath 451
Naqvi, Itrat Batool 97
Nasir, Jamal Abdul 433
Nasir, Jamal Abdul 555
Nasr, Mohamed 611
Nasr, Mohamed 619
Naveed, Shehryar 391, 399
Noshin, Ammara 533
Noureen, Neelum 391
Pasha, Ahmed Hesham 293
Pasha, G.R. 293
Qadeer, Muhammad Faisal 383
Qamar, Moneeb 533
Qammar, Ahmad 653
Qasim, Nadia 27
Qasim, Sadia 359
Qazi, Wajahat M. 109
Quamar, Quamar, Jawaid 321
Qureshi, Khalid Sarwar 489
Rahman, Rashid 367, 383
Raja, Mohammad Waqas 603
Rana, Hina 97
Rehman, Muhammad 533
Rehman, Nida 399
Riaz, Muhammad 521
Riaz, Sana 253, 631
Riazuddin, Riaz 479
Rind, Muhammad Qasim 27, 37, 359
Sabir, Hassan 629
Sadiq, Muhammad Qasim 465
Saeed, Muhammad Anwar 125
Saeed, Nazia 235
Safdar, Suboohi 513
Saif-ur-Rehman, 73
Saleem, Muhammad 185
Saleem, Muhammad A. 313
Saleem, S.M. 27
Salman, Hafiz M. 161
Sami Ullah, 475
Sara Azher, 631
Sepehrdoust, Hamid 679
Shafique, Muhammad 367
Shahzad, Mirza Naveed 185
Shaikh, F.M. 545, 563, 567
Shamsi, Muhammad Ibrahim 133
Shaw, Hamad Sarwar 267
Sheikh, Muhammad Azhar 433
Shoaib, Riffat 253
Shoaib, Riffat 253
Siddiqi, Ahmed F. 629
Siddiqi, Junaid Saghir 423
Siddique, Muhammad 653
Slahudin, Choudhary 347
Tahir, Asma 243
Tanveer, Samia 503
Tauqir, M. Ahmad 673
Wahab-ul-Hassan, Syed 81
Waliullah, 497
Yaseen, Muhammad 475
Yasmin, Iram 475
YousufZai, M. Ayub Khan 321, 333, 341
Zafar, Farid 611
Zafar, Sana 219
Zia-ul-Haque, S.M. 341