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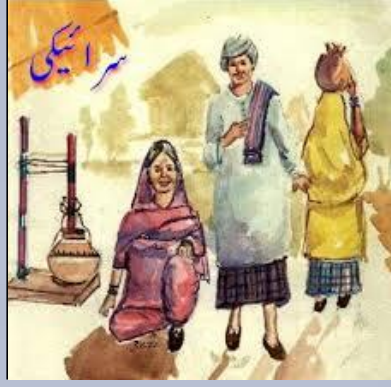

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Dr. Munir Ahmad
Editor

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THE ROLE OF GRID COMPUTING TECHNOLOGY IN 21st CENTURY COMMUNICATIONS

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ABSTRACT

Grid computing is the collection of computer resources from multiple locations to reach a common goal. It is considered as a distributed system with non-interactive workloads that involve a large number of files. It is an interconnected computer system where the machines utilize the same resources collectively. Grid computing usually consists of one main computer that distributes information and tasks to a group of networked computers to accomplish a common goal. Grid computing is often used to complete complicated or tedious mathematical or scientific calculations. In this paper we have described the research activities carried out on various aspects of the Grid computing technology. These research activities are categorized in three areas of Grid computing .i.e. Grid applications, Grid computing tools, Grid Architecture and Models, which provides a comprehensive look of Grid computing development in the World. The development in these mentioned three areas has brought substantial progress in the field of grid technology. Finally, the research paper has highlighted current developments and future challenges in the field of grid technology.

KEYWORDS

Grid computing, Grid applications, Grid tools, Grid Architecture, Grid Models.

1. INTRODUCTION

The ideas of the grid were brought together by Ian Foster, Carl Kesselman, and Steve Tuecke, widely regarded as the "fathers of the grid". They led the effort to create the Globus Toolkit incorporating not just computation management but also storage management, security provisioning, data movement, monitoring, and a toolkit for developing additional services based on the same infrastructure, including agreement negotiation, notification mechanisms, trigger services, and information aggregation. While the Globus Toolkit remains the de facto standard for building grid solutions, a number of other tools have been built that answer some subset of services needed to create an enterprise or global grid. In 2007 the term cloud computing came into popularity, which is conceptually similar to the canonical Foster definition of grid computing and earlier utility computing. Indeed, grid computing is often associated with the delivery of cloud computing systems.

The grid can be thought of as a distributed system with non-interactive workloads that involve a large number of files. Grids are a form of distributed computing whereby a "super virtual computer" is composed of many networked loosely coupled computers acting together to perform large tasks. Grid computing combines computers from multiple administrative domains to reach a common goal, to solve a single task, and may then disappear just as quickly. One of the main strategies of grid computing is to use middleware to divide and apportion pieces of a program among several computers, sometimes up to many thousands. Grid computing involves computation in a distributed fashion, which may also involve the aggregation of large-scale clusters.

Grid computing is a form of distributed computing based on the dynamic sharing of resources between participants, organizations and companies to by combining them, and thereby carrying out intensive computing applications or processing very large amounts of data. Such applications would not be possible within a single body or company. Grid is an infrastructure that involves the integrated and collaborative use of computers, networks, databases and scientific instruments owned and managed by multiple organizations.

1.1 Working of Grid Computing System

In distributed computing, different computers within the same network share one or more resources. In the ideal grid computing system, every resource is shared, turning a computer network into a powerful supercomputer. Grid computing systems work on the principle of pooled resources. Let's say you and a couple of friends decide to go on a camping trip. You own a large tent, so you've volunteered to share it with the others. One of your friends offers to bring food and another says he'll drive the whole group up in his wagon. Once on the trip, the three of you share your knowledge and skills to make the trip fun and comfortable. If you had made the trip on your own, you would need more time to assemble the resources you'd need and you probably would have had to work a lot harder on the trip itself. A grid computing system uses that same concept: share the load across multiple computers to complete tasks more efficiently and quickly.

Several companies and organizations are working together to create a standardized set of rules called protocols to make it easier to set up grid computing environments. It's possible to create a grid computing system right now and several already exist. But what's missing is an agreed-upon approach. That means that two different grid computing systems may not be compatible with one another, because each is working with a unique set of protocols and tools. The emerging protocols for grid computing systems are designed to make it easier for developers to create applications and to facilitate communication between computers.

Grid applications often involve large amounts of data and/or computing resources that require secure resource sharing across organizational boundaries. This makes Grid application management and deployment a complex undertaking. Grid middle wares provide users with seamless computing ability and uniform access to resources in the heterogeneous Grid environment. Several software toolkits and systems have been developed, most of which are results of academic research projects, all over the world. There are various type girds which are given below:

2. TYPES OF GRIDS

Grid is a type of parallel and distributed system that enables the sharing, selection, and aggregation of geographically distributed "autonomous" resources dynamically at runtime depending on their availability, capability, performance, cost, and users' quality-of-service requirements. There are three primary types of grids which are summarized below.

2.1 Computational Grid

A computational grid is a grid that has the processing power as the main computing resource shared among its nodes. This is the most common type of grid and it has been used to perform high-performance computing to tackle processing-demanding tasks.

2.2 Scavenging Grid

A scavenging grid is most commonly used with large numbers of desktop machines. Machines are scavenged for available CPU cycles and other resources.

2.3 Data Grid

A data grid is responsible for housing and providing access to data across multiple organizations. The Users are not concerned with where this data is located as long as they have access to the data.

2.4 Network Grid

This is known as either a network grid or a delivery grid. The main purpose of this grid is to provide fault-tolerant and high-performance communication services. In this sense, each grid node works as a data router between two communication points, providing data-caching and other facilities to speed up the communications between such points.

3. TYPES OF GIRD RESOURCES

A grid is a collection of machines, sometimes referred to as nodes, resources, members, donors, clients, hosts, engines, and many other such terms. They all contribute any combination of resources to the grid as a whole. Some resources may be used by all users of the grid, while others may have specific restrictions.

3.1 Computation

The most common resource is computing cycles provided by the processors of the machines on the grid. The processors can vary in speed, architecture, software platform, and other associated factors, such as memory, storage, and connectivity.

3.2 Storage

The second most common resource used in a grid is data storage. A grid providing an integrated view of data storage is sometimes called a data grid. Each machine on the grid usually provides some quantity of storage for grid use, even if temporary. Storage can be memory attached to the processor or it can be secondary storage, using hard disk drives or other permanent storage media.

3.3 Communications

The important resource of a grid is data communication capacity. This includes communications within the grid and external to the grid. Communications within the grid are important for sending jobs and their required data to points within the grid. Some jobs require a large amount of data to be processed, and it may not always reside on the machine running the job. The bandwidth available for such communications can often be a critical resource that can limit utilization of the grid. Thus, there is a clear need for communication networks supporting reliable information transfer between the various entities in the electric grid, there are many issues related to network performance, suitability, interoperability, and security that need to be resolved.

3.5 Software and Licenses

There are many aspects to grid computing that typically are controlled through software. These functions can be handled across a spectrum of very manual procedures to process being handled automatically through sophisticated software. The software to perform these functions also ranges in capabilities and availability the grid may have software installed that may be too expensive to install on every grid machine. Using a grid, the jobs requiring this software are sent to the particular machines on which this software happens to be installed. When the licensing fees are significant, this approach can save significant expenses for an organization. Platforms on the grid will often have different architectures, operating systems, devices, capacities, and equipment. Each of these items represents a different kind of resource that the grid can use as criteria for assigning jobs to machines.

3.6 Scheduling of Jobs

The grid system is responsible for sending a job to a given machine to be executed. In the simplest of grid systems, the user may select a machine suitable for running his job and then execute a grid command that sends the job to the selected machine. More advanced grid systems would include a job scheduler of some kind that automatically finds the most appropriate machine on which to run any given job that is waiting to be executed. Schedulers react to current availability of resources on the grid.

4. GLOBUS TOOLKIT ARCHITECTURE

The Grid software stack with two sample technologies such as the Globus Toolkit and the Grid bus middleware**.** The Globus project provides open source software toolkit that can be used to build computational grids and grid based applications. It allows sharing of computing power, databases, and other resources securely across corporate, institutional

and geographic boundaries without sacrificing local autonomy. The core services, interfaces and protocols in the Globus toolkit allow users to access remote resources seamlessly while simultaneously preserving local control over who can use resources and when. The Globus architecture, shown in Figure 1, has three main groups of services accessible through a security layer. These groups are Resource Management, Data management and Information Services.

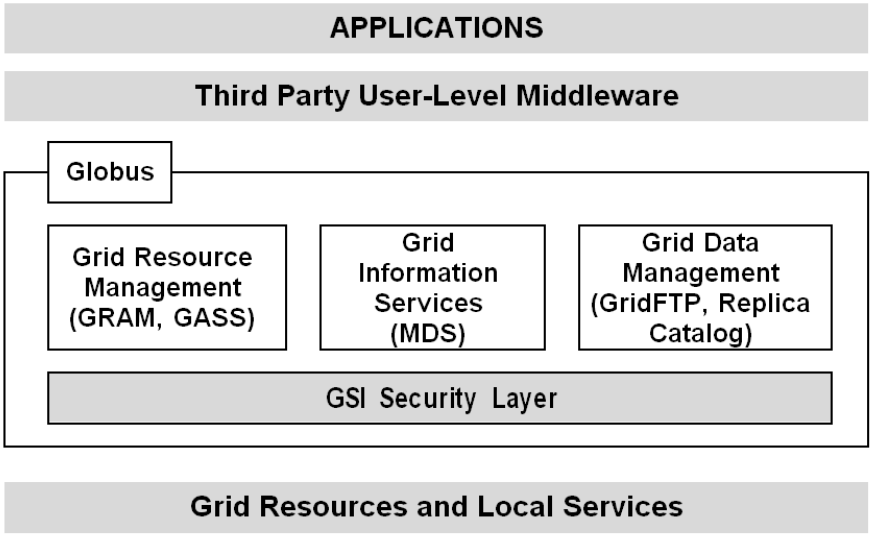

Fig. 1: The Globus Gird Architecture

4.1 The Local Services Layer

It contains the operating system services, network services like TCP/IP, cluster scheduling services provided by Load Leveler, job-submission, query of queues, and so on. The higher layers of the Globus model enable the integration of multiple or heterogeneous clusters. The core services layer contains the Globus toolkit building blocks for security, job submission, data management, and resource information management. The high-level services and tools layer contains tools that integrate the lower level services or implement missing functionality.

4.2 GSI Security Layer

The Grid Security Infrastructure (GSI) provides methods for authentication of Grid users and secures communication. It is based on SSL (Secure Sockets Layer), PKI (Public Key Infrastructure) and X.509 Certificate Architecture. The GSI provides services, protocols and libraries to achieve the following aims for Grid security:

- Single sign-on for using Grid services through user certificates
- Resource authentication through host certificates
- Data encryption
- Authorization

- Delegation of authority and trust through proxies and certificates.

The Users gain access to resources by having their Grid certificate subjects mapped to an account on the remote machine by its system administrators. This also requires that the CA that signed the user certificate be trusted by the remote system.

4.3 Resource Management

The resource management package enables resource allocation through job submission, staging of executable files, job monitoring and result gathering. The components of Globus within this package are:

4.3.1 Globus Resource Allocation Manager (GRAM)

GRAM provides remote execution capability and reports status for the course of the execution. A client requests a job submission to the gatekeeper daemon on the remote host. The gatekeeper daemon checks if the client is authorized (i.e., the client certificate is in order and there is a mapping of the certificate subject to any account on the system). Once authentication is over, the gatekeeper starts a job manager that initiates and monitors the job execution. Job managers are created depending on the local scheduler on that system. GRAM interfaces to various local schedulers such as Portable Batch System (PBS), Load Sharing Facility Load Leveler. The job details are specified through Resource Specification Language (RSL), which is a part of GRAM. RSL provides syntax consisting of attribute-value pairs for describing required for a job including the minimum memory and the number of CPUs.

4.3.2 Globus Access to Secondary Storage (GASS)

GASS is a file-access mechanism that allows applications to pre-fetch and open remote files and write them back. GASS is used for staging-in input files and executable for a job and for retrieving output once it is done. It is also used to access the standard output and error streams of the job. GASS uses secure HTTP based streams to channel the data and has GSI-enabled functions to enforce access permissions for both data and storage. Remote user account.

4.4 Information Services

The information services package provides static and dynamic properties of the nodes that are connected to the Grid. The Globus component within this package is called Monitoring and Discovery Service (MDS). MDS provides support for publishing and querying of resource information. Within MDS, schema defines classes that represent various properties of the system. MDS hasa three-tier structure at the bottom of which are Information Providers (IPs) that gather data about resource properties and status and translate them into the format defined by the object classes. The Grid Resource Information Service (GRIS) forms the second tier and is a daemon (guiding force) that runs on a single resource. GRIS responds to queries about the resource properties and updates it's the relevant IPs. At the topmost level, the GIIS (Grid cache at intervals defined by the time-to-live by querying Information Index Service) indexes the resource information provided by other GRISs and GIISs that are registered with it.

4.5 Data Management

The data management package provides utilities and libraries for transmitting, storing and managing massive data sets that are part and parcel of many scientific computing applications. The elements of this package are:

4.5.1 Grid File Transfer Protocol (FTP)

It is an extension of the standard FTP protocol that provides secure, efficient and reliable data movements in grid environments. In addition to standard FTP data transfer, third-party transfer invocation and striped, functions, GridFTP provides Global System Integrator (GSI) support for authenticated parallel and partial data transfer support.

4.5.2 Replica Location and Management

This component supports multiple locations for the same file throughout the grid. Using the replica management functions, a file can be registered with the Replica Location Service (RLS) and its replicas can be created and deleted. Within RLS, a file is identified by its Logical File Name (LFN) and is registered within a logical collection. The record for a file points to its physical locations. This information is available from the RLS upon querying.

5. DEMONSTRATION OF GIRD APPLICATION

The Gird application is a system that takes Scalable Vector Graphics (SVG) files and uses nodes on a grid to render a set of JPEG files representing sub-images of the complete image. As it is a demonstration system, certain design decisions and assumptions have been made to accelerate development. The three components of the application system are:

5.1 Render Client

This is a Java application with a graphical interface for the user that drives the rendering work on the grid and displays the resulting sub-images into a final large image. There is only one running in the grid.

5.2 Render Worker

This is a Java application with no graphical user interface that converts one sub-image of the SVG file into a JPEG file. There is one or more running on each node in the grid. Due to the strong parallelism inherent in rendering an SVG file to multiple JPEG sub-images, the more nodes in the grid, the faster the SVG file will be fully rendered.

5.3 Render Source Service

This is a Globus Toolkit 4 grid service, deployed into a Globus Toolkit 4 container. It is initialized by the Render Client and hands out work instructions to Render Worker processes on the grid. We use the following Globus Toolkit 4 features in this gird demonstration application:

5.4 Grid Service

A stateful Java class with methods using complex parameter passing and return objects.

5.5 Multipoint Distribution Service (MDS)

Registration and query of nodes participating in the virtual organization

5.6 Security

Grid proxies and certificates for secure execution of tasks and file transfers

5.7 Reliable File Transfer (RFT) / Grid FTP

High-performance file transfers.

5.8 GRAM

Staging all files required for the Render Worker to the node, executing the Render Worker, and staging back the resulting JPEG file. (http://www.w3.org/TR/SVG).

6. GIRD APPLICATIONS

Grid Computing has many application fields. The first is the improvement of performance and the reduction of costs due to the combining of resources. The possibility of creating virtual organizations to establish collaboration between teams with scarce and costly data and resources is another. Scientists, who use applications that require enormous resources in terms of computing or data processing, are large consumers of computational grids. Grids are massively present in the automobile and aeronautical business, where digital simulation plays an important role. In practice, grids are very useful in crash simulations, as well as for computer-aided design. More recently, grids have emerged in other areas with the purpose of optimizing company business. The aim is to combine material resources for several services by reallocating them in a dynamic way depending on performance peaks.

Knowledge-oriented activities are performed in a variety of environments such as: Schools, Colleges, Universities, Research Institutes, large corporations, and organizations. Each type of grid may be more or less suitable for each type of institutions. We use grids in research and education because a computational grid provides high-performance computing; a data grid provides large storage capacity; and a network grid provides high throughput communication that may be useful for a variety of applications, such as virtual conferences. Thus, the Gird computing has following benefits for organizations:

- Improve efficiency/reduce costs
- Exploit under-utilized resources
- Enable collaborations
- Virtual resources and virtual organizations (VO)
- Increase capacity and productivity

- Parallel processing capacity
- Support heterogeneous systems
- Provide reliability/availability
- Access to additional resources
- Resource balancing
- Reduce time to results

7. SUMMARY AND CONCLUSION

Grid computing makes more resources available to more people and organizations while allowing those responsible for the IT infrastructure to enhance resource balancing, reliability, and manageability. Grid computing technologies are entering the mainstream of computing in the financial services industry. Just as the internet provided a means for explosive growth in information sharing, grid computing provides an infrastructure leading to explosive growth in the sharing of computational resources. Grids are a form of distributed computing whereby a "super virtual computer" is composed of many networked loosely coupled computers acting together to perform very large tasks. and it is used in commercial enterprises for such diverse applications as drug discovery, economic forecasting, seismic analysis, and back office data processing in support for e-commerce and Web services.

Grid technologies such as Globus provide capabilities and services required for secure access and execution of a job on a resource in a uniform manner on heterogeneous resources. However, to achieve the complete vision of Grid as a utility computing environment, a number of challenges need to be addressed. Grid computing can play a vital role in bridging the digital divide to some extent. Grid Computing is also an effort toward establishing a global village in which resources will be available to all users irrespective of their geographical location. Countries that cannot afford supercomputing can use services provided by grid for resource intensive jobs. It will provide easier access to data and computing intensive for smaller research groups, new sciences and developing countries. Grid will also provide an easier access to global market.

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EMPLOYMENT STATUS IN FEDERAL GOVERNMENT OF PAKISTAN

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ABSTRACT

Employment is an important indicator of development even in developed countries. Utilization of workforce of a country can be accessed through employment rate generally. Major employment portion in Pakistan is available in the public sector just like other countries in the world. We tried to analyze the case of Pakistan particularly with reference to the employment in public sector at federal level. Data generated through census of federal government civil servants and annual statistical bulletins for civil servants as well as employees of autonomous bodies working under federal government of Pakistan have been analyzed in this paper and conclusions are drawn regarding employment in Pakistan at federal level including prediction for future.

KEY WORDS

Employment, public sector, civil servant, government servant, census, labour force.

1. INTRODUCTION

It is observed that there are very few articles and studies regarding public sector employment in different countries. The reasons might be difficulty to distinguish between public and private sector employment, hard to differentiate between their pay structures due to changes in public sector earnings, lack of information or data, difficult to define the objectives of public sector decision makers which are barriers to publish the studies in this area (Köllő, 2013).

Keeping in view the above fact, we tried to probe the issue of public sector employment in Pakistan. Government sector in any country is usually called the public sector and the individuals serving the public sector are called the public servants as they are providing services to the public and community. Tasmanian government (2015) announced public sector employees those who included general public servants, teachers, nurses, police, fire fighters, ambulance staff, doctors, state parliamentarians and senior executive service in order to reduce public sector employment. Heap (2005) said that public sector employees include those who are working in government sector.

All over the world it is accepted that the public sector is an important phenomena in the economy of a country and at least 200 million people are working in the government

sector throughout the world. At world level the public sector share of employment in the total employment remained largest about 30 per cent depending upon economic conditions of every country (Hammouya, 1999). Bino et al. (2009) said that the public sector has more intension to create more employment opportunities and public sector investment is the important phase of planning. Bossaert (2005) analyzed that job security in public sector is generally higher as compared to the private sector and a public sector employee could hardly be dismissed from his job. Low salaries of civil servants particularly for higher officers compensate them with their job security even in bad economic conditions of the country.

According to Pakistan Economic Survey 2015-16, Pakistan is the 6th populous country in the world with 191.71 million projected population. Pakistan has 10th largest labour force in the world. According to the labour force survey of Pakistan 2014-15, out of total 61.04 million labour force in the country, 3.62 million people are unemployed while 57.42 million are employed in the country. Annual population growth rate of 1.92 percent is adding a large number of youth to the labour force every year. The young population of any country is considered as an asset of the nation because they affect the socioeconomic issues. They are the actual workforce and are economically active and productive for the country but could be problematic if unemployed and their energies are not properly utilized by the planners. Government can utilize this workforce for economic development of the country through providing proper employment opportunities. In this scenario how much employment opportunities are created in all the provincial and federal governments must be analyzed. But we are restricted to the following objectives for this paper:

OBJECTIVES

Main objectives of the study are:

1. Highlight the overall employment in Pakistan.
2. Uncover the employment opportunities in Federal Government of Pakistan.
3. Analyze the Federal Government Civil Servants working in different areas in the Federal Government of Pakistan.
4. Analytical picture of Federal Government Employees working in Autonomous Bodies, Corporations, Authorities etc.
5. Prediction of sanctioned posts as well as actual working strength in Federal Government.

2. OVERALL EMPLOYMENT IN PAKISTAN

According to Pakistan Economic Survey 2015-16, the unemployment rate in the country is 6 % which means that employment rate is 94 %. In labour force survey of Pakistan 2014-15, the employed people are defined as all the individuals may be males or females, having age of ten years or above who were engaged in any work at least for one hour during the last one week i.e. seven days before the enumeration day (reference period). They were either “paid employed” or “self-employed”. Those persons who were permanent or regular employees but were not working during reference period due to any reason e.g. leave, illness, family matters etc., were also treated as employed.

Similarly the unemployed people are defined as all the individuals i.e. males or females, having age of ten years or above and were reported during the reference period i.e. last one week from interview date, who were willing to work but:

i) without any type of work i.e. not with paid or self-employment,
ii) currently available for any type of paid or self-employed work,
iii) currently not available due to illness, waiting for offer letter expected within a month, temporarily laid off, is an apprentice or trainee etc.,
iv) during reference period of last week was seeking work.

Labour force or currently active population is defined as all the persons having age of ten years or above who can be identified as employed or unemployed during the reference period of one week before enumeration day. The persons who are not in the labour force or not currently active comprised all the individuals not employed during the reference period. Those who are not in labour force include:

(a) attending educational institutions,
(b) engaged in household duties,
(c) retired or old age,
(d) too young to work,
(e) unable to work / handicapped,
(f) agricultural landlord and / or property owner, but they do not work.

According to the labour force survey 2014-15, out of 57.42 million employed people, the maximum employment portion goes to the salaried people (employees) having 38.7% out of total employment. From this percentage of employees out of total employment in Pakistan, it is highlighted that maximum employment is generated by the employees working in different sectors of the economy in Pakistan. Although labour force survey has reference period of one week but the employees usually work on fixed monthly salaries who may be in government, semi government or private sectors, institutions, departments, organizations etc. Therefore, we choose to analyze the employees working in federal government of Pakistan. Although employees working in provincial governments and private organizations could also be analyzed to uncover the facts. But we have limitations in data availability and scope of the study is restricted to the employment status in federal government of Pakistan.

3. EMPLOYMENT OPPORTUNITIES IN FEDERAL GOVERNMENT OF PAKISTAN

Pakistan is not an industrial country and employment opportunities are very rare as compared to industrial countries where private investment in industrial sector creates employment for the labour force of that country. In addition to this the security challenges are adding more to worsen the position of investment in private sector while private sector could be a job creation hub for the country labour force. However, public sector is contributing a lot for providing employment opportunities in Pakistan as compared to the private sector.

The definition of employment in labour force survey of Pakistan as indicated above is not satisfying the general perception of employment to feed a family on permanent basis.

A person who did some work for one hour during the last week since the day of enumeration is considered as employed which is little bit confusing to general perception regarding employed people. In order to provide food and fiber to a family on permanent basis, someone needs a permanent employment which is provided by the public sector in Pakistan to the maximum. Therefore, employment opportunities available in different federal as well as provincial departments in public sector must be highlighted. In this paper we try to analyze the employment opportunities in the federal government of Pakistan.

There are two types of employees working in the Federal Government of Pakistan i.e. civil servants and government servants. A civil servant is also a government servant but a government servant is not necessarily a civil servant. Estacode-2015 defines civil servant as: "Civil Servant means a person who is member of an All Pakistan Service or of a civil service of the Federation, or who holds a civil post in connection with the affairs of the Federation, including any such post connected with defence". So following employees are not considered as civil servants:

i) A person on deputation to the Federation from any province or other authority.
ii) A person employed on contract or work-charged basis or who is paid from the contingencies.
iii) A person working under Factories Act 1934 but employed by the Federal government.
iv) Army employees (paid from defence estimates).

3.1 Sanctioned and Actual Posts of Civil Servants

The total number of sanctioned posts in different departments of federal government provides a picture of employment chances in federal government of Pakistan as civil servant. The civil servants are usually working in different divisions of federal secretariat, their attached or subordinates departments / offices, deputed in the provincial governments and autonomous bodies etc. These total sanctioned posts are available for the labour force of Pakistan and every one can compete for recruitment on these posts in order to have a permanent employment in public sector.

Table 1
Sanctioned and Actual Posts of Federal Government Civil Servants

Year	Number of Posts		Increase / Decrease		Percent Change	
	Sanctioned	Actual	Sanctioned	Actual	Sanctioned	Actual
1997	397219	338759				
1998	431365	367841	34146	29082	8.60	8.58
1999	408704	376233	-22661	8392	-5.25	2.28
2000	413577	351716	4873	-24517	1.19	-6.52
2001	416795	383816	3218	32100	0.78	9.13
2002	398307	367069	-18488	-16747	-4.44	-4.36
2003	393290	356055	-5017	-11014	-1.26	-3.00
2004	389163	360166	-4127	4111	-1.05	1.15
2005	409711	358130	20548	-2036	5.28	-0.57
2006	419499	375932	9788	17802	2.39	4.97
2007	480086	425242	60587	49310	14.44	13.12
2008	491860	439010	11774	13768	2.45	3.24
2009	499923	447155	8063	8145	1.64	1.86
2010	509239	449964	9316	2809	1.86	0.63
2011	500572	451161	-8667	1197	-1.70	0.27
2012	497846	446816	-2726	-4345	-0.54	-0.96
2013	500382	444521	2536	-2295	0.51	-0.51
2014	510455	438921	10073	-5600	2.01	-1.26
2015	520382	444517	9927	5596	1.94	1.27

According to the different Statistical Bulletins of Federal Government Employees, the sanctioned posts and actual working strength of different posts for civil servants have been indicated in the Table-1. This table reveals that total sanctioned posts for civil employees were 397219 in 1997 which were increased by 34146 (8.6 %) posts in one year and approached 431365 sanctioned posts in 1998 which was a big jump in the sanctioned posts to create new employment opportunities in the public sector. After that a mix trend of increase and decrease was remained in sanctioned posts till 2006. In 2007 there was a remarkable increase of 60587 sanctioned pots of civil employees in federal government and the total sanctioned posts increased up to 480086 posts with 14.44 % increase from the last year. In the following years with mix trend of increase and decrease total 520382 sanctioned posts were observed in 2015. In short overall 31 % sanctioned posts were increased from 1997 to 2015 during last 19 years to create new employment opportunities in the federal government of Pakistan.

Out of total sanctioned posts for civil servants how many were filled during the same year in which posts were created, by employing labour force of Pakistan. Table-1 also shows the actual strength of federal government civil employees working in different Ministries / Divisions / Departments / Organizations in the Federal Government of Pakistan.

Table-1 also provides interesting information that how many people were employed as civil servants every year in the federal government of Pakistan. In the year of 1997 there were 338759 civil employees actually working in the federal government which were increased by 8.58 % in one year and total working strength approached 367841 posts in 1998. In indicates that 29028 people were recruited as civil servants by the federal government during one year. After that a mix trend of increase and decrease is shown till 2006. However, in 2007 the federal government provided employment to the 49310 people as civil servants with an increase of 13.12 % from the previous year. Ultimately in 2015 the federal government employed 5596 more people as compared to previous year. Overall actual working civil servants were increased form 338759 in 1997 to 444517 working employees in 2015 with an increase of 31.22 % during last 19 years. It means that the increased sanctioned posts were filled by fresh recruitments during this period by the federal government.

3.2 Federal Government Civil Servants by Basic Scales and Sex

According to fifteenth Census of Federal Government Civil Servants, total 410777 civil servants are working in different Ministries / Divisions / Departments / Organizations in the federal government of Pakistan. This number includes bureaucrats as well as technocrats who are federal government civil servants and are working in the federal government as well as in provinces including Gilgit Baltistan and Azad State of Jammu & Kashmir, foreign missions etc. These civil servants are also working on deputation in autonomous bodies and in some cases also in provinces. Table-2 provides information about male and female federal government civil servants working in different scales according to the fifteenth Census of Federal Government Civil Servants in Pakistan.

Table-2 uncovers that out of total 410777 federal government civil servants, there are 391297 (95.26 %) male employees and 19480 (4.74 %) are female employees working throughout the country. If we look into their scale wise distribution, it becomes clear that out of total civil servants 18130 (4.41 %) are working in BS 17 to 22 out of which 14787 (81.56 %) are male employees while 3343 (18.44%) are female employees. However, out of total civil servants, major portion comprising 392647 (95.59 %) employees are working in BS 1 to 16. Among federal government civil servants working in BS 1 to 16, there are 376510 (95.89 %) male employees and 16137 (4.11 %) female employees working throughout the country.

Table 2
Basic Scale and Sex Wise Distribution of Civil Servants

Basic Scale	Male	Female	Total	Percent Share
22	88	3	91	0.50
21	344	14	358	1.97
20	862	66	928	5.12
19	2129	337	2466	13.60
18	4202	834	5036	27.78
17	7162	2089	9251	51.03
Sub-total-i	14787	3343	18130	100.00
16	11918	3560	15478	3.94
15	5478	436	5914	1.51
14	18199	3490	21689	5.52
13	2550	17	2567	0.65
12	5835	141	5976	1.52
11	5948	316	6264	1.60
10	3586	305	3891	0.99
9	28899	3708	32607	8.30
8	13054	81	13135	3.35
7	41115	740	41855	10.66
6	36438	162	36600	9.32
5	126942	743	127685	32.52
4	10761	111	10872	2.77
3	10091	446	10537	2.68
2	40596	1208	41804	10.65
1	15100	673	15773	4.02
Sub-total-ii	376510	16137	392647	100.00
G. Total (i + ii)	391297	19480	410777	
Percentage	95.26	4.74	100	

Further analysis of Table-2 highlights that out of total officers working in BS 17 to 22, there are only 0.50% working in BS-22, 1.97% are working in BS-21, 5.12% are working in BS-20, 13.60% in BS-19, 27.78% in BS-18 and a majority of 51.03% are working in BS-17. Share of civil servants working in BS 17 to 22, is also shown in Figure-1 through a pie chart for every basic scale.

When we look into the civil servants working in basic scales 1 to 16, it could be analyzed from Table-2 that out of total employees working in these scales, maximum employees comprising 32.52 % are working in BS-5. However, 10.66 % civil servants are working in BS-7, 10.65 % are in BS-2, 9.32 % are in BS-6, 8.30 % are in BS-9 and 5.52 % are working in BS-14. The employees working in other scales are less than five percent in each scale among the category of employees working in basic scales 1 to 16.

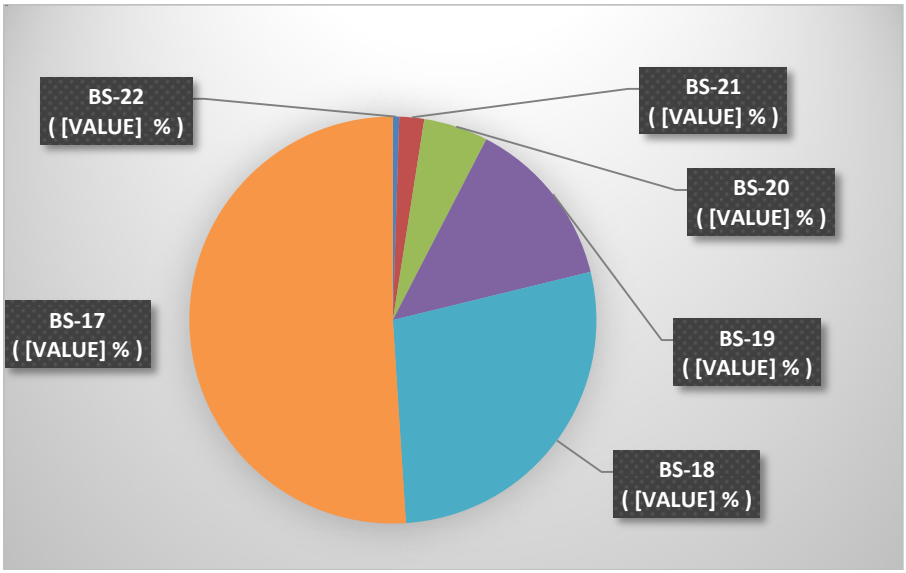

Figure 1: Share of Basic Scales for Civil Servants Working in BS-17 to 22

3.3 Sanctioned and Actual Posts of Employees Working in Autonomous Institutions

In addition to civil employees working in federal government, there are many other federal government employees working in autonomous / semi-autonomous bodies / corporations under the federal government e.g. WAPDA, National Highway Authority, and Printing Corporation of Pakistan Press etc. Many civil servants are also working in these organizations on deputation. However, these bodies make recruitments of even gazetted posts by themselves and not through Federal Public Service Commission. Their employees are also called government employees working in public sector but they are not civil servants. Table-3 shows the sanctioned posts and actual working strength of employees in autonomous / semi-autonomous bodies / corporations under the federal government.

Table-3 tells us that total sanctioned posts in autonomous bodies working under the federal government were 513910 in 1999 which were decreased or sometimes increased in coming years till 2008. In 2009 new jobs for 43768 people were created as compared to previous year with an annual increase of 11.92 %. After 2009 every year new posts were created and sanctioned posts were increased in coming years. This trend shows that in autonomous bodies new posts were created with the passage of time. This type of trend is also observed for actual working strength of employees in autonomous bodies.

Table 3
Sanctioned and Actual Posts in Autonomous Bodies of Federal Government

Year	Number of Posts		Increase / Decrease		Percent Change	
	Sanctioned	Actual	Sanctioned	Actual	Sanctioned	Actual
1999	513910	462091				
2000	502249	445665	-11661	-16426	-2.27	-3.55
2001	491027	429969	-11222	-15696	-2.23	-3.52
2002	475107	413882	-15920	-16087	-3.24	-3.74
2003	478608	417622	3501	3740	0.74	0.90
2004	442984	398161	-35624	-19461	-7.44	-4.66
2005	437778	389923	-5206	-8238	-1.18	-2.07
2006	385595	330531	-52183	-59392	-11.92	-15.23
2007	387497	332012	1902	1481	0.49	0.45
2008	367180	340820	-20317	8808	-5.24	2.65
2009	410948	349924	43768	9104	11.92	2.67
2010	425269	369285	14321	19361	3.48	5.53
2011	429518	375697	4249	6412	1.00	1.74
2012	444173	380151	14655	4454	3.41	1.19
2013	450338	385939	6165	5788	1.39	1.52
2014	447135	377556	-3203	-8383	-0.71	-2.17

The actual working strength of federal government employees in autonomous bodies was 462091 in 1999 which was increased or decreased in coming years till 2008. In 2009 new recruitments of 9104 people were made in autonomous organizations while in 2010 with an increase of 5.53 % new recruitments of 19361 people were matured. After that every year an increase in the recruitments is observed from the table.

However, since 1999 to 2014, the total sanctioned posts as well as actual working employees in autonomous bodies were reduced from 513910 to 447135 and from 462091 to 377556 respectively. It may be due to policies of autonomous organizations to reduce or increase the staff from time to time.

3.4 Collective Employment Status in Pakistan at Federal Level

In order to have total employees in the federal government, we make sum of civil servants working throughout the country and employees working in autonomous / semi-autonomous bodies / corporations under the federal government. When we analyze the employment status as a whole in the federal government of Pakistan including civil employees as well as employees of autonomous bodies, it becomes clear that overall position of employment in federal government improved with the passage of time as shown in bar chart given in Figure-2. We observe that total sanctioned posts in federal government were 915826 in the year of 2000 which were increased up to 957590 in 2014 in spite devolution plan as result of 18^{th} amendment. The bar chart also shows that total working strength in Pakistan at federal level was 797381 in the year of 2000 which was increased up to 816477 employees in 2014. Overall position of sanctioned as well as working strength of federal government employees improved within the specified period and more people got their jobs in public sector.

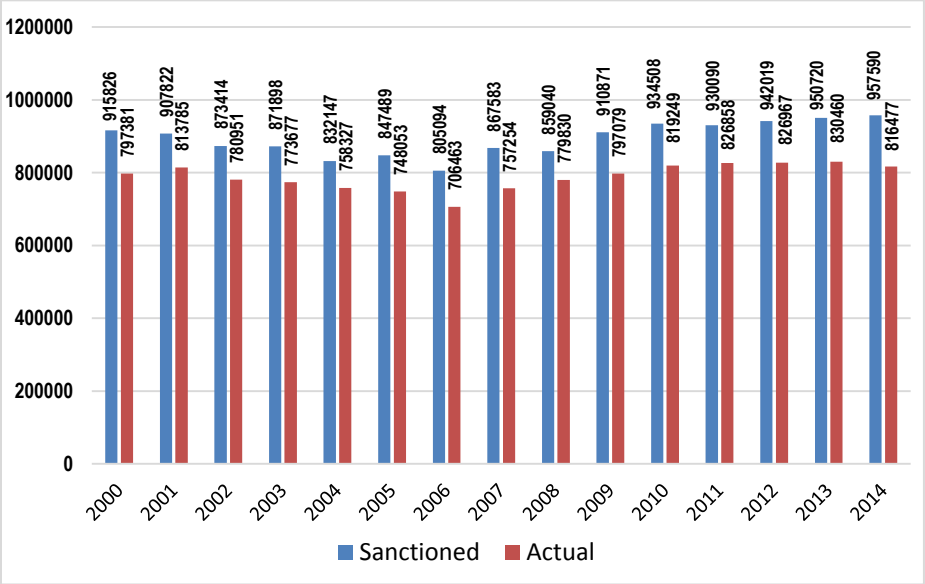

Figure 2: Total Employees in Federal Government of Pakistan

According to the 18th amendment in the constitution of Pakistan many subjects were transferred from federal government to the provincial governments and as result 17 federal ministries were devolved in three phases which was the biggest restructuring exercise in Pakistan since 1947 (Statistical Bulletin 2011-12). According to the bulletin, 17115 federal government employees were absorbed in the provincial governments and 403 employees were transferred to the FATA / Gilgit Baltistan and Azad State of Jammu & Kashmir. In spite of that biggest devolution at federal level, regular retirements of the employees, sometimes ban on recruitment of non-gazetted posts, the number of working employees were increased after 14 years which shows that new employment opportunities were created by the government at federal level.

Bar chart also indicates that for a period of six years from 2001 to 2006 there was a decreasing trend in employment opportunities at federal level regarding sanctioned as well as actual working strength of the employees. However, since 2007 to onward there is an increasing trend in the employment opportunities regarding sanctioned and actual working employees at federal level from year to year.

3.5 Female Employees at Federal Level in Pakistan

Government of Pakistan has provided equal opportunities for females to search a job on merit in any organization at federal level. Females also have additional chances to get jobs against female quota wherever applicable and they have 100 % jobs in female educational institutions. Data given in Table-4 show the position of female employment at federal level in Pakistan for the last ten years.

Table 4
Year Wise Female Employees in Federal Government of Pakistan

Year	Civil Female Employees	Female Employees in Autonomous Bodies	Total Female Employees	Increase / Decrease	Percent Change
2006	17488	10309	27797		
2007	18130	10787	28917	1120	4.03
2008	19000	10985	29985	1068	3.69
2009	20257	13045	33302	3317	11.06
2010	21133	15114	36247	2945	8.84
2011	19994	16236	36230	-17	-0.05
2012	20022	17129	37151	921	2.54
2013	20426	17206	37632	481	1.29
2014	21629	17901	39530	1898	5.04
2015	23298	18000	41298	1768	4.47

Female employees as civil servants were 17488 in 2006 and were increased every year till 2015 except a minor decrease in 2011. Female civil employees in federal government have increased from 17488 to 23298 in 2015 which is an increase of 33.22 % during this period. In autonomous bodies female employees were 10309 in 2006 which increased up to 18000 in 2015. The total female employees in federal government were 27797 in 2006 and after ten years this number has been increased up to 41298 in 2015 with an increase of 48.57 % during this period which shows a sufficient increase in ten years. When we look into the year to year change in female employees, it becomes clear that female employees were increased every year except 2011 which shows a minor decrease of 0.05 which is negligible. From these figures we can say that the federal government has provided sufficient opportunities of employment to the females.

It is pertinent to mention that there is no gender disparity in federal government of Pakistan regarding pay, allowances and other benefits. A male and female are getting equal befits if both are working in the same pay scale in public sector.

In order to see the picture of increase and decrease from year to year in number of female employees working in federal government of Pakistan, we have presented the data in bar chart in Figure-3 for the easement of the readers.

Figure-3 clearly indicates that female employees are increasing year to year in the government sector in Pakistan. They are provided good working environment, job security, salaries according to basic scales, and other benefits as per rules of government employees in Pakistan.

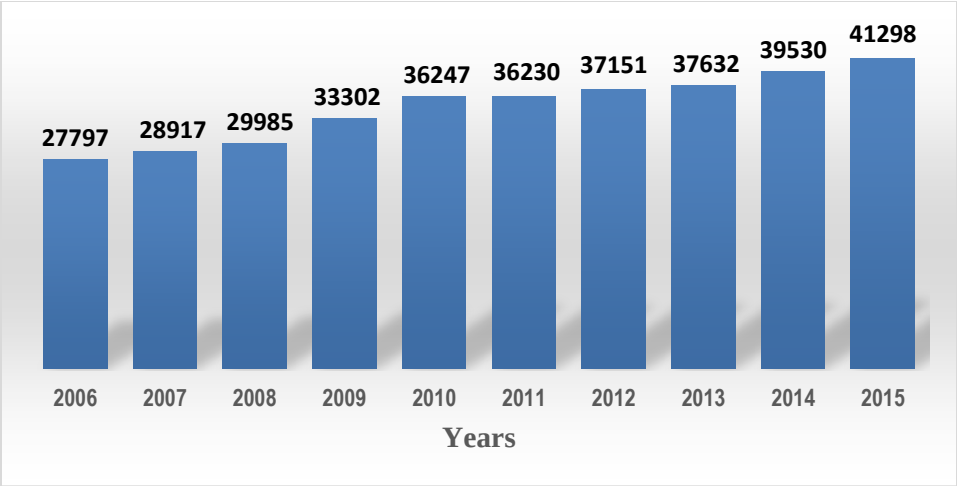

Figure 3: Female Employees in Federal Government

4. PREDICTED EMPLOYMENT OPPORTUNITIES IN FEDERAL GOVERNMENT

Prediction of employment opportunities in the federal government of Pakistan provides us an idea to know about the future prospects of employment in the country. The expected future sanctioned and actual working posts provide a chance of preparation to the job seekers for their expected future jobs. We use simple regression model for prediction of sanctioned and actual working posts in the federal government of Pakistan. The simple regression model is:

$$Y = \alpha + \beta X + \xi,$$

where Y is number of sanctioned posts and number of actual posts while X is number of years i.e. time and ξ is the error term. We use the data of total sanctioned and actual working posts in government sector as shown in Figure-2 for the last 15 years from 2000 to 2014. When we run the regression in excel using data for total sanctioned posts and resultantly putting the values of intercept and slope, we get the fitted line as:

$$\hat{y}_s = 847646 + 5762x \quad \text{(for sanctioned posts).}$$

Similarly for actual working posts the fitted line is:

$$\hat{y}_a = 759405 + 3681x \quad \text{(for actual working posts).}$$

Using these fitted lines $\hat{y}_s$ for sanctioned and $\hat{y}_a$ for actual posts, we predict sanctioned as well as actual working posts in the federal government of Pakistan for next six years till 2020 as given in Table-5.

Table 5
Predicted Posts for Future

Time	Sanctioned Posts	Actual Posts
2015	939838	818301
2016	945600	821982
2017	951362	825663
2018	957124	829344
2019	962886	833025
2020	968648	836706

Table-5 predicted that there will be 968648 sanctioned posts in government sector and hopefully 836706 posts will be filled till 2020 in federal government of Pakistan.

5. CONCLUSION

Government of Pakistan is facing a great challenge of unemployment in the country due to increasing labour force every year. There are 3.62 million unemployed people in the country. Public sector is the major source of employment and people feel more security in government jobs even with low salaries all over the world. In Pakistan government is the major sector for employment and government has created new employment opportunities for our labour force in the country.

With the passage of time government has created new jobs which is shown by increased sanctioned posts in the data analysis period. Similarly increased strength of actual working employees also proves that government has continually recruited new employees in the federal organizations with the passage of time. The predicted values of sanctioned as well as actual posts also reveal increasing trends for future. Female employees also increased every year in the federal government organizations. From increasing trends of federal government employees we can conclude that government is the major agency for employment for the labour force of Pakistan and people prefer to become government employee as compared to other jobs.

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NEXUS OF SOCIAL MEDIA WITH CUSTOMER RESPONSIVENESS AND CUSTOMER SATISFACTION

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ABSTRACT

Social Media is becoming most popular and efficient source for doing e-business nowadays. The aim of this paper is to find out the relationship between use of social media and customer responsiveness and also the relationship between social media use and customer satisfaction. This study is a quantitative research and causal research in nature. Data was collected from the social media users for buying the products and availing services with the help of five point Likert scale questionnaire. 150 online questionnaires were distributed among the users of social media and simple random sampling technique was used for this purpose. For testing the hypothesis of the study SPSS version 24th was used. The first finding shows that social media use and customer responsiveness has positive relationship and the second findings relate to the relationship between social media use and customer satisfaction also shows positive relationship. For the future study, demographics of the study can be used to check the moderation affect.

KEY WORDS

Social Media, Responsiveness, Customer satisfaction.

1. INTRODUCTION

Social media have transformed the buying and selling habits of people and facilitate them by providing ease of online commerce. On the one hand social media is used for social connections among each other and on the other side it is also used for e-commerce. According to American Marketing Association (AMA), social media is an acronym for "ask me anything," which originated in a popular subedit where users will use the term to prompt questions from other users. Customer satisfaction refers to what is the customer expect and perceived from services or goods, expectation plays a vital role and are derived from personal experiences. Customer satisfaction is defined as the number of customers, or percentage of total customers, whose reported experience with a firm, its product, or its services exceeds specified satisfaction goals. Responsiveness is willing to help customers and provide prompt services. These dimensions emphasize attentiveness and promptness in dealing with customer's request, questions, complaints and problems.

The Proliferation of social media platforms provide individuals with multiple choices of information sources, especially for risk and health message. In broad terms, incorporating the use of social media in customer interaction is a logical progression for

firms to expand communications with their customers (Avlonistis & Panagopoulos, 2010). For instance, trade media encourage the use of Social media (Writhman, 2013). Social media may have implications on customer satisfaction. In general, with increased interaction and contact with firms, power is shifting from seller to buyer (Prahalad & Ramaswamy, 2004). An increase in buyer seller collaboration and co-creation of knowledge and value has replaced buyers on more equal footing with sellers. As such customers may hold higher expectation of these interactions and engagements, such that firm and customers contact with employee must adapt and risk alienating or losing their customer base. The social media enables greater responsiveness and satisfaction. The findings of this research paper provide a springboard for additional research, and the practical implications are many.

In previous study, the relationship between use of social media, responsiveness and customer satisfaction were measured in salesperson's point of view in which there are chances of biasness while measuring the customer satisfaction and responsiveness (Agnihotri, et al., 2015). In this study, use of social media, customer satisfaction and customer responsiveness were measured in customers' view point.

Social media is an emerging networking channel of new era. As, the use of social media is growing quickly for social connections, in the same way it is also rapidly getting famous in business world for doing business on fast track. The problem statement of this study is to check the relationship of social media use with customer satisfaction and customer responsiveness in customers' view point.

2. OBJECTIVES OF STUDY

i) To find out the social media applications used for online buying of products and services.
ii) To find out the relationship between social media use and customer responsiveness.
iii) To find out the relationship between social media use and customer satisfaction

The main objectives of this research are to investigate the following questions:

a) Do customers use social media applications for buying products and services?
b) Does relationship exist between social media use and customer responsiveness?
c) Does relationship exist between social media use and customer satisfaction?

3. LITERATURE REVIEW

Social media is cluster of communicating, cooperative, and community oriented structure made upon “the conceptual and technical grounds of Web 2.0” (Mayfield, 2008; Kaplan & Haenlien, 2010). These systems have not only become significant information sources in daily life, but have become more significant for business. Social media contain social networking applications like Facebook and Google, micro blogging like Twitter, Blogs, Wikis, and media sharing websites like YouTube and Flickr. Social media is a part of the Web 2.0 development, which is described by user-generated particles, online identity creation, and interactive networking. Social media has a mainly interesting capacity for electronic participation (Bertot et al., 2010).

Social media applications have presented innovative customers oriented tools that help customers to build network with others in their social links and with businesses that become network members (Hermkens, 2013). Some of the social media platforms are blogs, discussion forums, users-created communities, and user generated content sites (Lehmkuhl, 2014). More specifically, applications like LinkedIn, Facebook, and Twitter have transformed from completely customer-specific to customer-oriented tools that permit organizations to take part in the interactions between network members (Tranior, 2012).

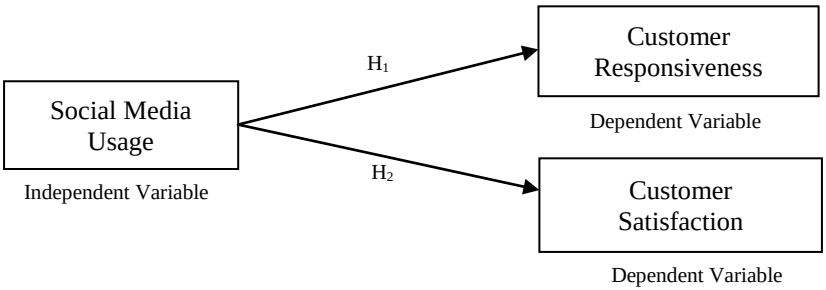
According to a recent report by McKinsey, the speed of adoption of social media applications (SMA) such as LINE, WeChat, Facebook and Whatsapp by companies is increasing rapidly over time (McKinsey & Company, 2014). SMA can be used to create a home page to make announcements, to share text, image and videos, to message and to set up groups for communications with customers and business partners. Companies, especially those in the industrial markets, can utilize SMA to achieve a variety of business purposes. Companies now use SMA to communicate with their customers and suppliers, to build relationships and trust, and to identify prospective trading partners (Shih, 2009), as well as to promote brands and to support the creation of brand communities (Kaplan, 2012; Leek & Christodoulides, 2011). For example, companies can create business accounts to promote their products and to share information with customers via their social media pages (Järvinen & Taiminen). As reported, one third of B2B marketers are using SMA for generating product demand (B2B Marketing, 2014). Responsiveness is the dimension of Service Quality which is defined as "the willingness to help customers and to provide prompt service" (Fitsimmons, 2011).

An organization's customer responsiveness, or its capacity to retort swiftly to customers' needs and wants, is critical for continuous accomplishments. In this new era the needs of customer are continuously evolving. To achieve the competitive advantages a company should monitor and respond effectively and efficiently according to continuous evolving needs of customers. Organizations that are more responsive to their customer needs are more likely to achieve a more loyal and sustainable customer base (Jayachandarran, 2004; Krasnikov, 2008). The ability to response quickly to customers' needs may also have a positive the firm's performance because it provides the firm with a first-mover advantages (Kerien, et al., 1992). According to Wilson et al, 2008, responsiveness is essential when interacting on Social Media. Customer responsiveness is the ability of a business to recognize and respond to changing customer needs. Responsiveness with reliability, by identifying salespeople who promptly returning phones calls, following up on commitments, fulfilling customer's requests and remaining available when needed (Ahearne, 2007).

Customer satisfaction is essential for consideration because it refers to the final satisfaction for a customer (Grewal & Sharma, 1991). Oliver (1999) defined customer satisfaction as "the consumer's fulfillment response, the degree to which the level of fulfillment is pleasant or unpleasant" and is being influenced throughout the entire sales process, from pre-purchase product expectation (Eggart & Ulaga, 2002). Resolving a customer effectively has a strong impact on customer satisfaction and loyalty. (Wilson, et al., 2008). Providing a better service to customer is essential to ensuring the

customer satisfaction. The companies who are using social media for business have better service quality and their customers are satisfied with their services (Lopez, 2013).

4. FRAMEWORK OF THE STUDY



5. HYPOTHESIS DEVELOPMENT

H_1 There is a significant relationship between a customer's use of social media and customer responsiveness.

H_2 There is a significant relationship between a customer's use of social media and customer satisfaction.

6. RESEARCH METHODOLOGY

There are three research methodologies qualitative, quantitative and mixed method. Quantitative research method is used by the researcher to find the outcomes of the study. The objectives of this research study are; i) to find out the social media applications used for online buying of products and services, ii) to find out the relationship between social media use and customer responsiveness, and iii) to find out the relationship between social media use and customer satisfaction.

7. RESEARCH DESIGN

This is a non-experimental quantitative research that gives direction and framework to entire research study. The research design is prospective research design in which researcher will assess that there is a relationship of social media use with customer responsiveness and customer satisfaction. This study setting is the cross sectional quantitative and logic of research is deductive.The data was collected from those personals who are using social media for buying the products and services in Pakistan.

8. SAMPLING FOR STUDY

To collect data, online survey was conducted through convenience sampling technique. Online Questionnaires were distributed among 150 respondents in which 100 were returned and 70 were found useful. The sample size was estimated equal to 70 respondents based on sample required by structural equation modeling that should be five times the number of questions in the questionnaire (Teimouri, et al., 2016).

9. DATA COLLECTION TOOL

Data is collected through adapted questionnaire. It measured the variables of this study on Five point Likret Scale which starts from 1 – 'always', 2 – 'Often', 3 – 'Sometimes', 4 – 'Rarely' to 5 – 'Never'. There are two parts of the questionnaire. First contains demographic information of the respondents and the second part contains 13 questions that measure the variables of study. The first part consists of demographic that includes gender, age group, marital status, education, career occupation, and social media application. Total numbers of respondents were 100 in which 70 were valid. Age of users were lying in the range of 20 years and below, 21 to 30 years, 31 to 40 years, 41 to 50 years, 51 to 60 years, and above 60 years. The education level is given from High School to Doctorate Degree and additionally Professional Degree was also given there. There were different career occupations mentioned and Social Media Applications were also mentioned in the instruments that includes Facebook, Twitter, Instagram, Flicker, LinkedIn, and other. Second part contains the indicators for measurement of variables;

- **Social media use** is an independent variable that was measured by using the 3 items of questions (Agnintori et al., 2009).
- **Customer responsiveness** is first dependent variable that was measured by using the 5 items of questions. This questionnaire was built by Olorunniwo et al., (2006) and used in another research (Takahashi).
- **Customer satisfaction** is second dependent variable that was measured by using the 5 items of questions. This questionnaire was built by Olorunniwo et al., (2006) and used in another research (Takahashi).

10. DATA ANALYSIS

Statistical Product for Social Sciences Version 24th (SPSS) was used for the analysis of data. The responses of social media users for e-commerce were gathered through questionnaire, entered in the SPSS 24. In this research study for quantitative research method, it is necessary to apply the statistical tests for the analysis. Following statistical tests are conducted through SPSS;

i) Frequency Analysis

ii) Descriptive Statistics

iii) Reliability Statistics

iv) Correlation Analysis

v) Linear Regression

10.1 Frequency Test Statistics

Table 1
Frequency Statistics of Respondents

Valid	Frequency	Percent
Social Media Applications		
Facebook	34	48.6
Twitter	18	25.7
Instagram	7	10.0
Flicker	1	1.4
Linked In	6	8.6
Whatsapp	4	5.7
Total	70	100.0
Gender		
Male	39	55.7
Female	31	44.3
Total	70	100.0
Marital Status		
Married	10	14.3
Single	59	84.3
Divorce	1	1.4
Total	70	100.0
Age in years		
Under 20	8	11.4
21 to 30	56	80.0
31 to 40	5	7.1
Above 60	1	1.4
Total	70	100.0
Educational Background		
High School	1	1.4
Bachelor's Degree	16	22.9
Master's Degree	43	61.4
Doctorate Degree	5	7.1
Professional Degree	4	5.7
Others	1	1.4
Total	70	100.0
Professional Career		
Student	37	52.9
Teacher	11	15.7
Self-Employed	8	11.4
Housewife	1	1.4
Others	13	18.6
Total	70	100.0

Table 1 depicts the frequency analysis of demographic information of the respondents. There were total 70 respondents that used social media applications for buying products and availing services, in which 34 users of Facebook, 18 users of Twitter, 7 users of Instagram, 1 user of Flicker, and 6 users of LinkedIn, and 4 users of Whatsapp. So, most of the people were used Facebook for buying products and availing services. 39 males and 31 females were used social media applications, which shows that 56% and 44% respectively, in which 10 were married, 59 were single, and 1 was divorced respondent. Responses show that 8 users were laid in the range of under 20 years, 56 users in 21 to 30 years, 5 users in 31 to 40 years, and the rest was laid in above 60 years. They were belonging from different educational background i.e. 1 user from High School, 16 users from Bachelor's Degree, 43 users from Master's Degree, 5 users from Doctorate Degree, 4 users from Professional Degree, and the rest 1 user was belong to other category. 37 students were used social media application, teachers were 11, self-employed were 7, one of them was house wife, and 13 were laid in others category.

10.2 Reliability Scale and Descriptive Statistics

The reliability of all the variables was checked by using the SPSS 24th version. The reliability scales of all constructs were measured by Cronbach's Alpha values and its acceptable value is 0.70. The purpose of descriptive statistics test is to get a general view of the data and the distributions of the constructs by basic statistics, such as mean and standard deviation.

Table 2
Reliability Statistics, Mean, and Standard Deviation

Variables	Cronbach's Alpha	No. of Items	Mean	Std. Deviation
All Variables	.904	13		
Social Media Use	.721	03	2.3476	.91935
Customer Satisfaction	.921	05	2.5686	1.04709
Customer Responsiveness	.813	05	2.3171	.71383

The Table 2 illustrates the reliability statistics of the variables. From the above table, the cronbach's alpha of social media use has 0.721 of 3 indicators, customer satisfaction has 0.921 of 5 indicators and customer responsiveness has 0.813 of 5 indicators. Mean values of each construct were calculated by averaging scores of items included in each construct. Mean of social media use, customer responsiveness, and customer satisfaction were 2.35, 2.32, and 2.57 respectively. Standard deviation of social media use, customer responsiveness, and customer satisfaction were 0.919, 0.714, and 1.05 respectively.

10.3 Correlation Coefficients

Correlation coefficient measures the strength and the direction of a linear relationship between two variables. The correlation coefficient lies between +1 to -1. A correlation greater than 0.8 is generally described as strong, whereas a correlation less than 0.5 is generally described as weak and correlation lies between 0.8 to 0.5 shows moderate strength.

Table 3
Correlation Coefficients

Sr. No.	Variables	1	2	3
1	Customer Responsiveness	1		
2	Customer Satisfaction	.453**	1	
3	Social Media Use	.519**	.643**	1
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 3 depicts the correlation coefficient between variables. All constructs are positively correlated with each other. There was moderate correlation between social media use and customer satisfaction with the value of 0.643 and social media use and customer responsiveness with the value of 0.519. Weak correlation between customer responsiveness and customer satisfaction with the value of 0.453.

10.4 Testing of Hypothesis

H_1 predicted that significant relationship exists between a customer's use of social media and customer responsiveness. H_2 predicted that significant relationship exists between a customer's use of social media and customer satisfaction. To test the hypothesis, linear regression analysis was performed in SPSS 24th.

H_1 There is a significant relationship between a customer's use of social media and customer satisfaction.

Table 4
Model Summary–Testing of H_1

Model	R	R Square (R^2)	Adjusted R Square	Std. Error of the Estimate
1	.519[a]	.269	.258	.61481

a. Predictors: (Constant), Social Media Use
b. Dependent Variable: Customer Responsiveness

Table 4 shows the model summary and overall fit statistics. In above table R value depicts the correlation between social media use and customer responsiveness. We find that the adjusted R^2 of our model 1 is 0.258 with the R^2 = .269 that means that the linear regression explains 26.9% of the variance in customer responsiveness is due to social media use.

Table 5
ANOVA-Testing of H_1

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9.456	1	9.456	25.015	.000[b]
	Residual	25.704	68	.378		
	Total	35.159	69			

a. Dependent Variable: Customer Responsiveness
b. Predictors: (Constant), Social Media Use

Table 5 illustrates the p-value for significance of the relationship between social media use and customer responsiveness. From the above table, p-value=0.000 that is less than 0.05 and results considered highly significant. So, there is a linear relationship between social media use and customer responsiveness.

Table 6
Beta Coefficient-Testing of H_1

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.372	.203		6.765	.000
	Social Media Use	.403	.081	.519	5.002	.000
a. Dependent Variable: Responsiveness						

Table 6 shows the beta coefficient for the actual regression equation. Positive beta coefficient = 0.519 that is significant at 0.000 level. So, H_1 is accepted.

H_2: There is a significant relationship between social media use and customer satisfaction.

Table 7
Model Summary-Testing of H2

Model	R	R Square (R^2)	Adjusted R Square	Std. Error of the Estimate
2	.643[a]	.413	.405	.80795

a. Predictors: (Constant), Social Media Use
b. Dependent Variable: Customer Satisfaction

In Table 7, R value depicts the correlation between social media use and customer satisfaction. The adjusted R^2 of our model 2 is 0.643 with the R^2 = .413 which means that the linear regression explains 41.3% of the variance in customer satisfaction is due to social media use.

Table 8
ANOVA-Testing of H2

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	31.261	1	31.261	47.889	.000[b]
	Residual	44.390	68	.653		
	Total	75.651	69			

a. Dependent Variable: Customer Satisfaction
b. Predictors: (Constant), Social Media Use

Table 8 illustrates the p-value for significance of the relationship between social media use and customer responsiveness. From the above table, p-value=0.000 that is less than 0.05 and results considered highly significant. So, there is a linear relationship between social media use and customer satisfaction.

Table 9
Beta Coefficient-Testing of H2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	.850	.266		3.189	.002
	Social Media Use	.732	.106	.643	6.920	.000

a. Dependent Variable: Customer Satisfaction

Table 9 shows positive beta coefficient = 0.732 that is significant at 0.000 level. So, H_2 is also accepted.

11. DISCUSSION AND CONCLUSION

Previous studies showed that social media enhance the customer satisfaction (Agnihotri et al., 2015) and the customer services (Takahashi). The current study examined the relationship between one independent variable i.e. 'Social Media Use' and two dependent variables i.e. 'Customer Responsiveness' and 'Customer Satisfaction'. Results shows that social media use has relationship with customer responsiveness and customer satisfaction.

Firstly, frequency statistics was performed to test the demographic information and found that male users are more than female users with ratio of 56:44. Facebook is most familiar SMA. 53% are students among all and 84% are unmarried who using social media for buying products and availing services. 80% of the users are lying in the range of 21 to 30 years. Secondly, reliability scale was measured and found that the data was reliable with 0.904 cronbach's alpha Thirdly, correlation coefficient was also performed which shows that correlation between social media use and customer satisfaction is more as compare to relationship between social media use and customer responsiveness. While there is weak correlation between customer responsiveness and customer satisfaction.

To test the hypothesis of the study, linear regression was conducted and induced that social media use has positive relationship with customer responsiveness and customer satisfaction. So, H_1 and H_2 are accepted. Furthermore, it is concluded from the obtained results that the relationship between social media use and customer satisfaction is more positively strong than the relationship between social media use and customer responsiveness.

12. LIMITATIONS AND FUTURE DIRECTIONS

The findings reported here are valid, there are many limitations to this study and on the basis these limitations there are few future directions given below;

- Due to the short time period sample size of the study was too small; in future sample size can be enhanced.
- Further sub dimensions of social media use did not discuss in the current research, in future researcher can measure its dimensions as well.
- Demographics of the study can be used to check the moderation affect.

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ESTIMATING THE POPULATION MEAN BY MIXTURE REGRESSION ESTIMATOR

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ABSTRACT

In this paper a Mixture Regression Estimators (Full Information case) for two phase sampling have been proposed by using information on auxiliary variables and attributes simultaneously. The mean square error of the estimators have been derived. Efficiency comparisons have been made with two phase mixture ratio estimators proposed by Waweru et al. (2014).

KEYWORD

Auxiliary attributes, mixture regression estimators, Point bi-serial correlation, sample design, Estimation procedure

1. INTRODUCTION

Regression and Ratio estimation make use of population totals or means for auxiliary variables and attributes to improve the weighting from sample values to population estimates. The purpose of employing these estimation techniques is to increase efficiency and precision of the estimators by using information available on auxiliary variables/attributes. The estimation procedure is suitable under the assumption of a high correlation between the auxiliary variables/attributes and the main variable Y. The two-phase sampling technique is appropriate if information on the auxiliary variable is easily and cheaply available relative to the variable of interest. Two-phase sampling is required in the absence of the knowledge on the population mean of the auxiliary variable. This sampling design can be used to reduce potential data collection costs by taking advantage of relationships between variables that are expensive to observe (Y) and those that are relatively inexpensive to observe. Examples may refer to the estimation of the mean yield of wheat per acre where the auxiliary variables and attributes associated with the yield of wheat include fertility of land, water availability, type of seed, amount of rainfall, type and quantity of fertilizer etc. or estimating mean weight of a population along with the auxiliary variables associated may be age, height, gender, education etc. The estimation process includes these variables and attributes by integrating with the main variable and constructs ratio, regression or product estimators of the population mean under single phase and two phase sampling.

2. NOTATIONS

1. N: Size of Population,
2. n_r : Size of rth phase sample, (r = 1,2).
3. $\bar{Y}$: Mean of the study variable Y.
4. $\bar{y}_{(r)}$: Sample mean of the study variable Y for the rth phase.
5. $\bar{x}_{i(r)}$: Sample mean of the auxiliary variable Xi (i=1,2) for the rth phase (r =1,2).

Let a simple random sample of size n units without replacement is to be drawn from a population of N units to estimate the population mean of the variable Y. Let there be two auxiliary variables X_1 and X_2 available and the let the population may be completely dichotomized with respect to presence or absence of an attribute τ_{ij}, $j=1,2$. Assuming that the attribute τ_{ij} takes only values '0' or '1' accordingly as:

τ_{ij} = 1 if the ith unit of the population possesses attribute.
= 0 otherwise.

Let for the auxiliary attribute τ_j,

$A_j = \sum_{i=1}^{N} \tau_{ij}$: total number of units in the population possessing attribute τ_j.

$a_j = \sum_{i=1}^{n} \tau_{ij}$: total number of units in the sample possessing attribute

$P_j = \frac{A_j}{N}$: proportion of units in the population possessing attribute τ_j.

$p_{j(r)} = \frac{a_{j(r)}}{n_r}$: proportion of units in the sample possessing attribute τ_j.

Let

$$\theta_1 = \left(\frac{1}{n_1} - \frac{1}{N}\right), \quad \theta_2 = \left(\frac{1}{n_2} - \frac{1}{N}\right); \quad \theta_1 < \theta_2.$$

$$\bar{y}_{(r)} = \bar{Y} + \bar{e}_{y_{(r)}}, \ \bar{x}_{j(r)} = \bar{X} + \bar{e}_{x_{j(r)}}, \ p_{j(r)} = P_j + \bar{e}_{\tau_{j(r)}},$$

where $\bar{e}_{y_{(r)}}$, $\bar{e}_{x_{j(r)}}$ and $\bar{e}_{\tau_{j(r)}}$ are assumed to be very small sampling errors respectively. It is assumed:

$$E\left(\bar{e}_{y_{(r)}}\right) = E\left(\bar{e}_{x_{j(r)}}\right) = E\left(\bar{e}_{\tau_{j(r)}}\right) = 0 \text{ for r =1,2.}$$

$$E\left(\bar{e}^2_{y(r)}\right) = \theta_r \bar{Y}^2 C^2_y, \ E\left(\bar{e}^2_{x_{i(r)}}\right) = \theta \bar{X}^2 C^2_{x_i}, \ E\left(\bar{e}^2_{\tau_{j(r)}}\right) = \theta_r P_j^2 C^2_{\tau_j},$$

$E(\bar{e}_{y_{(r)}}\bar{e}_{\tau_{j(r)}})=\theta_r \bar{Y}P_j C_y^2 C_{\tau_j}^2 \rho_{pb_j}$, $E(\bar{e}_{x_{i(r)}}\bar{e}_{\tau_{j(r)}})=\theta_r \bar{X}P_j C_{x_i}^2 C_{\tau_j}^2 \rho_{p_{x_i}b_j}$,

$$S_{y\tau_j}=\frac{1}{N-1}\sum_{i=1}^{N}\left(y_i-\bar{Y}\right)\left(\tau_{ij}-P_j\right), S_{x_k\tau_j}=\frac{1}{N-1}\sum_{i=1}^{N}\left(x_{ik}-\bar{X}\right)\left(\tau_{ij}-P_j\right)$$

$\rho_{P_y b_j}=S_{y\tau_j}\Big/\left(S_y S_{\tau_j}\right)$: point bi-serial correlation coefficient between auxiliary attribute and study variable.

$\rho_{P_{x_i} b_j}=S_{x_i\tau_j}\Big/\left(S_{x_i} S_{\tau_j}\right)$: point bi-serial correlation coefficient between j^{th} auxiliary attribute and i^{th} auxiliary variable.

Q_{js} $(-1\le Q_{js}\le +1)$: Phi coefficient between attributes τ_j and τ_s

$\Delta_{(\tau_1,x_1)}$: matrix of point bi-serial correlations between one auxiliary variable and one auxiliary attribute.

$\Delta_{(\underset{\sim}{x},\tau_1)}$: matrix of point bi-serial correlations between two auxiliary variables and one auxiliary attribute and correlations among two auxiliary variables.

$\left(\Delta^*_{y.x_k}\right)_{\underset{\sim}{x},\tau_1}$: matrix of point bi-serial correlations.

$\left(\Delta^*_{y.\tau_j}\right)_{\underset{\sim}{\tau},x_1}$: matrix of point bi-serial correlations and phi coefficients.

$a_{q\times 1}$: vector of α coefficients

$b_{r\times 1}$: vector of β coefficients

$c_{r\times 1}$: vector of correlation coefficients and a point bi-serial correlation coefficient.

$d_{q\times 1}$: vector of point bi-serial correlation coefficients and a correlation coefficient.

3. SOME PREVIOUS ESTIMATORS

Citation of literature gyrates around incorporating of auxiliary variables and attributes independently with the main variable to form efficient estimators. Cochran [1] proposed a ratio estimator using one auxiliary variable under single phase sampling. Hansen et al. [2] proposed a regression estimator to estimate population mean by using one auxiliary variable in single phase sampling. Samiuddin and Hanif [3] and Ahmad [4] proposed ratio and regression estimators using multi auxiliary variables in single-phase and two phase sampling. Singh et al. [5] used an auxiliary attribute and proposed a ratio estimator in single phase sampling. Hanif et al. [6] and Hanif et al. [7] proposed family of regression and ratio type estimators using multi auxiliary attributes in single-phase and two phase sampling. Moeen et al. [8] (2012) combined auxiliary variables and attributes with the study variable and proposed mixture ratio and regression estimators in single

phase sampling. Waweru et al. [9] extended the technique of Moeen et al. [8] and proposed mixture ratio estimators for estimating population mean by using information on auxiliary variables and attributes simultaneously in two-phase sampling under full, partial and no information cases and analyzed the properties of the estimators.

In this paper we will propose Mixture Regression Estimators under Full Information case Samiuddin and Hanif [10] for two phase sampling by using information on auxiliary variables and attributes simultaneously.

4. THE PROPOSED ESTIMATORS

4.1 Mixture Regression Estimators in Two Phase Sampling Full Information Case

Theorem 4.1.1

Let $t'_{1(2)}$ be a mixture regression estimator based on one auxiliary variable and one auxiliary attribute:

$$t'_{1(2)} = \bar{y}+\beta_1\left(\bar{X}_1-\bar{x}_{1(2)}\right)+\alpha_1\left(P_1-p_{1(2)}\right). \tag{4.4.1}$$

The mean square error of $t'_{1(2)}$ is given by:

$$\mathrm{MSE}\left(t'_{4(2)}\right)=\frac{\theta_2\bar{Y}^2C_y^2}{|\Delta_{(\tau_1,x_1)}|}\left[|\Delta_{(y,\tau_1,x_1)}|\right]. \tag{4.4.2}$$

Proof:

Using the usual assumptions and procedure we obtain the mean square error of $t'_{1(2)}$ as,

$$MSE\left(t'_{1(2)}\right)=E\left[\bar{e}_y-\alpha_1\bar{e}_{\tau_{1(2)}}-\beta_1\bar{e}_{x_{1(2)}}\right]^2, \tag{4.4.3}$$

The maximum values of α_1 and β_1 are,

$$\alpha_1=\frac{\bar{Y}C_y}{P_1C_{t_1}|\Delta_{(\tau_1,x_1)}|}\left[(-1)^{1+1}\left|\Delta_{y.\tau_1}\right|_{(\tau_1,x_1)}\right] \tag{4.4.4}$$

and

$$\beta_1=\frac{\bar{Y}C_y}{\bar{X}C_{X_1}|\Delta_{(\tau_1,x_1)}|}\left[(-1)^{2+1}\left|\Delta_{y.x_1}\right|_{\tau_1,x_1}\right]. \tag{4.4.5}$$

Substituting the values of α_1 and β_1 in (5.8.3) and on simplifying we obtain,

$$\mathrm{MSE}\left(t'_{1(2)}\right)=\frac{\theta_2\bar{Y}^2C_y^2}{|\Delta_{(\tau_1,x_1)}|}\left[|\Delta_{(y,\tau_1,x_1)}|\right]. \tag{4.4.6}$$

$$\mathrm{MSE}\left(t'_{1(2)}\right)=\theta_2\bar{Y}^2C_y^2\left[1-\rho^2_{y(\tau_1,x_1)}\right].$$ Arora and Lal [11]

The proof is complete.

The estimated mean square error of $t'_{1(2)}$ may be written in a straight forward manner as:

$$\text{MSE}\left(\hat{t}'_{1(2)}\right)=\theta_2\bar{y}^2c_y^2\left[1-\hat{\rho}^2_{y(\tau_1,x_1)}\right]. \tag{4.4.7}$$

Theorem 4.1.2

Let $t'_{2(2)}$ be a mixture regression estimator based on one auxiliary variable and two auxiliary attributes:

$$t'_{2(2)}=\bar{y}+\beta_1\left(\bar{X}_1-\bar{x}_{1(2)}\right)+\sum_{i=1}^{2}\alpha_i\left(P_i-p_{i(2)}\right). \tag{4.5.1}$$

The mean square error of $t'_{2(2)}$ is given by:

$$\text{MSE}\left(t'_{2(2)}\right)\approx\frac{\theta_2\bar{Y}^2C_y^2}{|\Delta_{(\tau_1,\tau_2,x_1)}|}\left[|\Delta_{(y,\tau_1,\tau_2,x_1)}|\right]. \tag{4.5.2}$$

Proof:

Using the usual assumptions and procedure we obtain the mean square error of $t'_{2(2)}$ as,

$$MSE\left(t'_{2(2)}\right)\approx E\left[\bar{e}_y-\sum_{i=1}^{2}\alpha_i\,\bar{e}_{\tau_{i(2)}}-\beta_1\,\bar{e}_{x_{1(2)}}\right]^2. \tag{4.5.3}$$

The maximum values of α_1 α_2, and β_1 are,

$$\alpha_1=\frac{\bar{Y}C_y}{P_1C_{t_1}|\Delta_{(\tau_1,\tau_2,x_1)}|}\left[(-1)^{1+1}\left|\Delta_{y.\tau_1}\right|_{(\tau_1,\tau_2,x_1)}\right] \tag{4.5.4}$$

$$\alpha_2=\frac{\bar{Y}C_y}{P_2C_{t_2}|\Delta_{(\tau_1,\tau_2,x_1)}|}\left[(-1)^{2+1}\left|\Delta_{y.\tau_1}\right|_{(\tau_1,\tau_2,x_1)}\right] \tag{4.5.5}$$

and

$$\beta_1=\frac{\bar{Y}C_y}{\bar{X}C_{x_1}|\Delta_{(\tau_1,\tau_2,x_1)}|}\left[(-1)^{3+1}\left|\Delta_{y.x_1}\right|_{(\tau_1,\tau_2,x_1)}\right]. \tag{4.5.6}$$

Substituting the values of α_1, α_2 and β_1 in (4.5.3) and on simplifying we obtain,

$$\text{MSE}\left(t'_{2(2)}\right)\approx\frac{\theta_2\bar{Y}^2C_y^2}{|\Delta_{(\tau_1,\tau_2,x_1)}|}\left[|\Delta_{(y,\tau_1,\tau_2,x_1)}|\right]. \tag{4.4.6}$$

$$\text{MSE}\left(t'_{2(2)}\right)\approx\theta_2\bar{Y}^2C_y^2\left[1-\rho^2_{y(\tau_1,\tau_2,x_1)}\right].$$

The proof is complete.

The estimated mean square error of $t'_{2(2)}$ may be written in a straight forward manner as:

$$\mathrm{MSE}\left(\hat{t}'_{5(2)}\right) \approx \frac{\theta_2 \bar{y}^2 c_y^2}{|\hat{\Delta}_{(\tau_1,\tau_2,x_1)}|}\left[|\hat{\Delta}_{(y,\tau_1,\tau_2,x_1)}|\right]. \tag{4.5.7}$$

Theorem 4.1.3

Let $t'_{3(2)}$ be a mixture regression estimator based on two auxiliary variables and one auxiliary attribute:

$$t'_{6(2)} = \bar{y} + \sum_{i=1}^{2} \beta'_i\left(\bar{X}_i - \bar{x}_{i(2)}\right) + \alpha'_1\left(P_1 - p_{1(2)}\right). \tag{4.6.1}$$

The mean square error of $t'_{3(2)}$ is given by:

$$\mathrm{MSE}\left(t'_{3(2)}\right) \approx \frac{\theta_2 \bar{Y}^2 C_y^2}{|\Delta_{(\tau_1,\tau_2,x_1)}|}\left[|\Delta_{(y,\tau_1,\tau_2,x_1)}|\right]. \tag{4.6.2}$$

Proof:

Using the usual procedure as adopted in previous sections we obtain the mean square error of $t_{3(2)}$ as,

$$MSE\left(t'_{3(2)}\right) \approx E\left[\bar{e}_y - \sum_{i=1}^{2} \beta'_i \bar{e}_{x_{i(2)}} - \alpha' \bar{e}_{\tau_{1(2)}}\right]^2, \tag{4.6.3}$$

The maximum values of α'_1, β'_1 and β'_2 are,

$$\beta'_1 = \frac{\bar{Y} C_y}{\bar{X}_1 C_{x_1} |\Delta_{(x_1,x_2,\tau_1)}|}\left[(-1)^{1+1}\left|\Delta_{y,x_1}\right|_{(x_1,x_2,\tau_1)}\right], \tag{4.6.4}$$

$$\beta'_2 = \frac{\bar{Y} C_y}{\bar{X}_2 C_{x_2} |\Delta_{(x_1,x_2,\tau_1)}|}\left[(-1)^{2+1}\left|\Delta_{y,x_2}\right|_{(x_1,x_2,\tau_1)}\right] \tag{4.6.5}$$

and

$$\alpha'_1 = \frac{\bar{Y} C_y}{P_1 C_{t_1} |\Delta_{(x_1,x_2,\tau_1)}|}\left[(-1)^{3+1}\left|\Delta_{y,\tau_1}\right|_{(x_1,x_2,\tau_1)}\right]. \tag{4.6.6}$$

Substituting the values of α'_1, β'_1 and β'_2 in (5.10.3) and on simplifying we obtain,

$$\mathrm{MSE}\left(t'_{3(2)}\right) \approx \frac{\theta \bar{Y}^2 C_y^2}{|\Delta_{(x_1,x_2,\tau_1)}|}\left[|\Delta_{(y,x_1,x_2,\tau_1)}|\right]. \tag{4.6.7}$$

$$\mathrm{MSE}\left(t'_{3(2)}\right) \approx \theta_2 \bar{Y}^2 C_y^2\left[1 - \rho^2_{y(x_1,x_2\tau_1)}\right].$$

The proof is complete.

The estimated mean square error of $t'_{3(2)}$ may be written in a straight forward manner as:

$$\text{MSE}\left(\hat{t}'_{3(2)}\right) \approx \frac{\theta\bar{y}^2 c_y^2}{|\hat{\Delta}_{(x_1,x_2,\tau_1)}|}\left[|\hat{\Delta}_{(y,x_1,x_2,\tau_1)}|\right]. \sim \quad (4.6.8)$$

$$\text{MSE}\left(t'_{3(2)}\right) \approx \theta_2 \bar{y}^2 c_y^2\left[1- \hat{\rho}^2_{y(x_1,x_2\tau_1)}\right].$$

6. SIMULATION STUDY FOR COMPARISON

The proposed estimators are compared with Waweru et al. (2014) ratio estimators. We obtain the mean square errors and relative efficiency of the proposed estimators by taking a hypothetical population of 2000 units for the study variable Y, the auxiliary variables X_1 and X_2 and auxiliary attributes τ_1 and τ_2. A first phase sample of size n_1=80 and second phase sample of size n_2=40 were selected. 250 simulations were performed.

The percentage relative efficiency has been compute by using the formula:

$$\text{Eff.}\left(t'_{m(r)}\right) = \frac{\text{MSE}\left(t'_{w(r)}\right)}{\text{MSE}\left(t'_{m(r)}\right)} * 100 \text{ ”}$$

The mean square errors and percentage relative efficiencies were computed. It was found out that the proposed estimators were more efficient than Waweru et al. [9] ratio estimators. See Appendix.

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BAYESIAN INFERENCE OF FACTOR EFFECTING STUDENT SATISFACTION AMONG HOSTEL LIVING USING METHOD OF PAIRED COMPARISON

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ABSTRACT

A sensitive issue all over the world is student fulfillment among hostel student. Like other Pakistan University is also facing the same problem since a long time. A variety of researches have accepted several condition and situation that explore various factors that affecting the students' stratification among hostel student. The objective of this research has to identifying the important influencing factors of affecting students' satisfaction among hostel student and rank over them. This research considers the Bayesian inference for the factors affecting the students' satisfaction among hostel student. Bayes' estimators are computed which reflects the overall worth probabilities for each factors. The ranking is done and posterior analytical probabilities are computed for each of the twenty one pairs of factors affecting the students' satisfaction among hostel student for future single comparisons of each pair. Results for analysis are computed in C language and programs coding are designed for seven parameters' inference. Furthermore' to ensure the appropriateness of the model, the goodness of fit criteria is used as used by Aslam (2002).

KEY WORDS

Hostel; Student; Factor.

1. INTRODUCTION

A hostel is referred to a place where people can stay when their house is located far from the educational institution and which is considered necessary to students' needs. Hostel is built with some institutional or formal characteristics and where students have access to the university entertaining facilities (Khozaei, Ayub, Hassan & Khozaei, 2010). Life in a maintainable on-campus hostel makes students more independent as they share room with at most four students at one time. Maintainable on-campus hostel life also makes them smart, active, disciplined, tolerant and entertained with other students and roommates, sharing space and facilities (Khozaei et al., 2010).

1.1 Hostels Location

Rinn (2010) found that students favored living on-campus because of its suitability, including walking distance to lecture halls, not having to wake up too early for a morning class and also the expediency of taking a shower between classes or going back to the hostel to get a forgotten item.

1.2 Hostels Facilities

Hostels include necessary bedroom units with other shared facilities such as bathrooms, toilets, laundry, kitchens, common lounges and cafeterias located either per floor level, per block or for the whole student housing somewhere to live (Amole, 2009).

1.3 Attitude and Satisfaction

Residence fulfillment contributes to university students' overall life satisfaction (Sirgy2007). However, Stauss and Neuhaus (1997) noted that it is impractical for a person to be truly fulfilled with his/her life only by estimating a stay in a hostel.

RESULTS AND DISCUSSION

In this chapter the data is investigated by Bayesian technique. Posterior means using Uniform prior distribution is gained. The posterior predictive probabilities are calculated for future single comparisons of each pair of Factor effecting student satisfaction among hostel living. The model goodness of fit is also obtained. Results are shown in the respective table with interpretation. The data is collected from hostel students of university of Gujrat and Punjab university Gujranwala campus.

'C' language is used for programming of complex integrations of seven factors given in the appendix. The data of paired comparisons for seven factor of student's satisfaction about hostel life is given below in Table 1 as follow:

Factors	Nij	Nji
Sb,sp	18	12
Sb,ne	15	15
Sb,hs	12	18
Sb,hf	14	16
Sb.hm	14	16
Sb,ef	14	16
sp,ne	10	20
sp,hs	12	18
sp,hf	14	16
sp,hm	11	19
sp,ef	13	17
ne,hs	15	15
ne,hf	14	16
ne,Hm	12	18
ne,ef	14	16
hs,hf	16	14
hs,Hm	13	17
hs,ef	15	15
hf,hm	15	15
hf,ef	15	15
Hm,ef	12	18

From Table : 1 ‘Sb’ denote the Student behavior, ‘SP’ denote the student personality, ‘NE’ denote the Negative Effect , ‘HS’ denote the hostel security, ‘HF’ denotes the Hostel facility, ‘EF’ denote the Entertainment facility, and ‘HM’ denote the hostel management. Nij denotes the number of preferences of 1st factor, and Nji denotes the number of preferences for 2nd factor for each pair of factors respectively.

2. POSTERIOR MEAN

Student Behavior	Student Personality	Negative Effect	Hostel Security	Health Facility	Hostel Management	Entertainment Facility
0.12290	0.10952	0.14695	0.15806	0.15093	0.16081	0.15083

This table interprets the result of hostel students of university of Gujrat and Punjab university Gujranwala campus. That probability shows the preferences of students on factor affecting students’ on hostel life. Also display the within preference of the difference factors affecting students’ on hostel life that probability shows the preference of the factor affecting students’ hostel life which one has most (least) probability attain that is the factor has more preferred from the hostel students of university of Gujrat and Punjab University of Gujranwala campus. That factor is greater who has maximum probability to achieve has strong roots because the hostel students of university of Gujrat and Punjab university Gujranwala campus have preferred. In this table result of student behavior is 0.12290 and it is 12.29% out of 100%. Result of student Personality is 0.10952 and it is 10.95% out of 100%. Result of Negative effect is 014695 out of 100% and further so on.

3. RANKING OF FACTOR AFFECTING STUDENTS’ SATISFACTION AMONG HOSTEL LIVING

Factors Affecting Students’ Academic Performance	Expected Probabilities (θ_i)	Rank
Student Behavior	0.12290	(6)
student Personality	0.10952	(7)
Negative effect	0.14695	(5)
Hostel security	0.15806	(2)
Health facility	0.15093	(3)
Hostel management	0.16081	(1)
Entertainment facility	0.15083	(4)

In this table Hostel Management have height probability so give him rank 1 hostel security have less than management probability so give him rank 2 according to hostel students. This table shows the ranking of the factor effecting student satisfaction among hostel living. The hostel students of university of Gujrat and University of Punjab Gujranwala campus more preferred the Hostel management as an affecting factor that has the maximum probability of the preference that probability is 0.16081so we give the first

rank order of the Hostel management and the second rank goes to the Hostel security the preferences probability is 0.15806 that probability is less than these Hostel management so give the second rank and the further third, fourth, fifth. Sixth and seventh order is given to the according Student Behavior, student Personality, Negative effect, Hostel security, Health facility, Hostel management and Entertainment facility. We also know that has less probability of the preferences of the first one so we gave the less order or rank to the first one. In this table we can see the more preferred affecting factor of students' academic performance is Hostel management and have a strong position and that less preferred effecting factor of satisfaction among hostel living is student Personality most hostel students of University of Gujrat and Punjab university Gujranwala campus are not preferred that factor have a weak position. Expected probabilities of the preferences is a long term probabilities we know that the $\sum\theta_i = 1$.

4. POSTERIOR PREDICTIVE PROBABILITIES FOR FACTOR EFFECTING STUDENT SATISFACTION AMONG HOSTEL LIVING

P(ij)	Estimate	P(ji)=1-P(ij)	Estimate
P(12)	0.574426	P(21)	0.425574
P(13)	0.481356	P(31)	0.518644
P(14)	0.462561	P(41)	0.537439
P(15)	0.476655	P(51)	0.523345
P(16)	0.453221	P(61)	0.546779
P(17)	0.453221	P(71)	0.546779
P(23)	0.407451	P(32)	0.592549
P(24)	0.389376	P(42)	0.610624
P(25)	0.402912	P(52)	0.597088
P(26)	0.380467	P(62)	0.619533
P(27)	0.380467	P(72)	0.619533
P(34)	0.481153	P(43)	0.518847
P(35)	0.495291	P(53)	0.504709
P(36)	0.471768	P(63)	0.528232
P(37)	0.471768	P(73)	0.528232
P(45)	0.514143	P(54)	0.485857
P(46)	0.490596	P(64)	0.509404
P(47)	0.490596	P(74)	0.509404
P(56)	0.476466	P(65)	0.523534
P(57)	0.476466	P(75)	0.523534
P(67)	0.5	P(76)	0.5

From the above table we also see that in a single comparison the first factor is Student Behavior having 0.574426 probabilities i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 57.44% out of 100%. Student Personality has the probability 0.425574 i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 42.55%. From this single pair of factors affecting the students' satisfaction among hostel we can see Student Behavior has greater preference than the Student Personality. In second pair factors affecting students' satisfaction among hostel student Behavior has 0.481356 probabilities i.e. hostel students of university of Gujrat and university of Punjab of preference of this factor is 48.13% out of 100%. Negative effect has the probability 0.462561 i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 46.25% and in this pair of factors affecting students' satisfaction among hostel student behavior have greater preference than the Hostel management. From the third pair of factors affecting the students' satisfaction among hostel student behavior has 0.462561 probability i.e. students of university of Gujrat preference of this factor is 46.25% out of 100%. Entrainment facility has the probability 0.546779 an i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 54.67% and in this pair of factors affecting students' satisfaction among hostel student personality have greater preference than the Entertainment facility .From the four pair of factors affecting the students' satisfaction among hostel student personality has 0.592549 probability i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 59.29% out of 100%. Hostel management has the probability 0.5233345 i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 52.33% and in this pair of factors affecting students' satisfaction among hostel student personality have greater preference than the Entertainment facility. From the five pair of factors affecting the students' satisfaction among hostel student behavior has 0.5433 probability i.e. students of university of Gujrat preference of this factor is 54.33% out of 100%. Entertainment facility has the probability 0.55533 an i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 55.533% and in this pair of factors affecting students' satisfaction among hostel student. Student behavior has greater preference than the Health Facility. From the next pair of factors affecting the students' satisfaction among hostel student, Student behavior has 0.5432 probabilities i.e. hostel students of university of Gujrat and university of Punjab preference of this factor is 54.32% out of 100% and so on.

(Observed and Expected Number of Preferences of Factor for hostel Students)

Xij	$\widehat{x_{ij}}$	Xji	$\widehat{x_{ji}}$
18	15.86352	12	14.13648
15	13.66315	15	16.33685
12	13.12286	18	16.87714
14	13.46456	16	16.53544
14	12.99566	16	17.00434
14	13.46948	16	16.53052
10	12.17565	20	16.33685
12	11.69419	18	16.87714
14	11.99869	16	16.53544
11	11.58084	19	17.00434
13	12.00307	17	16.53052
15	15.69085	15	16.87714
14	16.0994	16	16.53544
12	15.53875	18	17.00434
14	16.10529	16	16.53052
16	17.31658	14	16.53544
13	16.71355	17	17.00434
15	17.32291	15	16.53052
15	15.95961	15	17.00434
15	16.54148	15	16.53052
12	17.6243	18	17.643

The null and alternative hypotheses are as follow;

H_0: The model is good fit of the data
H_1: The model does not fit the data

We calculate the expected frequencies by the following formula

$\widehat{x_{ij}} = r_{ij}(\omega_{ij})$

For all i<j

Appendix A (Table A5)

The level of significance is 5%

The test statistic follows the Chi-Square distribution as

$$x^2=\sum_{i<j=1}^{m}\left\{\frac{(x_{ij}-\widehat{x_{ij}})2}{\widehat{x_{ij}}}+\frac{(x_{ji}-\widehat{x_{ji}})2}{\widehat{x_{ji}}}\right\}$$

We follow the consideration by Aslam (2002) about the degree of freedom in which he considered the choice of degree of freedom by this formula $d.f$ = m (m-2) =48.

In table x_{ij} denoted the observed number of preference of i^{th} university compared with j^{th} University. Similarly x_{ji} denoted the observed number of preference for j^{th} university compared with i^{th} University. The term $\widehat{x_{ij}}$ denotes the expected number of preference for i^{th} university compared with jth University and $\widehat{x_{Jt}}$ denotes the expected number of preference for jth university the Chi-Square test statistic value as

x^2_{cal}=9.07385539

The table value is $x^2_{(0.05,35)}$=49.4579

Since the x^2_{cal} doesn't not fall in the criteria region that is

$x^2_{cal} \ngeq x^2_{(0.05,35)}$

So as a conclusion we have no evidence to reject the null hypothesis. We conclude that the model is good fit the data.

4. CONCLUSION

The Hostel students of University of Gujrat most preferred the Hostel Management factor that has the highest worth probability, and the second rank goes to the Hostel Security that probability is less than one so give the second rank and the future third, fourth, fifth, sixth and seventh order is given to according Health facility, Entertainment facility, Negative effect, Student Behavior and student Personality. The most preferred factor of the students' Satisfaction about Hostel living is Hostel Management most Hostel students of University of Gujrat preferred this factor and have a strong influence on the factors affecting students' Satisfaction about Hostel living and that less preferred that factor and have a weak influence on the factor affecting students' Satisfaction about Hostel living is Student Personality most students of University of Gujrat are not preferred that factor and have a weak influence on affecting students' Satisfaction about Hostel living.

5. RECOMMENDATION

- In this paper paired comparisons methodology is considered. It can be further generalized to the multiple comparisons experimentations.
- In our study we analyzed the preferences of factor effecting student satisfaction among hostel living for which the opinions were collected from the hostel students of university of Gujrat and hostel student of Punjab university of Gujranwala campus. In future research may be conduct from faculty.
- Ranking of factor effecting student satisfaction among hostel living within Pakistan students is done and can be attained for different countries facing that kind of problem.

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AN INVESTIGATION OF MENTAL HEALTH ON ACADEMIC SUCCESS OF SECONDARY SCHOOL STUDENTS

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ABSTRACT

This study is done to investigate the impact of mental health of secondary school students and its impact on academic success of those students. Researcher conducted this study, to see how strongly mental health influence the success of secondary school students. The basic purpose of this study was to find the comparison between mental health of males and female's student of both sectors (private & public). School students the study was descriptive in nature. The questionnaire consisted of 29 items and administered on 106 secondary school students in order to know their judge their mental health. A total no. of 106 questionnaires was used for analyzing data. Sample was collected from 10 different secondary schools of Lahore. Sample of the students was taken by using convenient sampling technique. In which 62 were male and 44 were female students. SPSS was used to analyze the data by using mean score to see the prevalence of responses t-test and ANOVA were used to measure the difference among the mental health of male and female students, after checking the performance within the groups and between the groups, within the groups students shows better result and males students mental health is better than females students.

INTRODUCTION

As a developing country, Pakistan need good education to meet the challenges today's world. Education is imparted at school. A school is an organization established with specific aims, to promoting different level of skills and knowledge and developing certain attitudes among school organizational member. We spend a good deal of time class 1 to 10 included the age of children 5-16 years, at school. What we learn is going to affect over mental and physical health & dealing with people and handling the problems in life. C. Muse-Burke J.L (2010). Education is the process of learning new knowledge, ideas and skills for adjustment of students in society. Education is future oriented. It is about mental health development and physical growth. Thus, the accepts of thinking we tend to focus upon is academic records. As, we have stressed, much thinking is common, especially at secondary level. Education take us into conscious world. It involves activities that are intended to stimulate thinking, to foster learning of the mental health is good then learning is improved Tracey (March 2016).

In this study we analyze the connection between mental health and detailed measures of academic success of secondary school students.

Human believed that, Healthy mind is healthy soul. For this purpose the mental health of individuals is very important. As the studies show that in the modern economy, school education has become an increasingly important component of polishing the human (Ezra Golberstein, 1990). When individuals have better mental health then they can substantially earn higher (Jaeger & Page, 1996) (Kane & Rouse, 1995) thus better living is dependent upon better good mental health (Cutler & Lleras-Muney, 2006); (Ross & Murkowski, 1999). Previous studies have considered a range of factors and academic and social involvement that affect remaining in and completing school (Tinto, 1998).

Mental disorders frequently have first beginning shortly before or during the typical school age range (15&16), yet relatively little is known about the link between mental health and academic success in school (Kessler et al., 2005). Understanding this connection could be valuable due to the many ways in which secondary school settings can reach young people. We examine how symptoms of mental disorders predict academic outcomes during secondary school using unique data collected at a large, academically competitive, public schools. In this research, we focus on the most common types of mental disorders among adolescent: depression, anxiety disorders, and peer relationship. We link the survey data on mental health to academic measures collected from the different schools.

RESEARCH QUESTIONS

- To assess the mental health of male and female secondary school students.
- To assess whether mental health has an impact upon the academic success of secondary school students.

METHODOLOGY

The study was a survey type study/ research. After collecting data from secondary student's researcher analyze data by using SPSS. This study yield measurable facts and statistics. The measurable facts were acquired through questioners. Mean and standard deviation of each statement was calculated. For measuring the difference between mental health of public and private, Male and female students of secondary school T-TEST and ANOVA were used. Analysis of variance was applied to measure the difference between mentality of public and private, male and female students of Lahore.

DISCUSSION

The purpose of this study was to evaluate the mental Health at Secondary Level. The basic aim of the research was to know the comparison of mental health of males and females at public and private sector. Nordquist (2016) found that good mental health can easily take decisions easily even in difficult circumstances they seems much confident than mentally disturb students. "WHO" explains that especially in developing countries, mental health services are much underfunded. Most resources are channeled into treating and caring for mentally ill patients, rather than on any combined mental health system.

CONCLUSION

The conclusion of this study is drawn on the basis of the findings of the research on mental health of secondary school students. Researcher concludes that male's mental health was better result instead of female students.

- It is observed that Majority students are confident during their study tenure.
- They said that sometimes they have difficulty to solve any problem but mostly they said that they can solve their problems own self.
- Males and female mental health shows directional hypothesis. because male's mental health is higher than females.
- Mostly students said that they are not interested in co-operating with community work.
- Mostly students have negative remarks about their friends and family. They said that they never hale respect from them.

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AN EFFICIENT MEAN TIME APPROACH FOR DYNAMIC STOCHASTIC ACTIVITY NETWORK USING MONTE CARLO SIMULATION

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ABSTRACT

Analytical methods are excellent for the solution of many real world problems. But time and again such situations are encountered with when they are humble to deliver any tangible results. Such situations are usually addressed by the computational approaches. State-of-the-art Monte Carlo simulation approach is an offshoot of such approaches. On the other hand, stochastic activity networks are extensively being used to model and analyze the behavior of many real time projects. Real time systems are highly costly and it's always better to know its characteristics a priori before building and launching them. Some real time projects are so critical that their failure can claim a huge financial loss leading to many deaths in worst cases, the crash of a plane, for instance. In other disciplines like software engineering, various other techniques have been used for the analysis of the completion time of a project, but they are plagued with problems. Monte Carlo simulation technique has already been applied on stochastic activity networks to find the mean time but with a constraint of fixed network. One has to perform a lot of work followed by doing extensive mathematical calculation like developing node-incidence matrix. We are extending the input functionality of the already developed algorithm which will cater the network of any arbitrary nodes and edges at the execution time. In other words, the existing framework works only on some fixed static network. Our work will tailor the algorithm in such a way that it would be able to tackle the dynamic network of any arbitrary number of nodes and edges. Moreover, user will be asked to provide the minimum and maximum time limits an activity can take. Through random number generation, the time will be allocated to the given edge. So, our work will find the a priori statistic of mean time of the completion of any stochastic activity network with arbitrary number of nodes and edges. This will help a lot in saving the precious time and money. Further, since humans are intrinsically error prone, our framework will venture to automate the input functionality thus minimizing the chances of any potential error.

KEYWORDS

Modeling, Monte Carlo simulation, meantime, random numbers, a priori, stochastic activity networks, recursive algorithm.

1. INTRODUCTION

The discipline of mathematics is replete with the plethora of analytical techniques for the solution of many real world problems (Chapra & Canale, 2015). But frequently such scenarios arise in which these techniques are not sufficient. To gracefully cope with those problems, we have to resort to the computational approaches, one of them being the approach of Monte Carlo simulation (Leemis & Park, 2004). Traditionally, computational approaches are viewed as complementary to their analytical counterparts. The values of physical quantities are usually obtained either through measurement or by the help of different formulae. But sometimes a deadlock ensues due to the lack of both of these things. Monte Carlo simulation approach is a very smart and interesting technique to rescue us from such grim scenarios. Before embarking upon the crux of our paper, we would like to shed some light on the philosophy and working of Monte Carlo simulation approach. Monte Carlo simulation is a four-pronged strategy comprising of the following steps:

- To define the domain of possible input values
- To randomly generate the inputs in that domain
- To do a deterministic calculation by coming up with some suitable formula or equation
- To analyze or aggregate our results

By complying with the above-mentioned steps, one can find the value of the required physical quantity. Monte Carlo simulation is usually applied in the randomized algorithms (Cormen, Leiserson, & Rivest, 2001). Randomized algorithms are those which incorporate at least one variable which is random in character. In these algorithms, random numbers are used. These random numbers are not random per se (Park & Miller, 1988). Rather, they are pseudo random numbers. In the deep hard core of their implementation, they are deterministic. Monte Carlo simulation requires these random numbers for their implementation. Monte Carlo simulation is a vast field of computational algorithms that require repeatedly generated random numbers to get the required numerical results. In many situations, it is almost impossible to come up with a well-defined closed-form expression or it is not viable to apply some algorithm which is deterministic in character. Normally, we resort to the Monte Carlo simulation to handle the situation. These approaches are also used in those phenomena in which there is a tremendous amount of uncertainty, calculating the risk in the businesses, for example. Monte Carlo simulation approach has been successfully applied in the plethora of problems like economics (Boyle, 1977) and finance (Jäckel, 2002) . The use of computers has opened the new vistas of approaching the ancient problems. For instance, in (Avigad, 2010), the author has discussed the different ways that how computers can be used in the scientific and mathematical inquiry.

Project management and production management are two very important fields for handling projects. Project management is such a field of study which is meant for the management and analysis of the projects (Leemis & Park, 2004). Project management analyzes only those projects which typically occur only one time. In sharp contrast to that, production management is related to producing items which recur. There is a leniency in production management in the sense that their failures are forgivable whereas, there is no flexibility of failure in project management. Projects which fail cause a lot of

loss. Normally, all the projects are broken down into different activities. In the field of project management, the sequencing of these activities is a very important task (Homem--de--Mello, 2007). For example, when a building is constructed, first of all foundation is built then the seats are installed. One has to develop a precedence relationship among the different activities. Of course, some activities can't be started unless all other activities have not been completed. Different networks are designed to visually explain the precedence relationship. A network is a mathematical model consisting of nodes and arcs. Arcs denote the different activities and the nodes are for the different delays unless all other dependent activities have not been completed. Figure 1 denotes a network with the minimum and maximum duration times.

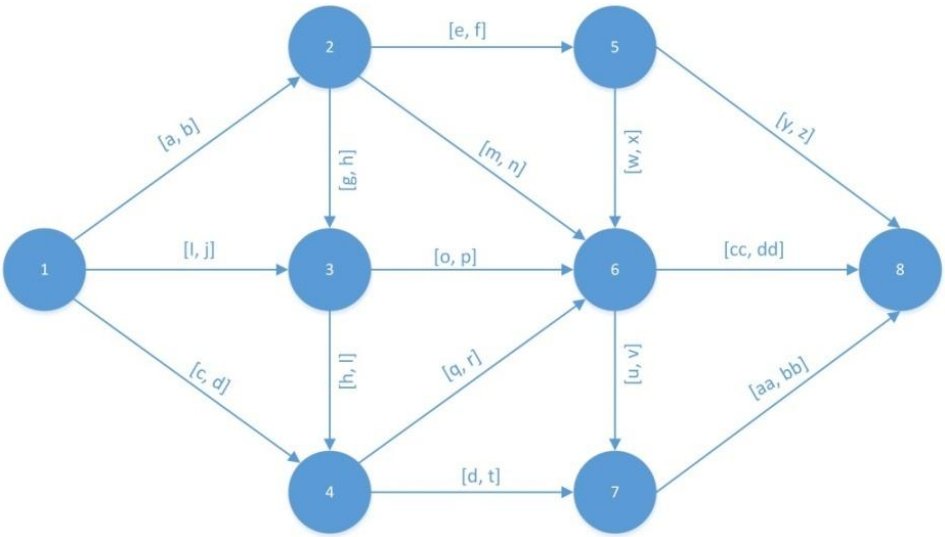

Figure 1: A Stochastic Activity Network with Minimum and Maximum Duration Times

Nodes and activities refer to the important points in the life of a project. Nodes refer to the maximum completion time of all the prior activities and the starting time of all the exiting activities, whereas the arcs refer to the durations of the different activities. The figure 1 above denotes a stochastic activity network. The weights of the edges are for the time to complete the network. Now the main theme of our paper is to randomly generate all possible values of these edges and to calculate the mean time to complete the entire project. Now, we require some suitable data structure to model the above stochastic activity network. The matrix is one of the best candidates for this purpose. Below in the equation (1) is the node incidence matrix which models our network. The number of rows is exactly equal to the number of nodes of the given network. Every column corresponds to one edge of the network. There is exactly one 1 and one -1. 1 denotes the starting or source node and -1 refers to the ending or destination node of the network. Zero is inserted in all the other irrelevant entries.

$$N = \begin{bmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & -1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & -1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0 & -1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & -1 & 0 & -1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & -1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & -1 & -1 \end{bmatrix} \quad \text{---(1)}$$

The analysis of those projects in which the activity durations are deterministic is very simple. But in many real world problems, we have a different scenario, i.e., the durations of different activities is not deterministic, rather they are stochastic or probabilistic in character. Here in our paper, we have generated the random numbers for the activity durations. Sometimes, projects disregarding the deadlines have to incur different penalties. In the same fashion, they are given different bonuses if they get completed before the deadlines. So we are justified in saying that the correct analysis of a project bears immense repercussions both financially and for the goodwill of the company.

Normally there are three stages of any simulation work (Leemis & Park, 2004). On the first stage, we develop the philosophical or conceptual understanding of the problem we are working on. Once it is refined, then we come up with the underpinning mathematical formulae and notations and if the situation dictates, we also have to develop some algorithms and lastly we require some number crunching gadgetry and of course, our ubiquitous computer system is there for this purpose.

2. LITERATURE REVIEW

The algorithms to calculate the distribution of the longest path length of a stochastic activity network with continuous activity durations have already developed in (Jing-Quan Li, 2006). They not only calculated the mean time for the completion of the stochastic activity networks but they also calculated the probability for each path to be the critical path. They used three techniques for this purpose, i.e., recursive algorithms for Monte Carlo simulation, series-parallel reduction and lastly the conditioning. Further, they illustrated the different examples for the practical effectiveness and utilization of the techniques under discussion.

Program Evaluation and Review Technique (PERT) was developed in the 1950's (Homem--de--Mello, 2007). U.S govt. applied PERT for the sake of planning and later on scheduling the Polaris Ballistic Missile. In this way, PERT began to be used as a framework for planning and scheduling different projects. This PERT is being extensively used in defense and industry and it is helping a lot for planning different projects. The underlying philosophy behind its usage is that a task can be decomposed into a number of activities. These activities depend on some other activities. A graph is the most suited structure to represent PERT. For example, node is used to represent different activities and the edges represent the completion time. The project starts from some initial node and, of course, it ends at some terminal node. All these nodes and edges are collectively dubbed as activity network. If activity times are fixed, the duration of the completion time of the project is determined by the longest path of the network. But, the

moment, we don't know the fixed duration times for the completion of activities, we have to resort towards the probabilistic analysis of the projects. And this has already been done but with a fixed network in (Jing-Quan Li, 2006).

In our work, we have used the random variables for the realization of our purpose. However, a probability programming language named as APPL (Glen, Evans, & Leemis, 2001) is available. This language can be used to manipulate the random variables in different tasks. In this package, different tasks can be performed by using the different features which are available in this package. In probability theory, a large number of axioms and theorems exist which can be used for the solution of a large number of problems. In static simulation models, different techniques have already been applied (Homem--de--Mello, 2007). They discussed the problem to estimate the probabilities of those events which are very rare in the context of static simulation models. Lastly, they also discussed the algorithms which can be implemented.

In (Sargent, 2005), they discussed the verification and validation of the simulation models. This is not sufficient to develop the simulation models. Once, they have been developed, both verification and validation is very essential. These both terms connote very interesting concepts regarding the projects. Verification is actually to investigate that whether what we envisioned in our project, whether that purpose has been realized or not. As for as the validation is concerned, it tries to probe whether we have developed the right model or not. Both these requirements are quintessential for the successful execution of the different projects.

The importance and utility of the random number generators have been extensively discussed in (Park & Miller, 1988). The good generation of random numbers lies at the heart of the philosophy of Monte Carlo simulation. If the random numbers are not really random per se, then the departure from the correct results is sure. Although, great strides have been made in the generation of correct random numbers, but at the heart of their core, they are actually deterministic in character. However, different statistical tests have been applied to inspect their efficacy. Lehmer gave a very satisfactory algorithm for the generation of random numbers (Park & Miller, 1988). This algorithm remained robust in the different statistical tests which were applied on this algorithm.

In (Wilson & Goldsman, 2001), they have discussed at length the important work of Alan Pritsker. He made important contributions in joining the theory and practice of computer simulation. He was much interested in bringing the latest developments in science and engineering to the field of modeling and simulation.

3. SIMULATION

Simulation is the state of the art technique. It is extensively being used in virtually every scientific and engineering field. Stochastic activity networks are extensively being used to model and analyze the behavior of different projects. The problem with the traditional techniques of critical path method is that they always work on paths of some fixed weight edges. The existing work gives a solution of this problem but the algorithm used by them works only on some fixed network. Moreover, there is no upper and lower limit of the time consumed given by them. Our framework tailors the existing algorithm in two ways, i.e., firstly, one can give any number of nodes and edges, and secondly, both lower and upper

limits of the time consumed can be given to each edge. These lower and upper limits can be given by the experience and intuition of the managers. Once these limits are given, our framework calculates some random number between these two limits. Then, the recursive algorithm calculates the mean time for the completion of some project. Of course, this single execution is not sufficient. It may have some intrinsic tilt towards some specific result. Now this algorithm was run 1000 times to get the most accurate result.

The algorithm is given an input of n nodes and there may be a maximum of $n\,(n-1)\,/\,2$ edges. The number of edges will be a subset of the given number.

Figure 2 denotes the network whose input was given to the program written in C language. The given network consists of 15 nodes and 24 edges. Each of the edge contains a pair [x, y] where x represents the lower limit of the time and y represents an upper limit. Our algorithm calculates some random number between these two limits by using the following algebraic expression:

$$x + \text{rand}(.)\text{mod}(y - x) + 1$$

where the built-in function of C library rand (.) gives any number between 0 and 32768 and mod is the remainder operator.

In the network given in figure 2, one can see the pair of integers for every edge. For instance, the pair [9, 12] in the edge from 1 to 2 represents the minimum and the maximum time. Below is the algebraic expression

Weight[i][j].sTime + rand() mod(Weight[i][j].eTime - Weight[i][j].sTime +1)

Here the function mod gives the remainder when the number generated by rand() is divided by Weight[i][j].eTime - Weight[i][j].sTime +1.

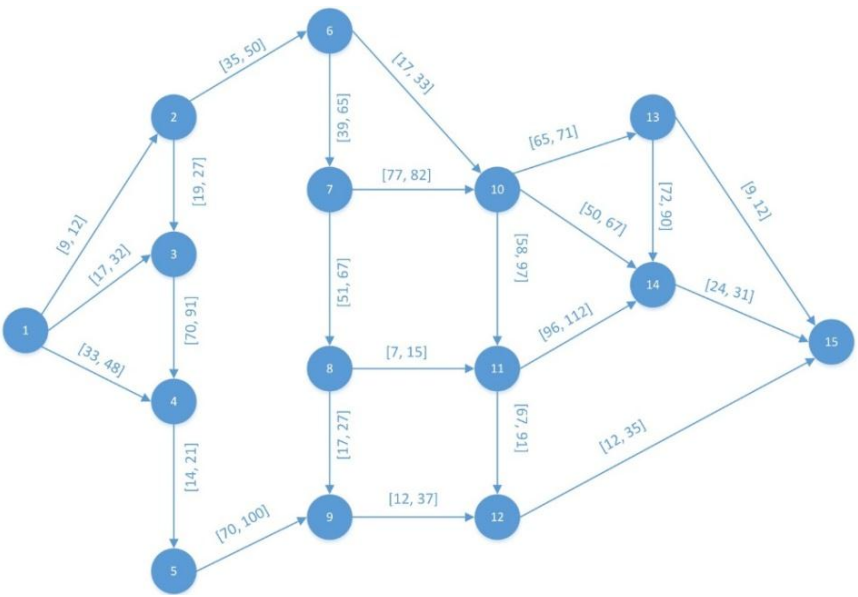

Figure 2: Stochastic Activity Network

Following is the corresponding node incidence matrix which models the given network:

$$N = \begin{bmatrix}
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & -1 & 0 & -1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & -1 & 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & -1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & -1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & -1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & -1 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & -1 & 0 & -1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & -1 & -1
\end{bmatrix} \quad \text{---(2)}$$

Following is the recursive algorithm that calculates the mean time for the completion of all the activities:

MeanTime(integer NodeNumber)

1. $k = 1$; // this is the index for the columns of node-incidence matrix
2. $l = 0$; // this is the index for the predecessors to any node j
3. tMax = 0; // this is the initialization of the longest time of all paths to node j
4. while (l < numPredecessor(NodeNumber))
5. if (N[j, k] == -1)
6. $i = 1$;
7. while (N[i, k] $\neq$ 1)
8. i++;
9. t = MeanTime (i) + Weight[i][j].sTime + rand() mod(Weight[i][j].eTime - Weight[i][j].sTime +1);
10. if (t >= tMax)
11. tMax = t;
12. l++;
13. k++;
14. return tMax;

4. RESULTS

After simulating the program 1000 times, we got the results shown in the table 1 below. The more one simulates the program, the more better and refined results will come out. This is the recurrent theme of the Monte Carlo simulation. The minimum taken by our network during the simulation is 338 days whereas the maximum time taken by the network is 449 days. The mean time calculated by the recursive algorithm is 395.42 days. This time is the result of the execution of the simulation for 1000 times as stated earlier.

5. CONCLUSION AND FUTURE DIRECTIONS

In this paper, we used the Monte Carlo simulation for the calculation of the mean time of the completion of a project. Although, the reported simulation has already been successfully applied but it was plagued with the problem of some fixed network. The main contribution of our paper is to tailor the recursive algorithm in such a way that it could cope with network of any arbitrary size. In the previous work, we had to do the drudgery of mathematical calculations, but through our contribution, it will remain no longer. Our work can be extended if the probability of each path to be critical is also calculated.

Table 1
Simulation Results

Sim #	Mean Time	Sim #	Mean Time	Sim #	Mean Time	Sim #	Mean Time	Sim #	Mean Time	Sim #	Mean Time
1	356.21	201	389.27	401	383.23	601	386.12	801	402.87	981	383.06
2	421.80	202	402.56	402	407.21	602	390.12	802	392.19	982	394.75
3	401.23	203	409.31	403	390.72	603	412.43	803	400.23	983	393.21
4	360.89	204	377.89	404	399.67	604	400.21	804	395.18	984	392.36
5	389.32	205	398.09	405	402.12	605	387.89	805	399.72	985	395.83
6	400.62	206	390.23	406	410.86	606	397.12	806	398.37	986	390.19
7	370.88	207	410.65	407	400.56	607	401.28	807	410.53	987	395.27
8	405.62	208	412.34	408	398.21	608	404.18	808	403.23	988	394.70
9	350.22	209	399.00	409	385.87	609	397.16	809	388.39	989	393.39
10	407.45	210	415.62	410	402.17	610	404.28	810	399.20	990	395.12
11	351.23	211	398.27	411	398.40	611	397.81	811	402.29	991	396.92
12	388.87	212	378.90	412	408.17	612	401.34	812	403.29	992	393.82
13	412.39	213	387.12	413	389.42	613	387.67	813	395.32	993	394.76
14	387.29	214	402.78	414	409.23	614	408.27	814	378.62	994	395.24
15	423.80	215	397.12	415	378.21	615	383.12	815	399.90	995	393.21
16	378.76	216	406.22	416	390.49	616	390.12	816	401.00	996	393.23
17	402.16	217	387.25	417	399.17	617	387.22	817	402.64	997	396.22
18	398.51	218	399.12	418	403.42	618	389.08	818	398.29	998	396.87
19	340.62	219	423.21	419	385.12	619	402.18	819	393.21	999	394.12
20	378.21	220	412.34	420	402.38	620	399.09	820	402.12	1000	395.42

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REMOTE HOME TEMPERATURE CONTROL USING IOT AND STOCHASTIC PROCESS

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ABSTRACT

A luxurious, peaceful and comfortable home is the dream of every human being. Humans struggle a lot to make their homes comfortable and more manageable. In doing so, their prime priority is to set the home temperature that is more suitable for comfortable living. Home temperature mostly depends upon the outside weather conditions. Therefore, setting the suitable living temperature for the home each time according to the weather conditions outside can be a hectic job for the home owner. On top of all, once the temperature is set than owner will have to wait until the home temperature changes from current temperature to desired one. This thing not only leads towards the uncomfortable living environment plus it also adds some undesirable effects on the owner's mood.

To overcome all these hurdles an algorithm was designed and implemented. We managed these devices from anywhere using our cellphone and saved the energy consumed by these devices.

By means of Information Technology and Statistical Approaches like IoT (Internet of Things) and Statistical Stochastic Process (Markov Chain) respectively, we managed the home temperature efficiently and overcome expected problems. Temperature sensors were used to sense the outside temperature conditions. Stochastic Processes controller based on Markov Chain were designed to adjustment the home temperature w.r.t. outside temperature conditions.

1. INTRODUCTION

There is no place like home in this world. Everybody struggles to make their home more decorative, manageable, and comfortable. For that purpose they install different electronic devices in their homes. These electronic devices can make the home look well decorated and very comfortable. The most important device is the air-conditioner. Air conditioners available today are used to control the temperature of the home according to the single temperature value set by the owner/operator. Unfortunately, this thing seems unrealistic and it is not understandable by most of owners. Because it is really difficult for the owner to tell the exact temperature value that should suite his/her mood and comfort level.

So, there should be a human friendly, easy to use, and personalized way for the home owner to manage the temperature of his/her home according to his/her mood. On top of all, air conditioners are heavy duty electronic devices and the cost of electricity is too

high now a day. Therefore there should also be a way to save the energy consumed by these devices.

So, by using fuzzy logic a solution will be provided to the home owner that would empower him to set the temperature of home by using easy to use and understandable temperature benchmarks like: cold, warm, hot, very hot, cold, and very cold. Then, by the use of IoT technology and Statistical Stochastic Process, the owner will be able to control the home temperature by using his smart phone anywhere in the world.

2. RELATED WORK

The proposed research is based on two most widely used technologies those are Fuzzy Logic and IoT. Fuzzy logic is an approach to computing based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based (“Fuzzy logic - Wikipedia,” 2016). A lot of work has done on fuzzy logic. Fuzzy logic is designed and implemented in microcontroller without using any special software tool (Hanamane et al., 2006). Different microprocessor based circuits can be used to implement the Fuzzy Logic like 8085 based circuit (Hanamane et al., 2006). The reason for using fuzzy logic in control applications stems from the idea of modeling uncertainties in the knowledge of a system’s behavior through fuzzy sets and rules that are vaguely or ambiguously specified (Aguilar et al., 2009). Fuzzy logic can also be implemented by using Java language then it can be used in all the Java supported hardware and microcontrollers (“jFuzzyLogic,” 2016). Arduino is Java based open-source electronics hardware platform that supports the low cost and easy to use implementation (Kumar et al., 2016). Arduino and Java technology can be used together to create a low cost Fuzzy Logic controller with the support of IoT (He, 2016).

The IoT links objects to the Internet, enabling data and insights never available before (“Internet of Things (IoT) - Cisco,” 2016). Internet of Things (IoT) is when the Internet and networks expand to places such as manufacturing floors, energy grids, healthcare facilities, and transportation (“Internet of Things (IoT) - Cisco,” 2016). By the use of IoT and Arduino the home owner would be able to check the temperature and would be able to manage the temperature of home regardless of time and place (Ra et al., 2016). The main factor IoT concept is the integration of different technologies. The IoT is empowered by the hottest developments in RFID, smart sensors, communication technologies, and Internet protocols (Shah, 2016).

According to Hanamane, 2006 a hardware was developed which is used to control temperature through fuzzy logic by ON-time of the heater through PPI 8255. The actual temperature is read by the thermistor and it is compared with the temperature set by the user. Microprocessor based control circuit is used to implement fuzzy controller.

Hasim, 2012 designed a fuzzy logic controller to control water bath temperature, it will control temperature of water in real time, that means that the temperature of the water will be controlled while bathing. It uses the MATLAB Fuzzy Logic Toolbox to get the goal achieved. For designing of a fuzzy controller the 4x4 matrix rule is followed.

Yu, 2010 proposed a fuzzy rule based system that successfully incorporates the flexibility of human decision making by means of the use of fuzzy set theory using

algorithms and different linear programming techniques. Plus, an evolvable hardware is also designed for making fuzzy controller more capable. The basic property of the evolvable hardware is to dynamically change its architecture and behavior according to the environment in which it is running.

To implement the automatic temperature setting in Textile Air Conditioning and monitoring system on the basis of IoT, three subsystems were composed by H. Chen, 2015. These subsystems were: remote monitoring subsystem, database subsystem, and local monitoring subsystem. The system uses GPRS communication and computer networks to control the data both remotely and locally. The humidity and temperature control has been done by the use of Fuzzy Controller.

Temperature control can be implemented in Green House by using adaptive method based on fuzzy logic control (L. Chen et al, 2013). To get the greenhouse the exact and desired temperature the mathematic model is constructed first. After that the MATLAB is used with Simulink tools to implement the fuzzy logic controller. L. Chen, 2013 has programmed the fuzzy controller by using the Visual Basic to control the greenhouse.

By the use of Arduino UNO a very low cost soil moisture check sensor can be designed (Kumar et al., 2016). It is really difficult for the farmers to purchase the devices to check the moisture level in the soil. The right moisture level in the soil guarantees the higher crop yields. In case of inappropriate moisture level the system will guide the farmer to give or stop the water supply to the crops.

A lot of work has been done on food monitoring during cooking and packing. But, for monitoring the quality of the food while transporting the food to different locations/destinations there is a need for some improvement in the standards. Maksimović, Vujović et al., 2015 has ensured the monitoring of the food safety and traceability while transportation of the food from one place to another. This is a low cost IoT solution that helps the managers to have an eye on the food even when it is being transported to some other location all the way.

IoT is being used most widely in home automation and in creating smart buildings. Different protocols are used in home automation, like: ZigBee, Wi-Fi, and Bluetooth. The problem is that the existing home equipment often require network communication enabled power plugs or devices. These devices use some unique communication protocol defined by the company. Therefore these devices are not able to communicate with other devices. In Ra et al., 2016, has solved this problem by using Smart Home Automation Framework (SHAF). Here Ruspberry Pi and ZigBee is used as the smart home server. Client is the android and windows smartphone.

In IoT the network and sensor performance is a really very critical thing. Network components and sensors works as the integral part of IoT. By using the soft computing technologies like Fuzzy Logic the performance of network and sensors can be improved a lot. Maksimović at al., 2015 used the soft computing technologies for the detection and monitoring of the residential based fire is being done very efficiently.

Internet of things defines the worldwide network of smart objects those can communicate with each other on the computer network and get the information on the basis of the sensors attached with them. This information can be accessed anywhere in

the world by the use of computer networks. These objects keeps on interacting with each other and it requires more power. The more these sensors are efficient the less power they will consume. Choice of the algorithms to program these objects also plays an important role in power/energy consumption. Vujovic et al., 2015 designed a prototype sensor node with fuzzy logic for decision making process is built and tested in real time.

Singhala et al., 2014 proposed a room temperature controller designed by using fuzzy logic controller. Here the first job of temperature control is to set the temperature up to the required temperature and second job of temperature control is to insure that the temperate is according to the desired value. The desired output is get by using the feedback controller. MATLAB is used here to design the Fuzzy Controller.

The short fuzzy logic tutorial is designed by Yildiz, 2010 that helps the starters to design the fuzzy logic controller. It explains that the crisp inputs are taken and then it is converted to the fuzzy set using the fuzzy linguistic variables, terms and member functions. This thing is called fuzzification (Yildiz, 2010). Than on the basis of rules inference is made. In the end by the use of defuzzification process the fuzzy output is mapped to the crisp output. It also identifies the way to control the temperature of the air conditioner.

Fuzzy logic technique is used to design the solution for multi-parameter and non-linear control model (Isizoh et al., 2012). It makes the solutions efficient than the traditional control design techniques. Here microcontroller, temperature sensor, and the operational amplifier, analogue to digital converter, display and output interface circuit are used to design the fuzzy logic based temperature control system.

Yao et al., 2015 stated that the buildings in United States consume 74% of electricity of the country. The number of energy efficient buildings is very less and their performance is unsatisfactory. Therefore there is a huge loss due to this huge electricity consumption. Plus the emission of greenhouse gases is resulting in the more polluted environment. Yao, 2015 offers to increase the efficiency and effectiveness of the buildings by installing smart building IoT features and putting them on to the solar power. As, at the day time the building will get the energy form the Sun and will also store that energy in the battery so that that energy could be consumed later on. And when the day light begins to wash away, the buildings are converted automatically to the battery source those were charged all day long, as at night the consumption of the electricity is lower comparing to the consumption of electricity at day time.

3. STOCHASTIC PROCESS

Stochastic process is statistical model which deals with random variable. In this process the changings in a system depend on the random variable which is taken as input and given as output. The initial state in stochastic process is important because depending on this state many other states can be derived. Next states in a system can be derived through prior and current state. Stochastic process can be used widely in different fields for verifying results of data for example in stock exchange, signals such as speech audio and video, medical data like blood pressure and temperature control.

Markov Chain or Markoff Chain is a probabilistic process which satisfies Markov property. Basic statement of Markov chain is if one can have the knowledge about the current status of the system than by this only piece of information we can predict the future of the system.

Because of these special features of stochastic process we are using this approach in our system for controlling temperature and adjusting it accordingly.

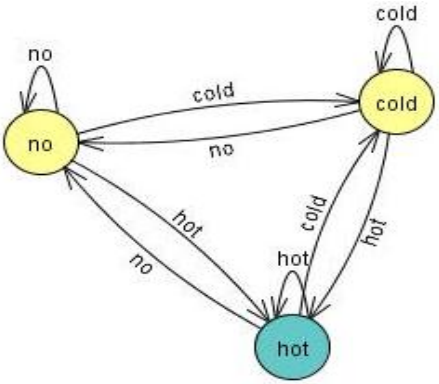

Fig 1: Stochastic Process Controller

4. FUZZY CONTROLLER

Fuzzy Controller is a system in which fuzzy logic is implemented for calculating the results. Fuzzy controller is built after following some major principles described below.

4.1 Fuzzification

Input variables of fuzzy system are mapped by sets of membership functions known as fuzzy sets. In our system the fuzzy sets related to temperature are too-cold, cold, warm, Hot, too-hot. Fuzzy sets and fuzzy membership functions are two important points to understand. As we have set 40°C<TEMP<80°C then if temperature is 40 it did not belong to hot but in fuzzy set it belong to hot with 0 membership function. And if temperature rises like 60°C<TEMP<80°C then membership function will be 0.98. The crisp input values are converted into fuzzy values and this process of conversion is called fuzzification.

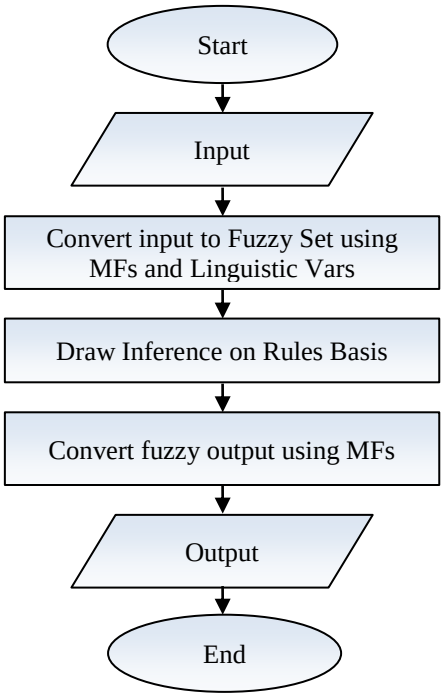

Fig 2: Fuzzy Logic System

4.2 Membership Functions:

Membership functions is curve built in MATLAB and are used to mapped membership values between 0 and 1. They actually show how input space is mapped to membership value. Membership function for inside temperature, outside temperature and set temperature are given below.

4.2.1 Inside Temperature Membership Function:

We will give inside temperature as input variable. The figure shows that temperature less than 24°C will be cold and temperature between 24°C and 26°C is warm and above that will be hot.

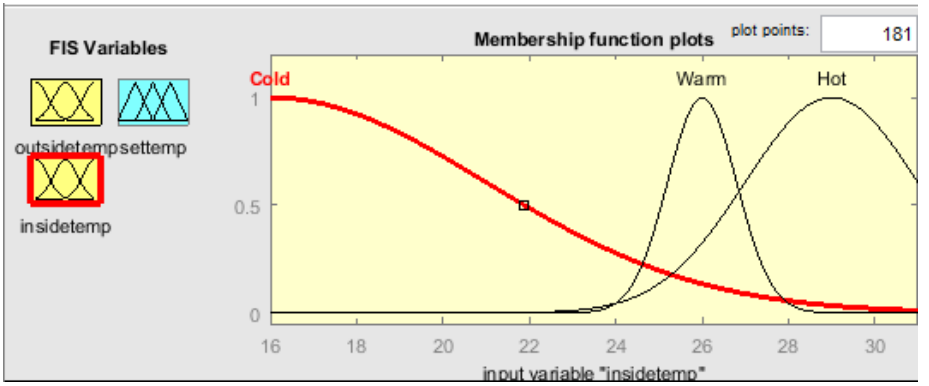

Fig 3: Inside Temperature

4.2.2 Outside Temperature Membership Function:

We will give outside temperature as output variable. The figure shows that temperature less than 24°C will be cold and after that variability in temperature is shown.

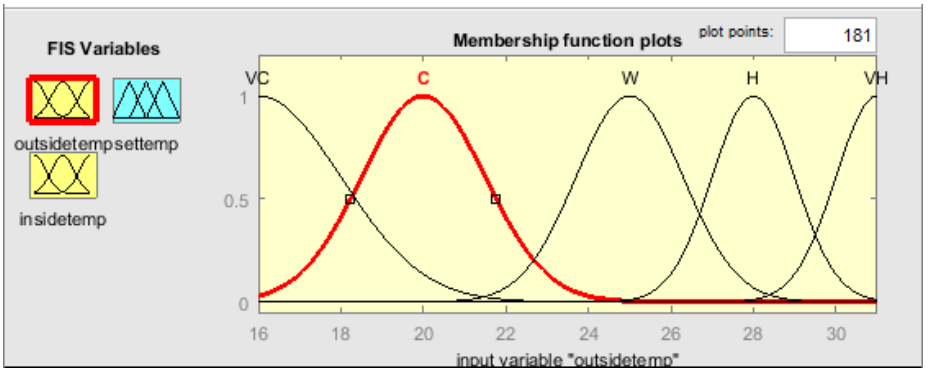

Fig 4: Outside Temperature

4.2.3 Set Temperature Membership Function:

If temperature is given in between 0°C and 24°C then hot air will be set and if temperature is greater than 26°C then cold air will be set.

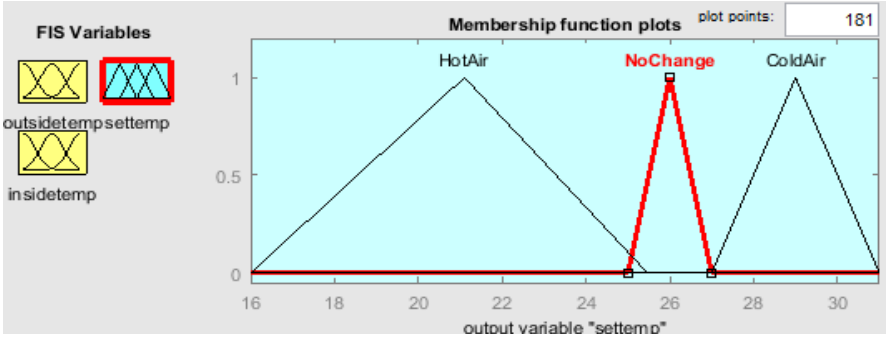

Fig 5: Set Temperature

4.3 Fuzzy Rules

Fuzzy rules are implemented by using simple IF ELSE logic. These rules are used for controlling the output variable. The heating and cooling will be turned on by the Temperature Controller on the basis of inside home temperature.

1. If (outsidetemp is VC) and (insidetemp is Cold) then (settemp is HotAir) (1)
2. If (outsidetemp is VC) and (insidetemp is Warm) then (settemp is NoChange) (1)
3. If (outsidetemp is VC) and (insidetemp is Hot) then (settemp is ColdAir) (1)
4. If (outsidetemp is C) and (insidetemp is Cold) then (settemp is HotAir) (1)
5. If (outsidetemp is C) and (insidetemp is Warm) then (settemp is NoChange) (1)
6. If (outsidetemp is C) and (insidetemp is Hot) then (settemp is ColdAir) (1)
7. If (outsidetemp is W) and (insidetemp is Cold) then (settemp is HotAir) (1)
8. If (outsidetemp is W) and (insidetemp is Warm) then (settemp is NoChange) (1)
9. If (outsidetemp is W) and (insidetemp is Hot) then (settemp is ColdAir) (1)
10. If (outsidetemp is H) and (insidetemp is Cold) then (settemp is HotAir) (1)
11. If (outsidetemp is H) and (insidetemp is Warm) then (settemp is NoChange) (1)
12. If (outsidetemp is H) and (insidetemp is Hot) then (settemp is ColdAir) (1)
13. If (outsidetemp is VH) and (insidetemp is Cold) then (settemp is HotAir) (1)
14. If (outsidetemp is VH) and (insidetemp is Warm) then (settemp is NoChange) (1)
15. If (outsidetemp is VH) and (insidetemp is Hot) then (settemp is ColdAir) (1)

Fig 6: Fuzzy Rules for Setting Temperature

A graph is also drawn in MATLAB for clearing fuzzy rules.

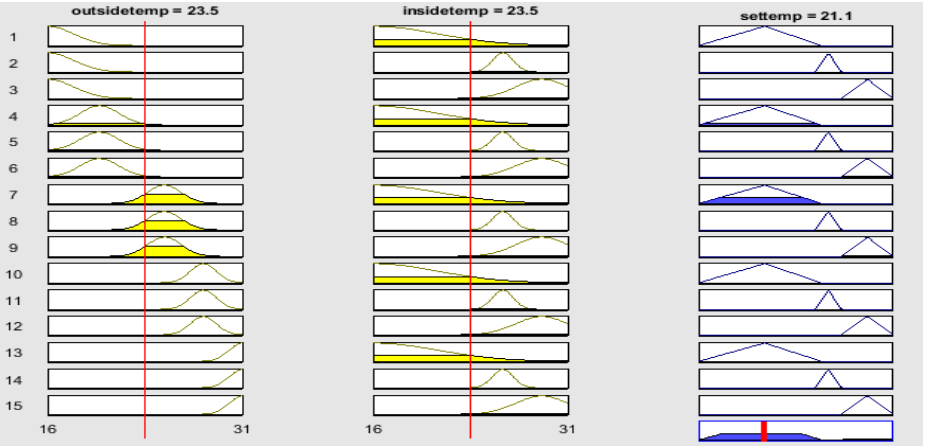

Fig 7: Fuzzy Rules Graph

4.4 Inference

Fuzzy Inference involves membership functions, fuzzy rules and logical operators. Mapping from given input to an output using fuzzy logic is fuzzy inference. This diagram is showing the surface view and inference of fuzzy system.

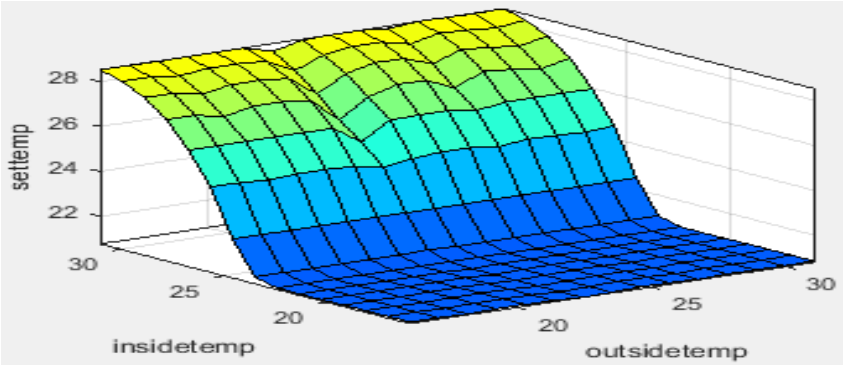

Fig 8: Surface View of Temperature Control System

4.5 Defuzzification

Combining all result and given a single output is called defuzzification.

5. IMPLEMENTATION OF WORK

The system will take two inputs by the use of temperature sensor TMP-36. One temperature sensor will be placed outside to monitor the outside temperature and one temperature sensor will be placed inside the room to sense the temperature of the room. Both temperature sensors will send the inputs to the following two components:

1. Fuzzy Controller
2. IoT Controller (Arduino Ethernet Shield)

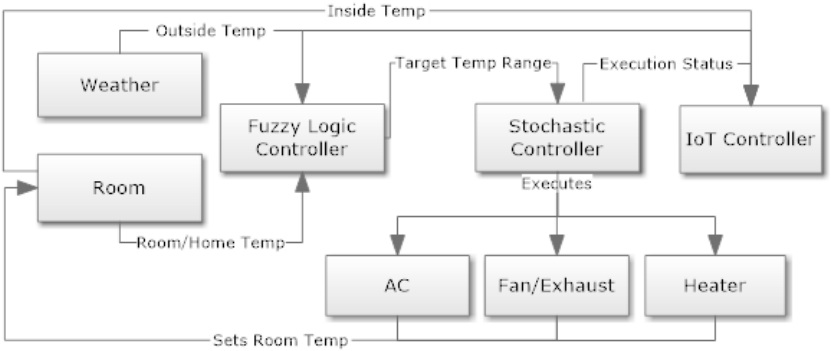

Fig 9: Structure of Proposed Temperature Control System

The fuzzy controller will convert both of the input temperatures to the user understandable output by using the linguistic variables and member functions. Temperatures will be converted to either Very Cold, Cold, Warm, Hot, and Very Hot. After converting the temperatures the fuzzy controller will choose and suggest the output temperature that would be most appropriate for the home. Fuzzy controller will send that temperature to the Stochastic Controller.

Stochastic Controller is attached directly with the home appliances (Fan, Heater, and Air Conditioner) and it is responsible for controlling these devices on the basis of the output gained from the Fuzzy Controller. Stochastic Controller is implemented by using Markov Chains.

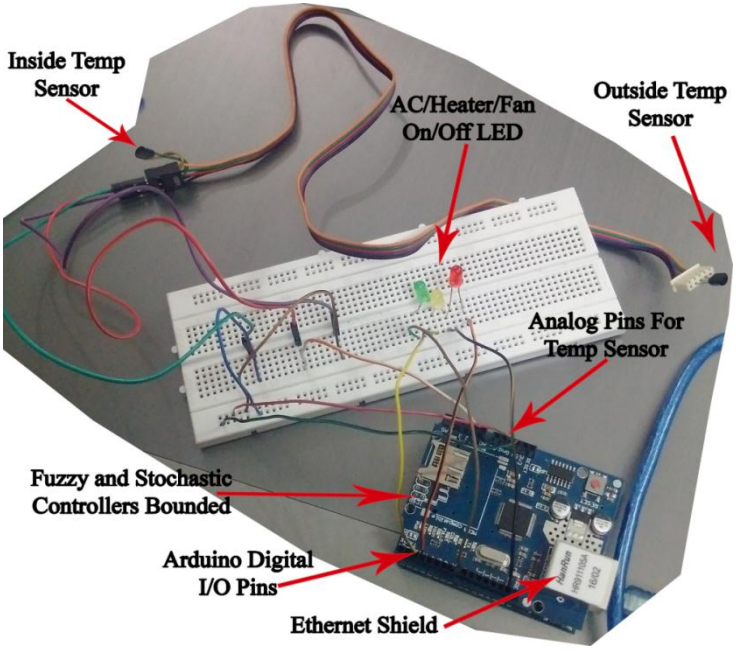

Fig 10: Implementation of the Fuzzy/Stochastic Temperature Controller

The stochastic controller, located inside the room, will adjust the most feasible and comfortable room/home temperature according to the states defined in the Markov Curve. The following states are defined in our Stochastic Controller:

1. Turn ON Heating Air
2. Turn OFF Heating Hair
3. Turn ON Cool Air
4. Turn OFF Cool Air
5. Turn ON Fan/Exhaust
6. Turn OFF Fan/Exhaust

All the room temperature controllers and devices do not consider the outside temperature to control the home temperature. Here the point is: if because of just turning on the exhaust the home environment can be made more feasible for living than why there is a need to turn on the heating and cooling to make room temperature stable? And surely this saves a lot of energy consumption. So, the Stochastic Controller will keep on switching the Fan/Exhaust if the fuzzy controller believes that the temperature can be maintained by just using the exhaust. This thing will make the home environment natural and will also reduce the energy consumption.

Both of the controllers in our system are connected to the Arduino Ethernet Shield that is connected to the internet and publishing the statuses of the Stochastic Controller and temperature conditions of the inside and outside temperatures. By the use of Arduino and Ethernet shield we have made it possible for our Temperature Controller to enable the Internet of Things (IoT) technology. Because of this the current temperature of the home and outside can be checked no matter wherever the home owner is. Second, the working and performance of the Air Conditioning devices is also accessible regardless of the location.

6. CONCLUSION

In the Temperature Controlling Systems available today, there is not any option to control the home temperature on the basis of the outside weather. Our temperature controller, by the use of Fuzzy Logic, Markov Chain, and IoT techniques makes it possible to design an efficient and power saving air conditioning controller device. Fuzzy Controller is designed for managing home temperature. The theme is to use the fresh air if it is feasible to change the home temperature. Simulations and testing have been shown in paper which is done in MATLAB. Stochastic process controller is setting temperature of inside according to outside weather. Through practical implementations of fuzzy controller and stochastic process controller it is seen that with affordable budget we can design an efficient and power efficient system that is also compatible with IoT technology.

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F.I.R. OF DIABETES EMPLOYING FUZZY LOGIC IN ANDROID OPERATING SYSTEM

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ABSTRACT

In the past, diagnosis of a disease was done by medical experts. Then computer came and some medical decision support system (MDSS) were introduced to accomplish the task. Now a days, computers are being replaced by portable devices including cell phones and tablets gradually. These devices use Android and iOS as their operating systems. In such circumstances, an application of MDSS is required that can give first information report (FIR) about a disease to a person without going to a doctor.

In this work, we focused on diabetes. Non pathological data of a person and standards of World Health Organization (W.H.O) were used to get FIR. Different fuzzy rules were made to design an inference engine. It was developed in Android framework. This work fulfills the need of MDSS and gives FIR to a lay person about his diabetic condition at any time and any place.

KEY WORDS

Diabetes, Fuzzy Logic, Android, iOS, MDSS, Non-pathological.

1. INTRODUCTION

Information is very important and vital part of this world. It makes us to be civilized and have a better power of decision. It also plays a fundamental role in the progress of this world. In the light of information, we can make our lives better, prosper and healthy. That's the reason that peoples or researchers have a race to get more information and facts and spread it out to the other peoples to make their lives better.

Today, technology is going to be common and affordable to almost every person. Spread of this technology has adverse effect on our life style. That's why human becomes the victim of different chronic diseases specially Diabetes Mellitus. According to World Health Organization (W.H.O), 194 million peoples in this world are suffering from this disease. According to a prediction of W.H.O, the number of diabetic patients can be increased up to 300 million in 2025. This number is alarming situation for this world. To control this number, we will have to predict or detect their diabetes at early stage.

Now a days, mobile technology has a great progress and is using by almost every person of this world. Android phones also become a part of people's life. By using the apps of this android phones, we can make our lives easy and better. This work is also an effort to detect Diabetes Mellitus at its early stage and give the suggestion to patients to visit doctor for further treatment and pathological tests.

A lot of work has been done by many researchers in Diabetes Detection. But I used fuzzy logic for this purpose. Although a lot of work is done in this field. But the specialty of this work is the use of non pathological data, android technology and fuzzy set operators. A new algorithm is also designed. This algorithm will take five inputs from the users. After getting input, it will process these inputs by using fuzzy logic. In processing, different fuzzy operators will be implemented and then defuzzify it.

1.1 Purpose of this Work

The purpose of this work is to inform the peoples about the initial status of their diabetic condition. Following persons can get benefit from the purposed system:-

- Everyone who is health conscious
- The persons who are so busy in their daily life
- The persons who are in remote areas

1.2 Assumptions: m kj

1. Only adults are focused in this research
2. Normal person are considered. Lactating or Pregnant women are not considered in this research
3. All the data is based upon the normal conditions e.g. normal temperature or normal life style of a person

2. LITERATURE REVIEW

A plenty of work has been done on fuzzy logic, medical diagnosis, android operating systems and diabetes detection. Many books and research articles of these field are also published.

Zadeh [15] introduced the fuzzy logic in 1964. In his work, he purposed the degree of vagueness in the contrast of traditional logic crisp where completely true and completely false were considered.

Kosko [6] discussed the past, present and future of fuzzy logic. The author described the fuzzy principal that everything in fuzzy is a matter of degree.

Wiriyasuttiwong and Narkbuakaew [14] purposed a medical knowledge base system (MKBS) for diagnosis from symptoms and signs. It was made to support medical knowledge construction about a disease based on production rules.

Licata [7] described a clinical case in the light of fuzzy logic. An inference engine for a person suffering from many diseases was developed and showed that fuzzy logic is much better than probabilistic analysis.

Balanacia et al. [2] discussed about the correct diagnosis and assessment of Breast cancer Risk. Different fuzzy variables were discussed under fuzzy rules and risk factor of Breast Cancer was also determined.

Soundararajan et al. [11] developed a decision support system based on fuzzy logic to detect Tuberculosis. Work on detecting the risk of tuberculosis was also done in this paper. The algorithm defined in this paper was based on fuzzy rules.

Pervin and Abhari [9] worked on Fuzzy Database for Heart Disease Diagnosis. An algorithm was developed based on different fuzzy variables and heart condition was calculated here.

Efosa et al. [4] worked on diagnosis and therapy of HIV/AIDS. For diagnosis and therapy of these diseases, Fuzzy logic and data mining approaches were used.

Margret et al. [8] worked on the design of a Diabetic Diagnosis System. For this purpose, simple Rough Sets in symptoms were used. An algorithm is also designed and system is implemented to diagnose diabetes.

Bodhe et al. [3] purposed a Health Care System. In their work, patient diagnostic system was purposed by using android operating system. They used client server model for communication with the users. Their purposed system tells about the degree of severity of illness.

Sreedevi et al. [13] introduced a model of Diabetes diagnosis. In their work, a Threshold Genetic Algorithm was used for Diagnosis of Diabetes using Minkowski Distance Method.

Giri and Todmal [4] worked on diabetes prediction. For this purpose, they used Neural Network, Fuzzy Logic and Gaussian Kernel Method in Prognosis of Diabetes.

Akter and Shorif [1] developed a new database management system with user friendly interface. They used android operating system for this purpose.

Sonawane and Patil [13] made a system for prediabetic patients. They used genetic programming to detect the pre diabetes. The purposed system worked in two portions i.e. one for training data and second one was for classification of the available features.

Jain and Raheja [9] worked for improving the Prediction Rate of Diabetes using Fuzzy Expert System. They first convert the experimental data set into crisp values and then from crisp into fuzzy values. The system provides knowledge about diabetes after fuzzification by applying different rules.

3. PURPOSED SYSTEM

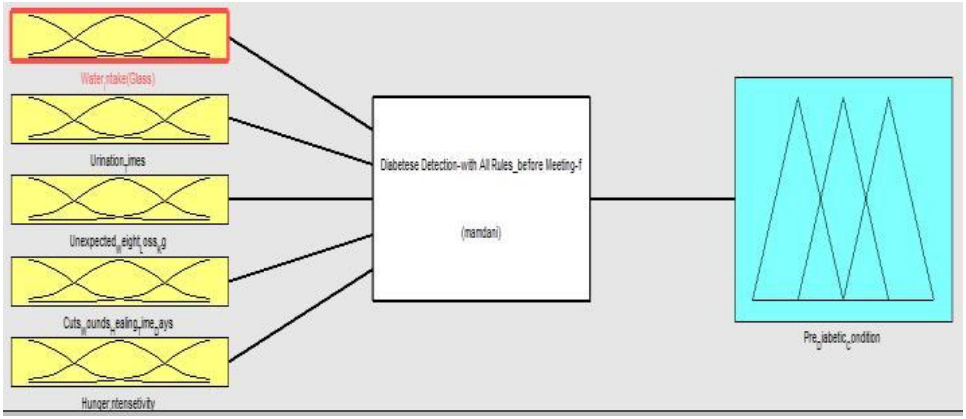

Fig. 1: Inference Engine

Plenty of work is done on medical diagnosis. Different applications are also made by different developers. But they mostly used pathological calculations. In this work, we only used early symptoms of different risk factors. No pathological values are used here. Methodology used in the this algorithm is Fuzzy Logic. Here we used different ranges of a fuzzy variables. Different fuzzy rules and defuzzification are also the part of this inference engine i.e. Matlab is used to handle these fuzzy ranges and their linguistic variables. In Matlab following variables with their ranges are defined:-

3.1 Variables

In the above defined inference engine, we have following fuzzy variables with ranges of their values.

i) Input Variable 1

Water_Intake_Glasses with member function (Below, Normal, High and Very High). Range of Fuzzy Values that are Defined Over this Variable is given below in the Table.

Table 1

S#	Input Field Name	Values Range	Fuzzy Linguistic Variable
1	Water_Intake_Glasses	< 5	Below
		5-11	Normal
		12-15	High
		> 15	Very High

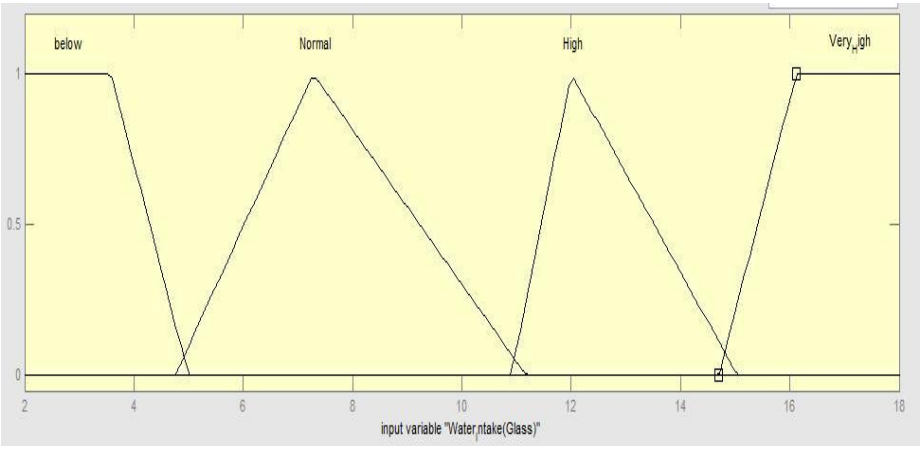

Fig. 2: Member Ship Function for input variable (Water_Intake_Glasses)

ii) Input Variable 2

Urination Times with member function (Below, Normal, High and Very High) Range of fuzzy values that are defined over this variable is given below in the table:

Table 2

S#	Input Field Name	Values Range	Fuzzy Linguistic Variable
2	Urination Times	<4	Below
		4-9	Normal
		10-14	High
		>14	Very High

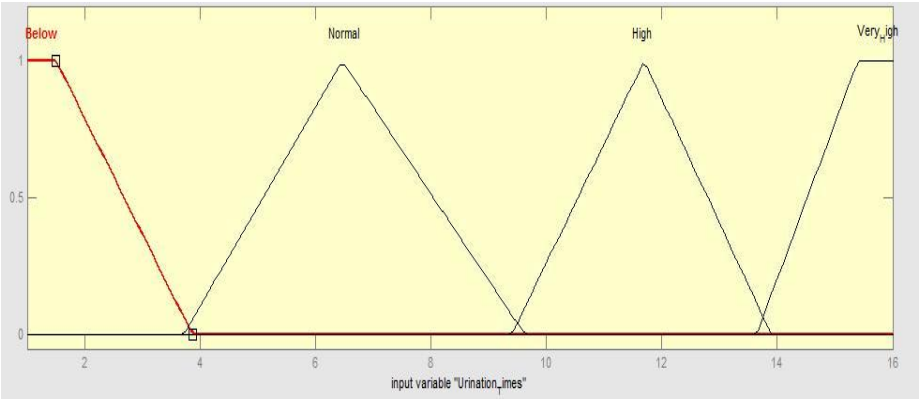

Fig. 3: Member Ship Function for Input Variable (Urination Times)

iii) Input Variable 3

Unexpected Weight Loss Kg with member function (Ignore, Normal, High and Very High). Range of fuzzy values that are defined over this variable is given below in the Table.

Table 3

S#	Input Field Name	Values Range	Fuzzy Linguistic Variable
3	Unexpected Weight Loss Kg	<2	Ignore
		2-4.5	Normal
		5-8	High
		>8	Very High

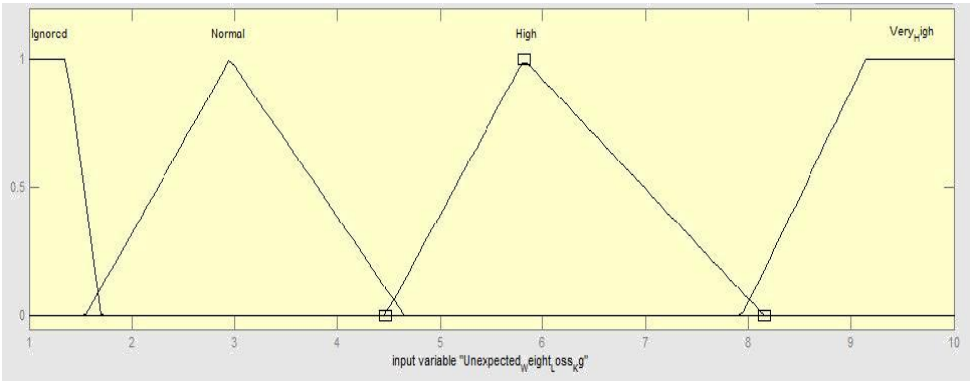

Fig. 4: Membership Function for Input Variable (Unexpected Weight Loss kg)

iv) Input Variable 4

Cuts Wounds Healing Time Days with member function (Early, Normal, Late and Very Late). Range of fuzzy values that are defined over this variable is given below in the Table.

Table 4

S#	Input Field Name	Values Range	Fuzzy Linguistic Variable
4	Cuts Wounds Healing Time Days	<5	Early
		5-12	Normal
		13-18	Late
		>18	Very Late

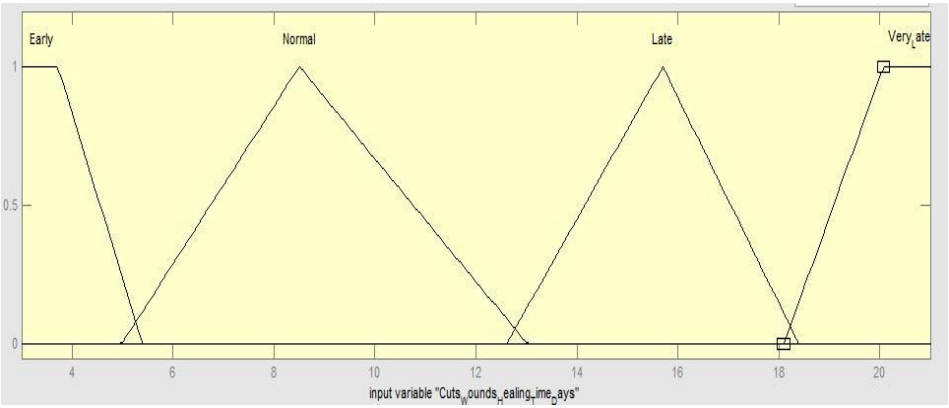

Fig. 5: Member Ship Function for input variable (Cuts Wounds Healing Time Days)

v) Input Variable 5

Hunger with member function (Low, Normal, Sharpe and Extreme). Range of fuzzy values that are defined over this variable is given below in the Table.

Table 5

S#	Input Field Name	Values Range	Fuzzy Linguistic Variable
5	Hunger Insensitivity	1	Low
		2	Normal
		3	Sharpe
		4	Extreme

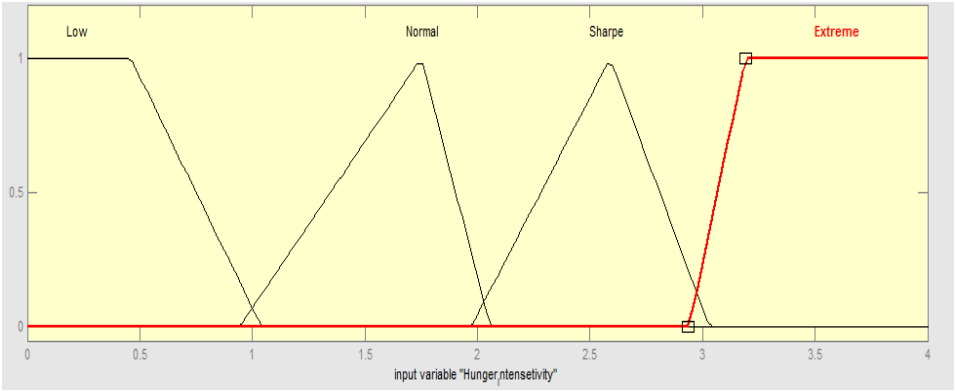

Fig. 6: Member Ship Function for input variable (Hunger Intensitivity)

vi) Output Variable 6

Prediabetic Condition with member function (Healthy, At Risk and Prediabetic). Prediabetic are the patients who have glucose level above the normal but below the diabetic condition. Range of fuzzy values that are defined over this variable is given below in the graph:

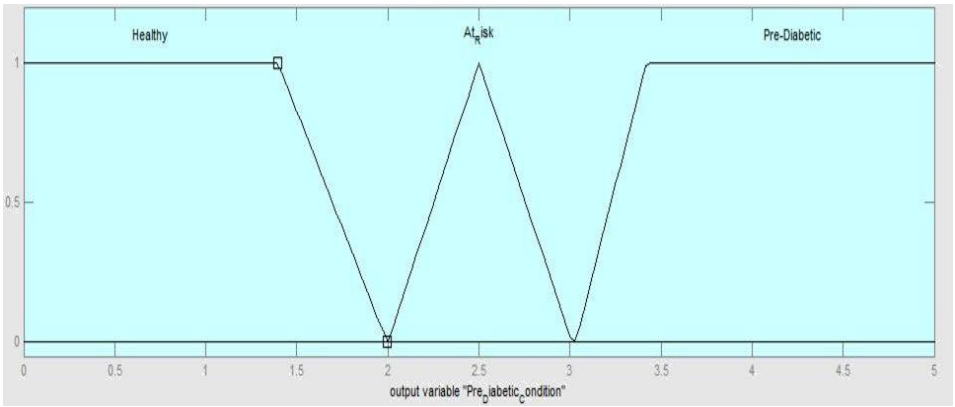

Fig. 7: Member Ship Function for output variable (Prediabetic Condition)

This output is calculated with some fuzzy rules. These rules contain 5 variables with different intensive value ranges. These rules with different variables and algorithm are given in the Table 6.

3.2 Algorithm

Each variable Range has 20% contribution in prediabetic situation. These ranges are defuzzified and produces output in the form of crisp logic i.e.0 or 1. The criteria of output is if the input of 2 variables belong to two upper classes, then there is "Healthy" is selected as outcome. While if value of 3 variables belongs to two upper classes, then it will produce "At Risk" and if the value of 4 or 5 variables belong to two upper classes, then it will show "Prediabetic".

Table 6

S#	Detail	Description
1	**Input Variables**	1. Water_Intake_Glasseds 2. Urination_Times 3. Unexpected_Wright_Loss_kg 4. Cut_Wounds_Healing_Times_Days 5. Hunger_Insensitivity
2	**Output Variables**	1. Healthy 2. At_Risk_being_Prediabetic 3. Prediabetic
3	**Methodology**	Fuzzy logic with linguistic variables having ranges expressed in member functions
4	**Algorithm**	**Button_Click()** **Start** **Integer Risk factor**=0 **if** (Water_Intake_Glasseds is equal to "High" OR "Very High") **Risk factor**=**Risk factor**+2; **if** (Urination_Times is equal to "High" OR "Very High") **Risk factor**=**Risk factor**+2; **if** (Unexpected_Wright_Loss_kg is equal to "High" OR "Very High") **Risk factor**=**Risk factor**+2; **if** (Cut_Wounds_Healing_Times_Days is equal to "Late" OR "Very Late") **Risk factor**=**Risk factor**+2; **if** (Hunger_Insensitivity is equal to "Sharpe" OR "Extreme") **Risk factor**=**Risk factor**+2; **if** (**Risk factor**<5) Display Toast **"You are Healthy"** **else** **if** (**Risk factor**<7) Display Toast **"You have a risk of being Pre-Diabetic"** **else** **if** (**Risk factor**>7) Display Toast **"You are Pre-Diabetic.** **Plz go to doctor for further proceedings."** **End**

For this purpose, different fuzzy rules are defined. Some of them are given below:-

3.3 Purposed System Implementation:-

A system was also developed in java by using android studio (2.1.3v). The snapshots of the different states of developed system are given below:

5554:Nexus_5X_API_23

Fig. 10: Initial State of the System

5554:Nexus_5X_API_23

Fig. 11: Healthy State

5554:Nexus_5X_API_23

Fig. 12: Risk of being Prediabetic State

5554:Nexus_5X_API_23

Fig. 13: Prediabetic State

3.4. Result and Discussion

The developed system was tested on different peoples including normal and diabetic patients. They used the application and gave good response in the sense of satisfaction. More than 98% peoples seemed to accept the result and were satisfied. Following table shows the result of testing.

Table 7

Total Persons	Healthy	At Risk	Prediabetic
237	95	40	102

4. CONCLUSION AND FUTURE WORK

In this work, an android base system is defined with the help of Matlab fuzzy tool. In this system, we used 5 risk factors including urine, thirst, Cuts and Wound Healing Time, Hunger and Un expected Weight Loss of diabetes. Here we defined some fuzzy values, then we made inference engine with some rules. Then we defuzzified the variable values and make the crisp logic from these fuzzy variables.

The case study that we choose for this paper is diabetes. This work only tells that either one is pre diabetic or not. My next Plan is to include pathological data and make it more useful for medical practitioners.

There is also a plan that same technique will also be applied to detect Heart diseases in further work. Medicines prescription can also be added in this work as future enhancement.

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EXPLORING FEASIBILITY OF INTERFACE FOR COMMON COMPUTER APPLICATIONS FOR ILLITERATE USERS

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ABSTRACT

Eight hundred million people in the world are illiterate they not only resides in developing countries, this is a matter of concern that 43% of United Sates population is functionally Illiterate. They are excluded from the benefits which computers provides because there illiteracy is the biggest hurdle for understanding and taking advantages from these modern and complex machines. To empower everyone and make computer more accessible for this type of user group we designed and evaluated a prototype of interface for common computer applications. To reach final prototype our early designed prototype which will be based on the illiterate users need and mental model would be refined over two usability iterations. Before starting the studies we well understood design needs for illiterate and low literacy population from prior studies. We also explored the understanding and special needs of illiterate users, we further discussed some software design recommendations for software designers and developers.

GENERAL TERMS

User Interface, Design.

KEYWORDS

Illiterate, User Interface, Design, Human Factors.

1. INTRODUCTION

U.N. defines an illiterate person as someone who can *"...with understanding both read write a short simple statements in his or her everyday life*" (Frisca 2012). Around 800 million people in the world are illiterate (Dew 2013; Frisca 2012; Knoche 2012) that mean they don't even know how to read or write simple sentences even using their mother tongue. Illiterate population not only reside in developing countries, even developed countries like U.S.A has 43% of population which is functionally illiterate (Choudry 2012; Knoche 2012). Low literacy and low education are linked to other disadvantages like poverty, unemployment and low-socioeconomic status (Choudry 2012; Medhi 2009).

To empower illiterate community world-wide so that they could also take advantage from modern day technologies. A computer based application has been developed which is providing an interface for common computing applications. In the recent past, many studies have been conducted to empower illiterate and semi-illiterate users worldwide but

most of the research work has focused mobile applications. Studies have shown that people with low literacy skills find mobile phones easy to operate and learn rather the desktop computers (Chaudry 2012), but this study was conducted in year 2007 mobile phones at that time were not as complicated as today, more over many American adults with low-income access internet from there smart phones rather than computers (Chaudry 2012). Also the increase in mobile subscription, which was estimated 91.8% and 73.5% inhabitants of developing countries and even in Africa respectively (Belay 2016). Emergence of new manufacturers also increased availability of smart phones and there market cost is less than 100 USD also mobile phones consumes very less power than computers to work and energy is one of the most biggest problem in developing regions like Africa (Agarwal 2013) and Asia. The rate of mobile phone usage is increasing even in poor community (Medhi 2009). After all studies and researches still usability remains a major hurdle for illiterate and semi-illiterate population (Medhi 2011; Mahmood 2014).

For designing our application we had used computers instead of smartphone for different reasons. Our application contains different multimedia supported features which include video and audio help support for the user which slightly increased the size of our designed application, limited memory, space and less hardware capabilities of mobile phones were not able to run our application properly (Belay 2016). If we put all the support features online it would had brought difficulty to our users because of high cost and minimum coverage of wireless internet world-wide. Another reason for developing computer application instead of mobile is cost, in developing countries smartphones with greater hardware specifications and software capabilities are still expensive roughly estimated cost above 100 USD (Agarwal 2013; Frisca 2012), but a desktop computer with above average hardware capabilities is not more than 60 USD. Moreover Chipchase *et al.* argued in against of making smartphones and applications for illiterate users which were visible and recognizable by others because it can stigmatize a user (Knoche 2012), therefore Kristin *et al.* proposed system was based upon values-sensitive design (Dew 2013) to avoid stigmatic issues, this is also another very important reason to design computer based application rather than mobile based.

The goal of this paper is to explore the feasibility of our application, which contains interface for common usable computer applications, our goal is to make this computer based application accessible for population with less to no literacy. We adapted User Centered design policy, we designed and built the application totally according to user's needs and capabilities which we understood during our study. We had also discussed some user interface design recommendations for illiterate and semi-illiterate population latter on.

We conducted our study in three phases. In the first phase we interviewed illiterate people and tried to find their needs and explored there understanding about computers to understand user's mental model, and from the information obtained from the first phase we developed first prototype. In second phase of our study we trained the participant about how to use the application, we also noticed the difficulties and coping strategies which they used for performing different tasks which were given to them. We also noted there suggestions regarding to the user interface, in short in the second phase participants performed usability testing. In the third phase of our study we developed a refined prototype based on the observation and recommendations given by our participants in

phase two, then again we asked participants to perform some tasks, and on the basis of the observation of third phase, we reached to our final prototype by some minor changes and modifications based on observation of third phase. On the basis of our studies we discussed some user interface design recommendations for illiterate users. Our study was focused on illiterate users in Pakistan which is the sixth most populous country in the world and second largest country in South East Asia after India with illiteracy rate of 79% (Mahmood 2014). We hope that our findings with the illiterate people in Pakistan will generalize to illiterate people in the developing regions especially in South Asia. We named our application CompABC we will refer our designed application from this name after on.

2. BACKGROUND

Many researches have been conducted around the world to facilitate illiterate people by addressing user interface design issues and provide interactive interfaces. Frisca *et al*. provided asynchronous communication through text messages by allowing illiterate users in Switzerland to listen received messages and compose messages by augmenting words with text initiated text-to-speech support (Frisca 2012). Form Chipchase *et al.* work it is proven that illiterate users even feel it difficult even to dial a number for outgoing call from their mobile phones, moreover Chipchase *et al* argued about the associated stigmatic issues of illiterate people and use of audio instead of text, Chipchase *et al* also find that some icons in an application are miss understood by the users he also gave some useful suggestions as well (Chipchase 2015). Medhi *et al*. found that text is not helpful for the user interfaces for illiterate population she recommended multimedia (video and audio) support (Prasad 2008; Medhi 2009) and live operator (Medhi 2011). Zainab *et al.* argued to enhance websites visually by audio, video and sound to make them more interactive for illiterate users (Mahmood 2014). Sheetal *et al.* argued to combine voice communication with graphical interfaces (Agarwal 2013). Knoche *et al.* explained the coping strategies of mobile usage by illiterate population that how they deal with text, they argued that the use of text is necessary in the mobile phone user interfaces, according to them it will make mobile phone more usable (Knoche 2012). Benish *et al.* preferred non-text based GUI widgets with large radio buttons according to them it was more useful for navigation form one screen to another by illiterate participants. Ahmed *et al.* showed how illiterate people interact with technical artifacts, he further defined usage pattern of these artifacts illiterate participants included in the research which would help to further design the user interfaces for illiterate population in future (Ahmed 2013). Dew *et al.* argued to build technology on the basis of value-sensitive design in order to avoid stigmatic issues (Dew 2013). Belay *et al.* showed design trends and problems form designers perspective in developing countries, they also classify mobile user group according to their literacy level (Belay 2016). Motofone F3 was introduces by Motorola, which was especially designed for illiterate people. It has many qualities like, audio feedback function, e-ink screen which is useful to read mobile screen even in bright sunlight, with a battery timing of 30 days (standby) and cost about 20 USD, but it was not success (Frisca 2012).

3. STUDY 1

We conducted interviews illiterate people in Pakistan to know their needs and understanding about computers, in order to understand the design needs for this community. We got access to them through a factory in Pakistan, because most of illiterate community works in factories, our desired population could easily be found in places like that. We told the managers of the factory about the intentions and the objectives of our research. Managers and officials of the factory although were very high qualified but found it very hard to understand what will come out of the study and how could it benefit the illiterate community, but at the end they were convinced when we explained overall objective of our study that how it would be helpful for illiterate community to learn computer and may raise their level of living.

3.1 Participants

We took a total of twenty participants consisting of ten men and ten women. The average age of our participants was 38.2 years. Most of them were working in packing and loading department .There average income was 120 USD per month. They came to get job in the city from different rural parts of the country. None of them were more qualified from 5^{th} standard. In term of level of computer knowledge seven participants never had used computers before remaining thirteen had some exposure. Two of them were having smartphones with average specifications, remaining of them were using simple mobile phones with keypads. This observation helped us to understand the technology exposure of our participants.

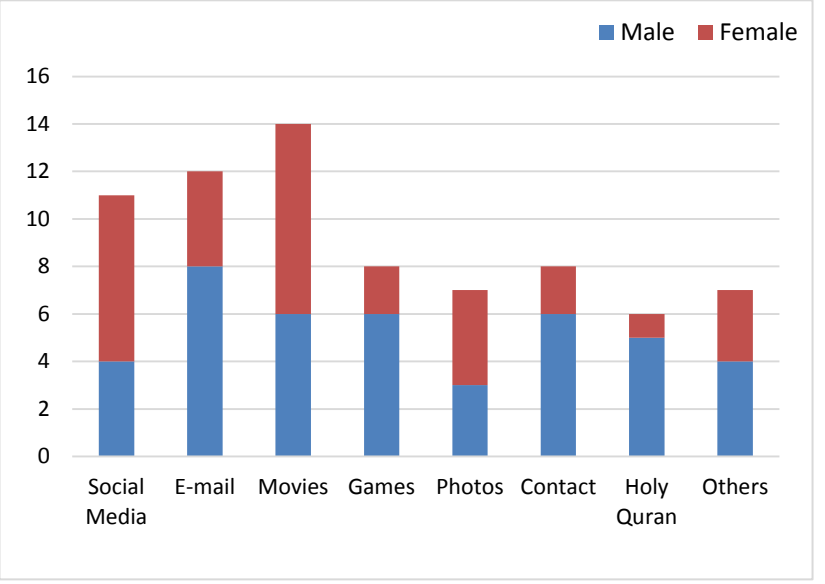
3.2 Phase 1

We started by introducing the objectives of our research, and motivating them that how beneficial they could be for their community by providing such a valuable information. We appreciated there efforts. Collecting information from the participants was not an easy task because some of our participants have no or very less technology exposure, so before conducting the interviews we also helped them by elaborating their ideas and views in 30 minutes group discussion. Then we conducted semi-structured 20-30 minute interview with every participant individually, The interview script included the general discussion about computers, to understand the user's thinking and understanding about computers to generate mental model, in this phase of our study we wanted to know that what they want to do from computers and how could computers became helpful for them if they learn the skills. After that we were interested to know that without proper reading and writing skill how they manage their day to day work and how they use all other technical artifacts like mobile phones, ATM's, or any other facilities which require reading and writing skills, to understand their individual coping strategies. This phase was quiet helpful for us to understand the special requirements of illiterate participants because we have to design CompABC according to the set of requirements specified by them as they were representing the whole populations.

3.2.1 Results

In our early questions we tried to find out the users most important needs. In our early questions we find that 11 participants (4m, 7f) asked about "*facebook*", we further

discussed the phenomena of social media with them but they have no knowledge about social media at all. All they wanted was to make *"friends"* on social media and to meet and interact with new people. Facebook is very good social media platform but still it is not easily accessible by illiterate community. Designing a social media application was beyond the scope of our study. Further 12 (8m, 4f) out of 20 participants agreed that doing e-mail would be their second most important priority to their friends who have computers and are using internet. 14 out of 20 (6m, 8f) participants showed there interest towards watching movies and listening songs. 8 out of 20 (6m, 2f) participant were interested in playing computer games. 7 participants (3m, 4f) female participant were interested to manage their photos. 8 participants (6m, 2f) shared that they feel difficult to manage their contacts phone numbers and addresses in their mobile phone. 6 participants (5m, 1f) participant shown their interest to read and search different chapters and verses of Holy Quran.



3.2.2 Conclusion

Form the results of phase 1 we noticed that all participants were belonging to almost same age group but male participants, have different requirements from female participants. Male participants were more focused on some serious aspects of computing like e-mails, contact book etc., On the other hand female participants were more interested towards social media, movies and photos. In this phase we also understood the requirements priorities of illiterate people.

3.3 First Prototype

The aim of first study was to understand user's requirements and to generate user's mental model. The first prototype is designed on the basis of prior researches (Prasad 2008; Chaudry 2012; Knoche 2012; Medhi 2009; Medhi 2011; Ahmed 2013; Agarwal 2013; Frisca 2012; Mahmood 2014) and participant's feedback. In first prototype we

covered six major requirements suggested by the participants except the social media application. First prototype has got video and audio help on screen. Video help will be active when user click on the help box. Audio help is activated on every step taken by user automatically, user can take help from audio and video support whenever he/she needs by clicking on help controls. The study required participants to perform task-based interactions each task can be done by not more than three simple steps, design of tasks follows linear navigation structure (Ahmed 2013). We used hand drawn icons on every button for more understanding (Chipchase 2015), also buttons used in first prototype are providing multiple information in form of color, text, icon image and number (Ahmed 2013). Buttons are designed to provide multiple information to help the participants because every person has unique text coping strategy, some memorize numbers very well, and similarly text and colors would be helpful for others. Icons are also providing meaning full information about each button. Text from the application is not completely removed as suggested by Knoche *et al.* (Knoche 2012). Figure 1(a) illustrates the main screen which shows six different features available in first prototype. Figure 1(b) illustrate the Contact-book.

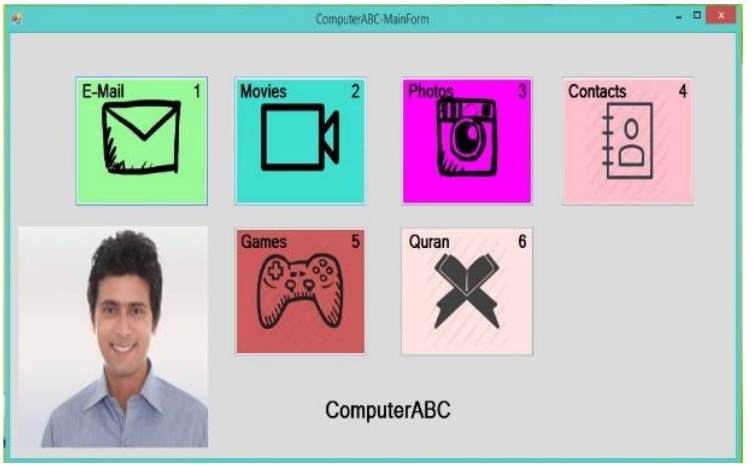


Fig. 1(a): Main Screen

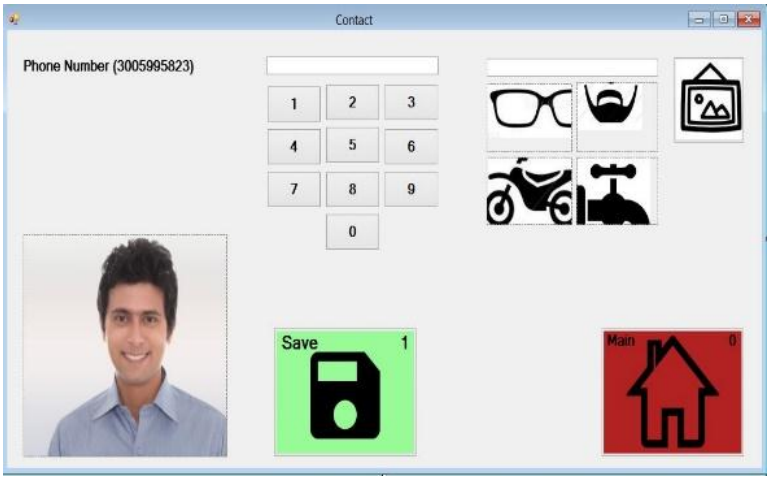


Fig. 1(b): Contact Book

The Contact-book is a unique feature provided by CompABC. In our first studies participants reported that they use notebooks or diaries to write contact numbers of their friends because it was very difficult for them to store a number in their mobile phone. Even if they save a contact number in their phone, they feel it very difficult to retrieve the phone number of particular contact because they are not able to read the name of the contact. Keeping this problem in mind we suggested a unique method to save the contact numbers. This idea would be more functional and helpful when it will be implemented on designing mobile phones applications for illiterate user. Most of illiterate people including our participants was familiar with numbers (digits). We provided them a user interface same as mobile phone keypad so they can write a phone number by simply clicking on to the buttons or they can type the contact number from keyboard. After this CompABC provide wide range of hand drawn and simple images which correlate the contact's name, and the image which will be helpful for illiterate people to remember the contact name. Figure 1(b) is illustrating an example where user can save up to four different type of images to correlate the contact's name, for example Figure 1(b) clearly showing that contacts characteristics that he wear glasses, having beard, he also has a motorcycle and he is a plumber. This characterization of contact gives enough information about a contact.

Email is another exciting feature provided by CompABC its mechanism is similar to the system which Prasad *et al.* (Prasad 2008) proposed. We also proposed video email instead of text based email, because speech to text converting systems are not very accurate and feasible, especially when you are designing an application for such population which is completely or almost technology illiterate. Figure 2(a) and Figure 2(b) is illustrating that how email functionality would be accessible by users.

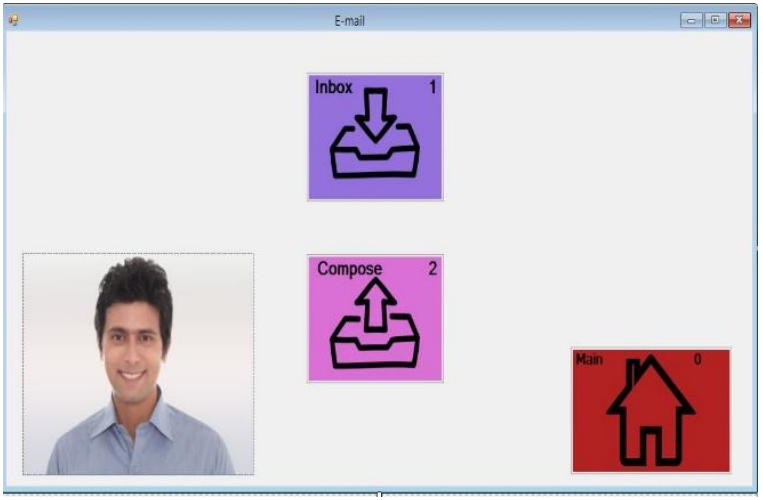


Fig. 2(a): Compose Email Screen

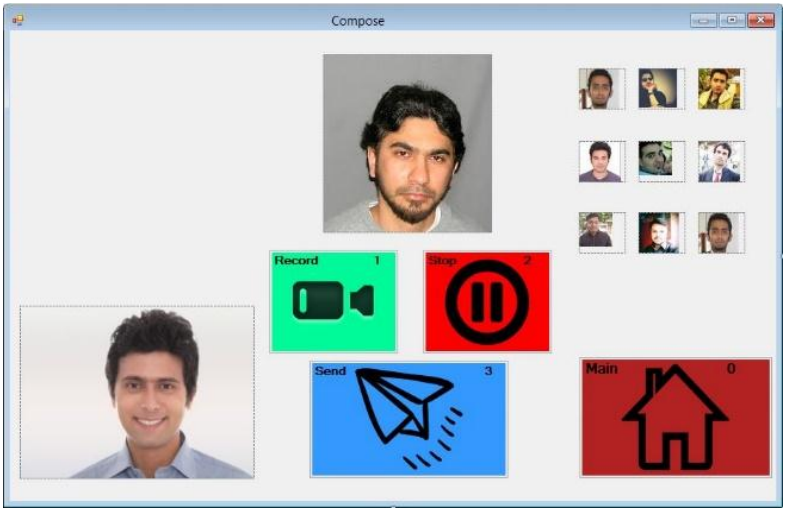


Fig. 2(b): Compose Email Screen

Similarly CompABC provide other features like Movies, Photos, Games and Holy Quran. The easiest way to search movies and photos was the "*thumbnail view"* (Ahmed 2013), we also used this technique in which user can select a video or photo easily and efficiently. The search between different movies and photos would become difficult if the length of the list increases, in this study we did not suggested any efficient searching technique. Users have to scroll down to select their desired videos or photos.

4. STUDY 2

In this phase of our research we again involved our previous participants. Study 2 started after five days of finishing study 1. One female and one male participant didn't showed up. In the first 30-45 minutes we demonstrated our application to our participants, and trained them how to use this application in a group session. After the group session, we started conducting experiments with each participants individually. A trainer was also available to each participant, for basic guidance and to observe there usage and coping patterns carefully. Participants was assigned by different tasks. After the completion of each experiment with the participant, we questioned about their experience. We were interested to know which factors in the user interface were more helpful and which were causing problems for them. This study was conducted in three phases, first we trained our participants, then we assigned different tasks and observe there usability strategy, and at the last we collected there suggestions to design final prototype. After conducting individual experiments and observation of participants we got the following results.

4.1 Results

4.1.1 Video Help

14 out of 18 participants (8m, 6f) preferred video help instead of asking help from trainer or using audio help. 2 participants which used audio help instead of video help, but they appreciated video help.

4.1.2 Audio Help

3 out 18 participants (2m, 1f) prefer audio help instead of video help. We further observed that participants using audio help are taking more time to finish a task, as compared to participants using video help frequently.

4.1.3 Multi-Informational Buttons

Almost every participant used buttons easily. 5 of our participants did not understood the concept of buttons first but with the minimum training of mouse drag and mouse click by the trainer, they were able to click the buttons properly for completion of their assigned tasks. The buttons which were providing multiple information about themselves in form of icon, text, color and number. 6 out of 9 female participants said that they remembered a button from the color. 2 female participants said that they remembered a button by the picture of icon. 1 said that she remembered the icon with color and number. 5 out of 9 male participants said that they remember the button with the button number. 2 male participants said that icons helped them because they were giving information which was so straight forward, 1 male participant tried to remember the color of every button and 1 tried to remember the text.

4.1.4 Video E-mail

Participants feel it very difficult to send email, because they did not understand properly how to record a message first. While executing this task participants used a lot of help from audio, video and trainer. They were confused which button is used to start recording video message and which button will be helpful for stop recording.

4.1.5 Contact Book

14 participants (7m, 7f) saved a contact number using *contact book* by taking help from their trainer. 2 participants (1m, 1f) finished their task with taking help from video and audio. 2 (1m, 1f) participants were not able to finish their task.

4.1.6 Thumbnail videos and photos

15 out of 18 (7m, 8f) participants completed their task of opening videos and photos very easily. Only 3 of them find it hard to find a photo or videos because of mouse scroll.

4.1.7 Home Button

In our training session we described or participants that whenever they became confuse or they did not find any way to perform the assigned task they could press "*home button"*, which will take them to the first or home screen, so they can start over again. 9 participants used this button.

4.2 Conclusion

First prototype was designed according to the requirements of participants, which were representing whole population of illiterate people in Pakistan. 8 participants asked about *"facebook"* but we convinced them that our latter versions will have social media application for our users. 10 participants were satisfied from the features of CompABC.

In Study 2 we observe that participants choose different help options, but in most of the cases we observe that audio help was distracting our participants to perform a specific task. Instead of using their memory they started listening to the audio help again and again. They started making correlation between audio and video help instead of using their own memory. Video help was used and was far more helpful then audio help or available trainer. Use of multi-informational buttons was helpful, we observed that most of female participant remembered buttons by colors and most of male participants tried to remember buttons by numbers, but use of many buttons on same screen make it difficult to remember a specific button. To design our final prototype we had make some major changes in *e-mail, audio support* and *buttons*. Rest of the features like *video help, contact button, thumbnail videos and photos* and others requires minor or no change.

5. FINAL PROTOTYPE

Final prototype was designed on the basis of conclusion drawn from study 2. Final Prototype is revised version of first prototype. In the final prototype, audio help is completely eliminated as it was not proved enough helpful in presence of video help. Video help was more refined. In *Email*, three buttons were replaced with one button. Only the button required to complete a task would appear on the screen, otherwise it will not be visible to user. Figure 3(a) and 3(b) illustrate the new update in CompABC, *E-mail* section.

Fig. 3(a) Showing Button Require to Record Message

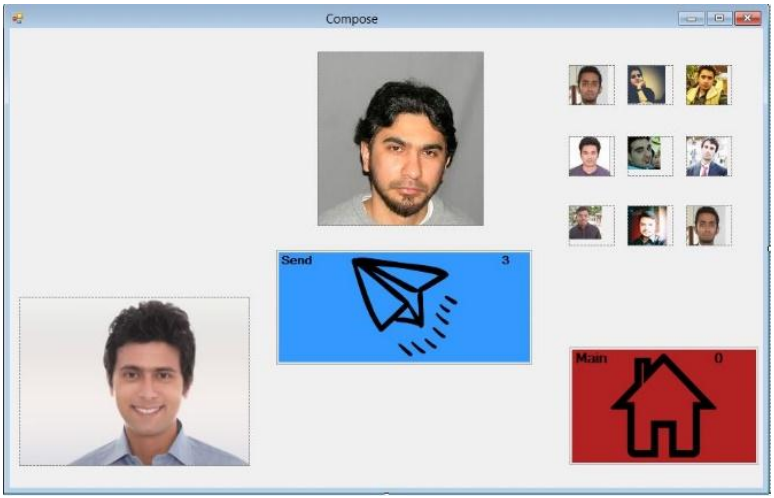


Fig. 3(b) Showing Button Require to Send Message

6. STUDY 3

In phase invited our participants again but this time we include only ten participants (5m, 5f) because they were the participants which felt difficulty to some areas where we had brought major change. 8 (4m, 4f) out of 10 participants were satisfied with the changes. 2 participant were feeling difficulty in saving a contact number in *Contact Book*.

7. DISCUSSION

The aim of this study was to develop such application which were not only usable but on the same time accessible for illiterate community. As for designing CompABC, we

identified the appropriate requirements and design foundation to build an application. We hired illiterate participants with little or either no computer skill. Here are some design recommendations for illiterate people based on our findings.

7.1 Design Recommendations

Our study shows the requirements of illiterate population of Pakistan, We are sure that our findings will help to generalize the problem of designing user interface for low illiteracy population worldwide. On the basis of our study we suggest the following design recommendations:

1. Every person, either literate or illiterate have different set of requirements.
2. Male and female participants have different set of requirements moreover they have separate coping strategies. Male participants' tries to memorize user control via text or number and female participants tried to memorize the controls via colors.
3. Instead of designing multiple applications for illiterate users we have to design single application which fulfill their most of their requirements.
4. The applications should be designed homogeneously i.e. they have identical user interfaces for illiterate users worldwide.
5. Audio help is not useful when video help is available, try to implement video help.
6. With extra help available users did not try to use their memory or coping skill they try to take help, which reduce learnability.
7. User Controls especially buttons should be providing multiple information inform of icon, color, text and number etc. which facilitate user to adopt his own coping strategy.
8. Many user controls like buttons, text boxes on the same screen make users confuse.
9. The idea of *Contact Book* which is implemented by us first time, can be useful in pictorial passwords, and social media applications design for illiterate users.

7.2 Future Work

The work presented here is just the start of what is required from to identify the requirements and user interface design needs of illiterate population. We carried out our study with very small sample and in future the study should be carry out with relatively large sample. CompABC is providing an interface to very basic applications, in future CompABC should have more features like social media application with a messenger and word processing application which uses text to speech and speech to text technology, which assist this community more. We are planning to port upcoming versions of CompABC on Android platform.

8. ACKNOWLEDGEMENTS

We thanks all of our participants, without their help the study was not possible.

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DETERMINE THE VARIATION IN STOCK PRICES IN HONDA ATLAS CARS

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ABSTRACT

In this study, we examine the impact of volume stock prices by utilizing the other stock prices (Open, low high, close) of Honda Atlas Cars. We used the information from 1 January 2010 to 1 August 2016. Augmented Dickey Fuller (ADF) test has been used to the essential estimation of the records. In this mentoring, dynamics models are used for evaluation. Outcomes disclose that stock prices of low, high, close, open are the key determinants of Stock prices of volume. This study looks into that every one of these factors are discovered quantifiably noteworthy with positive (+) signs. It creates the impression that these factors have significant impact on Volume stock prices of Honda Atlas Cars.

KEYWORDS

Volume stock prices, opening prices, closing prices, low prices, high prices.

1. INTRODUCTION

The corporation came into existence in 1992 by a dual endeavor of two leading companies of Japan and Pakistan which are Honda motors Japan and Atlas cars Pakistan and become listed on all three stock exchanges of Pakistan. Honda motors becomes parent company by gaining 51% stocks of the corporation. Honda Atlas's key business is to manufacture & assemble cars, provide these to end users, provide sufficient stock of spare parts throughout the country and provide after sales services. The corporation has launched the latest models of its best-selling products "Honda CR-V, Honda CR-Z, Honda HR-V, Honda Civic (four models), Honda City Aspire (four models) and Honda City (four models)".

Vision Statement:

"Striving to be a company that society wants to exist by sharing joys with people throughout the world creating products that maximize the joy of customers, with speed, affordability and low CO2".

Honda Atlas enrolled an advantageous development in car offers because the affiliation finished to provide 27% greater vehicles (2009: 11,144 - 2010: 14, 120) as opposed to the 28% drop it found within the principle year (Jun-Jul offers figures) actual gamers like Indus vehicles and Pak Suzuki in like way indicated exceptional alternate in plans by means of 49% and 41% autonomously. The little bit of the pie of Honda Atlas

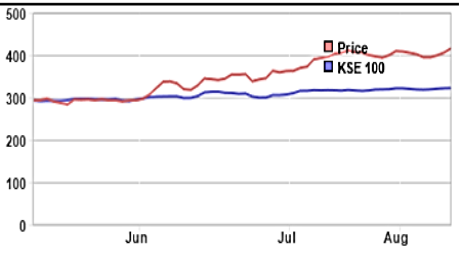
however has contracted 10% whilst confirmed up distinctively in connection to 11% in 2009. Indus vehicles little bit of the general enterprise stretched out from 35% to 37% from 2009-10 on the again of stable Toyota Corolla interest and guides of motion, Pak Suzuki is enthusiastic at 52% while Dewan vehicles dropped from 2% to at least one% in mild of frail gives in their pervasive get Shehzore.

Table 1
Trends and Growth in Honda Atlas Cars

Honda Atlas Cars (Pakistan) Ltd. AUTOMOBILE ASSEMBLER

415.10 9.57 / 2.31% 15:28:20

Open	409.50	Avg Vol (12 M)	320,937.60
High	423.00	52 Week Low	217.00
Low	408.00	52 Week High	424.70
Close	415.10	Market Cap	59.28 B
Volume	1,079,500	Beta	0.00
Change	9.79	Face Value	10.00
Free Float Shares	28.56 M	*Total No. Shares	142.80 M



Last annual EPS (based on 2016 final)is 24.90 up to 2017 Q1, price to earning P/E (based on 2016 final) 15.86 up to 2017 Q1 Exp Earning Growth (based on 2017 Q1) 18.23% based on 2017 Q1.

This study takes the impact of volume stock Prices by using the other stock prices (Open, low high, close) of HONDA ATLAS CARS. Results reveal that stock prices of low, high, close, open are the key determinants of Stock price of volume. This study investigates that every one of these variables are discovered quantifiably critical and have a (+) signs. This shows that this variables have critical effect on Volume stock costs of Honda Atlas Cars.

Specification of Variables:

Vol is a volume stock prices of a HONDA ATLAS CARS is utilized as dependent variable. The volume is consistently reported as the amount of shares that changed hands in the midst of a given day. Volume is the important technical analysis indicator through this we can measure the relative worth of market change. When the markets have a strong price movement, then the strength of that movement depends on the volume for that period. The more prominent the volume amid the value move, the more noteworthy the move The typical volume of a security over a more drawn out time allotment is the total aggregate traded that period, separated by the length of the period and low (LP) high (HP) close (CP) Open (OP) as an independent variable. I have a built information by taking verifiable stocks information on the websites of Honda atlas cars in Pak rupee covering a time of Jan 2010 to August 2016.

1) **Volume**
Volume is a standout amongst the most fundamental and valuable ideas to comprehend when exchanging stocks. Volume is characterized as, "the amount of stocks or agreements switched a security or a whole market amid a given timeframe.

2) **Closing Stock Price**
The end cost is the last cost at which a security is traded on a given trading day. The end cost addresses the most uncommon valuation of a security until trading starts again on the accompanying trading day.

3) **Opening Stock Price**
The opening expenses is the expense at which a collateral, first exchanges upon the opening of a trade on a given exchanging day.

4) **Low Stock Price**
Today's low is minimal cost at which a stock trades through the range of a trading day. Today's low is consistently lower than the opening or closing expense.

5) **High Stock Value**
Today's high is the most elevated cost at which a stock traded over the range of the day. Today's high is ordinarily higher than the end or opening expense.

2. LITERATURE REVIEW

Immeasurable studies have been directed by famous scientist. In this way, the audit of couple of imperative studies is along these lines clarified.

LaBarr. A (2014) Unpredictability estimation assumes an imperative part in the fields of stat and finance. A wide range of methods address the issue of assessing instability of financial resources. Autoregressive conditional heteroscedasticity (ARCH) models and the related summed up ARCH models are mainstream models for instability. This paper will present the requirement for instability demonstrating and additionally present the system of ARCH and GARCH models. A brief discourse about the structure of ARCH and GARCH models will then be contrasted with other instability demonstrating procedures.

Engle. R (1982) Customary econometric models expect a steady one-period forecast changes. To sum up this improbable presumption, another class of stochastic procedures called autoregressive conditional heteroscedastic (ARCH) procedures are presented in this paper. These are mean zero, serially uncorrelated procedures with noncontact changes restrictive on the past, however steady unrestricted fluctuations. For such procedures, the later past gives data about the one-time frame forecast fluctuation. A relapse model is then presented with unsettling influences taking after an ARCH procedure. Most extreme probability estimators are depicted and a basic scoring cycle detailed. Customary minimum squares keeps up its optimality properties in this set-up, yet greatest probability is more effective. The relative proficiency is computed and can be limitless. To test whether the aggravations take after an ARCH procedure, the Lagrange multiplier method is utilized. The test is construct essentially with respect to the autocorrelation of the squared OLS residuals. This model is utilized to gauge the methods

and fluctuations of swelling in the U.K. The ARCH impact is observed to be noteworthy and the evaluated differences increment significantly amid the disorganized seventies.

Starks. L (1988) This paper investigates the observational relationship between supreme stock value changes and exchanging volume in the share trading system. Utilizing Granger causality tests we find that there is a huge causal relationship between supreme value changes and volume at the firm level and that this relationship is more grounded in periods encompassing income declarations. We see this as proposing that data landing takes after a successive instead of a simultaneous procedure, in spite of the fact that the outcomes don't bolster an extraordinary variant of either data entry display.

Bar, K.M. et al., (2015) The concentrate experimentally examined the effect of sectoral unpredictability on the monetary development of India utilizing yearly time arrangement information for the years 1970-2011. It is endeavored to discover that to what surviving instability in monetary development rate of India is connected with unpredictability in development rate of various segments. ADF unit root test is utilized to check the stationarity of the information. Autoregressive Conditional Heteroscedasticity (ARCH) and General Autoregressive Conditional Heteroscedasticity (GARCH) have been utilized for assessing the instability as a part of development rate of GDP and segments. To see the effect of sectoral instability on financial development rate Ordinary Least Square (OLS) has been utilized. At long last to appraise the dependability of the model Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUMSQ) tests have been utilized. The outcomes clarify the presence of volatility in financial development rate to a more noteworthy degree. The horticulture segment, fares and imports likewise change to a more noteworthy degree. The outcomes have additionally demonstrated that slacked time of development rate of yield, farming division and additionally benefits area influences the present time frame's development rate of yield. Moreover, the outcomes uncovered that unpredictability in administrations segment contributes most astounding towards instability in monetary development rate when contrasted with different divisions and unpredictability in fares area impact the financial development vacillations adversely.

Rogers & Zhou (2007) In prior reviews, the estimation of the unpredictability of a stock utilizing information on the day by day opening, closing, high and low costs has been produced; the additional information in the high and low costs can be fused to produce unprejudiced (or near-impartial) estimators with significantly bring down variance than the basic open-close estimator. This paper handles the more troublesome assignment of evaluating the connection of two stocks in view of the everyday opening, closing, high and low costs of each. In the event that we could accept that we saw the high and low estimations of some direct blend of the two log costs, then we could utilize the univariate comes about by means of polarization, however this is not information that is accessible. The real issue is all the more difficult; we pre sent a fair estimator which parts the difference

Z. Leon (2007) on this paper we concentrate on the dynamic dating among exchanging volume, instability, and stock returns at the universal securities exchanges. In the first place, we look at the part of volume and unpredictability in the individual securities exchange flow utilizing an example of ten noteworthy created stock exchanges.

Next, we extend our investigation to a numerous business sector structure, taking into account a substantial example of cross-recorded firms. Our examination depends on each semi-nonparametric (flexible Fourier form) and parametric structures. Our significant discoveries are as per the following. To start with, we discover no confirmation of the exchanging volume influencing the sequential relationship of securities exchange returns, as anticipated through (Campbell et al. (1993). Next, the share trading system unpredictability had an adverse (–) and measurably noteworthy effect on the serial connection of the share trading system returns, predictable through the confident (+) input exchanging ideal of (Sentana and Wadhwani (1992)). Third, the slacked exchanging capacity is emphatically identified with money markets unpredictability, supporting the data stream hypothesis. Fourth, we discover the exchanging volume to have both a monetarily and measurably noteworthy effect on the value revelation process and the co-development between the universal securities exchanges. In general, these discoveries propose the significance of the exchanging volume as a data variable.

3. METHODOLOGY AND DATA ANALYSIS

Distinctive studies like Awan. Z (2011), Zeb. N (2014), Khalid Mushtaq et al. (2014), Junaid Ahmed et al. (2011) Salman Azam Joiya et al. (2013) has utilized diverse components for model investigation however this study joins the most vital elements of volume of Honda Atlas Cars. This education has been demonstrated the four consistent variables through elements of volume.

For the examination time arrangement information has been utilized for the period 1 January 2010 to 1 August 2016 got from source: Google finance Time-arrangement information is frequently covering a unit root alternately is non-stationary. ARDL evaluation are workable if in a model every one of the variables are non-stationary on level or some variables are stationary on level 1(0) or some are on 1st difference 1(1). It's a standard form of OLS techniques which incorporate Lags of both the prominent variable (volume) and non-prominent variables (open, low, high, close) as repressors (Greene, 2008). To check stationary properties of the information Increased Argument Dickey Fuller (ADF) unit root test has been connected. That indicate volume and high is stationary on 1(0) and remaining all the explanatorily variable are on 1(1). The unpredictability of the variables under dialog i.e. low, high, open, and close and volume are evaluated by Generalized Autoregressive Conditional Heteroscedasticity (GARCH). GARCH models have gotten to be vital instrument in the examination of time arrangement information, especially in monetary application. These models are particularly valuable when the objective of the study is to break down the future volatility. In the wake of evaluating unpredictability in every one of the variables standard form of Ordinary Least Square technique ARDL is utilized to check the relationship between unpredictability in Volume, low, high, close open To quantify the unpredictability in the variables, The essential adaptation of the least squares shows that, the expected estimation of all error terms when squared, is the same at any given point. This is said to be homoscedasticity and due to this statement that is the concentration of ARCH/GARCH models. Information in which the fluctuations of the error terms are not equivalent, in which the error terms may sensibly be anticipated that would be bigger for

a few points or scopes of the information than for others, are said to undergo from heteroskedasticity. GARCH (1, 1) model [20] has been utilized.

The GARCH (1,1) is a standard certification in which the 1st number indicates to what number of autoregressive lags or ARCH terms show up in the equation, while the 2nd number indicates to what number of moving average lags are determined which here is regularly called the quantity of GARCH terms. Some of the time models with more than one lags are expected to discover great fluctuation figures

The broad form of GARCH (p, q) model is:

$$Yt = a + \beta Xt + \mu t$$

$$h_t = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{P} \gamma_j h_{t-j}$$

ht is the variance parameter that relies on the past value of stuns which show with the square of residual lag term and the past values of ht is shows with the lag of ht terms. P demonstrate the structure of GARCH and q demonstrate the structure of ARCH model. GARCH (1, 1) is the modest type of GARCH (p, q) demonstrate. Difference equation for GARCH (1, 1) version is:

$$h_t = \gamma_0 + \delta_1 h_{t-1} + \gamma_1 u_{t-1}^2$$

In our model the different equation are molded for to check the variation volume, open low, high, close. For the estimation of variation GARCH (1,1) model is applied. ARDL technique is utilized to check the impact of volatility in Volume through individual explanatory variables.

1) Impact of closing stock prices on volume.
2) Impact of opening stock prices on volume.
3) Impact of low stock prices on volume.
4) Impact of high stock prices on volume.
5) Impact of all explanatory variables on volume.

$$V = \beta 0 + \beta 1\ CP + \beta 2\ CP(-1) + \beta 3\ vol(-1) + \mu t$$

$$V = \beta 0 + \beta 1\ OP + \beta 2\ OP(-1) + \beta 3\ vol(-1) + \mu t$$

$$V = \beta 0 + \beta 1\ LP + \beta 2\ LP(-1) + \beta 3\ vol(-1) + \mu t$$

$$V = \beta 0 + \beta 1\ HP + \beta 2\ HP(-1) + \beta 3\ vol(-1) + \mu t$$

$$\mathbf{Vol = \beta 0 + \beta 1\ OP + \beta 2\ OP(-1) + \beta 3\ LP + \beta 4\ LP(-1) + \beta 5\ CP + \beta 6\ CP(-1) + \beta 7\ HP + \beta\ vol(-1) + \mu t}$$

where vol_ shows variation, V = Volume of stock, OP = opening stock prices, CP = closing stock prices, HP =High stock prices, LP = Low stock prices, μt = error term.

ARDL Regression Analysis

To check the relationship between volume and what is the impact on volume by the variation in its determinants ARDL techniques is utilized. we used ARDL analysis by

taking volume as dependent variable and open low high close as independent and outcomes indicates that open low close have a significant impact on volume expect high which are not statistically significant .2616 > 0.05. R2 is 36% which shows is very low variation in volume and the Adj R2 = .3631 which is used to observe the effect of new independent variables in the model. D.W = 2.03 which is lie between 1.5 to 2.5 that's shows there is no auto correlation between the residuals and SC and HQ is 28.90, 28.91 that shows the complication of the model.

Table 2
ARDL MODELS

Variables	Coefficient	Std .Error	T. Static	Prob.	Variables	Coefficient	Std. Error	T. Static	Prob.
C	775760	109957.9	7.0551	0	C	784595.8	106804.4	7.3461	0
HIGH	-97260	22811	-4.2637	0	LOW	-229433	22428.87	-10.2294	0
HIGH(-1)	84234	22822.59	3.7171	0.0002	LOW(-1)	216228.7	22502.9	9.60892	0
VOLUME(-1)	0.4866	0.021417	22.719	0	VOLUME(-1)	0.504066	0.021019	23.9811	0
R2 = 26%,	D.W = 2.04,	HC/SC = 29.03			R2 = 30%,	D.W = 2.05,	HC/SC = 28.98		

Variables	Coefficient	Std. Error	T. Static	Prob.	Variables	Coefficient	Std. Error	T. Static	Prob.
C	792099	108928.6	7.2717	0	C	782690.1	109373.6	7.15612	0
CLOSE	-1E+05	22719.25	-5.7189	0	OPEN	-143512	23799.4	-6.03005	0
CLOSE(-1)	116889	22756.22	5.1366	0	OPEN(-1)	130795.4	23821.01	5.49076	0
VOLUME(-1)	0.4897	0.021345	22.944	0	VOLUME(-1)	0.487097	0.021319	22.8485	0
R2 = 27%,	D.W = 2.05,	HC/SC = 29.03			R2 = 27%,	D.W = 2.05,	HC/SC = 29.03		

Dependent Variable: VOLUME

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	563597.8	144541.4	3.89921	0.0001
OPEN	477835	60803.57	7.85867	0
LOW	-1152910	76607.98	-15.049	0
CLOSE	539397	58335.22	9.24651	0
HIGH	3211.392	2859.763	1.12296	0.2616
OPEN(-1)	-132556	56449.63	-2.3482	0.019
LOW(-1)	252721.6	60749.32	4.16007	0
VOLUME(-1)	0.489516	0.020871	23.4548	0
R-Squared	0.365888	HC	28.9015	
D.W.	2.036459	SC	28.918	
Adj. R2	0.363193			

Vol = 563597.8 + 477835 OP -132556 OP(-1)-1552910 LP
+ 252721 LP(-1)+ 539397 CP+ 3211.39 HP + .489516 vol(-1) + μt

Volatility in Variables

Empirical outcomes of volatility in elements under examination acquired through ARCH and GARCH process are accounted for in Table 1. From the outcomes in Table 1 the difference models acquired from GARCH (1,1) for **vol _V is:**

ht = 1.5611+ 0.093190ht-1 + 0.244626u^2t-1+ μt

The experimental results reported above are acquired from GARCH (1, 1) demonstrate. For accommodation we have indicated ARCH parameter by **a** and GARCH parameter by **β.** To check the volatility the estimation of ARCH and GARCH coefficients are included, i.e. (a+β) if the whole is near 1 it shows that highly quantifiable of volatility stuns in volume if near to 0 it means low quantifiable of volatility stuns in volume. Model indicates that (a+β) the sum of square of residual lag term and the lag of variance terms is equal to .33 which is close to zero that shows volume have a low quantifiable volatility stuns. And the R2 is 25% that indicates the variation in volume is low and Durbin Watson is 2.14 that indicates no auto correlation between the residuals And the ARCH and GARCH are statistically significant.

Table 3
Variance Acquire from GARCH (1,1) Model

Variables	Coefficient	Std .Error	z-static	Prob.	Variables	Coefficient	Std. Error	z-static	Prob.
	Dependent Variable: VOLUME Variance Equation					Dependent Variable: Close Variance Equation			
C	1.56E+11	2.07E+10	7.546845	0	C	0.01456	0.0045	3.228727	0.0012
RESID(-1)^2	0.09319	0.02716	3.431188	0.0006	RESID(-1)^2	0.048006	0.010052	4.775771	0
GARCH(-1)	0.244626	0.097464	2.509911	0.0121	GARCH(-1)	0.898681	0.024186	37.15687	0
	Dependent Variable: Open					Dependent Variable: Low			
C	0.006116	0.00192	3.18605	0.0014	C	0.021024	0.005252	4.003056	0.0001
RESID(-1)^2	0.046797	0.008462	5.530566	0	RESID(-1)^2	0.061583	0.012532	4.913887	0
GARCH(-1)	0.928887	0.013768	67.465	0	GARCH(-1)	0.861895	0.029629	29.08911	0

Variables	Coefficient	Std .Error	z-static	Prob.
	Dependent Variable: High Variance Equation			
C	9.61E-06	1.91E-06	5.021613	0
RESID(-1)^2	0.098623	0.00863	11.42764	0
GARCH(-1)	0.863527	0.013382	64.52882	0

Variance model is Vol_Opening Stock Prices

$$ht = 0.006116 + 0.046797ht\text{-}1 + 0.928887u\text{^}2t\text{-}1 + \mu t$$

Like as above model (a+β) the sum of square of residual lag term **a** and the lag of variance terms β is equal to .97 which is close to 1 that shows opening stock prices have a highly quantifiable volatility stuns. And the R2 is 98% that indicates the variation in volume is high and Durbin Watson is 1.88 that indicates no auto correlation between the residuals and the ARCH and GARCH Are statistically significant.

Variance Model is Vol_Closing Stock Prices

$$ht = 0.014530 + 0.048006ht\text{-}1 + 0.898681u\text{^}2t\text{-}1 + \mu t$$

Like as above model (a+β) the sum of square of residual lag term **a** and the lag of variance terms β is equal to .95 which is close to 1 that shows closing stock prices have a highly quantifiable volatility stuns. And the R2 is 98% that indicates the variation in

volume is low and Durbin Watson is 2.09 that indicates no auto correlation between the residuals and the ARCH and GARCH Are statistically significant

Variance Model is Vol_Low Stock Prices

ht = 0.021024+ 0.061583ht-1 +0.861895u^2t-1+ µt

Like as above model (a+β) the sum of square of residual lag term **a** and the lag of variance terms β is equal to .92 which is close to 1 that shows low stock prices have a highly quantifiable volatility stuns. And the R2 is 98% that indicates the variation in volume is low and Durbin Watson is 1.92 that indicates no auto correlation between the residuals and the ARCH and GARCH Are statistically significant

Variance Model is Vol_High Stock Prices

ht = 9.61E-06+ 0.098623ht-1 + 0.863527u^2t-1+ µt

Like as above model (a+β) the sum of square of residual lag term **a** and the lag of variance terms β is equal to .95 which is close to 1 that shows high stock prices have a highly quantifiable volatility stuns. And the R2 is 98% that indicates the variation in volume is low and Durbin Watson is 2.04 that indicates no auto correlation between the residuals and the ARCH and GARCH Are statistically significant

4. DISCUSSION

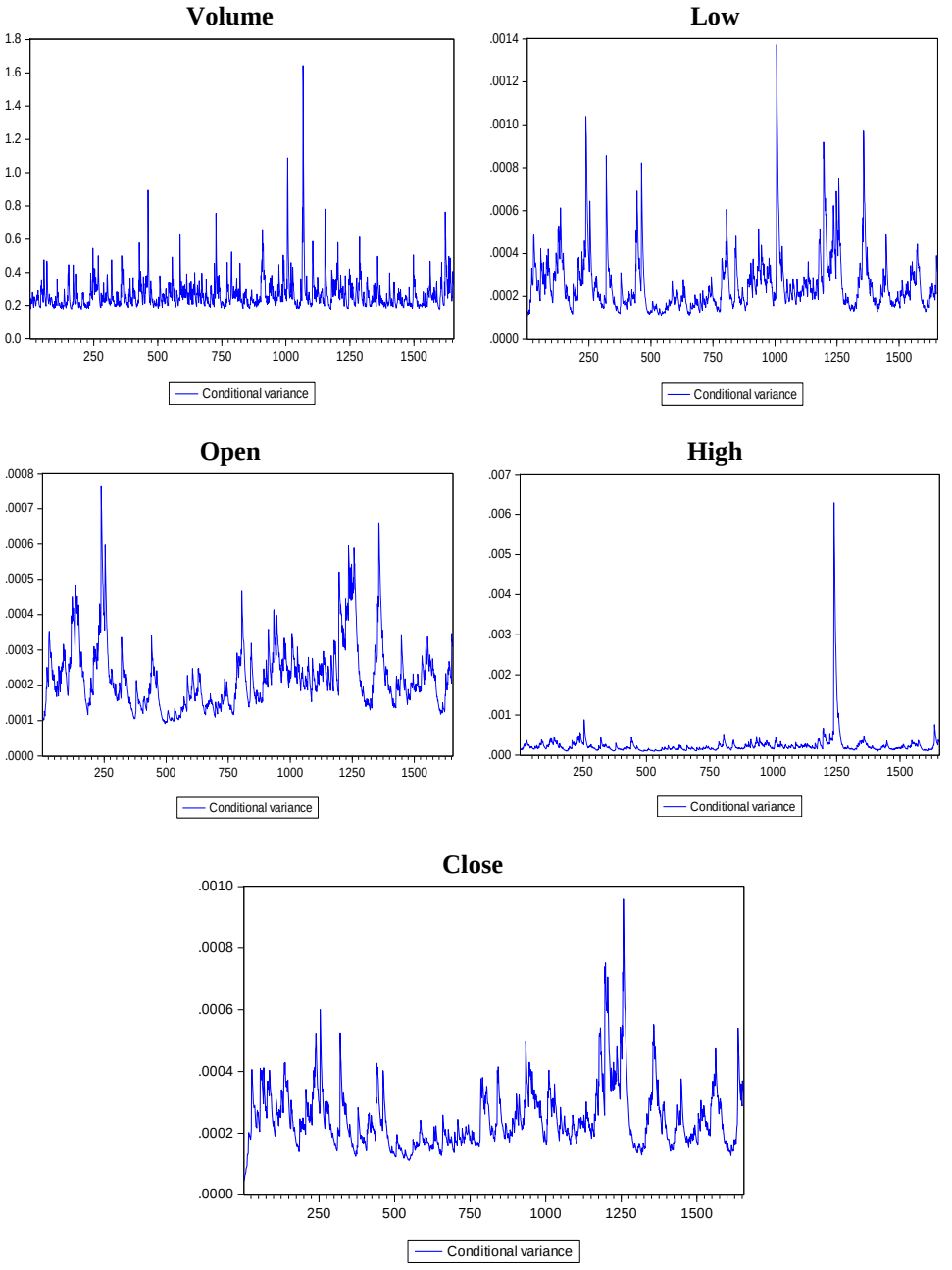
When the no of exchange shares in greater and the prices is also greater that's shows it's a good sign and if the no of exchange shares is greater and the prices of stocks going down that's indicate something is harmful. Because price tells us about a direction whether we purchase such stock or sell it and volume tells us how many buyer and seller are exit of a particular stock

Here volume volatility graph shows that a gradual development upward with steady volume this shows the ongoing upward trend There may be a customer in the market who is persistently purchasing shares while attempting to not attract in an excess of consideration. Volume graph shows Honda atlas car shares prices not in resistances position but at 1000 greater the volume, and the prices of stocks is also greater and after a periods goes below and touch support line but now it again in upward trend that's shows a good sign. Price and volume have a strong relation because volume travel with the pattern of price if the pattern of prices travel upward in graph at point(500 to 1000) volume shows increment trend but at point 1250 Prices travel upward but the volume shows go downward trend it is an indication that the pattern is beginning to lose its legs and may soon end.

At point 1250 when closing price is high that indicates the pressure of buying and at point 250 when opening price is high indicates the pressure of selling and at point 250 when opening and low prices move at same level indicates buyer control and at point 1250 when closing and high prices same indicates seller control.

By analyzing price and volume for a couple days will give you a thought regarding general path of the market and with some ability, you can detect the warning signs that an adjustment in pattern is coming.

Conditional Volatility Graph by GARCH (1,1) of Volume and its Determinants



5. CONCLUSION AND LIMITATION FOR FUTURE RESEARCH

This review highlights a few restrictions that may give roads to future research. This review concentrate on particular organization volume — specifically, Honda atlas cars — yet future studies could unquestionably explore how stocks prices effect on volume of a no of organization's other organization may impact the impact depicted thus. This study explores Price and volume have a significant relation because volume travel with the pattern if the pattern of prices travel upward in graph at point (500 to 1000) volume ought to increment but at point 1250 Prices travel upward but the volume shows go downward trend it is an indication that the pattern is beginning to lose its legs and may soon end. By analyzing price and volume for a couple days will give you a thought regarding general path of the market and with some ability, you can detect the warning signs that an adjustment in pattern is coming.

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SIMULATION AND PERFORMANCE ANALYSIS OF DSR, GRP AND TORA AD HOC ROUTING PROTOCOL

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ABSTRACT

MANET (Mobile AdHoc Network) is a collection of mobile nodes that are connected by wireless without any support of centralized control. These nodes are move freely and independently anywhere in the network in any direction. Due to its dynamic nature, each node acts as a router and is responsible for route the data between nodes. So, to select the suitable protocol is a challenging task in mobile ad hoc network. To analyze the performance of different routing protocol it is useful to route the data in different protocol using different metrics as each routing protocol has its own working and structure. In this paper three routing protocols of mobile adhoc network namely DSR, GRP and TORA are tested. OPNET Modeler 14.0 Simulator is used to evaluate the performance of these routing protocols with the help of three different metrics named as End-To-End Delay, Network Load and Through put. Simulation results show that the performance of GRP is better than others.

KEYWORDS

MANET, DSR, GRP, TORA, OPNET.

1. INTRODUCTION

Mobile Ad Hoc Network is a prominent wireless technology achieves the researcher consideration to explore the Mobile Ad Hoc network. Each node in the Mobile Ad Hoc Network is connected to other node with the help of wireless link and developed an infrastructure less multi-hop wireless network. Due to the limited range of transmission each node in the network work as a router or host to communicate its nearby nodes and transfer the data. The main challenge of Mobile Ad Hoc Network is to route the packets efficiently over the network. In the process of routing, the data is sent from one node to another in the form of packets and each node maintained its routing table and updates it when changes occur in the network. Routing tables are used to find the destination node for the delivery of packets.

The nodes in the network are not directly connected to other node and in this case, route discovery is started to find the route to send data packets from one node to another. Different routing protocols are used for the discovery of route to send data packets to its destination from a source. The purpose of routing protocols is to find an efficient routing for route discovery and packets delivery.

When we deployed the MANET, it has different topology change for the reason that it requires a reliable and efficient routing protocol. MANET is categorized into two groups, Reactive Mobile Ad hoc Network Protocol (RMP), Proactive Mobile Ad hoc Network Protocol (PMP), where the aforesaid network protocols combine to form a new network protocol named as Hybrid Mobile Ad hoc Network Protocol (HMP).

2. ROUTING PROTOCOLS

Routing protocols in mobile ad hoc network are mainly categorized as follows:

A. Proactive Routing Protocols (PMP)

The PMP is also called a table driven protocol. It is useful to identify the layout of network from time to time. To detect the most appropriate route in a network, the routing table is maintained at every node, from the source to the destination with lesser delay. The information in the routing table is updated continuously when a node in a network is not so proactive. These protocols are not appropriate for high speed nodes movement, as the information about routing cannot be updated in the routing table.

B. Reactive Routing Protocols (RMP)

RMP is also called an on-demand routing protocol. In these protocols when source wants to communicate, routes can be found with other node. RMP is suitable where the movement of nodes is high and the data is not transmitted continuously.

C. Hybrid Routing Protocols

Hybrid Protocol is a combination of PMP and RMP. Every node in the close region act reactively and outside that region, it acts proactively. Network is categorized into different zones and assigned a unique id named as zone ID, which is helpful to identify the physical location of node on network. Hybrid routing protocol provide a minimum routing overhead in forwarding of data packets source to destination.

Dynamic source routing protocol (DSR)

Dynamic Source Routing Protocol is a kind of reactive routing protocol that is also named as on demand routing protocol. It is an efficient and simple source routing protocol and it can be used in multihop wireless ad hoc networks. The route cashe in DSR is regularly updated for the availability of new routes. If it found any new routes then the nodes will send the packet to that new available route. The data packet in the network has detailed about the direction of route. So, the route information is sent in the data packet from the sender to reach its destination.

To find the route, this information helps to avoid the finding of route periodically. Two mechanisms are used in DSR protocol, one is route discovery and the other one is route maintenance. In Route Discovery Mechanism, a node in a network wants to send a message to any particular destination in two types of i.e. route request and route reply. Node broadcast the RREQ packet in the network when it needs to communicate with other node. In the range where the message is broadcasting, its neighbor node takes this RREQ packet and inserts its own address in it and after that it rebroadcast this RREQ packet in the network. If the RREQ message reaches to the destination, that route will called a specific destination. If the message did not reach to the destination then the node

that received the RREQ, will check the previous route, whether it was used by the specific destination or not.

Temporally ordered routing algorithm (TORA)

Temporally ordered routing algorithm (TORA) is one of the reactive protocol that is also called as link reversal protocol. In MANET routing protocols, one of the main problem is congestion that is due to the high mobility of nodes in the network. There are three basic operations used in TORA protocol viz. route maintenance, route creation, and route erasure. In route creation operation, the directions are assigned to link in the portion of undirected network; with the help of metric height nodes that build a DAG (directed acyclic graph), routed at destination. All the messages flow downstream in the network from a higher height node to a lower height node; and flow upstream in the network from a lower height node to a higher height node. Two packets named as (QRY) query and (UPD) update are used for the discovery of route. When a node has no link in downstream way with the destination route then in this case, it will broadcast the query (QRY) packet in the network. In the network, this QRY will be transmitted until it has a destination or a node that has a route. This node then again broadcasts the packet UPD to the node that contains the height of node. This process will help for building multiple routes in the network. In the phase of route maintenance, it refer the management of changes occur "in topology in the network", in such a way that in a certain period of time the routes are reestablished to the destination.

Gathering Based Routing Protocol (GRP)

In MANET the geographic routing is the most suitable routing strategy because of its scalability i.e.; there is no need to manage the explicit routes. Gathering-based Routing Protocol is the mixture of Proactive Routing Protocol (PRP) and Reactive Routing protocol (RRP). Whereas reactive routing protocols are not appropriate for real-time communication because the benefit is that it can decrease the overhead of routing when traffic of network is static and light.

The function of GRP in MANET is to quickly gather the information without overheads about the network at a source node. The source node in the routing procedure transmits a destination query through the network, when the destination will get the query then it transmits a packet using protocol named as Network Information Gathering (NIG) to the network. Many nodes in the network named as Effective Outgoing Links (EIL), where the packet of Network Information Gathering does not reach; and the routers transmit this information to these Effective Outgoing Links. Finally, a packet of NIG reaches at source node and it does acquire all network information [17,18]. The main benefit of GRP is that it does not need to maintain the routing tables or route building before and during the forward process.

3. SIMULATION TOOL

In this research, a network simulator named as OPNET Modeler 14.0 (Optimized Network Engineering Tool) is used. It gives different solutions for network and the application management. Three scenarios are used to simulate and each simulations display the necessary results to check the performance of DSR, GRP and TORA. Three

parameters are considered in the evaluation of these protocols; those metrics are delay, network load, and throughput. Below table 1 shows the summarize view of parameter details.

Table 1
Simulation Parameters

Parameters	Value
Simulator	OPNET Modeler 14.0
Number of Nodes	10,25,50
Maximum Speed	10 m/s
Simulation Time	20 minutes
Pause Time	60 sec
Environment Size	2000X2000
Traffic Type	FTP
Mobility Model	Random

4. PERFORMANCE METRICS

Different parameters are used for the evaluation of routing protocol performance. Each parameter has different behavior on the overall performance of network. The parameters used in the evaluation of routing protocols are throughput, network load and delay. In the communication network these parameter plays an important role for the consideration of evaluation. So, in any communication network these parameters have a strong impact in the selection of an efficient or best routing.

1. **DELAY**
   The time between the source and destination message reception is the packet of end-to-end delay and in this time, packet goes across to the network. In the network, all the delays are known as packet end-to-end delays, and they are measured in seconds. Sometimes this delay expressed as latency that has a same meaning as delay. Packet delay is sensitive to some applications i.e. voice. So, in the network, voice needs a low average delay. Due to different activities, delay in the network increases and the packet end-to-end delay show that how the routing protocol completely adjusts to different limitations in the network to provide reliability in it.

2. **NETWORK LOAD**
   Network load is the high traffic in the network and it is not easy to handle. It can be represented in bit/sec. Many techniques have been introduced to improve the network efficiency and to easily manage high traffic and make a better network. MANET routing packets affected by the high network load and slow down the packet delivery for reaching to the channel [27] that results the collisions of these control packets.

3. **THROUGHPUT**
   From sender to destination, the ratio of total data reaches is known as throughput; and it can be expressed as bits or bytes per sec (bit/sec or byte/sec). In the network, if many changes occur in the topology then few factors affect the throughput as unreliable communication between nodes, limited energy and limited bandwidth. In every network a high throughput is an unconditional choice.

5. SIMULATION AND PERFORMANCE ANALYSIS

In this paper, three different scenarios are used for simulation to evaluate the performance of adhoc routing protocols named as DSR, GRP and TORA under the metrics of throughput, delay and network load. 10, 25 and 50 mobile nodes are used with one fixed WLAN server. For the simulation, a network size of 2000x2000 meters was considered. Later, addressing of IPv4 was given to all nodes in the network.

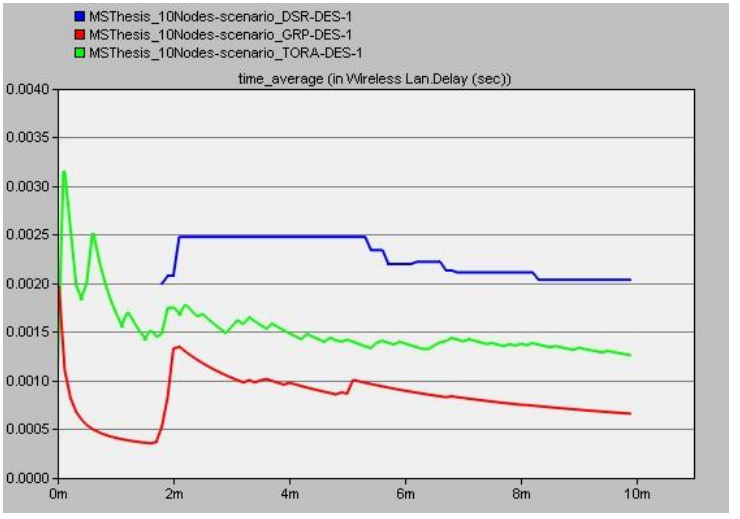

Figure 1: Delay in 10 Nodes Scenario

In Figure 1 a senario of 10 mobile nodes is simulated by using the metric delay. Graph shows that TORA is maximum in delay and GRP is best in delay than others .

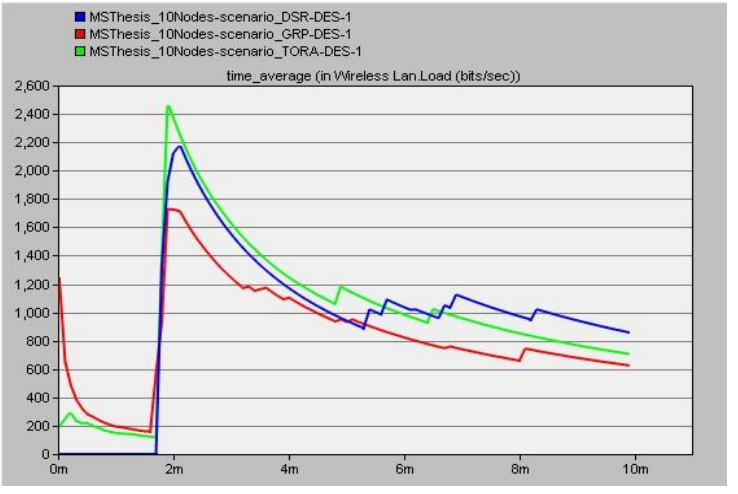

Figure 2: Network Load in 10 Nodes Scenario

Above graph (Figure 2) depicts that on the basis of network load in 10 mobile nodes, TORA is maximum whereas in this metric GRP is perform best.

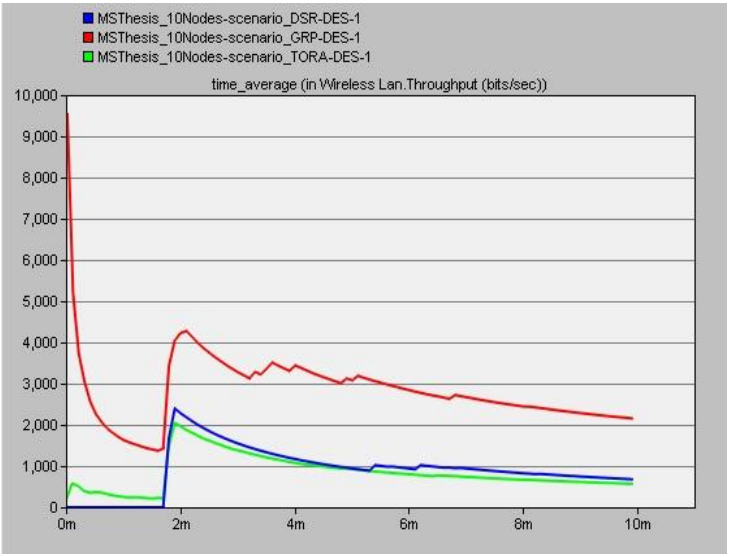

Figure 3: Throughput in 10 Nodes Scenario

Above graph (Figure 3) shows the throughput in 10 mobile nodes. In this graph GRP has maximum value and TORA shows good results.

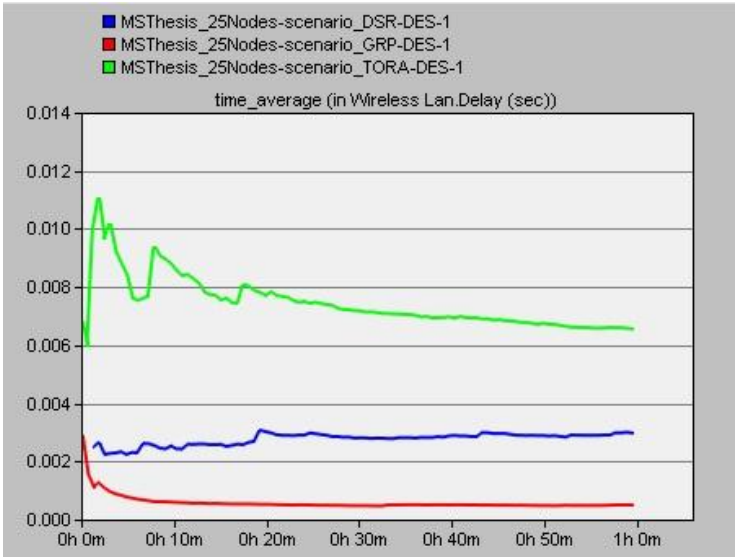

Figure 4: Delay in 25 Nodes Scenario

In Figure 4, performances of different protocols for 25 mobile nodes are presented on the basis of parameter delay. TORA shows maximum value and the GRP performs well in this scenario.

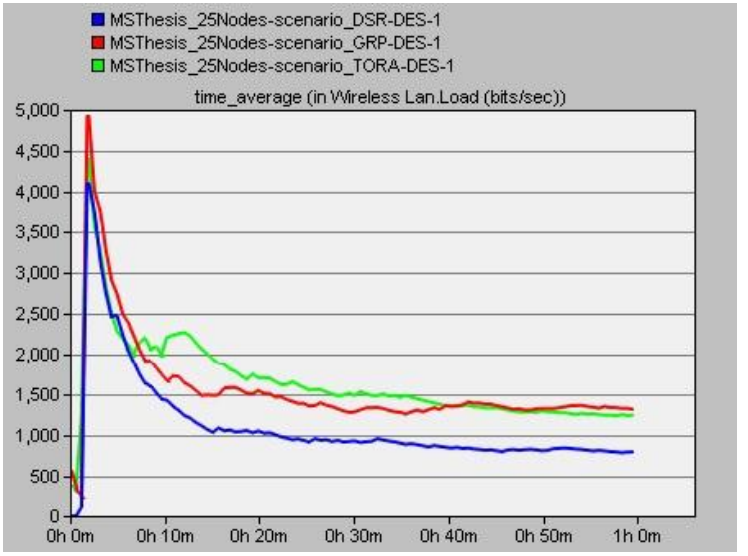

Figure 5: Network Load in 25 Nodes Scenario

In Figure 5, performances of different protocols for 25 mobile nodes are presented on the basis of parameter network load. GRP shows maximum value while DSR performs well in this scenario.

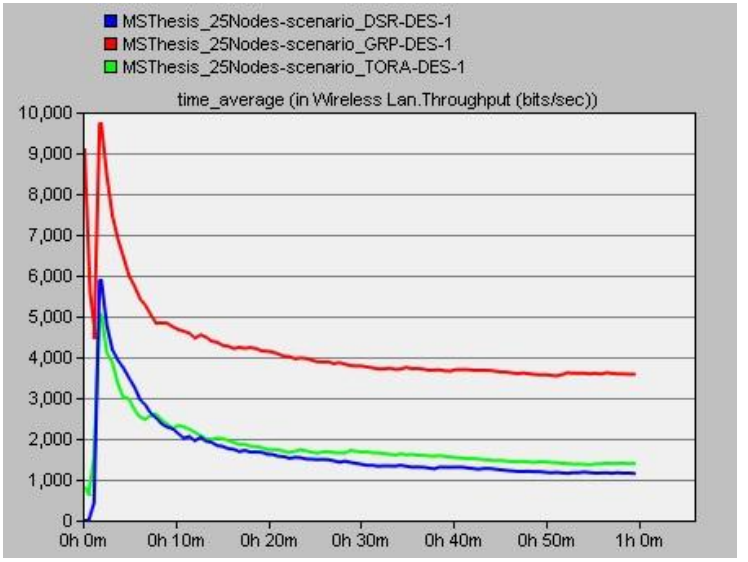

Figure 6: Throughput in 25 Nodes Scenario

In Figure 6, performances of different protocols for 25 mobile nodes are presented on the basis of parameter throughput. GRP shows maximum value and the TORA performs well in this scenario.

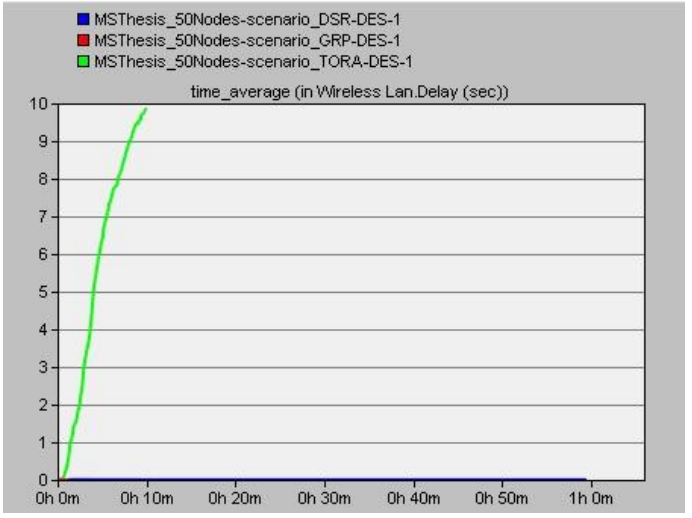

Figure 7: Delay in 50 Nodes Scenario

In Figure 7, performances of different protocols for 50 mobile nodes are presented on the basis of parameter delay. TORA shows maximum value and the GRP and DSR both perform well in this scenario.

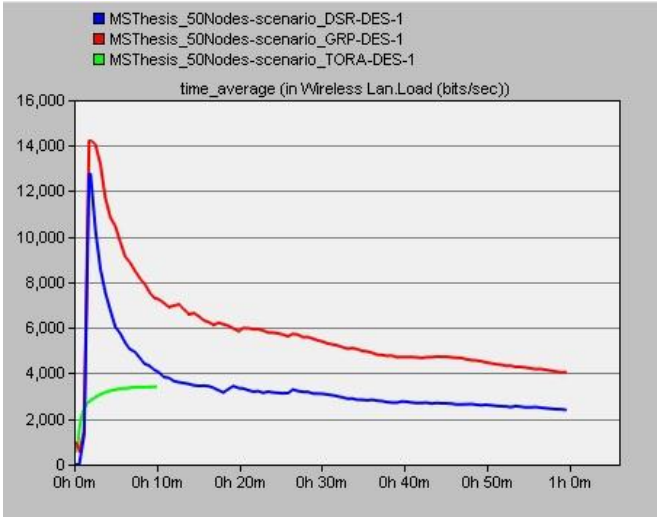

Figure 8: Network Load in 50 Nodes Scenario

In Figure 8, performances of different protocols for 25 mobile nodes are presented on the basis of parameter network load. GRP shows maximum value whereas TORA performs well in this scenario.

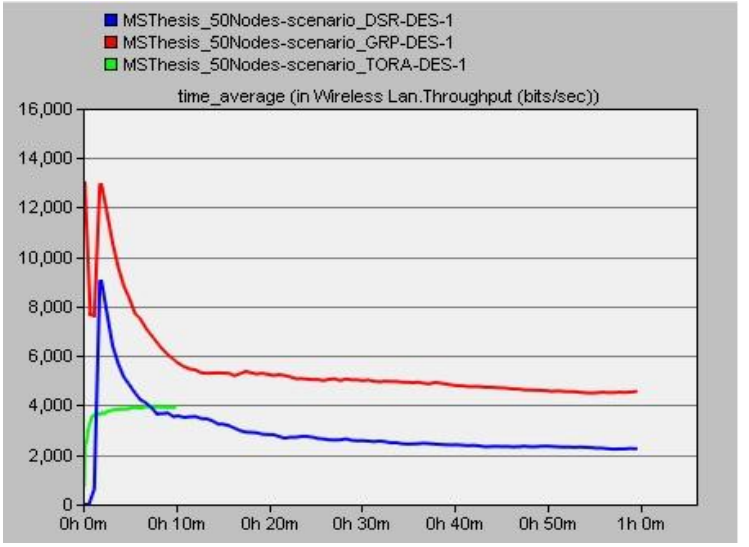

Figure 9. Throughput in 50 Nodes Scenario

In Figure 9 performances of different protocols for 25 mobile nodes are presented on the basis of parameter throughput. GRP shows maximum value while the TORA performs well in this scenario.

Here table 2 shows the average value of all protocols with the parameters in three scenarios.

Table 2
Resultant Values

Nodes	Parameters	DSR	GRP	TORA
10	Delay (sec)	0.0025	0.0020	0.0032
	Network Load (bit/sec)	2150	1740	2460
	Throughput (bit/sec)	2400	9600	2000
25	Delay (sec)	0.0032	0.003	0.0112
	Network Load (bit/sec)	4100	4900	4400
	Throughput (bit/sec)	5900	9800	5100
50	Delay (sec)	0	0	9.9
	Network Load (bit/sec)	12,900	14,100	3500
	Throughput (bit/sec)	9100	13,100	4000

6. CONCLUSION

This study was conducted for the performance analysis and simulation study of three routing protocols viz. DSR, GRP and TORA. Routing protocols perform a noticeable role in the communication; different routing protocols have different behaviors for the reason that the selection of routing protocol is difficult because the appropriate routing protocols enhance the reliability of network. The simulation study of our study is mainly focused on of three routing protocols viz. DSR, GRP and TORA using the traffic FTP to check the behavior against three parameters viz. delay, network load and throughput. Our purpose was to evaluate the performance of above mentioned parameters in these three routing protocols in MANET. The selection of most effective and consistent protocol is not an easy task. In the simulation work, we check the behaviors of all the routing protocols in different numbers of mobile nodes. From the analysis of 10 mobile nodes, GRP routing protocols showed the best performance as compared to DSR and TORA in all the above mentioned parameters. In 25 mobile nodes, again GRP is better in Delay while DSR is best in network load and TORA is best in throughput as compared to DSR and GRP. Finally in 50 mobile nodes, GRP is again at best in delay while TORA is performing well as compared to DSR and GRP. In MANET the control packets in routing is affected by high network load.

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A SCALABLE INTRUSION DETECTION SYSTEM FOR HIGH SPEED NETWORKS

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ABSTRACT

As the network growing so fast there is a need such mechanism that provides network security and such a way to increase the bandwidth, performance, memory and hardware utilization. Traditional centralized techniques to analyze the traffic were not scalable to increase the performance of network. In recent years few Distributed architecture have been used for dedicated network but they do not have a capability of scalable in high speed network. Our distributed architecture is scalable and 11 times faster than the centralized architecture. Our approach is based on switch based traffic splitting that distributes the load among sensors to increase the speed of intrusion detection in high speed network environment.

KEYWORDS

Scalability, Distributed Architecture, Intrusion Detection, Intrusion Prevention, High Speed Networks.

BACKGROUND

Backbone network speed has reached up to 10 GB so it is difficult for single network Intrusion Detection System to monitor the whole traffic and respond in real time against attack. In this paper we investigate on parallel Intrusion Detection System in distributed environment for high speed network [18,21] to enhance the network Intrusion Detection System efficiency and performance for high speed network. The Distributed architecture is the better choice [19,29].

1. INTRODUCTION

The usual sentiment in administrations is that Intrusion Detection Systems (IDS) will be overcome very fast in near future. Now the things are much more applicable Intrusion Prevention System (IPS). IPSs is the evolution of the IDSs, not a new technology and supplanted by firewalls of network layer filtering to make a more effective filtering of malicious storage. Objective to know about the both IDS and IPS systems and the evolution from IDS to IPS in organization as well as experiment with the present common conditions such as in open source IDS, Snort, & ip tables [30].

2. INTRUSION DETECTION SYSTEM

Attackers sign are determined by monitoring a computer system or a network and this process is called intrusion detection [1]. Or it may be defined as they are software, hardware or their combination which are used to determine the attackers activity caused by authorized users and accessing the system from internet. The misuse of given privileges by the users. Intrusion Detection Systems (IDSs) are products use for monitoring and analyzing process these products may be software or hardware. The efficiently of IDS differ depending upon their complexity. IDS may use both signatures and anomaly-based techniques [1,2]. The security system should be designed as which prevent the unauthorized resources and data access to the system. At present complete preventing breaches of security are not realistic. We can try to detect the attacker's attempts and can also repair the damages caused by them. This branch of research field is called intrusion detection system.

2.1 Purpose and Benefit of IDS

The main function to detect an attacker is to prevent the problems caused by undetected attackers. An effective security control program is formed to support security infrastructure. More efficient control system gives more efficient security information. The techniques which increase the effectiveness of an organizing policy is called appropriate technology. The most important quality of intrusion detection at present time is to detect an attacker's attempt.

When an attack is going to be attacked and being able to take sudden action significantly develop the odds of successfully stopping intrusions and detecting attacker's attempts to their source. Real-time signals consist having all activities involving the connected devices and the lead of system is applicable to interpret different events and diagnose exact attacks. Most traditional IDSs happen through a network- or a host-based approach toward identification and protecting against intrusions [2]. IDSs detect for attack signatures, specific patterns that ordinarily indicate malicious intent or suspicious activity and exactly effective IDS will use these techniques [31].

3. TYPES OF COMPUTER IDS

Commonly two kinds of IDS are used to detect the attacker on a network.

3.1 Network Based IDSs

Most common attacks are dependent upon the commercial circumstances and by use of IDSs detection of canalization and capture of the hackers is point out. One network-based IDS can lead a number of fragments for more than one host to catch and detect the hacker by only concentration of a single network and provide security. A set of single-purpose sensors or hosts keeps at various points in a network depending upon IDS based networks. Monitoring of network traffic and local or public analysis of performance is carry on by approach of these units and reports to a central console for the unsaved performance [3]. If sensors are unlimited, They can provide more safety against the attacks because of their making according to the "stealth" mode and detector cannot judge the exact location and system is safe [32].

3.1.1 Advantages of Network-Based IDSs:

- Some well-organized network-based IDSs can lead a wide variety of network.
- The development of network-based IDSs has small effect on a previous network. Network-based IDSs are commonly passive devices use for a network wire without dealing with the normal operation of a network, so it is easy to set again a network consisting of network-based lDSs with less effort.
- Network-based lDSs can form protected against attack and become unseen to most intruders.

3.1.2 Disadvantages of Network-Based IDSs

- Network-based IDSs cannot detect an attack during high traffic because they are not able to process all packets at a large scale or busy network. By converting IDSs completely in hardware vendors are trying to solve this problem as it is more efficient form [3] packet analysis is necessary to detect both smaller attacks and attacks with a little computing resource which reduce detection effectiveness by forcing vendors.
- Network-based IDSs are not applicable on modern switch based-networks. A network is subdivided by switches into small parts and is interconnected by these switches. Sometimes a network-based IDSs monitoring is limited to a single host because all switches cannot monitor universally. In such leading ports a single port cannot monitor all traffic traversing the switch.
- Corrupt information is not detected by Network-based IDSs and use of virtual private networks by organizations increases this problem.
- Most network-based lDSs only detect an attack but cannot tell about the success of attack. After the attack the administrator check each attack to determine its penetration. Some attacks cause fragmenting packets which cause the IDSs crash and unstable [33].

3.2 Host-Based IDSs

Collection of the observation in the system depends upon the Host-based lDSs for those applications or characters which are depending upon it in a real subset. Great reliability and accuracy in the determination of the processes and methods used by the user permitting the specific system to save it from the intrusion is a benefit of Host-based lDSs. It can also detect the out coming attacks going to be interrupting a file or systems which are becoming target by the attackers not like the network based IDSs.

Two types of the sources to compensate the information and then their utilization along with the audit trails, and system logs are usually present in the Host-based lDSs. The host is protected more affectively by using the Host-based lDSs because it save the system more deeply and operate the mechanism internally by activated it internally. So these are much easier to handle and so small to not depending upon the audit trails. Some host based IDSs are form in such a manner to allow only a single centralized management to report its outer structure to console the way of many users. While at the same place the other activates massages to detect the network management systems [23].

3.2.1 Advantages of Host Base IDS

- Ability to lead incidents from local to a resource the system user depending upon host based IDSs can point out by it if they are not detected.
- Operation of an environment in a network which is already interrupted before or after the information of host to being encrypted is generated depending upon host based IDSs.
- Switched networks are unaffected by Host-based IDSs.
- These happen as inconsistencies in execution methodology that could help in detection of the Trojan horse or other or other intruders when the Host-based JOSs operated as audit trials.

3.2.2 Disadvantages of Host-based IDS

- These are complex to manage or controlled for the configuration and for leading till the information is collected for the analysis of the data. So host based IDSs may be easily determined by the host targeting and attack for the detection.
- Scanning and surveillance for the internal system is not for the detection for a network is not more reliable by using the Host-based IDSs because it only can point out those attacks which are caused by the system and these are not applicable for different denial-of-service attacks. The amount of information can be get, as the requirement additional local storage on the host when host-based IDSs use operating system audit trails as an information source.
- The infliction caused by the performance cost on the monitored systems because Host-based IDSs utilize the computing resources of the hosts they are leading.

4. INTRUSION PREVENTION SYSTEMS

To detect the attack of application of a host are seen through the Intrusion Detection Systems (IDS) [4J because they not save any system from external harms due to the system which is not new now. Its aim is not only to protect the system from the attacks .It also removed them from the system. If we know the working of a firewall then we can suppose it as the combination of both firewall.

In the construction of the building to save the spread of fires [5, 9] and this is the idea behind it and within the network they perform same sort of activities. In an administration normally from the outside network to the internal network in sense of network these may transfer from building to building. Decision to pass out the package of IP for the examination of destination for IP addresses and port figures depending in both the directions according to the firewall [5, 9. 13] and it protect the traffic coming inside and outside from a system.

Operating the IP usage addresses and ports and their consideration is a very simple type of the firewall in information reading but the contents or data stored in the packet is not checked by it [10,13]. Hence due to the detection of the packet to attempt the application layer information is the benefit of it. For the prevention from the attack combination of the power of filtering that a firewall has is described. For these objectives lPSs are supposed to be among the promising of network technologies [12].

IPS is also subdivided like IDSs and also consist of include Network Based IPS (NIPS) and Host Based IPS (HIPS) and their detail is also very similar as compared to the IDSs.

5. IDS VS. IPS

Due to the heavily attacks by the intruders the organization are more rapidly use the IPS solution as compared to the IDSs because complete block of the system's intrusions is necessary to lead as well as IDSs in a system works [6]. Although legitimate traffic is mostly stop just as malicious network is, many host organizations trust that the advantages often outweigh the downsides, mostly when assuming the specific destruction that an experienced intruder or attacker can have on an administration [I2]. Blocking of legitimate traffic is the main problem of the IPSs but it is not only limited for these, other systems also face this problem. Hundred percent precision of the data is impossible and to get it the security system will show the false positive. So good traffic blocking must be introduced by the system or host organization for allowing some benefits to the system and some false negative values for the determination to check the data.

6. SWITCHING TECHNOLOGIES

Two main technologies can be used in parallel Intrusion Detection System.

6.1 Traffic Splitting

Traffic splitting design mainly focuses on the flow of traffic. Traffic principals are:

(a) same sensor will receive the same packets of attack.
(b) Works in real time [20,21].

6.2 Load Balance

Load Balancing principals are: assign the load among each sensor that can be done by traffic splitting [22]. This approach requires high speed network devices that work with high traffic. This approach will make the management easy for overall system [23,24].

7. PARALLELISM TECHNIQUES

Four techniques that are used in this literature to improve the performance of Intrusion Detection System are:

7.1 Packet Level Parallelism

Each packet sends across dependent sensors and each sensor has a complete set of rules. Round Robin algorithm is used for traffic splitting. This technique gives the guaranty of load balancing and the session analyzer is used for analysis that maintains all the information of incoming and outgoing packets just like database [25].

7.2 Session Level Parallelism

Different sessions are split to different independent sensors and one session is independent from another session. Session splitter is used for load balancing based on round Robin like algorithm but this technique does guaranteed load balancing [26,27].

7.3 Rule Level Parallelism

It defines a set of rules in each sensor. In this scenario traffic duplicator is used to send all the packets on each sensor. Each sensor checks the packets for that they are abused or not. If it is malicious then it will forward malicious packet to the central authority otherwise it will process it and then forward to the Local Area Network. If the administrator defines the rules perfect then it guarantees a load balancing [28].

7.4 Component level Parallelism

Traffic is divided into components that are isolated. Each sensor processes its relevant component just like pipelining technique. E-g first sensor reads the packet, second sensor process it and the third sensor validate the attack and take an appropriate action.

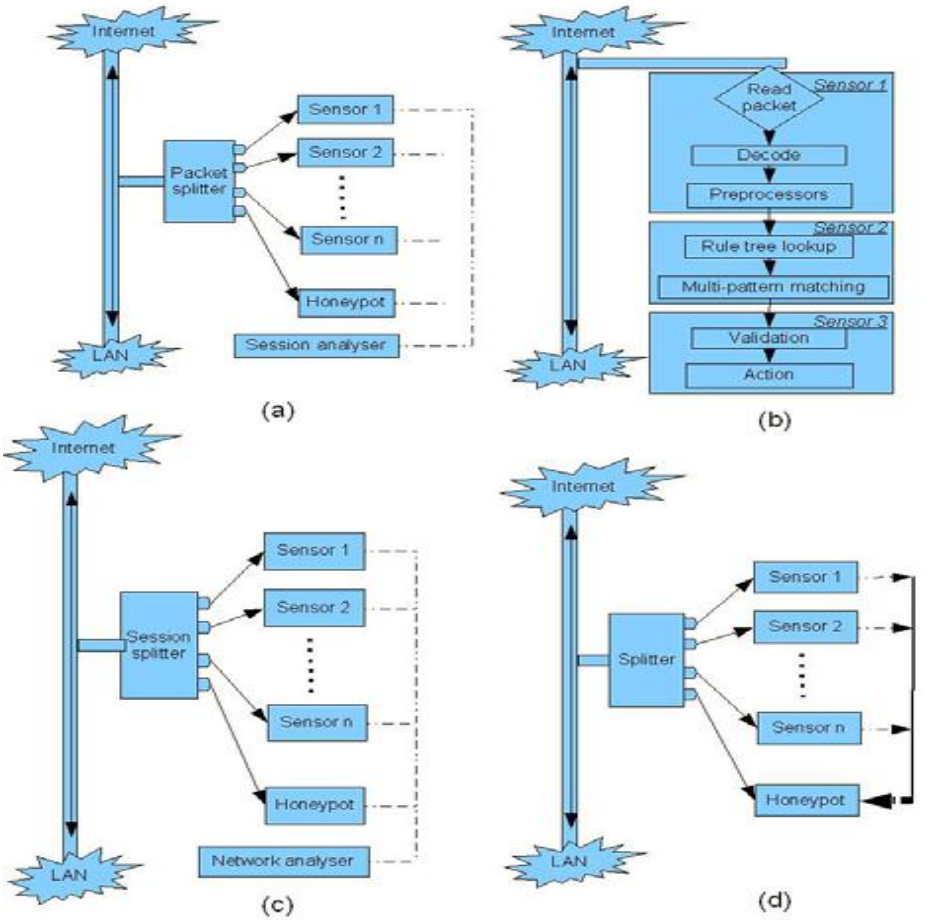

Figure 1: Component Level Parallelism

8. A DISTRIBUTED INTRUSION DETECTION SYSTEM (IDS) ARCHITECTURE

8.1 Design Challenge

In order to implement and design the new architecture or model, we should consider the main challenges in high speed and real time environment.

8.1.1 Scalability

As the network is growing so fast, the IDS have to handle a large amount of traffic load. So the IDS design should ne extendable and more flexible to accommodate the incoming changes in network.

8.1.2 Fault Tolerance

The IDS design should have a capability to transfer its load when one sensor fails down in case of attack and hardware failure or overloaded.

8.1.3 Statefull Analysis

In order to perform stateful analysis by traffic splitting, it should be ensure that one attacked or malicious packet is sent to only one sensor not to all. Honeypot is used to perform in depth analysis that discovers the technique and objective of attacker.

8.2 Architecture Design

The network router/switch splits the incoming traffic that is coming from outside of the network and sends it to the IDS sensor based on destination port. E-g FTP packets will be sent to FTP sensor and FTP sensor will select only that packets. Each sensor configured with rules in the basis on destination port number mean FTP sensor will only execute FTP rules for incoming FTP traffic. When any sensor detects an attack it will execute it and send it to the controller device (TSM) as an alarm. Otherwise it will forward to the LAN.

8.3 Benefits

This model does not need any special hardware. So it is easy to manage and deploy in existing environment. This Distributed IDS is very efficient, easy and simple to design for high speed network to meet their needs. The splitting mechanism reduces the traffic burden on IDS sensor because it will only execute the incoming packets coming from switch. Automatic security can be applied against attack for defense in real time. Otherwise administrator can be configured thee desired security actions itself.

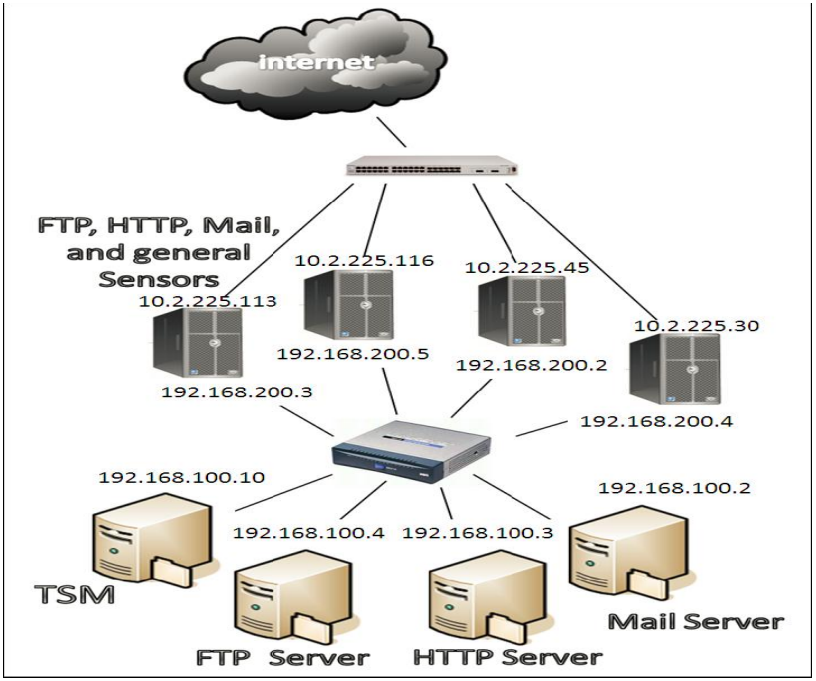

Figure 2: Traffic Splitting

9. PERFORMANCE STUDY

We use three architectures to measure the performance of our optimized architecture.

9.1 Four Scenarios

There are four types of architecture.

9.1.1 Centralized architecture

In this architecture which consist on all the snort rules that are configured only on one sensor and all the traffic fed into single sensor.

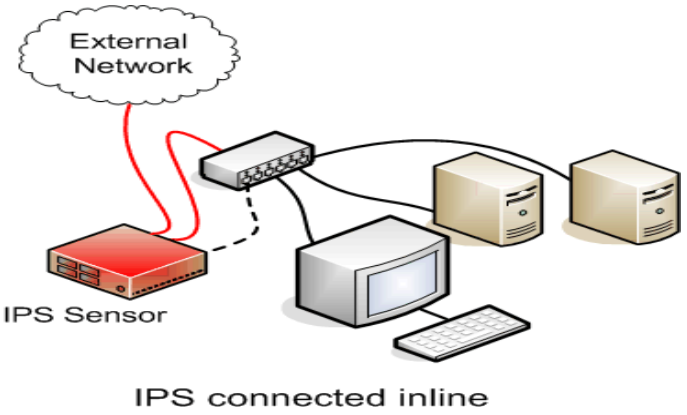

Figure 3: IPS Connected Inline

9.1.2 Rule-Based Architecture

This architecture consists on seven sensors. Each sensor configured in a way that contain only a part of rule-set and all the rule-sets that multiple sensor contains depends on destination port of traffic.

9.1.3 Data-Based Architecture

This architecture also consists on seven sensors and each sensor contains the whole rule-set and a part of whole traffic goes through each sensor. Data will be split on switch according to the destination port.

9.1.4 Optimized Architecture

Optimized architecture also consists on seven sensors and each sensor contains a part of rule-set and all the sensor use only a part of whole traffic.

10. TESTED

Seven sensors are used to compose this test. Each sensor has Intel core i3 CPU M 380 @ 2.53 GHz RAM 2.00 GB. System type: 64 bit operating system (Win 7) using snort 2.9 ……

According to traffic splitting on port basis the rules of snort configured into seven files and each file contains a set of rules that will further applied to the given range of port. E-g number one file that fed with a part of rule applied to the range of port [0-80] as a destination port. Tcp and udp packets are not included**.** In practical scenario, Snort is embed with thee given dump file, configure in a way that it can process specific number of packets. Each sensor examined 15 times. For each run processing time, the number of processed packets and generated alerts is kept. Then tool an average of processing time for each run. After each run snort database and log apply as empty. The maximum and minimum processing time is taken for each run.

11. PERFORMANCE ANALYSIS

A comparison between rule-based architecture and centralized architecture is picturized in Figure 4. The X-axis is the number of processed packets by the snort and the Y-axis is the processing time of processed packets. A normal behavior of centralized architecture is shown by a linear curve. In this rule-based scenario, all the sensors contain a part of rule-set and the whole dump file is fed into it. An additional feature of snort port filter is added to select particular packets that are matched to sensor port. In order to process 100000 packets by the sensor, snort will filter and read more than 100000 packets because there are more than 100000 packets in dump file but have to process only 100000 because rule-based sensor will only get those packets from dump file that are configured for rule-set.

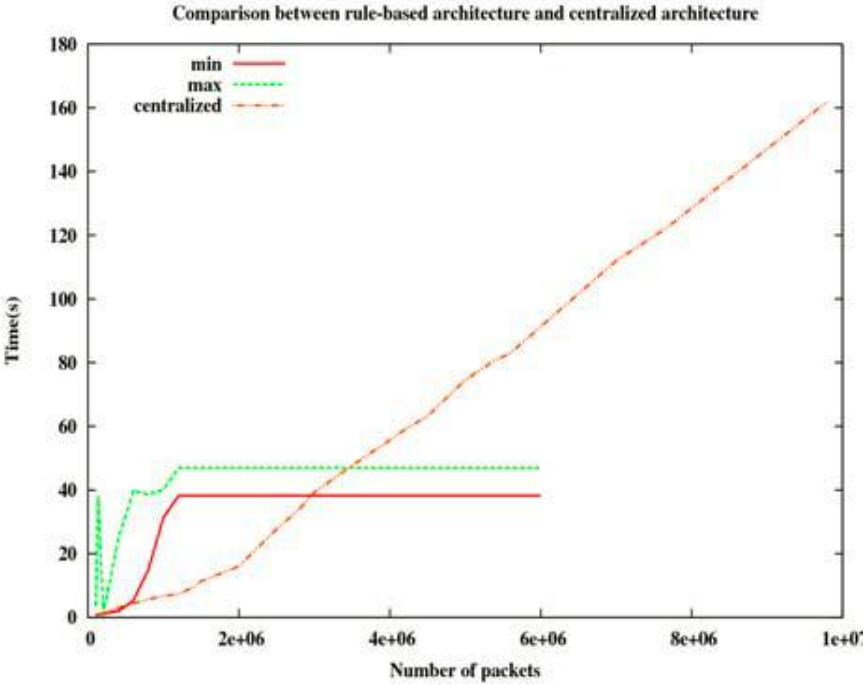

Figure 4: Comparison between Role-Based Architecture and Centralized Architecture

For example if we want to process 150000 packets which require 50 seconds but there are more than 150000 packets that need to be process by the sensor with the help of filter. The maximum number of packets is 1092915. So the maximum and minimum curve shows the maximum and minimum processing time between seven sensors.

Figure 5 shows the comparison between centralized and data-based architecture. Same axis is used as previous figure. Each sensor is configured with the range of port so traffic is split according to the port. The maximum and minimum curve shows the result.

The centralized architecture gives the best result from 700000 to 1600000 packets because of port that assign to it or due to rule-set that are configured.

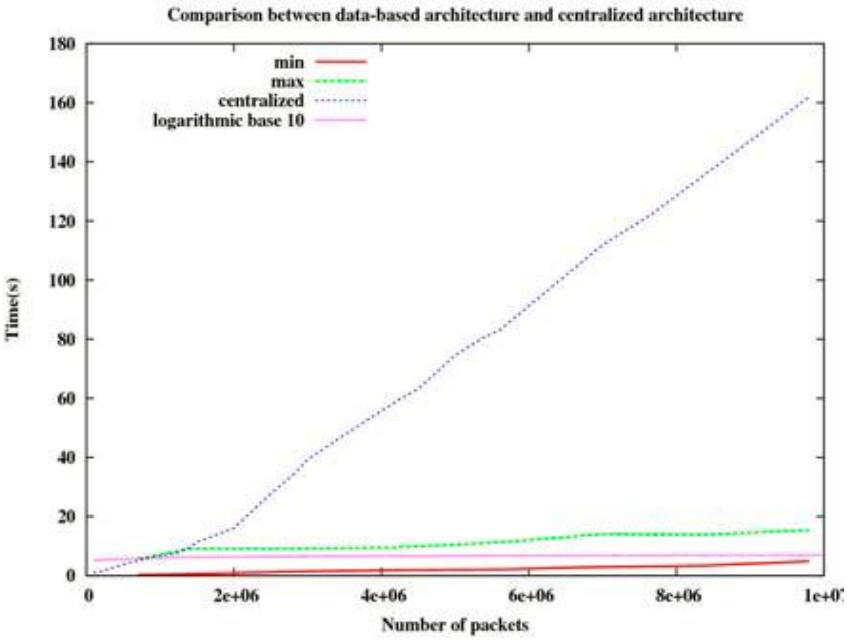

Figure 5: Comparison between Data-Based Architecture and Centralized Architecture

The centralized architecture generates 461 alerts with 700000 packets in which 143 are belongs to port 80 and the rule-set are for this particular port is 2400 but data-based architecture generates 128 alerts against 700000 packets with 1681 rules by sensor num one. Thee alerts are against ICMP packets.

The figure 6 is a comparison between the centralized architecture and the optimized architecture. In optimized architecture each sensor fed with a part of traffic and fed with a part of rule-set. The optimized architecture is much better than centralized architecture after processing of 1600000 packets. Because if ICMP packets that produce all alerts and decrease the packets processing time. Thee optimized architecture is much suitable for large scale network as we discussed above because it require only 15 seconds against 4800000 packets but centralized architecture require 162 seconds against 48000000 packets. So the optimized architecture is 11 times faster than centralized architecture. The maximum and minimum curve shows the maximum and minimum processing time. e.g. if we process 600000 packets then the maximum processing time will be 8 seconds which shows the load on each sensor that is not balanced. This is due to the sensor three who generates 1000 alerts against 600000 packets and sensor one generated only 87 alerts.

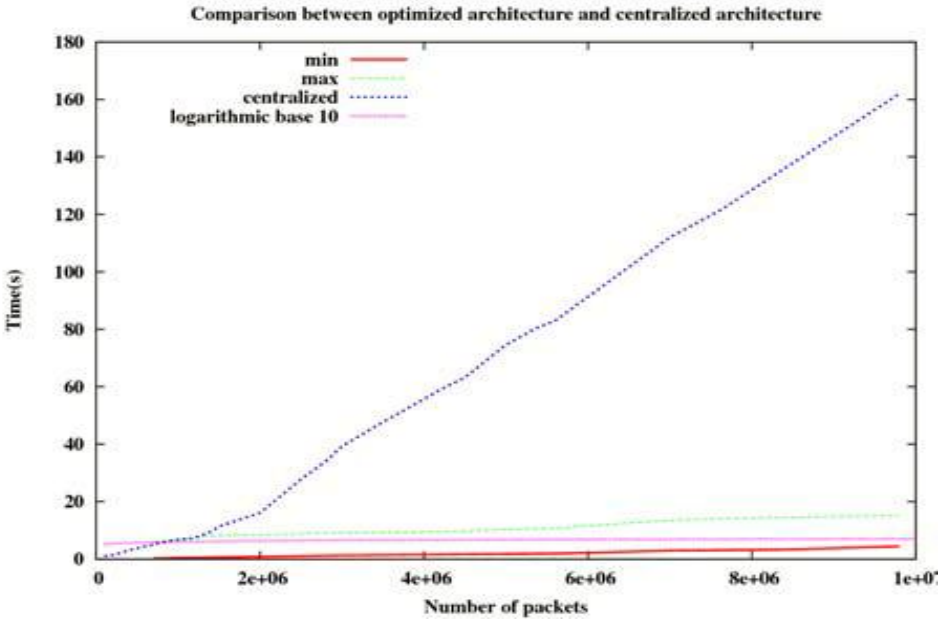

Figure 6: Comparison of optimized and Centralized Architecture

An optimized architecture is based on the technique of traffic splitting between sensors and the particular rule-set based on port number that leads to n-load balancing architecture. So we have to adopt same mechanism which split the balance traffic or load on each sensor to make the architecture much faster.

11. CONCLUSION

The result of our study shows that our optimized distributed Intrusion Detection System Architecture efficiently detects the intrusion for high speed network. Switch based splitting provides greater flexibility and scalability. So out Intrusion Detection System effectively monitor a large traffic and helps to detect the attack and vulnerability against security violations. In future we will propose a load-balanced architecture that will increase the utilization of each sensor and we will also consider such mechanism that reduces or decreases the false alarm so that our Intrusion Detection System could perform better than before.

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EFFECT OF ALL SECTORS ON GDP OUTPUT FLUCTUATIONS IN PAKISTAN ECONOMY

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ABSTRACT

By taking the values of the years 1951-2008 we found that all the small parts of GDP and their changes impact the progress of Pakistan. Study found that all sectors relate to each other and effect growth rate. ADF unit root test use to check the stationary of the variables and found that all variables are stationary on level. VAR model are used to check the effect of variables. Furthermore a simple regression run on all variables to check the how results on GDP. The result explains that Agriculture sector is very important for Pakistan and has a big portion in GDP and after this manufacturing sector as compare to others. All others variables effect at moderate level.

KEYWORDS

Economics Growth Industrial Sector Agriculture Sector Volatility in Growth.

1. INTRODUCTION

The high economic growth rate is an indicator of good functioning of an economy. Shares of economic sectors in Gross Domestic Product (GDP) have been recognized as key parameters for economic growth rate as well as economic development of the countries. The share of agriculture in GDP has traditionally been dominated in a pre-industrialized economy while the other two prominent sectors i.e. industry and service remained comparatively modest. Since the 1970s Asian countries have experienced remarkable structural changes through industrial development. Pakistan economy has also experienced remarkable structural transformation in composition of GDP. However, the growth of GDP has not revealed a smooth upward trend over a long period rather the growth of economy has been accompanied by tremendous volatility and instability not only at the national level but also at cross state level. In course of structural transformation the services sector enjoyed a comparatively advantage in playing a leading role towards the achievements of remarkable GDP growth rate such that the services sector led growth has been inaugurated as service sector revolution in Pakistan economy.

2. LITERATURE

Sabir and Ahmed (1983) concentrated on the effect of structural adjustment policies on TFP, reasoned that, in spite of the fact that the normal development in general economy has declined from GDP and private and non-private venture, utilizing quarterly

national salary and GDP Information for the period 1959-1992. Comes about demonstrated that private venture causes, be that as it may, is not brought about by GDP, while non-private venture does not bring about, be that as it may, is created by GDP. They inferred that lodging leads and different sorts of Venture slack the business cycle.

Tse and Ganesan (1997) additionally utilized the same econometric strategy (Granger causality test) to decide the causal relationship between development streams and GDP utilizing quarterly Hong Kong information from 1983 to 1989. They found that the GDP drives the development stream and not bad habit versa.

Sabir and Ahmed (2002) concentrated on the effect of structural adjustment policies on TFP, inferred that, despite the fact that, the normal development in general TFP of the general economy has declined from 2.8 percent in the pre-change period (1973-88) to 0.7 percent, in the post-change period (1988-2002), in the assembling division it declined from 5.9 percent to 1.9 percent, separately amid these two periods. Likewise, their outcomes show that amid pre-and post-change periods, the relative commitment of TFP to general esteem included has declined from 48 percent for every annum to 16 percent per annum though in the assembling esteem included its commitment has declined from 79 percent for each annum to 45 percent for each annum. They too seen that human capital has been the main consideration that added to TFP development amid these periods.

Hoque and Musa (2002) found that period somewhere around 1994 and 2001; the IPOs of Dhaka Stock Exchange (DSE) was to a great extent under estimated at 285.21 percent. At a similar period the level of under estimating in Malaysia was 46.44 percent. IMF (2002) had registered TFP of the general economy of Pakistan for the period 1961-2001. The discoveries demonstrate that, by and large, TFP experienced negative development in the 1960s, positive in the 1970s and 1980. Be that as it may, in the 1990s the development decrease to only 0.6 percent for every annum. Besides, human and physical capital has basically reinforced the GDP development amid this period.

Pasha et al., (2002) called attention to that the development of TFP of the producing part demonstrates a diligence declining pattern amid 1973-98, normal yearly development rate of TFP declined from 9.4 percent amid 1968-83 to small 1.4 percent amid 1993-98 for each annum commitment of TFP in general monetary development that was 55 percent amid 1968-83 declined to as low as 16 percent. They assist reasoned that human capital has played a driving part in the development of TFP of assembling area, of the 4.6 percent annum development of TFP amid 1973-98, 1.8 percent was the commitment by human capital.

Wizarat (2002) registered total factor production (TFP) of the vast scale fabricating division for the period 1951-91. Her outcomes demonstrate an increment in TFP incline. Also, she found that the commitment of TFP to financial development has been negative (- 27 percent), by and large, amid the period 1955-91. As per her study financial development was to a great extent driven by capital (88 percent) and work (40 percent).

Iffat Ara (2004) evaluated the aggressiveness of assembling segment of Pakistan by looking at the pattern in the development of variable and non-figure input costs with that of fare cost furthermore took a gander at the pattern in the development of efficiency. She

found that over the period 1972-73 to 2002-2003, both calculate and non-consider costs have developed at a rate higher than that of general value level and also of fare cost. She facilitate propose that despite the fact that the development in profitability is counterbalancing the negative effect of the development in input consider costs, the development in profitability itself delineates a declining pattern particularly for the latest time frame, 1999-03.

3. DATA AND METHODOLOGY

In this study Time arrangement information is utilized to discover the effects of agriculture, manufacturing sector, commodity producing sector and services sector on GDP for the time of 1951-2008. The information are taken from open door websites. The included elements in this investigation are: Gross Domestic Product (GDP) agriculture, Manufacturing sector, commodity producing sector.

Here, we have analyzed different related investigations, which were done by famous scientists. This study incorporates the effect of four vital factors. Augmented Dickey Fuller (ADF) test has been utilized for checking the stationary of the information. To demonstrate the contribution of agricultural growth rate, commodity sector growth rate C manufacturing sector market and services sector growth rate towards GDP growth rate, the technique for Ordinary Least Square method has been utilized and the accompanying model was evaluated enrolling explanatory variables while GDP growth rate as dependent variable The subsequent models has been expressed to evaluate the outcome

$$GDP= \beta 0 + \beta 1Agr+\mu t$$
$$GDP= \beta 0 + \beta 1comm+\mu t$$
$$GDP= \beta 0 + \beta 1ser+\mu t$$
$$GDP= \beta 0 + \beta 1Manu+\mu t$$
$$GDP= \beta 0 + \beta 1Agr + \beta 2Comm + \beta 3Ser + \beta 4\ Manu +\mu t$$

where GDP is the gross domestic product, Agr is the agriculture and Ser is the service sector and Manu is the manufacturing sector and Comm is the commodity producing sector.

3.1 Hypothesis

To direct our observational investigation we have figured an arrangement of working hypothesis which take a solid adaptation of the engine to developed hypothesis for purpose of departure. We take the log returns of all values before analyzing them.

a) Effect of Agriculture on GDP
b) Effect of Commodity on GDP
c) Effect of Manufacturing on GDP
d) Effect of all variables on GDP

Table 1

Regression Results of Relationship between AGR and Explanatory Variables

a) Effect of Agr on GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.741262	0.304650	12.28052	0.0000
AGRICULTURE	0.407765	0.055695	7.321380	0.0000

R-squared	0.493566	Mean dependent var	5.154561
Adjusted R-squared	0.484359	S.D. dependent var	2.477988
S.E. of regression	1.779398	Akaike info criterion	4.024885
Sum squared resid	174.1442	Schwarz criterion	4.096571
Log likelihood	-112.7092	Hannan-Quinn criter.	4.052744
F-statistic	53.60261	Durbin-Watson stat	1.381013
Prob(F-statistic)	0.000000		

b) Effect of Comm on GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.279882	0.285181	7.994499	0.0000
COMMODITY_PRODUCING_SECT	0.584326	0.046709	12.50989	0.0000

R-squared	0.739949	Mean dependent var	5.154561
Adjusted R-squared	0.735221	S.D. dependent var	2.477988
S.E. of regression	1.275090	Akaike info criterion	3.358368
Sum squared resid	89.42196	Schwarz criterion	3.430054
Log likelihood	-93.71348	Hannan-Quinn criter.	3.386227
F-statistic	156.4974	Durbin-Watson stat	1.678352
Prob(F-statistic)	0.000000		

c) Effect of Manu on GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.662630	0.623260	4.272102	0.0001
MANUFACTURING	0.341238	0.076019	4.488858	0.0000

R-squared	0.268129	Mean dependent var	5.154561
Adjusted R-squared	0.254822	S.D. dependent var	2.477988
S.E. of regression	2.139091	Akaike info criterion	4.393096
Sum squared resid	251.6640	Schwarz criterion	4.464782
Log likelihood	-123.2032	Hannan-Quinn criter.	4.420956
F-statistic	20.14984	Durbin-Watson stat	1.586992
Prob(F-statistic)	0.000037		

d) Effects of all sectors on GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.889579	0.385607	4.900275	0.0000
Agriculture	0.063503	0.092113	0.689400	0.4936
Manufacturing	0.100405	0.067633	1.484559	0.1436
Commodity Producing Sect	0.469883	0.124337	3.779124	0.0004
R-squared	0.750786	Mean dependent var		5.154561
Adjusted R-squared	0.736680	S.D. dependent var		2.477988
S.E. of regression	1.271573	Akaike info criterion		3.385978
Sum squared resid	85.69560	Schwarz criterion		3.529350
Log likelihood	-92.50038	Hannan-Quinn criter.		3.441697
F-statistic	53.22294	Durbin-Watson stat		1.574803
Prob(F-statistic)	0.000000			

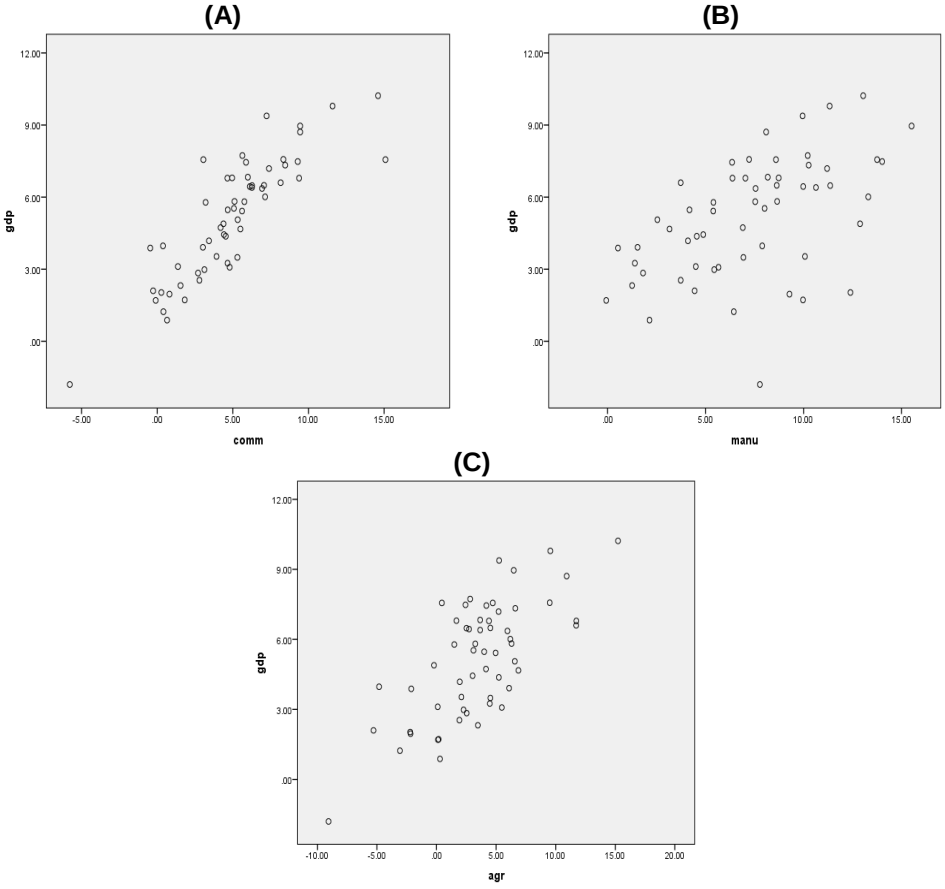
Dependent Variable: GDP	Method: Least Squares
Date: 01/06/17	Time: 00:11
Sample: 1 57	Included observations: 57

Regression outcomes with explanatory variables are given in Table II. The outcomes indicate that 1% expansion in the manufacturing growth rate acquires 10.04% expansion in GDP growth rate. 1% expansion in the commodity sector growth rate acquires 46.96% expansion in GDP growth rate. 1% expansion in the agriculture growth rate acquires 6.35% expansion in GDP growth rate. The coefficients are significantly at both 1% and 5% level of significance as demonstrated by low estimations of "P" in Table II. Results indicates that due to agriculture the variation in DGP is 49% and due to commodity sector is 73% and manufacturing sector is 26%.

The high estimation of R-square (0.75) which shows that 75% variation in GDP explained by explanatory variables proposes that the fit is great and the included independent variables are accountable elements for changes in GDP growth rate.

Durbin-Watson esteem (1.57) suggests positive serial autocorrelation. The Durbin Watson measurement is utilized to tests for 1st order autocorrelation in the residuals in regression analysis The Durbin-Watson value is lie between 1.5 and 2.5. here D.W value is 1.57 which is closed to 1.5 implies that there is no autocorrelation in the residuals. Values moving toward 1.5 demonstrate positive autocorrelation between the residuals.

$$GDP = 1.889579 + 0.063503Agr + 0.469883Comm + 0.100405Manu + \mu t$$



Graph A shows that there is a liner relationship between GDP and commodity producing sector because trend exits means mean doesn't same and the variance is not constant and not all the values is move in same fluctuation and there is no seasonality is exit and no outlier exits because some values are from the data

Graph B shows that there is a liner relationship between GDP and manufacturing sector of economy because trend exits means mean doesn't same and the variance is not constant and not all the values is move in same fluctuation and there is no seasonality is exit and no outlier exits because some values are from the data

Graph C shows that there is a liner relationship between GDP and agriculture sectors because trend exits means mean doesn't same and the variance is not constant and not all the values is move in same fluctuation and there is no seasonality is exit and no outlier exits because some values are from the data.

Results of ADF Test

Variables	t-Statistic	Levels	Conclusion
Gdp	-6.90831	0.00	0(0)
Agr	-9.747127	0.00	0(0)
Manu	-4.348654	0.001	0(0)
Ser	-5.995383	0.00	0(0)
Comm	-7.943284	-7.94	0(0)

ADF (augmented dickey fuller test) is used to check the stationary of data for acceptance or rejection of null hypothesis. Here results shows that all the variables are stationary on levels and have a significant value on level. That shows null hypothesis is not rejected because t*<critical test values means unit root does exit data in stationary on level. After completing the observation that all variables are stationary on level.

3.2 Discussion

Volatility in Growth of Agriculture Sector:

The fluctuation in agriculture sector positively influenced the volatility of national output growth. For overall economic development agriculture sectors considered key determinants for economic progress. Earning of foreign exchange, generating income, enhancing food production agriculture sector play a vital role in it. The economy cannot function and survive without the without agriculture and industry because both are the two hands of economy.

Volatility in Growth of Manufacturing Sector

The fluctuation in manufacturing sector is also positively influenced the volatility of national output growth. For overall economic development manufacturing sectors also considered key determinants for economic progress commodity producing sector

Volatility in Growth of commodity producing sector

The fluctuation in commodity producing sector is also positively influenced the volatility of national output growth. For overall economic development commodity producing sector also considered key determinants for economic progress commodity producing sector.

4. CONCLUSION

The fundamental target of the study to check the fluctuations in national output by the contribution of volatility. The volatility in sectors has been findings by this study. The effect of agriculture, commodity producing sector and manufacturing sector on volatility in national output is highly significant. The fluctuation in agriculture sector, manufacturing sector and commodity producing sectors are positively influenced the volatility of national output growth. For overall economic development all sectors considered key determinants for economic progress. Earning of foreign exchange, generating income, enhancing food production agriculture sector play a vital role in it. The economy cannot function and survive without the without agriculture sector, manufacturing sector and commodity producing sectors because all are the two hands of economy.

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IMPACT OF TERRORISM ON THE SUPPLY CHAIN OPERATIONS AT KARACHI - PAKISTAN

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ABSTRACT

In the aftermath of 9/11 terrorist attacks on the US World Trade Centers, a paradigm shift has come to surface with regard to security threats to the inbound and outbound logistics, the seller-purchaser relations, suppliers, clients and partners, in both the public and private sectors' commercial and trade activities. Today indiscriminate terrorist acts in any form and kind can be expected anywhere.

This study is an effort to estimate the impact of terrorism on supply chain operations in Karachi - Pakistan. The respondents are the supply chain managers from different organizations across diverse industries from Karachi. The sample size is 100 respondents. This study found that terrorism is damaging the supply chain operations and organizations face crisis due halt in their supply chain operations in Karachi. The study recommends the steps for institutional development regarding mitigating the impact of terrorism on the supply chains operations.

KEYWORDS

Supply chain operations, crisis, terrorism, inbound, outbound, mitigation Karachi.

1. INTRODUCTION

In the aftermath of September 11th terrorist attacks on the US World Trade Centers, a paradigm shift has come to surface with regard to security threats to the inbound and outbound logistics, the seller-purchaser relations, suppliers, clients and partners, in both the public and private sectors' commercial and trade activities. Soon after the attacks, organizations working on "Just-in-Time" (JIT) lines, experienced huge losses as a result of stoppage or inordinate delay in receipt of their inbound supplies (raw material) required to transform same into finished goods required by their valued customers.

Today indiscriminate terrorist acts in any form and kind can be expected anywhere e.g. Public Places, Motels/Hotels, Production/Manufacturing units, Under construction/ Private Buildings, Schools/Colleges, Health care centers, Militaries facilities/ installations, Pharmaceutical Companies, shipping/aircrafts, commercial/electronics market and state owned offices/premises which can be sources of supplies/materials and can definitely impact the supply of goods and services to industries. It has, therefore,

become a challenge for Supply Chain Managers to anticipate terrorism acts, plan countermeasures towards it, plan, test and implement strategic preparedness steps.

The paper attempts to recognize the essential elements of supply chain operations at Karachi which are impacted due to terrorism. This study differs in several aspects from the prevailing surveys under taken on the subject. Few of the distinctive aspects are that it uses actual data collected from the diverse business industries at Karachi. Previous researches on the subject have observed the commercials arenas on a much lesser frequency data. Therefore, this survey is unique in the sense that it is Karachi specific. We have examined the effect of terrorism on each essential element which harms the smooth supply chain operations.

2. LITERATURE REVIEW

Although studies are available discussing the causes of various uncertainties in supply chains due one reasons or the other and impact of terrorism on financial markets, economy and business etc., however no work related to our topic is available. The empirical literature indicates that the impact of terrorism on supply chain operations is multifaceted.

Gary and Michael (2008) declare the object of terrorist activities is to terrorize the general public and build pressure on governments to achieve a political goal. Terrorism has directly or indirectly affected the world businesses and the terror attacks have a big impact on international supply chain. Due to the fear of terrorist activities the supply chain has especially failed to deliver the goods effectively and efficiently.

Yi et al. (2011) identifies flexible supply chain in a stable environment using multiple instances of the textile and apparel companies in China. The study shows the result of four important strategies for supply chain to be flexible in an unstable environment, innovation, operating efficiently and traditional response.

Soon after the terrorist attacks on 11th September 2001, various companies including Ford were compelled to stop their assembly lines intermittently, supply of raw materials and spares etc. were stopped at the border of Canada and Mexico due security clearance. Resultantly the companies lost large quantity of production units. Ford lost 12,000 units of its production. The companies like Toyota which were working on JIT inventory discipline halted production with a few hours subsequent to the attack. According to the wall Street Journal (2001), due to disruption of steering sensors on account of shut down of air travel from Germany, production in one of its plants in Princeton, Indian (IN), came to a halt within 15 hours of the event of 9/11.

Tafur (2011) considers the grave impact of terrorism on the flow of international trade from the United States and other countries. Supply chain activities in ports and in oceans/seas is the single most important factor in the supply chain of the nation and these have not been saved from terrorist attacks.

According to Ahmad et al. (2013) safety and security are the issues most important to the tourist while traveling, and the first priority is that they consider to be protected from the dangers.

Dean et al. (2010) investigates how to minimize the risks faced by global sourcing and selecting the best supplier in an environment of uncertainty through the use of multiple criteria optimization technique, natural disasters, terrorist, social, political, culture, labor and other variables. The author suggests that these tools contribute to a high grade risk and businessmen are to make strategies to eliminate or reduce its impact on the supply chain and business.

Claudia (2013) argues that can you imagine life without the places where we gather? These are convenient places; places where we want to go, free to go. In airports, stadiums, railway stations, cinemas, parks etc. you can control access. You have a part to play to ensure freedom does not make you vulnerable. When people gather together freely, it offers an opportunity for those who want to cause chaos.

Konova (2012) discusses many qualitative studies have been carried out against terrorism and the events of September 11, 2001 have generated interest in the "war on terror" discourse further. Focusing on different aspects of the phenomenon, scholars have studied both the reasons and consequences.

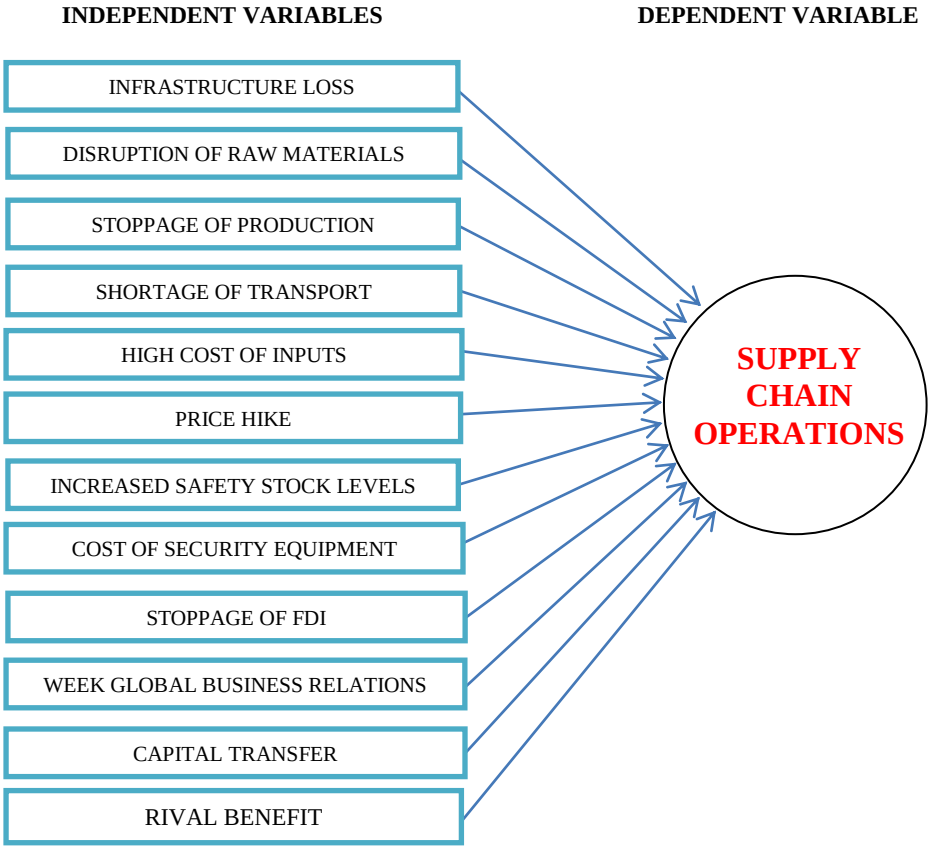
Manuj and Mentzer (2008) investigates the risk mitigating approaches in the international and domestic supply chain more important than before because they consider global supply chain exposed to more threat than domestic one. The authors use experimental research methods by interviewing senior executive through fourteen detailed interviews with senior executives of manufacturing companies. The study discloses 6 vital strategies for mitigating global sourcing risks.

Blos et al. (2009) analyze the risks faced by today's supply chain and its mitigating management throughout the operations of supply chain studying the electronics industry and cars in Brazil. The study confirms that mitigating and controlling the risks and threats to the supply chain operations ensure increase in company's profitability and drastically decreasing its losses.

Wei and Yang (2012) examine the role of risk management in the effectiveness of the security in the supply chain operations from the shipping company for containers in Taiwan. The results showed that all the variables (the management of relations with suppliers over the long term, management and exchange of information, and the reduction of accidents in the shipment and management skills) have a positive and significant influence on the working of security matters whereas positive effect on clearance can be ensured through engaging trusted, registered and pre-qualified supplier through sustaining good business relations.

While finding out the impact of terrorism on the supply chains operations at Karachi, the Dependent Variable (DV), we categorized the impact into eight distinct Independent Variables (IVs). Keeping in view the impact of terrorism, whether directly or indirectly, on the supply chain operations at Karachi, following model has been made in support of the study.

3. THEORETICAL FRAMEWORK



4. OBJECTIVES

The objective of undertaking this study is to analyze whether terrorism has any impact on the supply chain operations at Karachi - Pakistan. The topic of threat and risks to the supply chain due terrorism has been studied by the researchers around the globe. They have studied it from different perspectives i.e. risks faced by global sourcing, supply chain internationally and domestic resource mobility. All the researchers have deduced some conclusions from their studies. Most of the researchers have studied this topic from a qualitative angle as they showed the impact terrorism brings in qualified terms.

5. RESEARCH DESIGN

Sampling Procedure

Keeping in view the data, a number of organizations were identified, short listed and randomized in to a representative unit of about 10 Industries. Keeping in view the requirement for the data a comprehensive study device was designed, with due reference to prevailing terrorism threat to business sector in Karachi - Pakistan. This research is specific to the existing threat of terrorism being experienced by business sector and the events already taken place in Karachi - Pakistan.

Data Source

One hundred organizations were shortlisted from ten different sectors, consisting of local and multi-national organizations including SMEs. The shortlisted industries comprised of consumer products/services, leather and shoes, energy and fuel, fertilizer and chemical, building and cement, pharmaceuticals, textile, financial companies, IT/Telecom etc.

After identifying the potential respondents, questionnaires were sent directly to them. After a gap of 3-4 days, a trained data collector personally visited the respondents to clarify the queries, if any, and collect the filled survey forms. The factors of flexibility and adaptability were catered for in the methodology.

Statistical Tool Used

Multiple regression analysis was used through the well-known software package SPSS version 20 to assess the impact of the IVs on the DV.

6. RESULTS

We estimated the impact of terrorists' activities on the supply chain operations through eight independent variables. A total of four out of the eight categories have negative impact on the supply chain operations. The below tables show the results;

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.482[a]	.232	.164	26.52100

a. Predictors: (Constant), Rival country takes benefit, Increasing level of Safety Stock, Cost on purchase of Sec Eqpt, Stoppage of Production, Infrastructure Loss, Distrust in Global Bus Relations, Disruption of raw material, Increase in Cost of Inputs.
b. Dependent Variable: Supply Chain Operations

Model Summary Table

R^2 =.232 taken as a set, the predictors (IVs 1-8) account for 23% of variance in DV. It does not show how much individual IV accounts for.R^2 is significant if greater than zero (0).

Table 2: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	19318.906	8	2414.863	3.433	.002[b]
	Residual	64006.094	91	703.364		
	Total	83325.000	99			

a. Dependent Variable: Supply Chain Operations

b. Predictors: (Constant), Rival country takes benefit, Increasing level of Safety Stock, Cost on purchase of Sec Eqpt, Stoppage of Production, Infrastructure Loss, Distrust in Global Bus Relations, Disruption of raw material, Increase in Cost of Inputs

ANOVA Table (test using alpha = .05)
The overall regression model is significant
$F(8,91) = 3.433$, $p=.002$, $R^2=.232$

Table 3: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	168.930	42.117		4.011	.000		
	Disruption of raw material	-29.930	12.188	-.387	-2.456	.016	.339	2.948
	Stoppage of Production	12.876	5.631	.243	2.287	.025	.745	1.342
	Increasing level of Safety Stock	-31.739	10.837	-.381	-2.929	.004	.499	2.004
	Increase in Cost of Inputs	53.881	19.333	.589	2.787	.006	.189	5.293
	Infrastructure Loss	3.302	6.816	.058	.484	.629	.595	1.680
	Cost on purchase of Sec Eqpt	.609	3.388	.018	.180	.858	.821	1.217
	Distrust in Global Bus Relations	-30.038	17.790	-.311	-1.688	.095	.249	4.009
	Rival country takes benefit	-8.128	7.108	-.117	-1.144	.256	.811	1.233

a. Dependent Variable: Supply Chain Operations

Coefficient Table

(Test each predictor at alpha=.05)

1. Disruption of raw material sig. (p=.016)
2. Stoppage of production sig. (p=.025)
3. Increased safety stock levels sig. (p=.004)
4. High cost of inputs sig. (p=.006)
5. Infrastructure loss not sig. (p=.629)
6. Cost of security equipment not sig. (p=.858)
7. Weak global business relations not sig. (p=.095)
8. Rival benefit not sig. (p=.256)

7. OVERALL ANALYSIS

A multiple liner regression was calculated to predict "Supply chain Operations" (DV) based on Disruption of Raw Materials (IV1), Stoppage of Production (IV2), Increased Safety Stock Levels (IV3), High Cost of Inputs (IV4), Infrastructure Loss (IV5), Cost of Security Equipment (IV6), Weak Global Business Relations (IV7) and rival Benefit (IV8). A significant regression equation was found ($F(8,91) = 3.433$, $p = .002$), with an R^2 of .232.

Participants' predicted (DV) is equal to 168.930 – 8.128 (IV8) – 30.038 (IV7)+ .609 (IV6) +3.302 (IV5) + 53.881 (IV4) – 31.739 (IV3) + 12.876 (IV2), - 29.930 (IV1), whereas all (IVs) are coded or measured as 1 = Strongly Disagreed, 2 = Disagreed, 3 = Neutral, 4 = Agreed and 5 = Strongly Agreed.

Participant's weight increased 168.930 [DV unit of measure] for each IV.IV1, IV2, IV3, and IV4, were found significant predictors of DV.

8. COMMENTS AND CONCLUSIONS

Aim of the investigation was to assess the impact of terrorism on the supply chain operations at Karachi - Pakistan. The findings of the regression model enable us to conclude; that the supply chain operations at Karachi - Pakistan have been badly affected by the prevailing uncertainty due terrorism. The volatile security situation has badly and significantly damaged the effectiveness of the fundamentals (raw material, transportation, production, global business relations, costs of inputs, price hike etc) of supply chain operations. Result of the study is matching the theoretical framework and meeting the expectations. The upward pace of terrorism is, undoubtedly, badly affecting the business and affecting the country's economy. Businesses will continue to be targets of the terrorist activities mainly to weaken the financial position of the country.

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A CASE STUDY OF FACTORS AFFECTING MONEY DEMAND IN PAKISTAN: AN ECONOMETRIC STUDY USING TIME SERIES DATA

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ABSTRACT

Money demand function plays a key role in monetary policy formulation. In this paper, we have examined the determinants of money demand function in Pakistan using time series data from 1972 to 2010. By using the OLS estimation technique, important findings of this paper i.e. population growth, per capita income and financial innovation are positively affecting demand for money. While inflation rate and exchange rate are negatively related to money demand in Pakistan. Breusch – Godfrey serial correlations LM test shows no problem of autocorrelation in both the models. Ramsey RESET test examines that model is correctly specified. On the basis of results demand of money may be controlled through controlling inflation, population growth rate, per capita income, exchange rate and financial innovation.

KEYWORDS

Population Growth, Financial Innovation, Exchange rate, Ordinary Least Square Method.

1. INTRODUCTION

Everlasting rises of developing countries are worldwide economic crises that become a new challenge for them. World Bank is becoming a source of financial help but many millions of the people are focusing on this financial aid. This economic chaos is spreading speedily and the filter of it is prevailing in the all of the World, together with Asian countries. Losing investors' wealth is an obstacle among Asian countries. Panic selling of goods becomes alarming in the stock markets of the world and become a cause of falling worldwide capital markets. A situation in which the money supply will be more than the demand for money represents financial crises. One main factor that affects the amount of demands for money is the uncertain circumstances of the financial market that economic representatives want to keep.

Demand for Money is currently an important policy implication debate in the world especially in Asia. A well specified demand for money has a greater importance for the regulation of stable monetary as well as much more important for Pakistan economy. The demand for money arises from two important functions of money. The first is that money acts as medium of exchange and the second is that it is a store of value. Thus individuals and businesses wish to hold money partly in cash and partly in the form of assets. There

are three approaches to demand for money; the Classical, the Keynesian, and the post – Keynesian. The classical economists did not explicitly formulate demand for money theory but their views are inherent in the quantity theory of money.

The purpose of the study is to examine the determinants of money demand function based on broad and narrow money on the economy of Pakistan. After the theoretical framework in first section, the rest of the paper is organized as follows; Section second discusses literature review, Section third presents the data and methodological issues, section forth is consisting upon results and discussion and finally Section five is regarding conclusions and policy recommendations.

2. LITERATURE REVIEW

A vast literature is available on the topic money demand function nationally as well as internationally. This section summarizes few of them as follows. Fisher (1911) emphasized on the transactions demand for money in terms of velocity of circulation of money. This is because money acts as a medium of exchange and facilitates the exchange of goods and services. Transactions demand for money is determined by the level of full employment income. This is because the classical believed in Say's Law whereby supply created its own demand, assuming the full employment level of income. Thus the demand for money in Fisher's approach is a constant proportion of the level of transactions which in turn bears a constant relationship to the level of national income. Further, the demand for money is linked to the volume of trade going on in an economy at any time. People hold money to buy goods and services, to earn interest and to provide against unforeseen events.

Keynes (1936) abandoned the classical view that velocity was a constant and developed a theory of money demand that emphasized the importance of interest rates. His theory of the demand for money which he called the liquidity preference theory asked the question: Why do individuals hold money? He postulated that there are three motives behind the demand for money: the transactions motive, the precautionary motive and the speculative motive. Transactions and Precautionary demand for money is a positive function of income but speculative demand for money is inversely influenced by interest rate.

Baumol (1952) analyzed the interest elasticity of the transactions demand for money on the basis of his inventory theoretical approach. He showed that the relation between transactions demand and income is neither linear nor proportional. Rather, changes in income lead to less than proportionate changes in the transactions demand for money.

Tobin (1956) formulated the risk aversion theory of liquidity preference based on portfolio selection. This theory removed two major defects of the Keynesian theory of liquidity preference. One, Keynes's liquidity preference function depended on the inelasticity of expectations of future interest rates and two individuals hold either money or bonds. His theory did not depend on the elasticity of expectations of future interest rates but proceeds on the assumption that the expected value of capital gain or loss from holding interest – bearing assets is always zero. Moreover, it explains that an individual's portfolio was holding money and bonds rather than only one at a time.

Friedman (1956) recognized that people want to hold a certain amount of real money balances. His real money demand function was a function of wealth (permanent Income), expected return on money, expected return on bonds, expected return on equity and expected inflation rate.

Rehman and Afzal (2003) empirically the impact of black market exchange rate on demand for money in Pakistan where official and black market exchange rate operates side by side due to exchange control. They gathered time series data during 1972-2000 following autoregressive and Distributed lag model for estimation. The authors concluded that real income peroxide by industrial production and black market exchange rate were increasingly affected by desired holding of real money balances and inflation was negatively influenced by desired holding of real money balances. They suggested that M2 monetary aggregate was the right aggregate to be considered for affective policy formulation.

Qayyum (2005) explored to estimate the dynamic demand for money function in Pakistan that could be used for policy analysis. They gathered time series data during 1960-1999 following Johansen co-integration technique. They concluded rate of inflation was negatively inducing in long run money demand function. Long run income was positively related to money demand function.

Khan and Sajjid (2005) had investigated both the long run and short run relationship between real money balances, real income, inflation rate, foreign investment rate and real effective exchange rate, They utilized time series data during 1982-2002 following auto regressive distributed lag approach for estimation. The study concluded that real GDP was giving positive effect on nominal money balances. Interest rate and Inflation were negatively related to nominal money balances. They suggested rebalancing effect resulting from variations in the real exchange rate that played a key role in Pakistan's money demand behavior.

Valadkhani (2008) examined the long and short run determinants of the demand for money in six countries .They collected panel data during 1975-2002. They concluded that real income had positively related to demand for real balances and interest rate spread. Inflation rate, real effective exchange rate and real interest rate were negatively related to demand for real balances. They suggested real M2 was a predictable monetary aggregate. They estimated long run income elasticity for all six countries exceeded unity.

Arshad (2008) made to reformulate and estimate the MABP for Pakistan. They made use of time series data during 1962 to 2005 following the Fully Modified Ordinary Least Square method and Johansen cointegration technique for estimation. The Author concluded that real income and real exchange rate were positively related to the money demand function in real term, and interest rate was negatively related to the money demand function in real term. They suggested that inverse relationship between foreign reserve and domestic credit recommend that the authorities may restrict the borrowing from the State Bank of Pakistan.

Hye et al. (2009) had explored to estimate the association between exchange rates, stock prices, and demand for money function in Pakistan. They made use of time series data during 1971 to 2006 following Johansen co-integration technique for estimation. The

authors concluded that economic activity, inflation and stock prices were positively influencing money demand and exchange rate and interest rate had negative affect on money demand. The analysis recommended an increase in stock price dictated an easier monetary policy to prevent a given nominal income or inflation target being undershot.

Omer (2010) evaluated to contribute to the ongoing debate; should central bank of Pakistan adopted the inflation targeting or continued with the monetary targeting as a monetary policy strategy. They collected time series data and employed Auto regressive and Distributed lag model for estimation. The analysis concluded that real permanent income per capita, real interest and expected inflation were directly affecting income velocity of money and transitory income was negatively affecting to income velocity of money. They suggested monetary authorities of Pakistan Mo and M2 as nominal anchors for operational and intermediate targets respectively while it had never used M1 officially for policy purpose.

Rutayisire (2010) explored to estimate the function of demand for money in short run and in long run for Rwanda economy. He utilized time series data during 1980-2005 following Johansen co-integration technique for estimation. They concluded that Log of real income was inducing M2. Central bank financing rate, the London interbank offered rate and the anticipated fluctuation of RWF exchange rate representing money depreciation were negatively influencing the log of M2. They suggested no significant role of interest rates in the demand for money in Rwanda. This suggested that the refinancing rate and BNR'S key interest rate had no effect on the composition of people's portfolio.

Sarwar et al. (2010) evaluated the money demand function that played a key role in monitory policy formulation. They utilized time series data following Auto regressive and Distributed lag model for estimation. The study concluded that log of real GDP and log of financial innovation were directly related to reserve money and price was negatively influenced by reserve money.

Suliman and Dafaalla (2011) made attempt to test the existence of stable money demand function in Soudan. The analysis collected time series data during 1960-2010 following co-integration technique for estimation. The study concluded that real income was affecting effecting on demand for real money balances and Inflation and exchange rate were negatively affecting to demand for real money balances. They recommended that it was possible to use the narrow money aggregate as target of monetary policy in Sudan

3. DATA AND METHODOLOGY

To analyze the factors determining money demand, the empirical equations are being modeled as below;

$$M2 = \beta_0 + \beta_1 POPG + \beta_2 PCI + \beta_3 INF + \beta_4 FINO + \beta_5 ER + \varepsilon$$
$$M0 = \lambda_0 + \lambda_1 POPG + \lambda_2 PCI + \lambda_3 INF + \lambda_4 FINO + \lambda_5 ER + \upsilon$$

In the above mentioned models, we have used the following variables.

Dependent Variable

M2 = Broad Money
M0 = Narrow Money

Explanatory Variables

POPG = Population Growth rate
PCI = Per Capita Income
INF = Inflation rate
FINO = Financial Innovation
ER = Exchange rate
ε and υ = Error Terms
$\beta's, \gamma's$ = Coefficients of variables

The current paper has utilized time series annual data for the time period from 1972 to 2010. The main sources of data are Handbook of statistics on Pakistan Economy 2010, Economic Survey of Pakistan (2010 – 11) and Statistical Year book 2010. We have employed Ordinary Least Square method to examine coefficients of regression equation and then applied some Diagnostic tests to find out Econometric problems. On the basis of Past studies and Hypothesis, the expected signs of explanatory variables are shown in the following Table 1.

Table 1
Expected Signs

Variables	Expected Sign
Population Growth	Positive
Per Capita Income	Positive
Inflation	Negative
Financial Innovation	Positive
Exchange Rate	Negative

4. RESULTS AND DISCUSSION

In Table 2, values for Mean, Minimum, Maximum and Standard Deviation are given corresponding to the variables. In the above table M2 and M0 are dependent variable and POPG, PCI, INF, FINO and ER are independent variables. The sample size comprises of 38 observations from the period of 1972 to 2010. The minimum and maximum values of M2 are 5137205 and 22059 respectively, whereas the mean value is 1040628 and standard deviation is 1372136. POPG having minimum value is equal to 2.07, maximum value is 3.24, mean value is 2.66 and standard deviation is 0.32. PCI has minimum value 1012.60, maximum value 75024.85, mean value 16927.07 and standard deviation 18711.36. Minimum and maximum values are respectively 2.46 and 23.87; similarly mean and standard deviation are 9.94 and 5.12). Mean, Standard Deviation, minimum and maximum values are respectively 0.40, 0.04, 0.29 and 0.46. Minimum and maximum

values are 8.50 and 83.80 respectively. Whereas mean value is 31.29 and standard deviation is 22.48. The minimum and maximum values of M0 are 8138 and 8138 respectively. Mean value is 335011.30 and standard deviation is 411813.60.

Table 2
Descriptive Statistics

	M2	M0	POPG	PCI	INF	FINO	ER
Mean	1040628.0	335011.3	2.66	16927.07	9.94	0.40	31.29
Median	370947.5	155023.0	2.57	8571.28	9.39	0.40	22.75
Maximum	5137205.0	1507581.0	3.24	75024.85	23.87	0.46	83.80
Minimum	22059.0	8138.0	2.07	1012.60	2.46	0.29	8.50
Std. Dev.	1372136.0	411813.6	0.32	18711.36	5.12	0.04	22.48

Table 3 and 4 reports estimated results of regression model, in which columns 1, 2, 3, 4 and 5 respectively denote Variables, Coefficients, Standard Errors, T – Statistics, and Probability values. Diagnostic tests are also mentioned at the end of table with their Null Hypothesis, F – Statistics and probability values.

With regards to population growth, that is positively related to demand for broad and narrow money with statistically significant coefficient. The rationale behind this relationship is that when population is increased, there will be more people to consume and it would lead to higher demand for broad and narrow money. Due to increase of one percent population growth, demand for money will increase by rupees 395050 or 88952 on the average. Per capita income, it suggests positive relationship with broad and narrow money having significant coefficient. Demand for broad and narrow money will increase by rupees 93 or 24 if per capita income is increased by 1 rupee on the average. Reason may be that more per person income lead to higher demand for broad and narrow money. This result is matched with the study of Muhammad Omer (2010).

In this study, inflation rate is found to have negative relationship with demand for broad and narrow money. It is statistically insignificant in both the models. Keeping money income fixed when inflation rate increased, goods and services will be more expansive, and it would be difficult for people to sustain their life style so ultimately demand for broad and narrow money will decline. This relationship is consistent with the studies of Khan and Sajjid (2005), Qayyum (2005), Rehman and Afzal (2003), Suliman and Dafaalla (2011), Valadkhani (2008).

Financial innovation has positive sign in both the models and it is statistically significant because its probability is less than 0.10. If financial innovation rate is increased by one point then demand for money will increase by rupees 2188510 or 587854 on the average. While easy financial developments and sophistications in modes of payments and lesser user cost in term of time and money for drawing the money positively affect the demand for money. Our result is matched with the study of Sarwar et al. (2010).

Table 3
Regression Estimates of Demand for Broad Money

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1966300	482806.40	-4.07	0.00
POPG	395050.60	113058.50	3.49	0.00
PCI	93.07	3.04	30.53	0.00
INF	-2051.63	3677.48	-0.55	0.58
FINO	2188510	561501.80	3.89	0.00
ER	-15312.09	2722.13	-5.62	0.00
R-squared	0.79	**F-statistic**		1638.31
Adjusted R-squared	0.78	**Durbin-Watson stat**		1.94
Diagnostic Tests				
Breusch-Godfrey Serial Correlation LM Test				
F-statistic	1.16	**Probability**		0.28
Obs*R-squared	1.38	**Probability**		0.24
Null hypothesis: there is no problem of autocorrelation.				
Ramsey RESET Test:				
F-statistic	2.28	**Probability**		0.14
Log likelihood ratio	2.69	**Probability**		0.10
Null hypothesis: regression model is correctly specified.				

Exchange rate is negatively related to demand for broad and narrow money. It is statistically significant because its probability is less than 0.10. If exchange rate will increase by one point then demand for broad and narrow money will decrease by rupees 15312 or 2273 on the average. Reason may be that due to increase in exchange rate, foreign goods and services will be expansive for domestic customers, imports will decline and ultimately it will affect demand for money in negative direction. Our results are similar to comparable with the studies of Hye et al. (2009), Suliman and Dafaalla (2011), and Valadkhani (2008).

Co-efficient of determination (R^2 = 0.79, 78) shows that the 79 and 78 percent variations in the dependent variable is explained variations in explanatory variables. F – Statistics 1638.317 and the probability 0.00, explain that the overall regression model is statistically significant. Durbin Watson statistics is 1.94 or 2.15, which is around 2 therefore there is no autocorrelation in the regression models. Bruesch – Godfrey Serial Correlation test (Probability > 0.10) may not reject the null hypothesis and confirms the absence of autocorrelation problem from the regression model. Ramsey RESET Test (Probability > 0.10) also explains that regression models are correctly specified.

Table 4
Regression estimates of Demand for Narrow Money

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-485508.70	190951.50	-2.54	0.01
POPG	88952.70	44715.02	1.98	0.05
PCI	24.99	1.20	20.73	0.00
INF	-442.94	1454.45	-0.30	0.76
FINO	587854.70	222075.80	2.64	0.01
ER	-2273.22	1076.61	-2.11	0.04
R-squared	0.78	**F-statistic**		940.70
Adjusted R-squared	0.77	**Durbin-Watson stat**		2.15
Diagnostic Tests				
Breusch-Godfrey Serial Correlation LM Test				
F-statistic	2.09	**Probability**		0.14
Obs*R-squared	4.66	**Probability**		0.09
Null hypothesis: there is no problem of autocorrelation.				
Ramsey RESET Test				
F-statistic	0.82	**Probability**		0.37
Log likelihood ratio	0.99	**Probability**		0.31
Null hypothesis: regression model is correctly specified.				

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

The study examines factors affecting money demand function on the economy of Pakistan. Population growth, per capita income and financial innovation are found to have positive influence on demand for money in Pakistan. Due to increase in population growth and per capita income, people will consume more on goods and services. To consume more, they need more money and ultimately demand for narrow and broad money will increase. Financial innovation is positively related to money demand, as there is financial innovation people want to purchase financial instruments (bonds, equity), therefore people will demand money and money demand will increase. On the other side, two most important variables; exchange rate and inflation are concluded to affect demand for broad and narrow money indirectly in Pakistan. Reason may be that keeping income constant, due to increase in price level, people can purchase less goods and services and will demand less money. While an increase in exchange rate makes imports more costly, people will consume less on imported items and will demand less as previous.

On the basis of results, the study suggests some policy implications that responsible authorities should control population growth rate and per capita income because more demand for goods and services will lead to higher price level which will affect the poor nation of economy. Financial innovation is necessary element for the nation, as it leads to higher internal savings, investment and exports as well. Inflation is harmful for stabilization of the economy it should be controlled.

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ORGANIZATIONAL CHANGE AND UP-GRADATION OF HIGHER EDUCATION INSTITUTIONS IN PAKISTAN THROUGH INSTITUTIONAL PERSPECTIVE: A CASE STUDY OF LAHORE COLLEGE FOR WOMEN UNIVERSITY

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ABSTRACT

The up-gradation of higher education institution in Pakistan is the continuation of the change agenda of the government started in 1990's under the new public management (NPM) reforms. Higher education institutions in general and policy making institutions including Higher Education Commission of Pakistan in particular are focusing more on restructuring the higher education institutions through various methods such as up-gradation.

The present study evaluated up-gradation of Lahore College for women to a University. Case study method was utilized for this research project. Twelve in-depth interviews were conducted including Registrar, Deputy Registrar, Head of Departments, Dean of faculty and Faculty members to collect the primary data. Using interpretive perspective up-gradation process and changes introduced in University were discovered. Theoretical rationalization of phenomenon is also elaborated in the light of institutional theory and social political and agency pressures.

KEYWORDS

Up-gradation, New Public Management.

INTRODUCTION

Educational infrastructures of Western countries have encountered a big wave of reforms, resulting in great improvements in the administration of higher educational institutions. The systematic implementation of these reforms has affected the whole world. Since education is a global phenomenon, the developing countries have begun to feel the pressures in maintaining international standards of education and restructuring their institutions according to higher education standards set by international institutions (NEP, 2009; Azam, 2007).

In the pursuit of this reform agenda Higher Education Commission of Pakistan has given guidelines to education institutions to adopt a standard set of practices to align with international standards of education (Jahangir, 2008). Many higher education institutions

are restructuring themselves in the light of Higher Education Commission guidance by reforming and up-grading (Raouf, 2006).

The present study is conducted to study the changes introduces in LCWU after up-gradation of a college to university. The major aim of the study is to observe

- What changes are introduced in the administration of LCWU after up-gradation?
- How up-gradation is carried out in LCWU?

LITERATURE REVIEW

In 1970's and 1980's transitional and developing countries of the world has observed a wave of public sector management reforms. The major focus of these reforms was on the role and institutionalization process of the countries and in introducing market principles of profit maximization and greater efficiency in public sectors. These reforms were started in developed nations and implemented on developing countries through aided schemes of International Monetary fund and World Bank (Hughes, 1998).

The reasons behind these reforms were manifold including financial crisis and enlarged size of government that raised serious questions on the role of state especially when economy was derailing. In West, failure of Keynesian welfare state was basic reason to introduce some new and innovative ways of governing. The fiscal crisis of 1970s and 1980s played important role in redefining responsibility of state and introducing market principles of profitability and competition in government sector (Marini, 1971). These techniques are being introduced in developing countries to strengthen their unstable governments and to support them in establishing a sustainable legal environment (OECD, 1993). NPM (new public management) is the label given to these practices and techniques (Hood, 1991).

The vital element of NPM is the attempt to initiate or suggest the efficient ways of work by introducing incentives and linking performance with promotion in public sector. The primary supposition is that public sector can be more efficient by introducing private sector principles of competition (Metcalfe and Richards, 1991).

BASIC CONCEPT OF NPM

The term is defined as:

> "An innovative set of practices to deal with the public issues in a participative way to increase efficiency in minimum possible time (OECD, 1993)."

NPM is collection of up to date ideas and practices that hunt for utilizing efficient ways of service delivery. The basic idea is reforming structures in government sector by introducing market base mechanisms and healthy competition (Denhardt & Denhardt 2003).These changing efforts were started in 1980s from that time this concept of change and reforming governments is being practiced around the world with great success. NPM focused on innovation, accountability, openness, organizational change, clarity, time management, smart learning, project management, performance linkages, incentives and flat structures (Gruening, 2001; Larbi, 1999; Polidano, 1999; Batley 1999; Pollitt & Sorin, 2011).

ORGANIZATIONAL CHANGE

NPM focuses on reforming organizations through organizational change. Organizational change has always been a focus of the governments in the developing world. As developing countries are facing issues of unstable political environment, weak institutional structures and derailing economies. The administrative reforms introduced under NPM agenda are apprehensive and encouraging for organizational change. These reforms are more focused on structural and functional changes in developing countries in order to change their organizational setup according to changing world. Education is the most important tool for bringing change in developing countries. So; changes are introduced through Higher Education in developing countries. Demand for education grows as society undergoes development. Education teaches people and gives them wisdom. During reform process education sector is the most important sector to be considered and plays a vital role in development. So, while introducing reforms public educational institutions cannot be neglected and these institutions should be introduced a systematic reforms in order to make development process successful (Gabriele, 2000).

Western countries have introduced drastic changes in structure and pattern of higher education during last twenty years. They introduced business sector practices to the educational institutions to enhance their efficiency. They also encouraged developing countries to embrace these trends education by offering funded higher education to their students and by developing associations with their institutions. They also demanded higher education institutions to change their structures according to international standards to compete the developed countries in the field of education (Altbach & Ogawa, 2001; Teichler, 2003).

DEFINING CHANGE MANAGEMENT

Change management is defined in a numerous ways in literature change is termed as altering organizations and introducing innovations in its structures and functions (Hayes, 2007). Management of change is defined as proper execution of new practices and successful implementation of new methods with overcoming resistance (Danielson, 2008).

THEORIES OF ORGANIZATION CHANGE

The literature of organization change is enriched with different theories that elaborates basic components of change and illustrates processes and stages through which an organization passes while introducing change (Gabriele, 2000).All these points towards an "ideal-based, holistic, long-lasting, participatory, accessible, fine-tune, and emancipator" circumstances. Though there are a lot of theories of change management but theories that illustrate education institutional changes are institutional, free market and round table theory.

Institutional Change Theory:

The major focus of this theory is on introducing change in order to make organization legitimate. This theory was proposed by John Meyer and colleagues in the 1970's and described that organizations work in relation with their environment. They interact with the other organizations and institutes working in the similar environment. They exchange

goods and services with each other and also learn ways of working in specific surroundings. Each society has its distinct norms and values. These norms and values shape the behavior of people and also the institutions of the society. There are certain activities and behaviors which are approved in every society and people living in that society are required to conform to these norms and values to be accepted in the culture. The basic assumption of institutional theory lies in the idea that norms and values of society shape organizational composition and organizations adopt structures approved by the norms of the society to be accepted in the society. Institutional theory is also defined as 'the pressure exerted by the environment on an organizational structure and behavior, it explains the ways how societal rules and norms outline organizational actions (Huerta and Zuckerman, 2009).

Free Market Theory:

This theory states that all the institutions are in constant struggle and they compete with each other and as a result of this competition changes occur. This theory states that all organizations seek to achieve excellence and have equal chances of success so they compete with other organization in getting success. The supporter of this theory proposes that organization success or failure is dependent upon its own effort.

Adnett and Davies (2000) and Lubienski (2006) proposed the concept of free markets for educational institutions and states that organizations are guided by their own wishes and have to face competition and market pressures.(Lubienski, 2006).The concept of free markets in educational institution was criticized by Eyal as the idea of free markets if introduce in educational institutions will cause failure as mechanisms of this system will not allow to create conditions necessary for change hence causing inertia in any system leading to disaster(Eyal, 2009).

Roundtable Theory:

The roundtable theory (RT) proposes the concept of shared leadership for an educational institution.The theory revolves around the idea that decision making should be participative and leaders should involve all stakeholders in this process (Gabriele, 2002).Theory presents the idea that by involving stakeholders in decision making process resistance to change can be overcome. It will generate more commitment and will make implementation of change easy. It also focuses on continuing change efforts by introducing one after the other hence changing whole organization.

Universal Expansion and Increasing Demand for Higher Education:

Education is the most important source of development (Chakrabarti & Lester, 2002). The assembly of United Nations gives an outline of basic human rights which include education, health and basic necessities of life. They said that basic necessities should be provided all the citizens without any discrimination and principle of equality should be followed. They include education in basic human rights list and states that all have equal right to education.

Article 26 clarifies that

"Everyone has the right to education (UN, Universal Declaration of Human Rights, 1948)."

Demand for higher education has been doubled during the last ten (10) years. In 2004, there were 132 million students registered worldwide while it was 68 million in 1991(Van der Wende, 2007). Most of this enlargement has been in Africa, Asia, Latin America and the Caribbean, the Arab countries, and in Eastern and Central Europe. In China and India enrolments in the past 10 years has been doubled. In many countries, this trend is found in youth and young adults but in others, such as Canada, New Zealand, and the United Kingdom, a considerable number of older adults have also been entering the system (Tremblay and Basri, 2005). In 2006 in Canada, for example, the bulk of part-time students (approximately 190,000 of 275,000) were 25 years old or older (Association of Universities and Colleges of Canada) Worldwide participation rates in higher education are increasing (Tremblay and Basri, 2005).

Rationale for Expansion, Up-gradation of Higher Education Institutions:

The right to a primary and secondary education has long been acknowledged, but the suggestion that higher education is also a human right has also become widely received around the globe. This prospect has awaken from the cross-cultural and increasingly universal conviction that education offers hope for employment, a better life for one's self and one's children, and accomplishment of one's personal aspirations. Thus, while population growth and demand for entrance are beyond the capacity of institutions to serve, we have at the same time raising expectations of people that access to education is their right. This disparity brings an added pressure on the efforts of governments and institutions to determine in order to evade further social unrest (Nicholas H. Allen, in written correspondence with ICDE, December 5, 2009)

Clearly, the probable growth of the universal population of competent people to proceed from high school to higher education will yield a momentous increase in demand that cannot be met by present capability or infrastructure. According to a report in order to meet this ever increasing demand of higher education Asia, South America, and Africa would have to build tens of thousands of traditional universities, each accommodating 40,000 students. To meet this demand of people for higher education up-gradation, expansion, distance learning is the best solution (Neave, 1988).

Theoretical framework:

Theoretical framework intends at explaining the up-gradation in Lahore College for Women University. As discussed in literature review NPM is the broader paradigm marked with sweeping transformations in the delivery of public services and governance mechanism of public sector institutions. NPM focused on changing the organization by introducing innovation, accountability, openness, organizational change, clarity, time management, smart learning, project management, performance linkages, incentives and flat structures. Change is encouraged by reforming structures, introducing market base mechanisms and healthy competition thus; change management is a sub component of the extensive NPM paradigm. There are different theories that elaborate basic components of change and illustrate processes and stages which an organization experiences while introducing change (Gabriele, 2000).According to Garbiele the theories that illustrate education institutional changes are institutional, free market and round table theory. However, institutional theory is the most important theory that explains the forces and processes while discussing change in an educational institution.

Institutional Theory:

The basic idea of this theory is postulation i.e. the norms and values of society outline organizational composition and organizations adopt certain structures that are approved by the norms of the society. Institutional theory is also defined as 'the pressure exerted by the environment on an organizational structure and behavior, it explains the ways how societal rules and norms shape the organizational actions (Huerta and Zuckerman, 2009).

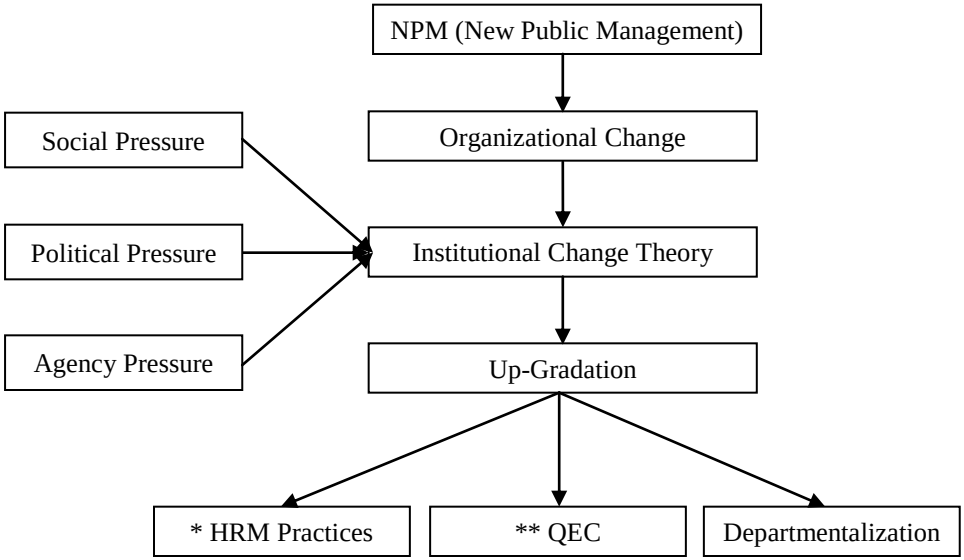
Organizations do not work in isolation as, they are part of the environment and are liable to follow the rules and regulations set by guiding forces. So organizations shape their structures according to the norms and values of the cultures in which they operate and they have to adopt practices required by them in order to get legitimacy. Therefore, Institutionalization is referred as the adoption of required organizational structures and practices in order to get legitimacy (Scott, 1994). There are three renowned institutional pressures: **social, political and agency pressure**.

Social pressures are referred to as the pressure exerted by the competitors and other institutions in the society and forces to adopt similar practices (Scott, 1994).Society is basically collection of institutions. There are different set of organizations present in every society. Organizations working for similar goals form a social group e.g. manufacturing organizations, multinational organizations, educational institutes etc. In every social group similar institutes grouped together. These groups are guided by some norms and values which are accepted by all the members in the group. These are social obligations and expected behavior of the society. These are guided by wishes of the society. One has to accept these values to live and be acknowledged in a society. These societal rules and expectations are termed as social pressure (Zuker, 1989).

Political pressures are exerted by the distinctive political structure of the country. Each country has its unique political culture. The whole infrastructure of the country is designed according to it's the political structure. Government policies are formulated in the light of political environment. These policies are guidelines for the working of all the units within a country. Political pressures are specifically affected by the government policy which imposes similar changes in all institutions and focus on adoption of same activities for all the units in one industry (DiMaggio, 1995).

Agency pressure refers to as institutional strain and requirement that affect the flexibility of organizations in choosing systems or to establish a particular department (Paauwe, 2003). Agencies are referred as regulatory authorities. These authorities prepare laws and rules to promote desired behaviors. They put constrains and demanded the institution to fulfill requirements to attain a particular position. Organizations are legally responsible to fulfill the demands of these agencies in order to acquire legality (Ostrom and Picht, 1988).

These three pressures constitute the institutional profile of a sector in the country. These pressures guide and motivate the institutions in the process of development. Organizations respond differently to this pressures. Upgradation, expansion and development are the reactions to these driving forces. The proposed theoretical model for the study is given on the next page



Theoretical Framework

* Human Resource Management
**Quality Enhancement Cell

RESEARCH METHODOLOGY

The research is aimed to study the changes introduced after up-gradation of college to university. Considering the objective of the study an interpretive research design is used to find answers to research questions. According to Merriam (2009) interpretive study is an attempt to describe an existing phenomenon in the light of information provided by the participants. Qualitative research methodology is used in the study because explanatory requirements of a study are satisfied with qualitative approach. Qualitative research provides explanation of a social phenomenon (yin, 2003). A case study approach is adopted to have detailed analysis of the event. Case study is defined as detailed, in-depth study of specific event or an organization to have better understanding and. The present study is conducted at Lahore College for women university (LCWU), an educational institution. Administrative staff and faculty members are the population for the study. Purposive sampling is used to select the respondents. In purposive sampling "sample is chosen on the basis of their distinctiveness (Denzin & Lincoln, 2000). During selection those respondents are selected who have been working in the university for more than 10 years and have experienced these changes in order to have most relevant information. Individuals at key administrative positions, Dean, Head of departments, faculty members, administrative staff and Registrar are selected as respondents. Primary data is collected through interviews. In qualitative research finest way to collect data is interviews. Interviews are exchange of words and ideas between two individuals about an event (Macnabb, 2012).An unstructured interview guide is used for data collection.

FINDINGS AND DISCUSSION

As it is described in theoretical framework, paradigm of NPM is the motivating force of current public sector reforms in developing countries (Dunsire, 1995). International funding institutions i.e. World Bank and IMF played a significant role in implementing these reforms in developing countries. These funding institutions strengthen the NPM reforms by institutionalizing these changing efforts. As higher education is largely funded by international institutions so, the structure and pattern of higher education institution has also undergone transformation. The expansion of higher education institutions is the continuation of this sequence of reforming public sector under New Public Management (Altbach & Rumbley, 2009; Lin, 2005).In Pakistan NPM reforms are implemented by the international funding institutions. Reforms introduced in the education sector of the country are also part of this NPM reform agenda (Jadoon & Jabeen, 2000). Higher education at first was supervised by Inter-University Board in Pakistan that was altered into University Grants Commission in 1974. Then its name and establishment were changed under the reforms introduced by NPM as Higher Education Commission in 2002 with more authority and independence in order to improve quality and worth of higher education in Pakistan.

As discussed in theoretical framework major focus of the reforms introduced by NPM agenda was on changing organizations. (Gabriele, 2000).The up-gradation of college to university has also introduced several administrative, managerial and structural changing's. After up-gradation and achieving the status of university, Lahore College for Women University has introduced changes in organizational structures and departments. The university has two wings i.e. Academic and Administrative. Vice chancellor, Dean, Head of department/institute/college/centre are concerning authorities for managing academic affairs. Heads of departments are answerable to the respective Deans. Dean has been delegated some financial and administrative powers. They can also hire visiting faculty and lower staff.

The statutory bodies of the university to deal with administrative and academic affairs are

- Syndicate
- Academic council
- Committee of control
- Board of faculty

University has four faculties which have their own board headed by the respective Deans. University has established a research centre under the supervision of committee of control to promote and guide quality research, a planning committee for scheduling development plans, selection board to help in hiring competent faculty, affiliation committee and a discipline committee. All these developments are made under the guidance given in the up-gradation act. New faculty positions have been introduced and targeted the commencement of fund-raising activities. Moreover prominent set of responses at the main campus(Lahore campus) level are to modify the academic structure by adding, or conversely by deleting, courses, degree programs, and departments.

Institutional theory is based on the idea that norms and values of society devise organizational composition and organizations adopt structures approved by the norms of

the society to be accepted in the society (Huerta and Zuckerman, 2007). Therefore, Institutionalization is referred as the adoption of required organizational structures and practices in order to get legitimacy (Scott, 1994). It proposes that policy institutions force the organization to adopt certain activities.

The up-gradation process of LCWU is directed by the aspiration of getting legitimacy. It was a long continuous process started in the year 1990, the administrative and financial autonomy was given to the institution, and this proved to be the turning point in the history of LCWU. The very same year, on 13th August 1990, it was declared as a Degree-Awarding Institution. And finally on 10th September 2002 the institution was granted the status of a Women University. University is governed under the Lahore College for Women University ordinance, 2002 which became act in 2004.

The process of up-gradation was directed by HEC guidelines. In response to HEC requirements, measures have been adopted by the university after up-gradation to strengthen its academic capabilities. Special attention has been devoted to the management of human resources. Registrar office has been established to perform the recruitment and selection activities. Finance and treasury department has been established to deal with compensation and monetary affairs of the university. Quality enhancement cell QEC have been established to compare and check the quality of research and publication.

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MODELING STOCK MARKET VOLATILITY USING GARCH MODELS: A CASE STUDY OF NAIROBI SECURITIES EXCHANGE (NSE)

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ABSTRACT

The aim of this paper is to use the General Autoregressive Conditional Heteroscedastic (GARCH) type models for the estimation of volatility of the daily returns of the Kenyan stock market: that is Nairobi Stock Exchange (NSE). The conditional variance is estimated using the data from January 2013 to May 2016. We employ both symmetric and asymmetric models to capture the most common features of the stock markets like leverage effect and volatility clustering. The results show that the volatility process is highly persistent thus giving evidence of the existence of risk premium for the NSE index return series. This in turn supports the positive correlation hypothesis: that is between volatility and expected stock returns. Another fact shown by the results is that the asymmetric GARCH models provide better fit for NSE than the symmetric models. This proves the presence of leverage effect in the NSE and high volatility of index return series.

1. INTRODUCTION

Modeling and forecasting volatility in financial time series has become an area that has attracted a lot of research in both empirical and theoretical aspects. In this situation, the models established to capture the variations in conditional mean of financial time series become no longer useful and hence, the performance of such mean models is reduced to give accuracy in estimation process. Engle (1982) first identified this dilemma and presented an equation of variance which helps to capture the volatility in the series. He observed the autoregressive effect in conditional variance and suggested an autoregressive conditional heteroscedasticity (ARCH) process using lag disturbances. Since the publication of ARCH model on the subject, there has been a lot of research work done in this area. Some limitations of ARCH model are identified and listed by Brooks (2008), and Tsay (2010). The empirical evidence based on Engle's work showed that an ARCH process of high order is needed to capture the dynamic behavior of conditional variance. Thus, Bollerslev (1986) proposed an extension of the ARCH type models which is called Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. The GARCH model has fulfilled this requirement since it is based on an infinite ARCH specifications. Many useful properties of GARCH models are given by Posedel (2005), Enders (2004), and Patterson (2000).

ARCH and GARCH models are used to capture both volatility and leptokurtosis. The so called "leverage effect" is also often observed in the financial time series (see Black (1976)). This usually occurs when stock price changes are negatively correlated with

changes in volatility. Since ARCH and GARCH models are symmetric in nature, they fail to capture leverage effect. In order to address this problem, many nonlinear extensions of the GARCH models have been proposed. These include asymmetric class of GARCH models such as exponential GARCH (EGARCH) model by Nelson (1991), the so-called GJR model by Glosten et al. (1993) and the power GARCH (PGARCH) model by Ding, et al. (1993). In the light of these observations in the financial time series, a wide range of varying variance models have been used to estimate and predict volatility.

Financial time series have the property of thick tails which are thicker than those of normal distribution. The other problem encountered by the GARCH models is that they do not fully embrace this property of thick/heavy tails which is so much evident in the behavior of financial time series. To address this problem, again Bollerslev (1987), Baillie and Bollerslev (1989) used the Student's t-distribution and non-normal distribution. Liu and Brorsen (1995) used an asymmetric stable density to capture skewness. Fernandez and Steel (1998) used the skewed Student's t-distribution to model both skewness and kurtosis.

Today, the emphasis is mostly given towards the application of heteroscedastic models to the financial data. A large number of empirical studies have been accomplished to address the concept of volatility of stock markets using the family of ARCH/GARCH processes. The progress in such studies are provided for the purpose of estimation and prediction of the conditional variance of stock returns over the specified period. For instance, the reader might get benefit from the research done by Ahmed and Suliman (2011), Naimy (2013), Shamiri and Isa (2009), and Kalu (2010). They used some models from GARCH family both symmetric and asymmetric to capture the stock market volatility. Ahmed and Suliman (2011) worked with the reference of Sudan stock market, while Kalu (2010) provides the volatility analysis of Nigerian stock exchange. Modeling volatility of Paris stock market using GARCH (1,1) and compared with exponential weighted moving average (EWMA) was done by Naimy (2013). Similarly, Shamiri and Isa (2009) provide the comparison of usual GARCH model with the non linear asymmetric NAGARCH models based on Malaysian stock market. Another study by Wagala et al. (2012), considers the Nairobi securities exchange (NSE) weekly returns using ARCH-type models. See also Sharma and Vipul (2016).

The main objective of this paper is to model stock returns volatility for the Kenya's Nairobi Securities Exchange (NSE), by applying different univariate specifications of GARCH type models. The rest of this paper is organized as follows. Following this introduction, Section 2 provides a brief review of the methodology of modeling volatility using some well-known symmetric and asymmetric GARCH models. A general overview of Nairobi Securities Exchange is provided in section 3. The description of data and summary statistics are also presented in the same section. The results of the estimated GARCH models are discussed in section 3.3. Lastly, section 4 concludes the paper.

2. METHODOLOGY OF MODELING VOLATILITY

Since the development of GARCH models, a number of extensions and variants have been proposed. These variants are well classified in one of the two broad classes of symmetric and asymmetric GARCH models. Before we discuss these extensions, let us

assume some notations that are useful to describe the general GARCH framework. Let ε_t denote a real valued discrete time stochastic process and ψ_t is the information set of all information through time t. We define the model that contains the features of both conditional mean and conditional variance as given below.

$$r_t = E(r_t / \psi_{t-1}) + \varepsilon_t; \quad \varepsilon_t \sim N(0, \sigma_t^2) \tag{1}$$

Equation (1) can be rewritten as

$$r_t = \mu_t + \varepsilon_t \tag{2}$$

Here, $\mu_t = E(r_t / \psi_{t-1})$ is the expression used to model the conditional mean of r_t given that the information through time t-1. The error is assumed to be non-constant quantity with respect to time and thus given by

$$\varepsilon_t = \sigma_t a_t \tag{3}$$

Where $\sigma_t = \sqrt{V(r_t / \psi_{t-1})}$ and $a_t \sim N(0,1)$. Keeping equation (2) as for modeling the conditional mean of return, we briefly present a number of specifications of GARCH models to represent the situations for expressing the conditional variance. These are given by the following sub-sections.

2.1. Symmetric GARCH Models

In the symmetric GARCH models, the conditional variance only depends on the magnitude of the underlying asset and not on the sign. This ignores the effect raised by the positive or negative asset on conditional variance. The widely used symmetric GARCH models include generalized autoregressive conditional heteroscedasticity (GARCH) model and GARCH in mean model. These are discussed below.

GARCH Models

A generalized autoregressive conditional heteroscedasticity (GARCH) model is the first and basic symmetric model developed by Bollerslev (1986). It is defined as the linear function of past squared residuals and the lagged conditional variances as given below

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i \sigma_{t-i}^2 \tag{4}$$

Where α_0 is the constant term, $\alpha_1, \alpha_2, \ldots, \alpha_q$ are the parameters or coefficients of ARCH specifications, and $\beta_1, \beta_2, \ldots, \beta_p$ are the parameters or coefficients of GARCH specifications. The q and p are the respective orders of ARCH and GARCH processes. The simplest specification of this model is GARCH (1,1) model, that is,

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \tag{5}$$

GARCH-in-Mean (GARCH-M) Model

Another well known symmetric model is GARCH in Mean (GARCH-M) model developed by Engle, et al. (1987). In most of the financial markets, we expect risk to be compensated by a higher return and hence the return of a security may depend on its volatility. To model such phenomenon one might consider GARCH-M model. This variant of GARCH family allows the conditional mean of return series to depend on its conditional variance. A simple GARCH-M (1,1) model is defined by the two equations, the one for conditional mean is given by

$$r_t = \mu_t + \varepsilon_t \quad \text{where } \mu_t = \mu + \lambda\sigma_t^2 \tag{6}$$

The equation for conditional variance is same as provided by the GARCH (p, q) model in equation (4) and its specific case GARCH (1,1) by equation (5).

2.2 Asymmetric GARCH Models

This section deals with the asymmetric models that are extensively motivated by the need to distinguish between good news and bad news and their impact on volatility in financial markets. Engle, and Ng, (1993) introduced the news impact curve and summarized the effect of a shock interpreted as negative shocks (bad news) or a positive shock (good news) on the time varying conditional variance. For many stock returns, there is a negative correlation between the current return and the future volatility. The tendency of volatility to decline when return rises and to rise when return falls is called the leverage effect. Symmetric models fail to explain the leverage effect due to incapability of conditional variance to respond asymmetrically. Consequently, many asymmetric variants of GARCH models have been established to deal with this phenomena. Some of them are discussed below.

Exponential GARCH (EGARCH) Models

Nelson (1991) proposed the exponential GARCH (EGARCH) models particularly designed to allow asymmetric effect between positive and negative asset returns. The EGARCH (p, q) specification is given by

$$\log(\sigma_t^2) = \alpha_0 + \sum_{i=1}^{q} \alpha_i \left[\left| \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \right| \right] + \sum_{i=1}^{p} \beta_i \log(\sigma_{t-i}^2) + \sum_{i=1}^{q} \gamma_i \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \tag{7}$$

Where γ_i is the asymmetric or leverage effect parameter. The value of conditional variance will be positive even if the parameters are negative because it models the log of conditional variance. If the relationship between the current return and future volatility is negative then γ will be negative and hence the leverage effect is confined.

Threshold GARCH (TGARCH) Models

Another important volatility model commonly used to handle the leverage effect is the threshold GARCH (TGARCH) model. This model is developed by Glosten,

Jagannathan, and Runkle in 1993 so that it is also called GJR model (see Zakoian (1994)). The TGARCH (p, q) framework of conditional variance is given by

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i \sigma_{t-i}^2 + \sum_{i=1}^{q} \gamma_i \varepsilon_{t-i}^2 I_{t-i} \quad (8)$$

Where $I_{t-i} = 1, if\ \varepsilon_{t-i} < 0$, otherwise $I_{t-i} = 0$, and γ_i is the parameter of leverage effect. If $\gamma_i = 0$, the model collapses to the classical GARCH (p, q) process. Otherwise, when the shock is positive, the effect on volatility is α_i (i.e. $I_{t-i} = 0$), and when the shock is negative, the effect on volatility is $\alpha_i + \gamma_i$ (i.e. $I_{t-i} = 1$). Hence, we can say that for $\alpha_i > 0$, the effect of bad news have larger impact on conditional variance than does good news.

Power GARCH (PGARCH) Model

Ding, et al. (1993) proposed a variant to asymmetric GARCH models and provided with power GARCH (PGARCH) models. Unlike the GARCH family, we are able to model both the conditional standard deviation as well as conditional variance. The PGARCH (p,q) specification is as under;

$$\sigma_t^{\delta} = \alpha_0 + \sum_{i=1}^{q} \alpha_i \left(\left| \varepsilon_{t-i} - \gamma_i \varepsilon_{t-i} \right| \right)^{\delta} + \sum_{i=1}^{p} \beta_i \sigma_{t-i}^{\delta} \quad (9)$$

Where δ is the parameter for power term such that $\delta > 0$. For $\delta = 2$, the model simply becomes a standard GARCH model that allows for leverage effect. For $\delta = 1$, we deal with the model used to estimate the conditional standard deviation rather conditional variance.

3. MODELING VOLATILITY OF NAIROBI SECURITIES EXCHANGE

3.1 An Overview of Nairobi Securities Exchange

Nairobi Securities Exchange is the only stock exchange of Kenya. It is abbreviated as NSE. It was started as Nairobi Stock Exchange in 1954 as a voluntary association of stockbrokers in the European community registered under the Societies Act. This was when Kenya was still a British colony. It changed its name to Nairobi Securities Exchange in July 2011. It is based in Nairobi the capital city of Kenya. The principle index of NSE is the NSE 25 Share Index. It uses the local currency (Kenyan shilling) for its operations and on 24th October 2014, it had a market capitalization of about Ksh 2.248 trillion. NSE is the leading securities exchange in East Africa.

Securities traded in NSE are ordinary shares and investment units. There are other products also available and being traded at the NSE which include derivative securities and debt securities which include government bonds. NEXT is the Nairobi Securities Exchange Derivatives market where members can trade future contracts across variety of

asset classes such as equities, currencies and fixed income securities. It is regulated by the Central Bank of Kenya (CBK).

The self-listing of NSE stock through an IPO on 27th June 2014, made the NSE to join the Johannesburg Stock Exchange being the only exchange in Africa that is self-listed. In March 2015, the NSE officially joined the United Nations Sustainable Stock Exchanges (SSE) initiative whereby they made a voluntary pledge to inform their stakeholders of the importance of integrating sustainability in their capital markets.

3.2. Data Description and Basic Statistics

The time series data used for modeling volatility in this paper is the daily closing prices of Nairobi Securities Exchange (NSE) index over the period from 18th March 2013 to 18th February 2016, resulting in total observations of 730 excluding public holidays. The daily returns (r_t) are calculated as the continuously compounded returns which are the first differences of log prices of NSE-Index of successive days:

$$r_t = \log\left(\frac{p_t}{p_{t-1}}\right)$$

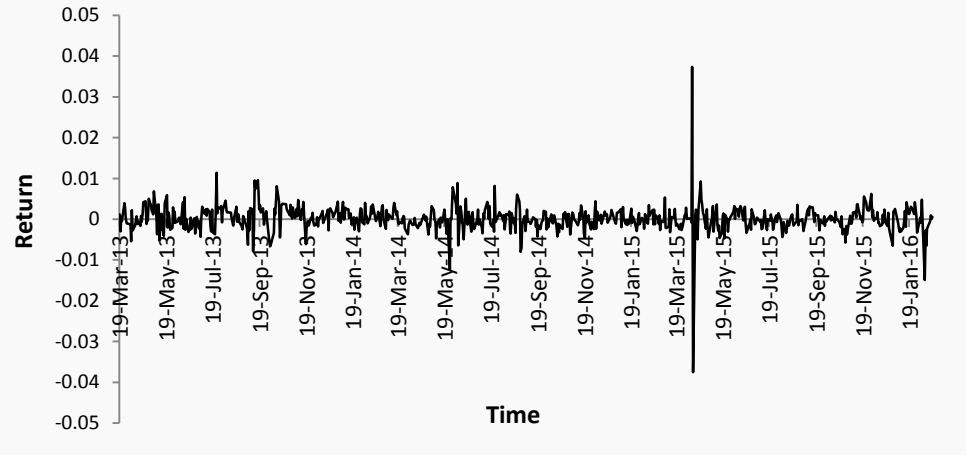

Figure 1: Time Plot of NSE dAily Return Series

Where p_t and p_{t-1} are respectively the closing market index of NSE at the current day and previous day. Various descriptive statistics are calculated and reported in table 1. This is in order to specify the descriptive properties of the daily NSE return series (r_t) during the period of the study. The mean return is 0.000297 with the standard deviation of 0.007429. There is also an excess in kurtosis as can be seen clearly. A high value of kurtosis 52.377 indicates a leptokurtic distribution that is an apparent departure from normality. Another important test of normality is the Jarque-Bera (JB) statistic, which confirms the null hypothesis of normality for the daily NSE returns should be rejected at 1% level of significance. We can thus summarize that the NSE return series do not conform to normality but actually tend to have positive skewness (i.e. the distribution has

a thick tail). The plot of NSE daily returns is displayed in figure 1. We observe a large swing in the period of April 2015 with maximum and minimum returns are respectively 0.0373 and -0.0374.

3.3. Analysis of NSE Return

In order to analyze the return series, the first step is to check the stationary scenario of return series. For this purpose, we employed the familiar Augmented Dickey Fuller (ADF) test and Phillips Perron (PP) test for original series (p_t) and the return series (r_t). The test results are presented in table 2. The series (p_t) is not stationary, however the results for return (r_t) led towards the rejection of null hypothesis of unit root, and hence stationarity is present in return series.

Table 1
Various descriptive statistics of NSE daily return series

Descriptive Statistics	Values
Mean	0.000129
Median	1.08e-05
Maximum	0.03735
Minimum	-0.03749
Standard Deviation	0.00322
Skewness	-0.11621
Kurtosis	52.2665
Jarque –Bera (Prob.)	73727.59 (0.0000)

Table 2
Results of Unit Root Test for Original NSE Index Series, and NSE Return Series

Time Series	Test Statistic	P-value	Critical Values		Durbin-Watson
			1%	5%	Test
Augmented Dickey Fuller Test					
NSE Prices	-2.354	0.155	-3.3439	-2.865	2.130
NSE Return	-28.042*	0.000	-3.439	-2.865	1.991
Phillips Perron Test					
NSE Prices	-2.357	0.154	-3.3439	-2.865	2.130
NSE Return	-28.043*	0.000	-3.439	-2.865	1.991

*Significant at both levels of 1% and 5%

It is important to examine the residuals to find the evidence of possible heteroscedasticity before applying the methodology of modeling conditional variance. In order to test the presence of heteroscedasticity in the residuals of NSE index returns series, the Lagrange Multiplier (LM) test is applied to test the hypothesis that $\alpha_1 = \alpha_2 = ... = \alpha_q$, where q is the order of ARCH effect. The test procedure entails

first obtaining the residuals $\hat{\varepsilon}_t$ from the ordinary least square regression of the conditional mean equation which might be an autoregressive (AR) process, moving average (MA) process, or a combination of the two processes termed as ARMA process. We assume a constant mean model for modeling the conditional mean and the LM test is applied to compute the test statistic value TR^2, where T is the number of observations and R^2 is the coefficient of multiple correlation obtained from regressing the squared residuals on q own lagged values. The test statistic is evaluated against chi-square $\chi^2(q)$ distribution (see Patterson (2000) for details on ARCH-LM test). The results of LM test for various ARCH order q are presented in table 3, which provide strong evidence of rejecting the null hypothesis of constant variance for all lags included. Rejecting H_0 indicates the presence of ARCH effect in the residuals series and therefore we can conclude that the variance of the return of NSE index is no-constant for all periods specified.

Once the volatility is confirmed in data, we proceed our analysis further to estimate the parameters of both conditional mean and conditional variance equations. For this purpose, we employed the symmetric and asymmetric GARCH models including GARCH(1,1), GARCH-M(1,1), EGARCH(1,1), TGARCH(1,1), and PGARCH(1,1). The estimation procedure uses the Broyden-Fletcher-Goldfarb—Shanno (BFGS) optimization method useful for solving unconstrained non-linear problems. The estimation results are presented in table 4. The constant mean parameter in mean equation is not significant in any of these underlying models. However, we observe the significant constant (α_0), significant ARCH effect (α_1), and significant GARCH effect (β_1) in conditional variance equation of GARCH (1,1), GARCH-M (1,1), EGARCH (1,1), and TGARCH (1,1). There is an insignificant contribution of GARCH effect in conditional mean of GARCH-M (1,1) model and also the estimates of conditional variance equations in GARCH(1,1), and GARCH-M(1,1) are observed similar. Therefore, due to insignificant GARCH in mean model one has to prefer the simple parsimonious GARCH (1,1) model. The estimated power parameter (δ) in Power GARCH model is found to be 3.697 which is significant at 5% level. However, PGARCH model provides only significant GARCH effect and does not offer the considerable contribution of lag squared disturbances that is the ARCH effect. The leverage effect (γ) is estimated for three asymmetric GARCH models taking the values 0.0506, -0.1076, and 0.165 respectively for EGARCH, TGARCH, and PGARCH models. We found significance only for TGARCH (1,1) process that confirms the leverage effect.

Table 3
Results of ARCH-LM Test for Different Values of q

ARCH order q	Test Statistic TR^2	Probability
1	166.942	0.0000
2	216.89	0.0000
3	236.186	0.0000

Table 4
Estimation results of GARCH (1,1), GARCH-M (1,1), EGARCH (1,1), TGARCH (1,1), and PGARCH (1,1) models

GARCH (1,1)

$$r_t = 0.00014$$

$$\sigma_t^2 = 3.58\times10^{-6}\ ** + 0.1082**\varepsilon_{t-1}^2 + 0.4964**\sigma_{t-1}^2$$

GARCH-M (1,1)

$$r_t = 0.000426 - 32.047\sigma_t^2$$

$$\sigma_t^2 = 3.91\times10^{-6}\ ** + 0.1113**\varepsilon_{t-1}^2 + 0.455**\sigma_{t-1}^2$$

EGARCH (1,1)

$$r_t = 0.00023$$

$$\log(\sigma_t^2) = -10.656** + 0.2484**\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + 0.1007\log(\sigma_{t-1}^2) + 0.0506\frac{\varepsilon_{t-1}}{\sigma_{t-1}}$$

TGARCH (1,1)

$$r_t = 0.00013$$

$$\sigma_t^2 = 3.278\times10^{-6}\ ** + 0.1388**\varepsilon_{t-1}^2 + 0.5472**\sigma_{t-1}^2 - 0.1076*\varepsilon_{t-1}^2 I_{t-1}$$

PGARCH (1,1)

$$r_t = 0.00013$$

$$\sigma_t^{\delta} = 2.118\times10^{-10} + 0.0528\left(\left|\varepsilon_{t-1} + 0.165\varepsilon_{t-1}\right|\right)^{\delta} + 0.3756*\sigma_{t-1}^{\delta};\ \text{where},\delta = 3.697*$$

* Significant at 5% level
** Significant at 1% level

Table 5
Some Accuracy measures for different specifications of GARCH Models

GARCH Models	AIC	SC	RMSE
GARCH (1,1)	-8.8247	-8.7995	0.0032
GARCH=M (1,1)	-8.8228	-8.7913	0.0031
EGARCH (1,1)	-8.8173	-8.7858	0.0032
TGARCH (1,1)	-8.8268	-8.7953	0.0032
PGARCH (1,1)	-8.8318	-8.7940	0.0032

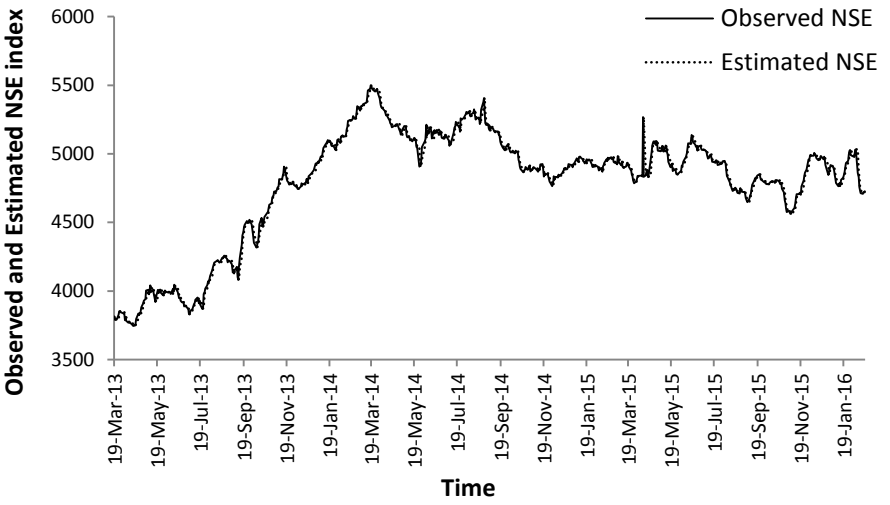

Figure 2(a): Plot of Observed and Estimated NSE Prices from GARCH(1,1) Model

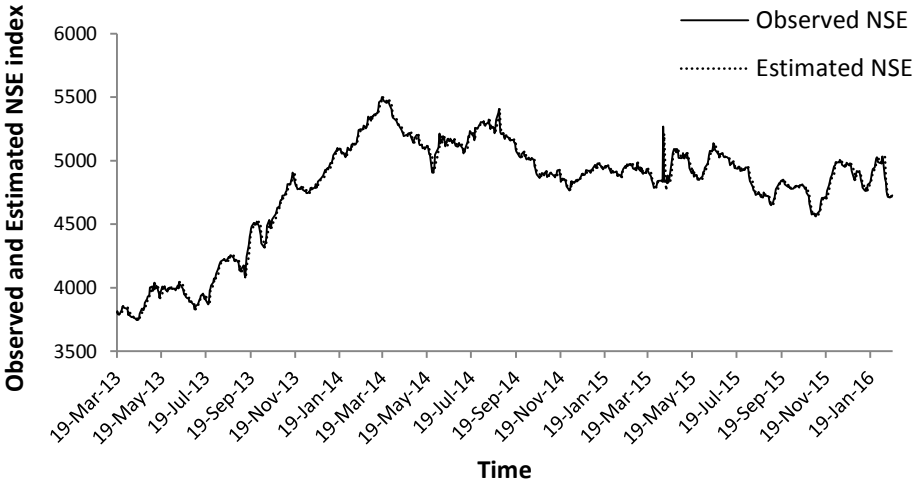

Figure 2(b): Plot of Observed and Estimated NSE prices from GARCH-M (1,1) Model

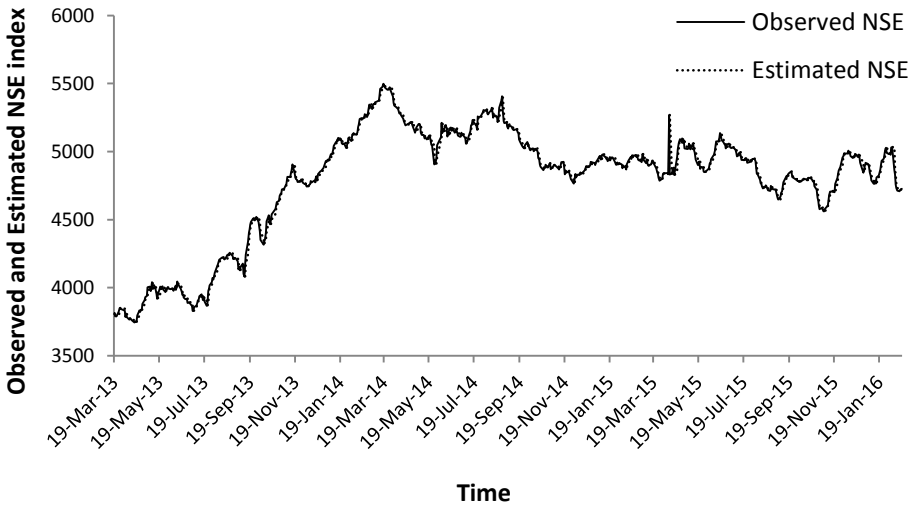

Figure 2(c): Plot of Observed and Estimated NSE Prices from EGARCH(1,1) Model

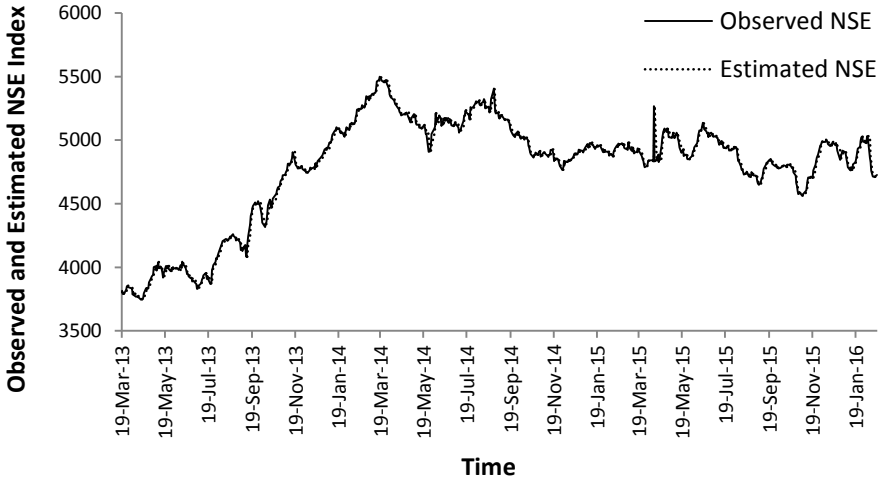

Figure 2(d): Plot of Observed and Estimated NSE Prices from TGARCH(1,1) Model

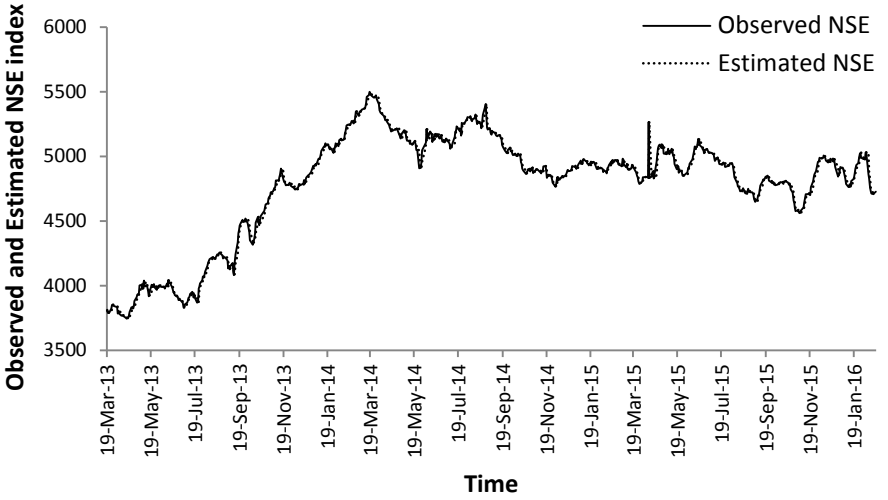

Figure 2(e): Plot of Observed and Estimated NSE Prices from PGARCH(1,1) Model

The performance of these estimated models are determined on the basis of some accuracy measures. In our study, we compute the Akaike information criteria (AIC), Schwarz criteria (SC),and Root mean square error (RMSE). The results are displayed in table 5. A look on the table reveals that there is not much differences seen among the values of accuracy measures obtained for all of five estimated models. Based on these measures, we may suggest that TGARCH (1,1) is more suitable process to capture the main features of NSE return like the volatility and the leverage effect. We plot the observed and estimated NSE prices for the period from 19th March 2013 to 18th February 2016 in figure 2(a-e). These graphs show a close match to the data exhibiting that these estimated econometric models provide a good fit to the observed NSE time series.

4. CONCLUSION

In this paper, we presented an empirical study to model the Nairobi securities exchange (NSE) using the family of GARCH models. Among many symmetric and asymmetric type heteroscedastic processes, we estimated GARCH(1,1), GARCH-M(1,1), EGARCH(1,1), TGRACH(1,1), and PGARCH(1,1) models. On one hand, the presence of volatility clustering is strongly confined from all these estimated models as we obtained the significant estimates corresponding to ARCH effect and GARCH effect parameters. The leverage effect in NSE return is also confirmed on the other hand. The asymmetric TGARCH (1,1) model has the significant estimates of leverage effect and by this we might say that the TGARCH(1,1) model is more appropriate in term of capturing the volatility clustering and leverage effect of the NSE stock market.

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IMPACT OF AID AND FDI ON ECONOMIC GROWTH (PANEL DATA ANALYSIS OF TWENTY COUNTRIES)

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ABSTRACT

A lot of the studies have conducted over the different periods to analyze the effect of aid and the FDI on the economic growth. They are having the different results due to the different countries and different variables used in the studies, our study analysis of the twenty different countries some are poor and some are developing from Asia and Africa. Our objective of this study is to explore the relation of AID, Foreign Direct Investment (FDI) and Exports and their impact on economics growth of the countries. We use the panel data analysis technique and multilevel mixed effect model for estimation of data. Data of 31 years from 1982-2012 under study. This study concluded that over all models is statistically significant. Over all models explains the variation in the GDP due to FDI, AID and Exports of goods and services. There is the positive relationship between ODA (Official Development Assistance) and GDP (Gross Domestic Product) and FDI (Foreign direct investment) and GDP (Gross Domestic Product) have also the positive relationship. The relation between export of goods and services with the GDP (Gross Domestic Product) also positive and significant it plays important role to raise the level of income (GDP) in the economies.

KEYWORDS

ODA (Official Development Assistance), FDI (Foreign Direct Investment), Exports of goods and services, GDP, Panel data, Multilevel Mixed effect model.

INTRODUCTION

Official aid refers to aid flows from official donors to countries and territories in part II of developing countries and territories. Official aid is provided under terms and conditions similar to those the DAC list of recipients: more advanced countries of Central and Eastern Europe, Net the countries of the former Soviet Union, and certain advanced for ODA. (World Bank)

After the World War II lots of the destruction in the European countries they are not have the saving and the investment income level is also very low. So, they can't have built the infrastructure again. Actually they need the capital and they do not have enough resources to meet the basic needs. They are effected by hunger malnutrition low level of income to meet the expenditure they have the two option either they have to take the loan are getting the aid from the developed countries to meet their basic need. In this case Africa and Asia are also the same situation level of the income is too low and low level of

the living so as a result their excess to the clean water and sanitation facilities is too low. The government of the African due to lack of utilization of the resources does not have the capability to meet the gap between income and the expenditures. A lot of the countries' government due to that reason do not have income to fight against the malnutrition and hunger, infant mortality rate and the infrastructure low level of the saving and the investment. So they have to go to the aid of agencies; the world bilateral agencies like IMF and the WORLD BANK meet the gap between income and expenditures situation in the Asian courtiers like Pakistan India and Bangladesh also getting the aid to meet the gap of income and expenditures so as to mitigate the severity of the gap. Poor HDI and a lot of flood and the famines force the government to get the foreign aid. Many of the studies have been performed for the analysis the relationship of the growth and the aid they have the different its vary from country to country and the used of the variables is also different in the studies. Our study is also the extension of analysis of the impact of foreign aid FDI, Exports of goods and services on economic growth. Over the twenty different countries we use the panel data analysis technique our the period of the 31 years from 1982-2012

OBJECTIVE OF THE STUDY

Objective of our study is to research the following questions

1. Is Exports promoting the GDP Growth in the poor and developing economies?
2. Effect of the FDI on the economic is growth of the economies.
3. Effect of the aid (ODA) over the economy of the Asian and the African countries.

LITERATURE REVIEW

Adeyemi et al., (2014) checks the impact of the foreign aid impact growth rate in the Africa. He uses the real GDP per capita from 1996-2010 as a dependent variable gross fixed capital formation, labor force input, official development assistance, institutional quality use as the independent variable and uses Generalized Method of Moments (GMM) technique. He concludes that foreign aid does not significantly influence GDP per capita in Sub-Saharan Africa and the data shows that the other factor like rule of law, control of corruption, human capital improve then the effects of the aid will be improved on Africa economy.

Mehta (2014) studies the impact of the foreign aid and the growth over the period of 2000 to 2012, he uses Official development assistance variable as the dependent variable and GDP Growth, inflation and infant mortality he concludes that when the foreign aid increases then the GDP declines and the inflation rises with the increase in the foreign aid inflow number of infant deaths decline with the increase in the foreign aid foreign aid has overall negative affect on economic growth of Pakistan.

Tombofa et al., (2013) studies the relationship of the growth debt and foreign time series data of the 1981-2010 of the real GDP growth as the dependent variable Domestic debt, External debt, (net official development assistance) as the independent variable using the ordinary least squares econometric technique the data concludes relationship between each Of these variables and economic growth is complicated. Increased external debt is leading to decrease in economic growth. Increased foreign aid

and domestic Debt (however, within the official limits) lead to higher real Gross domestic product.

Ekanayake (2009) see the foreign aid on economic growth in developing countries he get the data of 85 developing countries from 1980 to 2007 using the variables real GDP per capita as the dependent variable and growth rate of population, investment of country, AID, initial level of GDP, inflation rate . The growth rate of population is a proxy for the growth as the independent variable by using the panel least squares estimation method he concludes that foreign aid has the mixed effect on the growth of the different countries.

Hansen and Tarp (2000) analyzed the effect of the foreign aid of the growth in the real GDP per capita as the dependent variable by using the method of the Generalized method of moments its shows that aid increase then GDP also increases and also the aid has the decreasing returns and also the aid effectiveness also change as change in the variables if the investment and the human capital control then there is no positive effect of the aid on growth.

EROĞLU and YAVUZ (2009) study about the effect of the foreign aid of the LDC, she show that donor countries foreign aid increase tying it show that negative effect of the foreign aid on the growth rate, balance of the payment and the employment.

Lohani (2004) studies the effect by using the method of the least square HDI as the dependent variable and the social aid, foreign Direct investment, domestic investment, military expenditure, GDP per Capita as the independent variables the results show that FDI, Domestic investment and GDP per capita have the positive effect on the human development but the Aid and the military expenditure have the negative effects.

Abouraia (2O14) study on the Philippines by using the OLS regression technique and economic Growth as the dependent variable and FDI, ODA per capita, social aid as the independent variables the data concludes that FDI and AID has the positive impact on the growth of the Philippines and the current system support the lower saving to gain more aid.

Sameem (2013) uses the three elements ODA, Growth and the policies to check there impact on the each other it concluded that it's the not the contract relationship and ambiguous results some positive some negative without any policy condition.

Mallaye and Thierry(2013) uses the sample of 34 couturiers and data of 20 year from 1990 to 2010 by using the technique of the OLS and taking the (growth rate) as the dependent variable Aid (ODA)as A Percentage of the GDP, X. The data concludes that it is an ambiguous result if we neglect the governance there is the negative impact on the growth and aid but if the governance includes in the model then the results become positive on growth.

MANTY (2013) study on the west African countries using the GDP as the dependent variable and the AID, FDI, Inflation, as the independent variables panel co integration technique apply the results show that there is the long run relationship between growth and aid. And also the results of relations vary from country to country.

Easterly (2003) by using the TSLS, OLS methodology they concluded that impact of the aid is puzzled and ambiguous the amount did not use properly and the donors just

want to help the few of the people of country, at some of the time but not all the time to give benefits to the poor.

Durbar yet et al (1998) he uses the growth as dependent variable and SAV: Domestic savings as a percentage of GDP.WOPEN: percentage of GDP.PRIV: Total net private capital flows as a percentage of GDP, FAIDOECD: Official Development Assistance (DAC), percentage of the gross domestic product (GDP) as the independent variable by using the augmented Fischer-Easterly type model, cross-section and panel data techniques on the data he obtain results that aid has some positive impact on the growth of the countries if there is the strong and good policy environment .

Alabi (2014) studies the African countries he uses the foreign agricultural aid (FA). As the dependent variable and the agricultural GDP (AG) as the independent variables concludes that agriculture have the positive impact over the real growth of the agriculture sector in the Africa the study also says that agriculture productivity will be improved due to the foreign aid and the crop losses also reduced.

Mullick (2004) studies on the Pakistan war against terrorism and benefit and the losses of the aid and the growth of the Pakistan economy after the 9/11 attacks he use the percentage change in the real GDP dependent variables and the economic aid from the US, total investment, foreign reserves, unemployment rate, stock exchange index as the independent variables and Log-Log Ordinary Least Squares analysis used him he concludes that economic factor like the growth and the aid has the positive impact after analyses the cost and benefit of the aid he say the aid is best interest of the both of the countries and Pakistan have to fight against war and terror.

Mubarak (2008) is the foreign assistance is good for the Pakistan uses the GDP Growth dependent variable in the article the External debt as % of GDP, External aid, Aid % of GDP debt as the independent variables concluded that Pakistan will be better off by the using the aid it will be get more benefit if the aid is stable and in the control of the government authority the source of the aid should me stable if there source will not be stable it will adverse effect on the economy of the Pakistan

Data and Methodology

In our model we get the data of the twenty different countries of Africa and the Asia (Name of Countries are attached in annexure) from 1982 to 2012 for period of 31 years we uses the panel data of 4 variables ODA GDP Export of good and the services and foreign direct investment list of the countries is listed under all the variables data in the us dollar all the data is gather from the world bank data source (world Bank development indicator)

Model:-

GDP = (ODA, FDI, X) **……** **(i)**

GDP = Gross Domestic Product

FDI = Foreign Direct Investment

X = Exports of goods and services

ODA = Official Development Assistance

Definitions of the Variables

Gross Domestic Product

GDP of the country is the production of the country at the domestic it is the production by the residents of the country the data of the GDP is taken from World Development Indicator data base in us dollars.

Foreign Direct Investment

Foreign direct investment inflow is the flow of the foreign capital in the from of investment.

To get the benefit from the reporting country it's the cross border investment one country firm or the residential to the other country the data taken from the World Development Indicator (WDI)in us dollars.

Exports of Goods And Services

All the exports of goods and the other services given by the country to the world residents are called the exports. It involves all the services and goods like transports, insurances and traveling and much more all the data about exports of goods and services taken from the World Development Indicator (WDI) in US dollars.

Official Development Assistance

ODA is simple we say that the aid. Aid is given by the some country or some multinational organizations to the poor country for the development and welfare and some of the cases the political motive it can also a loan on the concessional term the data of ODA is taken from the World Development Indicator (WDI) in the current us dollars

Econometric Models

Model

$$GDP = \beta_o + \beta_1 ODA + \beta_2 X + \beta_3 FDi + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{(ii)}$$

Model Estimation

We get the panel data of 20 countries including the Asia and Africa we firstly get the data from the WDI data base data of the all the variables in current us dollars we firstly convert all the data in the pooled from and then apply the multilevel mixed effect model on the data then taken the results firstly we have discuss the model.

1. Fixed effect :(intercept and slop) tells that the population study as the whole this effect are have the just like the intercept and slops in the conventional regression analysis
2. Random effect: up and the down over the population intercept and slop which are used to describes the sub population these effect can be vary across the sub population
3. Mixed effect: is use for the multilevel modeling growth curve analysis panel data analysis also used for the time series and cross sectional data and more complex model.

Mixed effect model =Fixed effect model +Random effect model

Mixed Effect Model

A multilevel mixed effect model is a statistical model containing both fixed effects and random effects. These models are helpful in a broad diversity of disciplines in the physical, natural science and social sciences. It is too much useful in settings where recurrent and frequent measurements are prepared on the same statistical units (longitudinal study), and whenever where measurements are made on clusters of related statistical units. This is to much useful for handling with missing values, mixed effects models are often favorite over traditional methods such as repeated measures ANOVA.

Multilevel mixed effect models are now used in education research or geographical research, if we want to estimate separately the variation between pupils within the same school, and the variation between schools. In psychological fields, the multiple levels are items in an instrument, individuals, and families. In sociological fields, multilevel models are used to examine individuals entrenched within regions or countries. In organizational psychology research, data from individuals must often be nested within teams or other functional units. Different co variables may be relevant on different levels. It can also be used for longitudinal studies, as with growth studies, to separate changes within one individual and differences between individuals.

Matrix notation of mixed effect model is as below

$$Y = X\beta + Zu + \varepsilon$$

- Y is a known vector of observations, with mean $E(y) = X\beta$;
- β is an unknown vector of fixed effects
- u is an unknown vector of random effects, with mean $E(u) = 0$ and variance –covariant matrix $\text{var}(u) = G$;
- ε is an unknown vector of random errors, with mean $E(\varepsilon) = 0$ and variance $\text{var}(\varepsilon) = R$
- X and Z are known design matrices relating the observations y to β and u, respectively.

RESULTS AND INTERPRETATION

After apply the multilevel mixed effect model we get the results table of the results are shown below our whole model is significant because Prob > chi2 = 0.0000

The entire variables are significant because the probability value is less than the 5 % Value of the (ODA) P>|z| is zero its show that the variable is significant because its prob value is less than the 5% so our included variable have the influence on our dependent variable significantly and have the positive coefficient .Value of the coefficient is 45.56878 which indicate that if ODA will increases value of the GDP 45.56878 us dollars. Value of the (FDI) P>|z| is zero its show that the variable is significant because its prob value is less than the 5% so our included variable have the influence on our dependent variable GDP and have the positive coefficient. Value of the coefficient is 24.27495 which indicate that if FDI

will increases value of the GDP (24.27495) us dollars. Value of the (Export) P>|z| is zero its show that the variable is significant because its prob value is less than the 5% so our included variable have the influence on our dependent variable GDP and have the positive coefficient. Value of the coefficient is (.0001535) which indicate that if Export will increases value of the GDP (.0001535) us dollars.

Mixed-effects ML regression Number of obs = 1620
Wald chi2 (4) = 11419.25
Log likelihood = -16824.272 Prob> chi2 = 0.0000

Results of Multilevel Mixed Effect Model:
***GDP* [Dependent Variable]**

Variables	Coefficients	Std. Err.	P- values	Z
ODA	45.56878	8.034792	0.000	5.67
FDI	24.27495	.2370654	0.000	102.40
Export	0.0001535	.0000334	0.000	4.59

CONCLUSION AND POLICY RECOMMENDATION

The impact of our paper study is ODA (Official Development Assistance), FDI (Foreign direct investment) and Exports of goods and services on the GDP(Gross Domestic Product).Data collected for31 years from 1982-2012 from World Bank data base. After analysis of the data and using multilevel mixed effect model we concluded that FDI and export of goods and services and ODA are significant in over model because probe value is less the 5 %. There is positive impact of ODA on the economy's growth of the country. So if the aid is utilized properly then it will improve the production and income of the countries. FDI (Foreign direct investment) is also significant and has the positive impact on the economy. It means that FDI have the directly impact on the GDP. And if the FDI increases then the production level also increased in the country. Exports of the good and services also play an important role in the production process and to raise the level of the GDP. Export of the countries has the positive impact on the economic growth of the country Positive impact of the exports of goods and services on the GDP growth of the countries. If a country wants to raise the level of the income and growth they have to improve the level of exports of goods and services, FDI. And if the ODA is utilized properly and use of the aid the raise the efficiency of the institution then ODA also play a tremendous role to raise the level of income and the growth of the economies.

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ANNEXURE

S#	Name of Country	S#	Name of Country
1	Egypt	11	India
2	Kenya	12	Sri Lanka
3	Tunisia	13	Pakistan
4	Algeria	14	Nigeria
5	China	15	Jordan
6	Chad	16	Indonesia
7	Thailand	17	Zimbabwe
8	Malaysia	18	Zambia
9	Philippines	19	Saudi Arabia
10	Bangladesh	20	Turkey

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MODELING AND FORECASTING OF THE GENERAL SHARE INDEX OF CEMENT AND OIL PRICES

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ABSTRACT

The aim of this study is to determine the model for the general share index of cement and oil prices in Pakistan. Here we have the time series data of cement and oil prices from Jan, 1990 to Aug 2015. Firstly we have check the stationary of the data, the HEGY test is used for testing the seasonal and the non-seasonal unit roots. Box-Pierce Q-Statistic, Breusch-Godfrey Serial Correlation LM test are used for testing the white noise of the error term and serial correlation respectively. We find that there are more than one potential model which fit to this data, but the final and best model is selected using the criteria of the AIC, BIC and RMSE. At the end we have forecast observation for the suitable selected model. Since the forecasted values through the fitted model is close to the original values so we conclude that our fitted model is a good model.

KEYWORDS

Stationary, HEGY test, unit roots, Box-Pierce Q-Statistic, Breusch-Godfrey Serial Correlation LM test.

1. INTRODUCTION

Pakistan Oilfields Limited is a growth oriented leading exploration and Production Company of Pakistan. Prediction is an interesting area of research making researchers in the domain field always desiring to improve existing predictive models. Institutions and individuals are empowered to make investment decisions and ability to plan and develop effective strategy about their daily and future endevours Adebiyi et al., (2014). This remains a motivating factor for researchers to evolve and develop new predictive models Atsalakis (2011).

In the past years several models and techniques had been developed to oil price prediction. Among them are artificial neural networks (ANNs) model which are very popular due to its ability to learn patterns from data and infer solution from unknown data (see Mitra (2009); Atsalakis and Kimon (2009); Mohamed(2010)). In recent time, ARIMA models are from statistical models perspectives.

Moreover, it is reported in literature that prediction can be done from two perspectives: statistical and artificial intelligence techniques Wang (2012). ARIMA models are known to be robust and efficient in financial time series forecasting especially short-term prediction (see Kyungjoo, et al., (2007); Merh, et al., (2010); Sterba and Hilovska (2010)). It has been extensively used in field of economics and finance. Other

statistics models are regression method, generalized autoregressive conditional heteroskedasticity (GARCH). Many researchers used ARIMA model for forecasting includes Javier (2003); Rangan and Titida (2006); Khasel, et al., (2009); Lee (2011); Khashei, et al., (2012); Wang (2012). The rest of the paper is organized as follows. Section 2 presents brief methodology and discusses the experimental results obtained. The paper is concluded in section 3.

2. METHODOLOGY

Data collected the assigned monthly series of general index of oil prices from Jan, 1980 to Aug 2014 from the monthly bulletins of Federal Bureau of Statistics. Before doing further calculations we change all the values to the same base year. Here we have values with 5 different base years i.e. (1969-70), (1975-76), (1980-81), (1990-91), (2000-01), (2010-11). We change all the values to the base year of (1980-81). We change base year by taking the ratio of the overlapping value of index number. Then we multiply or divide, accordingly, that ratio by the values which are desired to be changed. First of all we check what type of model we run i.e. include intercept term or not, Include trend component in the model or not. First we run equation without intercept & trend.

$$\Delta Y_t = \rho Y_{t-1} + V_t \quad (1)$$

where Δ is first difference of the Y_t, t is time trend and Y_{t-1} is the lag of Y_t .V_t is the error term.

Table 1
Model Without Intercept

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y(-1)	-0.008081	0.020540	-0.393419	0.6949
R-squared	-0.002875	Mean dependent var		3.025758
Adjusted R-squared	-0.002875	S.D. dependent var		45.54092
S.E. of regression	45.60634	Akaike info criterion		10.48802
Sum squared resid	203834.0	Schwarz criterion		10.51423
Log likelihood	-518.1570	Durbin-Watson stat		1.999555

As the coefficient of Y_{t-1} is positive, so we have to include intercept in our model and estimate the equation by OLS, now the equation is

$$\mathbf{\Delta Y_t = u + \rho Y_{t-1} + V_t} \quad (2)$$

Table 2
Model With Intercept

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.92552	7.972460	1.746703	0.0839
Y(-1)	-0.059396	0.035726	-1.662559	0.0996
R-squared	0.027706	Mean dependent var		3.025758
Adjusted R-squared	0.017683	S.D. dependent var		45.54092
S.E. of regression	45.13648	Akaike info criterion		10.47725
Sum squared resid	197618.2	Schwarz criterion		10.52968
Log likelihood	-516.6241	F-statistic		2.764102
Durbin-Watson stat	1.959475	Prob (F-statistic)		0.099629

As Table 2 shows that the coefficient of Y_{t-1} is positive, so we have to include the intercept term. Before applying the unit root test we check that errors are white noise or not. For this we use Breusch-Godfrey Serial Correlation LM Test. Hypothesis stated as:

Ho: The residual term is white noise.
H1: The residual term is not white noise.

Table 3
Breusch-Godfrey Serial Correlation LM Test

F-statistic	**0.034195**	**Probability**		**0.853682**
Obs*R-squared	0.035251	Probability		0.851070
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.451500	8.376200	0.053903	0.9571
Y(-1)	-0.002427	0.038228	-0.063485	0.9495
RESID(-1)	0.020138	0.108901	0.184920	0.8537
R-squared	0.000356	Mean dependent var		-5.02E-16
Adjusted R-squared	-0.020470	S.D. dependent var		44.90560
S.E. of regression	45.36287	Akaike info criterion		10.49710
Sum squared resid	197547.9	Schwarz criterion		10.57574
Log likelihood	-516.6064	F-statistic		0.017098
Durbin-Watson stat	1.992314	Prob(F-statistic)		0.983051

Table 3 indicates that p-value associated with F-statistic is greater than α so we accept Ho and conclude that error term is white noise.

Now we apply ADF test to check the presence or absence of unit root. For this hypothesis is as:

Ho: Unit root exist.
H1: Unit root not exist.

Table 4
ADF Test Testing For Unit Root

ADF Test Statistic	-1.699067	1% Critical Value*		-3.4972
		5% Critical Value		-2.8906
		10% Critical Value		-2.5821
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Z(-1)	-0.060626	0.035682	-1.699067	0.0925
C	14.29558	8.082913	1.768618	0.0801
R-squared	0.028901	Mean dependent var		2.964646
Adjusted R-squared	0.018890	S.D. dependent var		45.87814
S.E. of regression	45.44277	Akaike info criterion		10.49078
Sum squared resid	200309.4	Schwarz criterion		10.54321
Log likelihood	-517.2936	F-statistic		2.886830
Durbin-Watson stat	1.988803	Prob(F-statistic)		0.092512

Hence the value of ADF test statistic is less than the critical values in absolute terms so we conclude the presence of unit root & even after taking care of possible autocorrelation in error term, the series is non-stationary.

Testing for stationarity on first difference, the following equation runs:

$$\Delta Y_t = u + \rho \Delta Y_{t-1} + V_t \quad (3)$$

Firstly we test that regression is sufficient, means errors are white noise. For the purpose, serial correlation LM test to check white noise of error term is used and hypothesis is defined as:

Ho: The residual term is white noise.

Table 5
Breusch-Godfrey Serial Correlation LM Test

F-statistic	**0.678432**	**Probability**		**0.412190**
Obs*R-squared	0.694894	Probability		0.404505
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-18.59320	23.05043	-0.806631	0.4219
D(Y(-1))	6.147034	7.463682	0.823593	0.4122
RESID(-1)	-6.148123	7.464303	-0.823670	0.4122
R-squared	0.007091	Mean dependent var		-6.53E-16
Adjusted R-squared	-0.013813	S.D. dependent var		45.77077
S.E. of regression	46.08579	Akaike info criterion		10.52902
Sum squared resid	201770.5	Schwarz criterion		10.60815
Log likelihood	-512.9220	F-statistic		0.339216
Durbin-Watson stat	2.031107	Prob(F-statistic)		0.713188

As we observe from the table 5 that p-value associated with F-statistic is greater than α so we accept Ho and conclude that error term of the oil price series is white noise at first difference.

For the unit root testing ADF test is applied to check the presence or absence of unit root. Hypothesis is stated as:

Ho: Unit root exist

Table 6
ADF Test Unit Root Testing

ADF Test Statistic	-9.904673	1% Critical Value*		-3.4979
		5% Critical Value		-2.8909
		10% Critical Value		-2.5822
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-1.011935	0.102167	-9.904673	0.0000
C	3.090155	4.656414	0.663634	0.5085
R-squared	0.505416	Mean dependent var		0.247959
Adjusted R-squared	0.500264	S.D. dependent var		65.08309
S.E. of regression	46.00854	Akaike info criterion		10.51573
Sum squared resid	203211.4	Schwarz criterion		10.56848
Log likelihood	-513.2707	F-statistic		98.10255
Durbin-Watson stat	2.000054	Prob(F-statistic)		0.000000

The value of ADF test statistic is greater than the critical values in absolute terms for the given data series so we reject the presence of unit root; hence the oil price series is stationary at first difference.

3. FITTED MODEL

Series stationary at first difference indicates the ARIMA fitting. We run different models of the oil price series and the best fitted model on the differenced series is ARIMA(1,1,2). Since we have only one model through which series of error term becomes white noise.

4. COMMENTS AND CONCLUSION

This paper presents extensive process of building ARIMA model for oil price prediction. The experimental results obtained with best ARIMA model demonstrated the potential of ARIMA models to predict oil prices satisfactory. This could guide investors in oil field to make profitable investment decisions. With the results obtained ARIMA models can compete reasonably well with emerging forecasting techniques.

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CEMENT PRICE PREDICTION USING TIME SERIES ANALYSIS

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ABSTRACT

Cement industry, has a special place in most countries. Close relationship between cement industry and the construction indicates the fundamental importance of this product in the economy of each country. Having a reliable forecast of the price of this product becomes very valuable in the future. The main objective of this study is to assess the cement stock price prediction using time series model. In this study, the stock price of cement has been predicted using prediction methods.

1. INTRODUCTION

The usage of time series models is twofold: Obtain an understanding of the underlying forces and structure that produced the observed data, Fit a model and proceed to forecasting, monitoring or even feedback and feed forward control. The early research in this field focused on the use of preliminary rather than final data. Cole (1969) gives evidence that certain types of forecasts were strongly affected by data. She found that "the use of preliminary rather than revised data resulted in a doubling of the forecast error". Moreover, Diebold and Rudebusch (1991) looked at the importance of data revisions for the index of leading indicators. They found that the use of real-time data was crucial, since the variables included in the index of leading indicators were chosen expost. Their results were supported by the work of Robertson and Tallman (1998a), indicates that a VAR that uses real-time data from the index of leading indicators produces no better forecasts for industrial production than an AR model using ust lagged data on industrial production.

Numerous researchers have voiced concerns about data revisions. Denton and Kuiper (1965) agreed with Coles results that the use of preliminary (rather than final) data led to large forecast errors, but Trivellato and Rettore (1986) found effects that were much more modest. Stekler (1967) discussed there was some value in early data releases even though they contained errors. Howrey (1978) noted that it was important to adjust for the fact that data within aparticular vintage have been revised to differing degrees. Howrey (1996) compared forecasts of the level of GNP to forecasts of growth rates, finding the former more sensitive to data revisions than the latter. Swanson (1996) investigated optimal model selection for a number of variables using real-time data. Robertson and Tallman (1998b) evaluated alternative VAR model specifications for forecasting major macroeconomic variables using a real-time data set. Real-time data have also been used by Koenig and Dolmas (1997) and Koenig et al., (1999) in developing a method for forecasting real output growth using monthly data.

2. METHODOLOGY

The fitting of time series models can be an ambitious undertaking. There are many methods of model fitting including the Box-Jenkins ARIMA models, Box-Jenkins Multivariate Models, Holt-Winters Exponential Smoothing (single, double). Data collected the assigned monthly series of general index of cement prices from Jan, 1980 to Aug 2014 from the monthly bulletins of Federal Bureau of Statistics. Total No of units are 23. 4 units are in the public sector, while the remaining 19 units are owned by the private sector. Two of the four units in the public sector (Mustehkam Cement Ltd. & A.C. Rohri Cement Ltd.) had to close down their operation due to stiff competition and heavy cost of production. Total installed capacity is over 17 million tons. Total domestic demand is approximately 9.6 million tons which is only 56% of the installed capacity.

In provision wise distribution, three additional cement plants with installed capacity of over 2.1 million tons are in the final stages of completion despite the available excess capacity in this sector. The table shows installation of new cement factories and expansion of the existing facilities during the current decade.

- D.G. K Cement Limited
- Company profile: D.G. Khan Cement Company Limited
- Ticker: DGKC
- Exchanges: KAR
- 2012Sale: 7,955,700,000
- Major Industry: CONSTRUCTION
- Sub Industry: CEMENT PRODUCERS
- Country: PAKISTAN
- Employees: 665

Analysis (for D.G.K. Cement)

First of all we check what type of model we run i.e. include intercept term or not, trend component in the model or not. First we run equation without intercept & trend.

$$\Delta Y_t = \rho Y_{t-1} + V_t$$

where Δ is first difference of the Y_t , t is time ternd and Y_{t-1} is the lag of Y_t .V_t is the error term.

Table 1
Model 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y(-1)	-0.000531	0.014989	-0.035411	0.9718
R-squared	-0.008321	Mean dependent var		0.650500
Adjusted R-squared	-0.008321	S.D. dependent var		7.161586
S.E. of regression	7.191320	Akaike info criterion		6.793576
Sum squared resid	5119.793	Schwarz criterion		6.819628
Log likelihood	-338.6788	Durbin-Watson stat		1.260838

As a result indicates that the coefficient of Y_{t-1} is positive, so we have to include intercept in our model and estimate the equation by OLS. Now the equation is

$\Delta Y_t = u + \rho Y_{t-1} + V_t$

Table 2
Model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.224488	0.970987	1.261076	0.2103
Y(-1)	-0.017741	0.020238	-0.876620	0.3828
R-squared	0.007780	Mean dependent var		0.650500
Adjusted R-squared	-0.002344	S.D. dependent var		7.161586
S.E. of regression	7.169975	Akaike info criterion		6.797479
Sum squared resid	5038.037	Schwarz criterion		6.849582
Log likelihood	-337.8739	F-statistic		0.768462
Durbin-Watson stat	1.260305	Prob(F-statistic)		0.382837

As table shows that the coefficient of Y_{t-1} is positive, so we have to include the intercept term. So, before applying the unit root test we check that errors are white noise or not. For this we use Breusch-Godfrey Serial Correlation LM Test which formulates following hypothesis:

H0: The residual term is white noise.
H1: The residual term is not white noise.

Table 3
Breusch-Godfrey Serial Correlation LM Test

F-statistic	14.92391	Probability		0.000202
Obs*R-squared	13.33398	Probability		0.000261
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.496210	0.917618	0.540759	0.5899
Y(-1)	-0.017081	0.019446	-0.878349	0.3819
RESID(-1)	0.383394	0.099244	3.863147	0.0002
R-squared	0.133340	Mean dependent var		2.84E-16
Adjusted R-squared	0.115470	S.D. dependent var		7.133671
S.E. of regression	6.709177	Akaike info criterion		6.674370
Sum squared resid	4366.266	Schwarz criterion		6.752526
Log likelihood	-330.7185	F-statistic		7.461954
Durbin-Watson stat	1.851192	Prob(F-statistic)		0.000968

Here p-value associated with F-statistic is less than α so we reject Ho and conclude that error term is not white noise. Now we cannot apply ADF test on the cement price series, to check the presence or absence of unit root because error term is not white noise. Hence there is need to testing for stationary on first difference for the purpose we run the following model:

$$\Delta Y_t = u + \rho \Delta Y_{t-1} + V_t$$

First we have to check the white noise of the error term at first difference series then apply the ADF test. With the help of LM test regression has sufficient means errors of white noise run for the following hypothesis:

H0: The residual term is white noise.
H1: The residual term is not white noise.

Serial correlation LM test to check white noise of error term is given below

Table 4
Breusch-Godfrey Serial Correlation LM Test

F-statistic	**3.869473**	**Probability**		**0.052059**
Obs*R-squared	3.835785	Probability		0.050169
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.340279	0.697808	0.487639	0.6269
D(Y(-1))	-0.501939	0.272679	-1.840772	0.0687
RESID(-1)	0.566764	0.288122	1.967098	0.0521
R-squared	0.038745	Mean dependent var		1.08E-16
Adjusted R-squared	0.018719	S.D. dependent var		6.745194
S.E. of regression	6.681763	Akaike info criterion		6.666475
Sum squared resid	4286.012	Schwarz criterion		6.745115
Log likelihood	-326.9905	F-statistic		1.934737
Durbin-Watson stat	2.018795	Prob(F-statistic)		0.150054

As we see from the table that p-value associated with F-statistic is greater than α so we accept Ho and conclude that error term is white noise at first difference of the cement price series which indicates ARIMA type model. To fit the appropriate ARIMA we have to check the stationary of the first difference series. So, we apply ADF test to check the presence or absence of unit root.

H0: Unit root exist
H1: Unit root not exist.

ADF Test Statistic	**-6.592662**	**1% Critical Value***		**-3.4972**
		5% Critical Value		-2.8906
		10% Critical Value		-2.5821
Augmented Dickey-Fuller Test Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.643136	0.097553	-6.592662	0.0000
C	0.381142	0.685953	0.555638	0.5797
R-squared	0.309428	Mean dependent var		-0.138889
Adjusted R-squared	0.302308	S.D. dependent var		8.116893
S.E. of regression	6.779874	Akaike info criterion		6.685789
Sum squared resid	4458.769	Schwarz criterion		6.738216
Log likelihood	-328.9466	F-statistic		43.46319
Durbin-Watson stat	1.833831	Prob(F-statistic)		0.000000

The value of ADF test statistic is greater than the critical values in absolute terms so we reject the presence of unit root; hence the series is stationary at first difference. For the given data series appropriate modeling is the ARIMA. Different lag models can be run to pick the best one for the prediction of cement price series.

3. COMMENTS AND CONCLUSION

We have investigated the usefulness of time series tools for the prediction of cement prices. The following facts seem to emerge: the predictions are almost equivalent with respect to the model of the cement prices. However, the main benefit of the fitted model seems to be the greater flexibility for generalizations. Further research is required to tie in input variables of material costs based on leading cost indicators and to explore how the effects of sudden events can be realized and hopefully predicted, if possible.

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AUTOMATED FAULT DETECTION IN MOBILE APPLICATIONS

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ABSTRACT

In the previous years, we have been cooperating with an exponential development of the cell phones business sector. In 2011, the quantity of gadgets sent surpassed the quantity of PCs. In spite of this business sector development and the changes made to the portable architectures, troubleshooting versatile applications are still manual, mistake inclined and a tedious undertaking. While the dependability of an application can be incredibly enhanced by widely testing and troubleshooting it, this procedure regularly clashes with economic situations. Shortcoming limitations have been a dynamic range of exploration, prompting the formation of a few devices, for example, Tarantula and GZOLTAR. Range based Fault Localization (SFL)- the strategy behind the sketched out apparatuses- is a factual troubleshooting system that depends on code scope data. In any case, the implanted way of cell phones represents some specific difficulties; in this way, not many have been accounted for in the territory of versatile programming. This theory proposes a way to deal with the difficulties displayed by the cell phones structural engineering.

The methodology, named MZOLTAR, had been applied on the models to suit both the Android system Lollipop and the new Marshmallow version, consolidates static (utilizing Lint) and element examinations (utilizing SFL) of portable applications so as to deliver an analytic report to recognize potential surrenders rapidly. Moreover, the strategy offers a graphical representation of the explanatory report, making it less difficult to understand. To review the authenticity and execution of MZOLTAR, a trial appraisal was performed, by mixing deficiencies into 4 bona fide open-source Android applications. The results exhibit that the strategy requires low runtime overhead (5.75% all things considered), while the analyzer needs to audit 5 portions overall to find the weakness. Also, it displays that Lint helps revealing bugs that would largely go undetected by the SFL issue control strategy. In those cases, the joining with Lint reduced the amount of portions to explore by 99.9% overall.

KEYWORDS

MZOLTAR, GZOLTAR, SFL, Lint, ASM, Android SDK, Static Analysis, Dynamic Analysis, Emulator.

1. INTRODUCTION

In present days, selling cell phones with multiple functions has become a very profitable and developing enterprise. It is even larger now that the one for PCs, as the number of importations from 2015 show. The rival companies Apple's IOS and Google's

Android are the principal systems used for smart phones, and have been so for the past 8 years. The former owns only a small part of the market (13%), while the latter is the undoubted winner with an 82% of the shares. This information clearly shows how systems and ideologies change, particularly regarding technology and, as a result, the areas that produce software need to keep up-to-date.

The procedure for this is composed of four steps: crafting, use, assessment and liberation (see Figure 1.1).

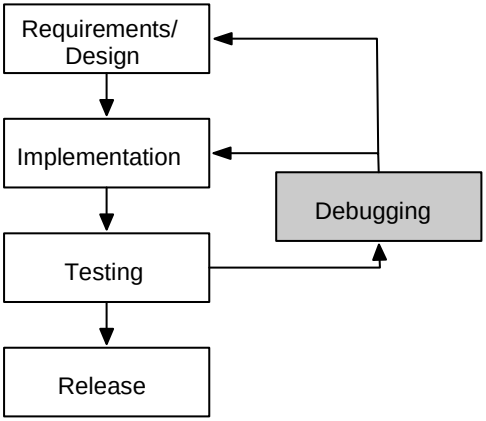

Figure 1.1: Software Development Process

On the other hand, not all the forms of assessment are going to be implemented in the testing phase. It means that a new one needs to be incorporated into the mentioned procedure, as transforming the way it is implemented so as to make sure the app functions properly and accordingly to the way it was specified. As a result, a period is set up, and if the assessment phase (individual or multiple) is not effective, a debugging one would follow so as to correct and smooth any issues. Afterwards, the app would go through the evaluation phase once more. The process of taking out the bugs is not a smooth one since not only it is prone to mistakes in the software cycle, but also is time (and also other supplies) consuming.

Taking all these into account, this last process needs to have cheaper costs so as to be able to attain greater traits by spending less money. The information about this area is little, so taking the bugs out of cell phone's apps is neither a systematized nor an efficient activity. The crucial objective behind this research paper is to make the aforementioned process smoother, making it more reliable and efficient and making it quicker for its delivery in the market.

OBJECTIVES

Because the technological inventions are limited, these questionnaires were devised:

- Are the MZOLTAR's instruments futile?
- Does MZOLTAR provide valid diagnoses for Android cell phones and tablets?
- If it is integrated with Lint, is the quality of the report better?

In order to tackle these inquiries, this study was devised together with a methodology that is based on the combination of SFL and Lint.

In addition, the devised methodology will provide the pictures mentioned above that will present the non-mobile and mobile investigations. In the end, an information analysis to evaluate MZoltar's progress and show its validity was used so the methods save time and ease the validity problems that software developers have to confront, enhancing the apps' reliability.

2. METHODOLOGY

2.1 Testing Android Applications

Android SDK provides a testing framework that amplifies J Unit with features that offer accessibility to Android's component systems and facilitates the application of a variety of testing strategies. The framework for the testing of Android apps is summarized in Figure 2.1. The implementation framework, as well as Monkey Runner, Robotium and Monkey tools, will be examined in this segment.

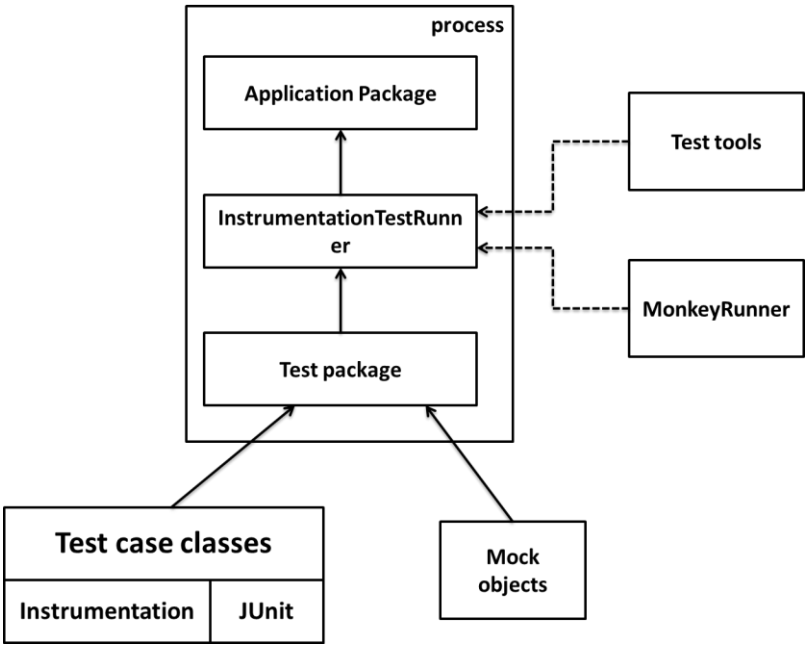

Figure 2.1: Android test framework diagram

2.2 Automated Debugging and Testing

One kind of automatic debugging, statistical debugging, provides program's statistical models, which are used for tracking program bugs. Those models present the correlations between a program's behaviour and an execution's failure or success. This approach helps developers to figure out the bugs' root causes, since it correlates program

misbehaviour with its failures and then presents the irregularities (if any) of a selected component.

In this segment, the SFL debugging approach, together with other statistical tools will be explained.

2.3 Spectrum-Based Fault Localization (SFL)

This technique is, as the name says, a spectrum-based fault localization method, being considered one of the most efficient tools. This technique makes use of a productive analysis method, relying on *program spectrum* (program execution data) from former runs to equate the components of the software with the observable failures, determining the potential deficiencies of each one of the components. Passed runs comprise executions that are completed correctly, whereas failed runs comprise executions with a detected error. *Program Spectrum* offers a collection of information that point out the software components that were hit while running.

2.4 Research Methodologies

In order to develop the apps by the use of SFL, some decisions have to be taken (see Figure 2.2). It is important to remark that most of these models have been adapted from the models of Ferreira Machado (2013).

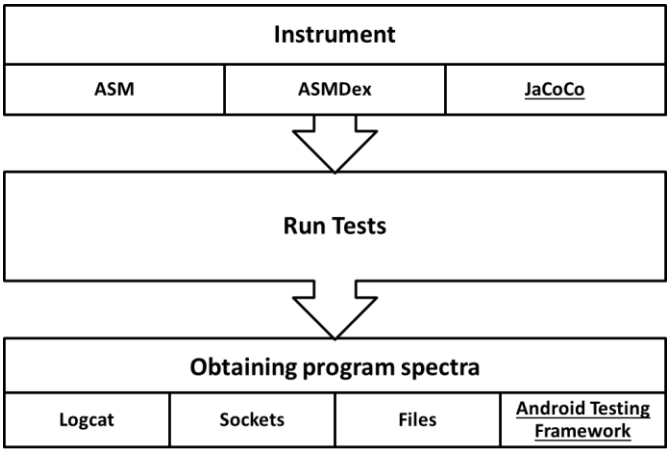

Figure 2.2: Tool execution phases

2.5 Developmental Procedures and Tools

GZOLTAR, Tarantula, or EzUnit offer finding faulty spectrum. The first two offer visuals so as to make it easy to see the mistakes. The third one provides lines in colour to visualize the scores.

3. RESULTS

The study tries to provide an answer to this questionnaire:

1. Is MZoltar futile?
2. Does it render appropriate diagnoses in Android's platforms?
3. If combining it with Lint, is it more efficient?

3.1 Experimental Setup

Subject	Version	Line Of Code (LOC)	Test Cases	Test Cases LOC	Coverage	Resources LOC
CharCount	1.0	148	10	133	92.2%	115
ConnectBot	1.7.1	32911	14	484	0.7%	7673
Google Authenticator	2.21	3659	170	2825	76.6%	5275
StarDroid	1.6.5	13783	187	3029	29.7%	2694

Different cell phones and programs were used to answer these questions. Table 3.1 Shows information about:

- a sample for motivation is Char Count
- Google Authenticator has two steps in making itself authentic.

By the use of Code Analyzer, the Stream of Code (LOC) was OBTAINED. The assessment of the apps was done with it, and the Android background was the one utilized to assess the information got by the JaCoCo. EclEmma was applied afterwards, together with the Eclipse.

Some popular mistakes were put into each device, creating a background that made it possible to activate or not the mistakes, by the utilization of Instrumentation Test Runner, named MZoltar Test Runner. After that, the apps were played several times in $\{(f,g) \mid f \in \{1,2,3,5\} \wedge g \in \{1,2,3,5,10\}\}$, where f is the number of mistakes that were put and g is the number of tests assessment, taking into account that they could fail or not. Assessing independently is time consuming, so our aim is to assess the results when putting many tests into play at the same time.

3.2 Evaluation Metric

When assessing how well this method had worked, we consider an adapted model of Ferreira Machado (2013), in which the diagnosis quality C_d, that calculates how many the test parts needs to examine so as to find the problem . The value of C_d for the real fault d_* is the average of the ranks with a result alike.

$$\theta = |\{j | s_O(m) > s_O(d_*)\}|,\ 1 \leq j \leq M$$

$$\phi = |\{j | s_O(m) \geq s_O(d_*)\}|,\ 1 \leq j \leq M$$

$$C_d = \frac{\theta + \phi - 1}{2}$$

In all the cases we put into use, again utilizing the one at-a-time method.

3.3 Experimental Results

In this part we show the results got and the answers to the questions.

RQ1: Is MZoltar Futile?

Table 3.1 discusses the time that it took the users to execute it, with an average of 5.75%, so it is not futile.

Table 3.2
Execution Times

Subject	Original	Instrumented	Overhead
Char Count	1.72s	1.78s	3%
Connect Bot	1.15s	1.25s	9%
Google Authenticator	60.49s	57.26s	6%
Star Droid	12.60s	13.34s	6%

RQ2: Does it render appropriate diagnoses in Android's platforms?

In Figure 3.1 we can see the diagnoses for C_d for the 8 problems that are usually found. At least 5 parts have to be examined before discovering an issue, which proves that SFL is good when diagnosing, even when Android has resource constraints. As a result C_d's efficiency is decreased as well as *N*.

In Figure 3.2 we can see what happens to C_d when categorizes many test – between 5 and 10 at the same time. For Char Count and Connect Bot, the C_d goes up, but for Google Auth and Star Droid C_d the number is stable, since they do not need to start the VM again. For instance, when 10 tests were put into play, the execution overhead decreased in a 78%, but losing diagnoses' accuracy in 73%.

RQ3: If Combining it with lint, is it more efficient?

Table 3.3 depicts how these issues were ignored by SFL, rendering a big high C_d. When taking SLF into account, static and dynamic analysis together rendered a reduction of 99.9% ($\sigma = 0.21$)

Table 3.3
C_d comparison with and without Lint

Subject	SFL		SFL + Lint	
	Bug 1	Bug 2	Bug 1	Bug 2
Char Count	124	124	0	1
Connect Bot	30812	30812	31	20
Google Authenticator	3513	3513	2	2
Star Droid	12672	12672	16	13

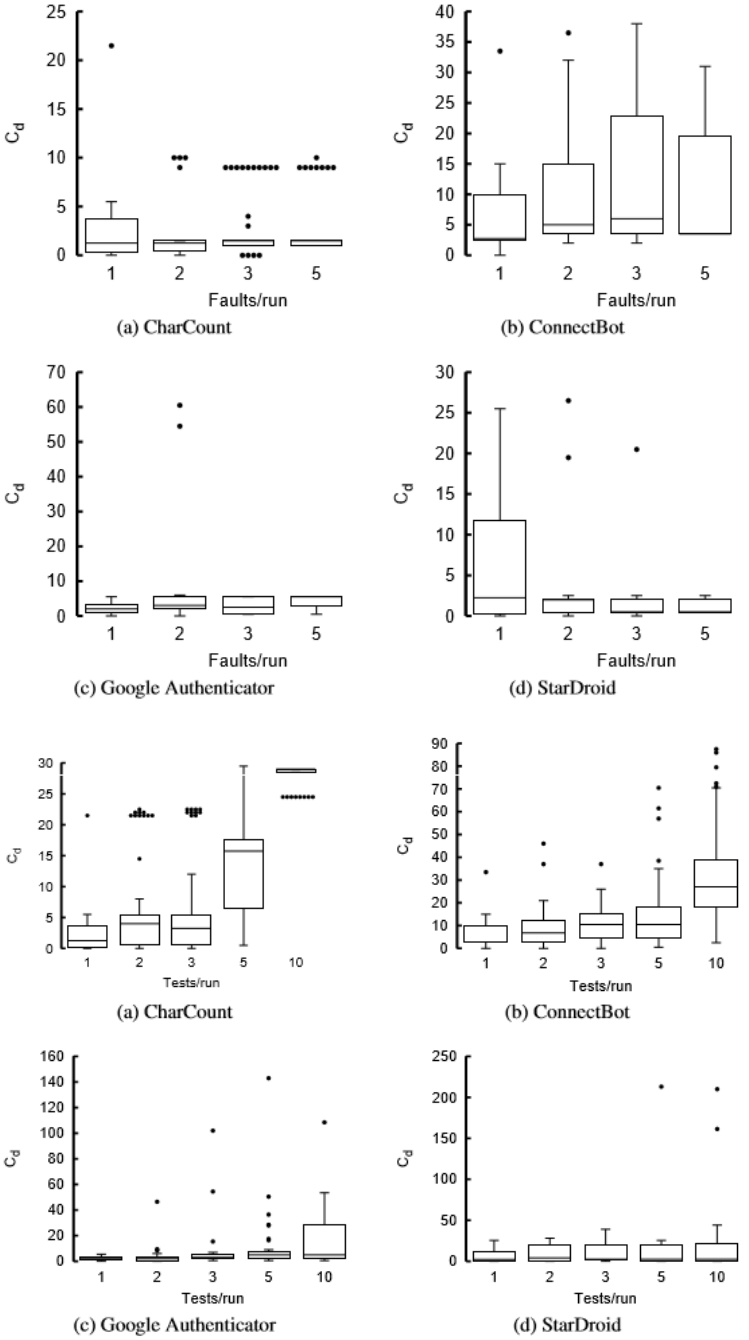

Figure 3.1 Diagnostic Accuracy C_d

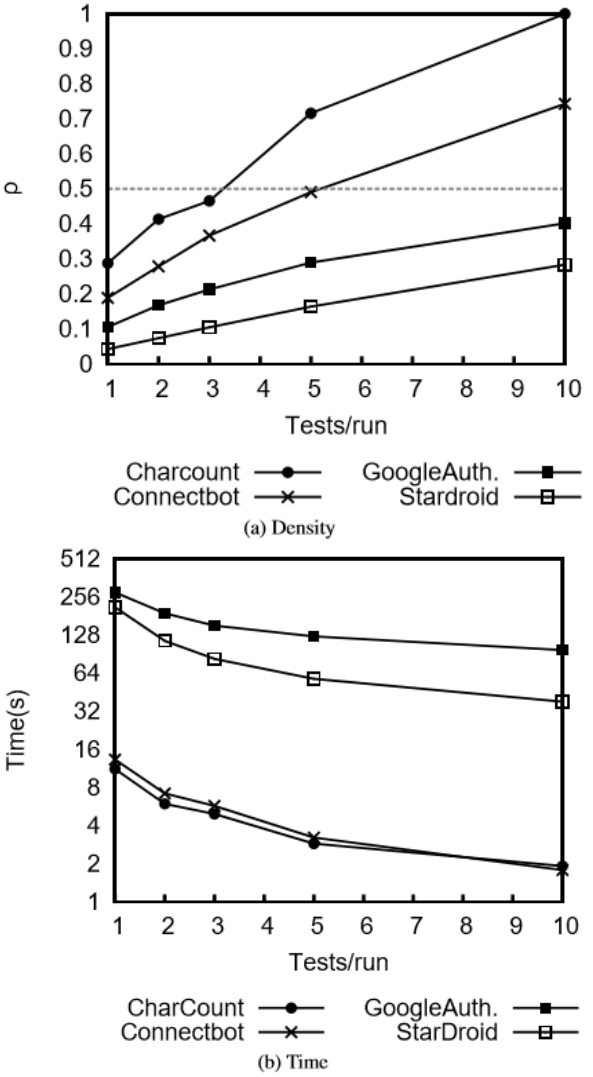

Figure 3.2

4. COMMENTS AND CONCLUSION

4.1 Related Work

Finally, the mechanisms to debugging processes in Android are not efficient and involve a complicated method; an automatic methodology would certainly made the process easier and more reliable. There are still some problems when using these methods for devices, since they are not available for mobile apps, and manual techniques have to be applied. As a result, MZoltar is a good solution by automatizing the process, combining it with SFL and Lint.

4.2 Methodologies

These techniques help in easing the problems when using them. Some factors are crucial like efficacy, scalability and losing information when the time comes to choosing which techniques are going to be applied. In addition, JaCoCo was used in the instrumental section, together with the ATF so as to produce coverage information documents, acquiring them from ADB. Finally, Lint method was added to enhance the existing one, since the permission examination was old and did not function when considering the distinct Andriod versions, particularly in Lollipop or in the upcoming Marshmallow.

4.3 Empirical Evaluation Results

The framework used to gather the information was overhead of 6.75% ± 2.35% on average, and the validity of diagnoses was alike the one of general-purpose apps [15]. Moreover, we examined the option of gathering assessment to ease the time consumed in executions, getting a reduction of 79% ± 8.36%, but losing reliability of diagnoses in 70% ± 9%. In addition, the integration of Lint with MZoltar was valuable; since it improves the limitations the SFL carry. As regards the Android particular problems, this framework could reduce several parts that designers require to examine so as to find problems by 98.7% ± 0.34%.

4.4 Main Contributions

The crucial findings of this study are:

- showing how relevant the problems of faulty findings is;
- looking for an automatized technique for debugging and locating issues.
- A coefficient (Lint coefficient L_c) , mapping the report yielded by Lint to a $0-1$ scale, to (i) identifies the problems of an app and integrates it with dynamism;
- MZoltar is efficient particularly in mobile devices.

Particularly, utilizing both types of analysis has not been treated in depth before.

4.5 Conclusion

In future, I would try to offer MZoltar in the Android Studio IDE and to other devices as well, probably IOS and Windows Phone, and also in Android upcoming new version, Marshmallow. In addition, Lint hides some problems that could end up being bugs, even when those may not cause the failure of the app. Furthermore, some problems will only be important if they meet very particular points, so they are not likely to be turned into bugs. Hence, comprehending the problems that can cause faulties in apps is one of the features I intend to raise awareness about. In addition, the range of colours that was implemented for the graphics is still to be enhanced; tough they were clear, the research was not intended for the visuals, so a new client research should be conducted and decide which is the better for designers. Finally, Google reported results showed that the debugging process is decreased taking into account how old they are.

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QUANTIZATION BASED ROBUST IMAGE CONTENT WATERMARKING IN DWT DOMAIN

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ABSTRACT

Digital Image Watermarking (DIW) is a technique that is used for the protection of digital images from illegitimate manipulations. Basic difference between the watermarking and encryption is that watermarking permits the user to view, access and construe the signal (image) but is responsive for protection of the ownership of the data. To increase the robustness, apply the watermarking technique to all high-frequency sub-bands coefficients which are above a level adaptive threshold. To measure the association among the wavelet coefficients of a corrupted watermarked image and the watermark on which threshold is applied, the embedded watermark can be detected. By testing a variety of legal and prohibited image processing operations including consistent and Gaussian noise addition, median filtering, cropping, it efficiently indicate that the embedded watermark is robust against various solidity attacks.

KEYWORDS

Digital image watermarking, Discrete Wavelet Transform (DWT), Threshold, Corrupted Image, Decomposition.

I. INTRODUCTION

Digital image watermarking is the technique in which the data that is embedded is basically depicted as watermark and it will be embedded in the interactive multimedia objects such that, it can be detected or extracted to make a contention about the object [1]. Different applicatory areas for digital watermarking includes broadcast monitoring, finger-printing, indexing, medical applications, rather than only copy control and copyright legitimacy. The most important properties are robustness and imperceptibility to design and mount a new watermarking algorithm in relevant areas. [2].Following techniques are used for embedding the watermark: spatial domain and transform domain watermarking. Precisely, the spatial domain is the way on which watermark is embedded by mitigating the pixel values in the original image. The data bits are embedded into the least significant bit-plane of the host image[3].Both the domains are comparable; in the second case, the coefficients of transforms such as discrete cosine transform (DCT),discrete Fourier transform (DFT), or discrete wavelet transform (DWT) are modified [4]. Watermark detection is classified into 3 categories: non-blind, blind, and semi-blind watermarking.

- In Non-blind watermarking, host image is necessary for perceiving the watermark.

- In Blind technique, host image is not necessary to retrieve the watermark.
- In Semi-blind watermarking technique, the watermarked script is necessary for recognition.

II. PREVIOUS WORK

Watermarking technology has a key role in the prevention of copyright infringement because it allows the user to hardly notice the watermark or sometimes totally perceptible. The technique is usually implemented on the major sub-parts of the host image, i.e. modification in low frequency band or subbands will results in the effective and robust image. The information is encoded in the low subbands. This helps in the progress of watermarking schemes that are to be embedded in the frequency domain. Most of the image transforms were measured like DCT (Discrete Cosine Transform), DHT (Discrete Hartley Transform). With the help of the homogeny process of JPEG2000, Moving from DCT to DWT domain, it becomes more mesmerizing to perform watermarking and make the image more robust rather than DCT. A translucent and robust watermark should be such that the watermark is perceptible in the original image.

It is fascinating approach that helps for tracing copyright infringements and for authentication. Currently, digital watermarking has wide area of research and has different applications such as broadcast supervision, owner identification (proofs of own image), data validation, help to protect from copying, and file renovation. Watermark images can be embedded in both spatial domain and frequency domain, but it is describable that spatial domain is less stout to attacks rather than in frequency domain. Different techniques works in frequency domain in which the image can be transformed using DCT, DWT, DFT and the frequency coefficients embeds the watermarks image onto the transformed image. Addition of the watermark to different subbands of the host image, the quality should be enhanced and by adding the qualitative value of noise in those bands outranged by the decomposition of the image, the watermarked image quality will remain preserved in very efficient manner. It is highly-adaptive way, which will increase the robustness of the image even after applying some kinds of distortions i.e. image solidity, geometric attacks, and noise accumulation. The discrete wavelet transform (DWT) converts a signal into low (L) and high (H) frequency sub- bands. The image can be partitioned by performing a DWT in both vertical and horizontal directions, that will result into one low frequency sub-band (LL) and three high frequency sub- bands (LH, HL, and HH).

Similarly, a few wavelet-based algorithm were intended for the embedding of the watermark signal into the lower level sub-bands. An important way to protect rational properties of digital media is digital watermarking. Digital watermarking figures out the problem of how to protect copyright. And it is the key for the shelter of permissible rights of digital content owner and customer.

Discrete Wavelet Transform:

Wavelet Transform is a contemporary technique normally used in digital image processing, solidity attacks, watermarking etc. Transforms on small waves, called wavelet, are basically of changeable frequency and limited duration. A wavelet series is a depiction of a four-sided figure integrable function by a certain ortho-normal sequence generated by a wavelet.

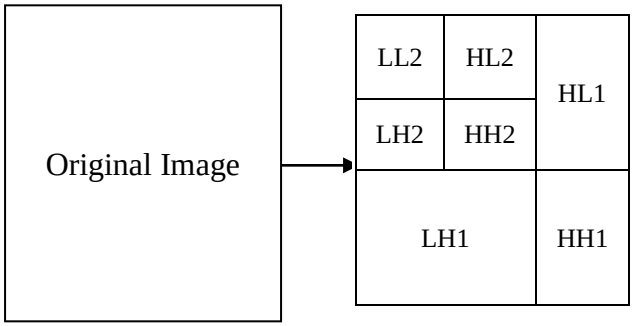


Figure 1: Coefficients in Subbands

Wavelet-based Watermarking Schemes:

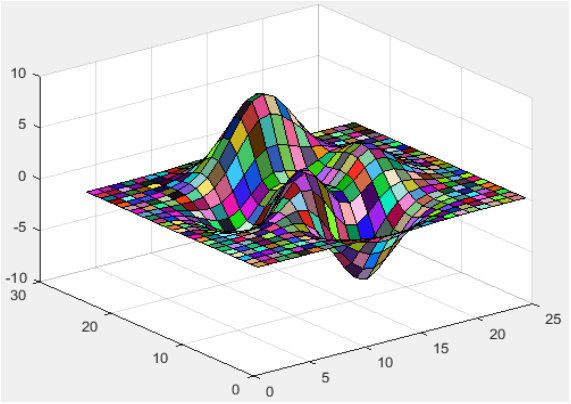
Basically the overview of wavelet based watermarking schemes, the popularly accommodated algorithms is taken into a general gibbet by dissecting the algorithms into common practical modes and hence calculating a decisive embedding form that is as follows:

$$I'_{m,n} = I_{m,n} + \Delta_{m,n,} \quad (1)$$

where

$I'_{m,n}$ is the modified coefficient at (m,n) position, $I_{m,n}$ is the coefficient to be modified and $\Delta_{m,n}$ is the modification due to watermark embedding. These modification algorithms were broadly categorized into two groups.

- Direct modification
- Quantization based modification.



Watermarking algorithms are also divided into two categories. Blind watermarking and Non-Blind Watermarking. Because of the nature of embedding algorithms, most of the direct modification algorithms are laid in non-blind category whereas most of the quantization based schemes are referred as blind.

III. SYSTEM DESCRIPTION

The block diagram of the proposed image adaptive watermarking algorithm is shown in figure 2. The figure below shows, the proposed watermarking algorithm divides in three main steps. In the first step, the image is decomposed into n-levels wavelet decomposition coefficients. As Daubechies is in wide-use in most common image processing techniques that is why, these filters belong to our concerned technique as basic function. In the next step, the watermark embedding takes place, in which the most significant parts of the original image is embedded by the wavelet coefficients.

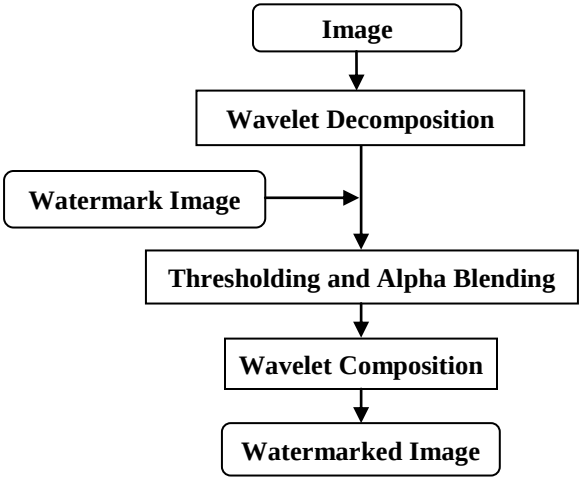


Figure 2: High Level Block of the System

Let İ, V, V* indicate the wavelet coefficients of the cover image, the original watermark image, and the weighted watermark of the image, respectively. Hence,

$$V^*(x,y) = I(x,y) * V(x,y)$$

where İ, the watermark image contains the wavelet coefficient coefficients and V* defines the threshold of the original watermark image. In the next step, inverse wavelet transform is applied and will result in the watermarked image that is computed to produce the watermarked coefficients of the cover image, the designing of the weighting function and thresholding schemes are made in such a way that it results in a robust algorithm, that is used to preserve the image quality in efficient way. In the former step, that is watermark detection step, the computation is carried out, in which the wavelet representations of the received image and the cover image are calculated. After that, subtraction between both the coefficients of the image are take out, and a binary image is (helps in the extraction of the existing watermark from the received image)(V*). In addition, as in [7, 8] the additive Gaussian noise is also calculated by thresholding error. At the end, it is concluded that the probability distribution of the original watermark is approximately same to that of extracted watermark.

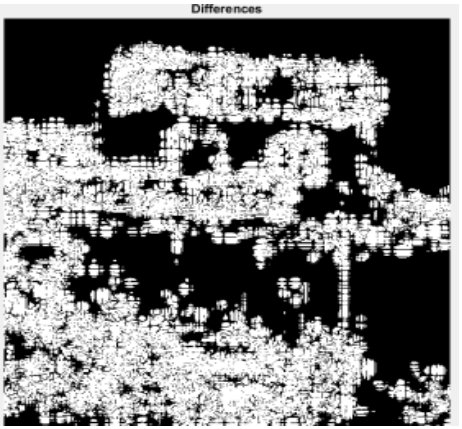
IV. EXPERIMENTAL RESULTS

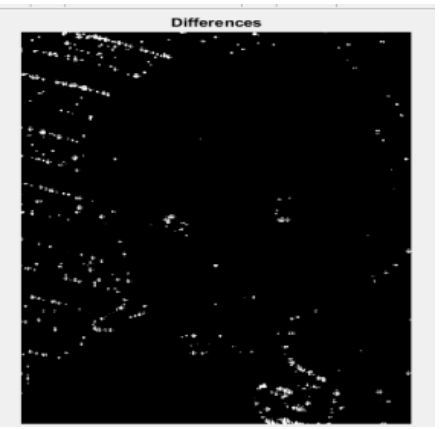
The experimentations describes that the watermarked image are liable towards this proposed scheme against common image processing attacks. 512x512 RGB images are first transformed to grayscale images that are used as cover image and watermark image correspondingly. Different images are shown as follows.

Original Images

Corrupted Images

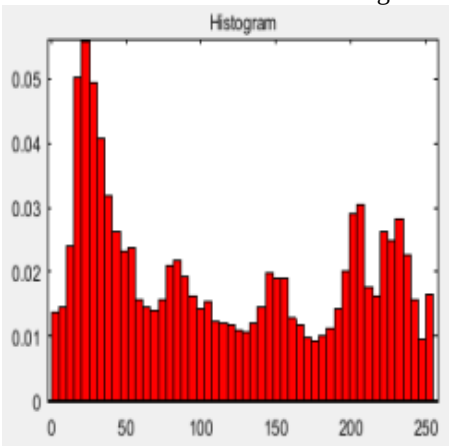
Differences

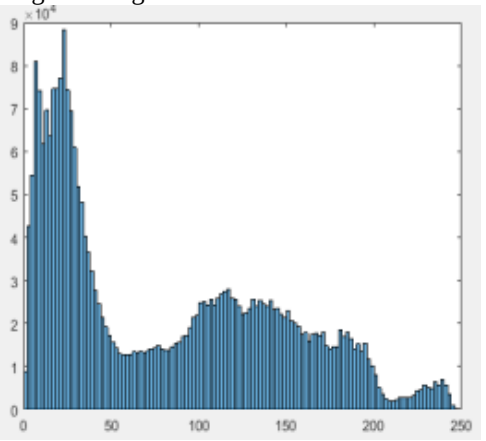




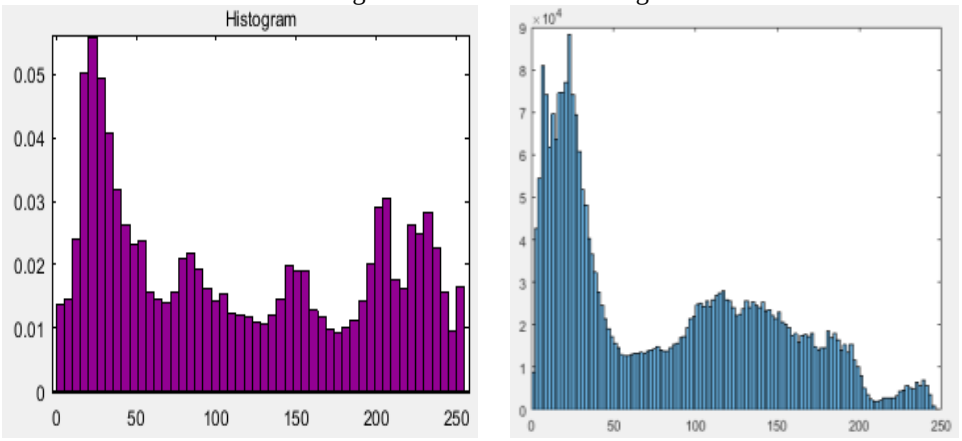
Watermarked Image

Histogram for Original image

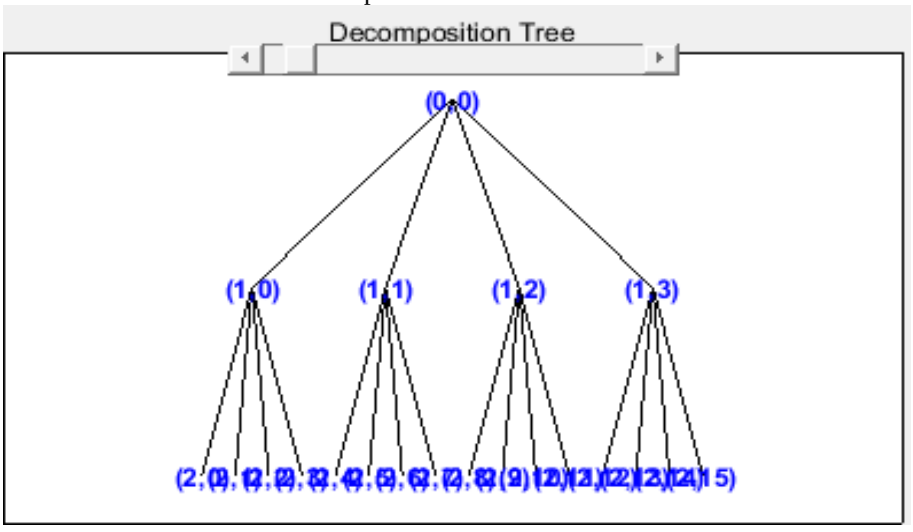




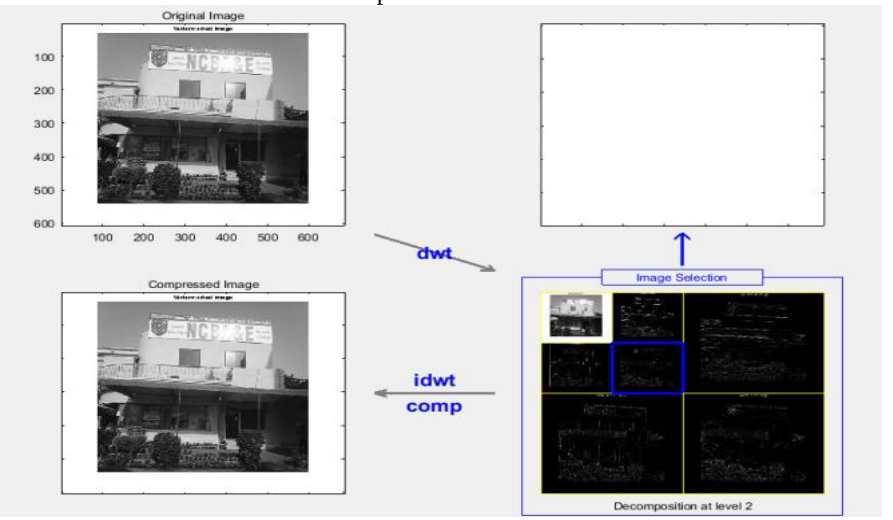
Histogram of Watermarked Image



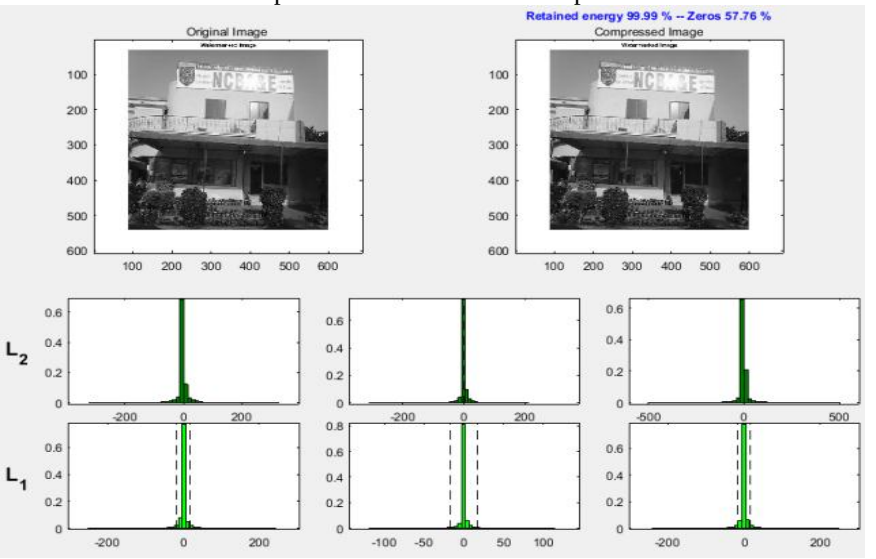
Decomposition Tree Formation



Decomposition at Level-2



Decomposed co-efficients and compression



The above method defines the frequency domain is embedded in a pseudo-random sequence of real numbers in a preferred set of DCT coefficients.The watermark is selectively added in the preferred coefficients with the significant image energy in the discrete wavelet transform(DWT) domain in such a way that it will help in ensuring the non- erasability of the watermark. Experimentation shows that the watermarked image is robust to different signal processing techniques and geometric distortions. Results

demonstrate that the anticipated scheme works effieciently for the extraction of the qualitative watermark various image processing attacks like JPEG compression, average filtering, median filtering and cropping.

The original image and the watermark are nearly same but some difference in the pixel will occur. The calculated value will be given according to the experiment performed.

Threshold value	9.4549
SNR Signal-to-Noise Ratio	27.0484
PSNR Peak Signal-to-Noise Ratio	32.3577

The range of PSNR values are considered adequate if it remains in between 30-40 dB, and the experiments figures out that the watermark embedding algorithm is flourishing enough to be used in several applications. PSNR greater than 40, will lead to dimness of an image. This scheme(non-blind) is to be believed as the most robust than the other schemes as it exchanges very little information and requires access to secret material.

V: ACKNOWLEDGEMENT

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ROBUSTNESS OF IMAGE CONTENT USING NON-BLIND DWT-SVD BASED WATERMARKING TECHNIQUE

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ABSTRACT

The security of the multimedia file is one of the central concerns in online trade and communication. Non-blind watermarking scheme is based on Discrete Wavelet Transformation (DWT) and Singular Value Decomposition (SVD). It is used for the strongly robustness and authenticity of digital image against various attacks through embedding and extracting watermarking into host image.

The DWT recovered embedded information efficiently. It is completely secured because the embedded information is not visible to any non-authorized person. Using DWT- SVD technique the color components of host and watermark image were separated into R, G and B channels first. For watermarking process a threshold values from R planes of watermark image was integrated into R channel of the host image. A reverse system was applied to retrieve the watermark. The results were also analyzed with PSNR and NC values and showed robustness against unintentional attacks. This method gave much more satisfactory results on jpeg compression rotation and cropping than that of previous methods.

1. INTRODUCTION

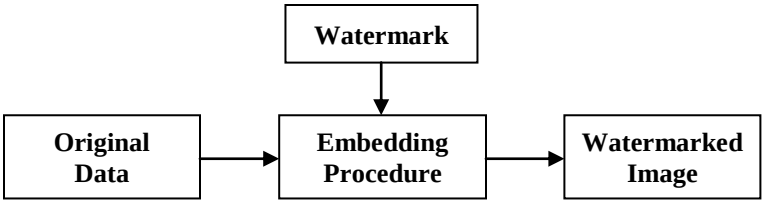
Over the past two decades, there has been a tremendous growth in computer networks and more specifically, the World Wide Web. This along with the exceptional increase in Computer performance has facilitated extensive distribution of multimedia data such as images over the internet quite easily. Publishers, artists, and photographers, however, may be unwilling to distribute pictures over the Internet due to a lack of security, images can be easily duplicated and distributed without the owner's consent. Digital watermarks have been proposed as a way to tackle this tough issue. In a traditional watermarking the watermark is intended to be visible due to identifying the manufacturing attacks.

The digital watermarking is intended to be imperceptible in the noise tolerant signal of image, audio and video file in such way that the host data does not distort and also provides a possible solution to the problem of easy editing and duplication of images, since it makes possible to identify the author of an image by embedding secret information in it [2]. Digital watermarking need to be within an acceptable limit and robust when different types of processing is applied in digital content namely adding noise, cropping, compression, resizing [1].

Ideal properties of a digital watermark:

1. A digital watermark should be imperceptible, meaning that it should be perceptually invisible to prevent obstruction of the original image.
2. Watermarks should be robust to filtering, additive noise, compression, cropping and other forms of image manipulations.

BLOCK DIAGRAM FOR WATERMARKING



Watermarking Scheme

Watermarks can be categorized into blind, semi-blind and non-blind schemes [15].

There are mainly two general methods for watermarking which are commonly known as spatial domain technique and frequency domain technique. Insert the watermark in spatial domain done by direct change the brightness values of pixels through methods like LSB. Watermark in frequency domain inserted in coefficients of transformation domain [4][20]. The Sample Transformations of this domain can be noted to discrete wavelet transformation (DWT), discrete cosine transformation (DCT), Discrete Fourier transformation (DFT), integer wavelet domain (IWT) [14]. The obtained frequency component is then modified to hide the watermark. The RGB, YIQ and YUV color space are used for embedding watermark in host image. The Discrete Wavelet Transformation (DWT) function is combined with the Singular Value Decomposition (SVD) for embedding the watermark in the YUV color space.

In the proposed method, the R planes of the watermark is converted using thresholds. Then combined with SVD and DWT to embed data in frequency domain of cover image.

2. RELATED WORK

Some researchers have used DCT, DWT and SVD technique on the R, G and B components of a host and watermark image. The watermarking technique used with SVD overcomes the weakness that was found in other methods [4].The technique of converting the RGB color components first into the YIQ color component and then embedding the watermark image into Y and Q color space is shown by Sun and Yu [5]. Gunjal and Mali proposed embedding watermark in all YIQ, RGB and YUV color channels [6].

3. PROPOSED WORK

The R, G and B planes of host image and watermark image are separated first. Then the R plane is used for embedding. A threshold technique is applied to R planes of watermark image and then 2D-DWT technique to R planes of cover image to decompose into four band of frequency namely LL, LH, HL and HH. The LL3 (Approximation

Coefficient) of fourth level decomposition increases the PNSR by reducing the effect of noise on the cover image. SVD technique is applied on LL3 band of original image and R planes of watermark image. The equation for embedding is:

$$Swmi = Sori + Swm \quad (1)$$

Apply inverse SVD and inverse DWT to obtain the customized band R. Then construct watermarked image. The embedding procedure is shown through the figure 1.

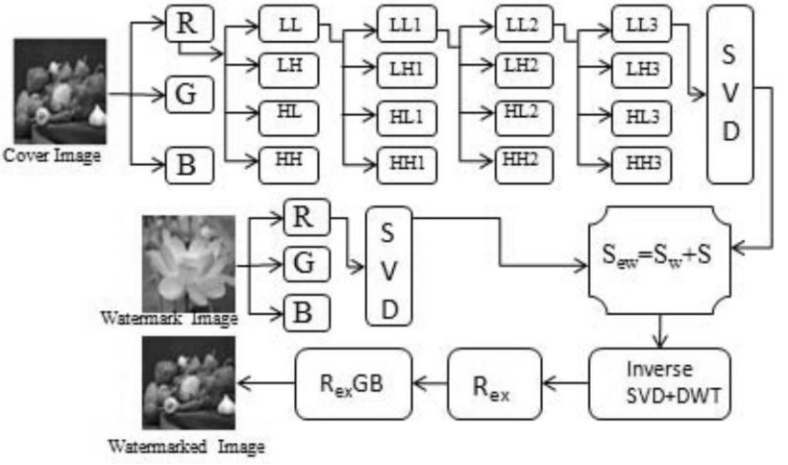


Fig 1: Embedding Process

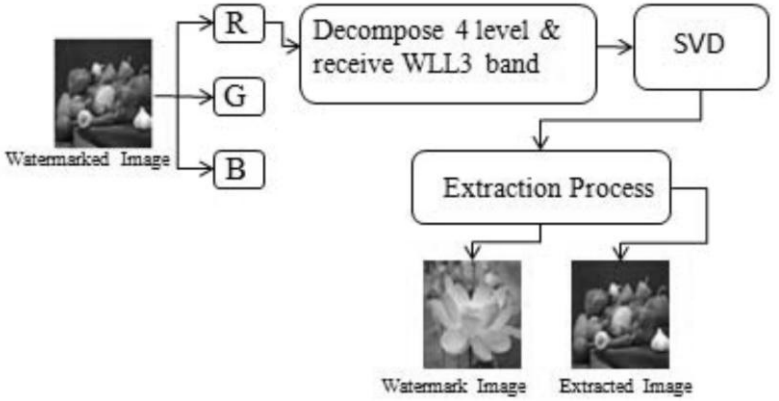


Fig. 2: Extraction Process

Extraction Process

The watermark and the cover picture are extracted applying the reverse process on the watermarked image. The extraction procedure is described below:

Separate *Rwmi*, *Gwmi* and *Bwmi* planes from the watermarked image. Decompose *Rwmi* planes four times to receive *WLL3* band. Apply SVD on WLL3 band and perform

the equation SEWM = SWMI - SORI to receive watermark. The SEWM is the extracted watermark. SWMI has come from watermarked image and SORI from cover image. Apply inversed SVD, inversed DWT and threshold technique to re-construct the watermark image. The extraction formula is exposed through the figure 2.

Original images Watermarks Watermarked one step decompositions

4. COMMENTS AND CONCLUSION

In our experiment we have used a watermark to embed into a cover image to construct the watermarked image. Figure-3 shows the watermarked image derived with Cover image and watermark image. The performance of the proposed algorithm is measured through the obtained values. The peak signal to noise ratio (PSNR) and normalized correlation (NC) are used as the performance criteria. The table-1 describes PSNR values between watermarked image and attacked image. It also demonstrates the NC values of original watermark and the extracted watermark from attacked image. The PNSR value shows the intensity of noise added on the watermarked image through different types of noise attacks. The lower is PSNR, the higher is the noise added in watermarked image. The higher is normalized correlation (NC) the better is the similarity between original and extracted watermark image.

Noise	PSNR for Original and Watermarked Image	NC for Original and Watermarked Image
Gaussian	54.0387	1.0
Motion	38.364	0.9996
Average	39.4771	1.0
Prewitt	8.2853	0.9940
Un-sharp	34.9559	0.995
Log	8.0648	0.9926
Cropping	11.1895	0.9902
Rotate (90)	11.087	0.9941

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A VARIABLE SAMPLING PLAN USING SIMPLE LINEAR PROFILES UNDER REPETITIVE SAMPLING SCHEME

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ABSTRACT

In this article a variable sampling plan based upon simple linear profile is proposed by using the repetitive sampling scheme. The optimum plan parameters of proposed plan are determined by using the two point approach, by satisfying the producer and consumer risk at optimum point by minimizing the average sample size (ASN). The comparison of the proposed sampling plan is carried out with single sampling plan using linear profile in term ASN. The proposed plan is more efficient in minimizing ASN.

KEYWORDS

Repetitive sampling; average sample number; producers' risk; consumers' risk; process yield; linear profiles.

1. INTRODUCTION

The statistical quality control comprises of the technique that involve in the process improvement and enhancing the quality of product. In this regard quality control is subdivided in three different sub sections the control chart used during the manufacturing process in order to control the variation, the second major tool used is the experimental design that is applied to see the most critical characteristics and to find out the optimum parameters for the maximization of the product with maximization of profit and minimization of cost. The sampling plan is the main toll that is implemented to assure that the product is according to specifications that are set by producer and consumer respectively.

The development of sampling plan is usually made on the basis of quality characteristic of the interest, on this base the sampling plan are classified as Attribute and variable sampling plan. Lieberman and Resnikoff (1955) developed a sampling plan for variable quality characteristic, whereas the sampling plan for a quality characteristic following the normal distribution was developed by Owen (1967). In order to enhance the performance of sampling plan Daudin (1992) developed a double sampling plan on the bases of sample mean. The idea of repetitive sampling plan was introduced bySherman (1965) whereas the designing of sampling plan and plan parameter estimation procedure

is available. For more detailed work on variable repetitive sampling schemes seeRadhakrishnan and Mallika (2010).

Ebadi and Shahriari (2013) developed a criteria for the monitoring of process capability where the quality characteristic of interest is expressed in term of linear profile. Further for the detail of process capability index for a multivariate linear profile see Ebadi and Amiri (2012)for further detail of linear profile see (Hosseinifard and Abbasi (2012); Zahra Hosseinifard and Abbasi (2012); Zhu and Lin (2009)).

Hosseinifard and Abbasi (2012) discussed the use of process capability index $\hat{C}_{PK}$ with nonlinear regression profiles.Wang (2014a) developed a procedure for 100(1- α) % lower confidence bound for process yield using simple linear profiles $\hat{S}_{PKA}$, they also elaborated that optimization procedure estimated $\hat{S}_{PKA}$ values are closest to the target values and have smaller standard deviations than $\hat{C}_{PK}$ and $\hat{C}_{PKA}$. Here in this paper we developed a sampling plan for the process yield using the linear profile under repetitive sampling scheme. The plan parameters *n, ka and kr* are estimated by the two point approach by simultaneously satisfying the producer's risk and consumer's risk respectively by suing the simulation approach for the parameters estimation.

2. DETERMINING THE DISTRIBUTION OF S_{PKA}

Profile monitoring is used in control charts in a case where the quality of a process or product can be characterized by a functional relationship between an explained variable and one or more controlled variables. The profile monitoring considers the case in which the profiles can be adequately represented by a simple linear regression model.

$$Y_{ij} = \alpha + \beta X_i + \varepsilon_{ij} \; ; i = 1,2,3\ldots, n; j = 1,2,3 \ldots, k$$

where x_i is the level of independent variables, and ε_{ij}'s are independently distributed normal random variables with 0 mean and σ^2 variance .

In 1994, Boyles developed the Process Capability Index

$$S_{pki} = \frac{1}{3}\Phi^{-1}\left\{\frac{1}{2}\Phi\left(\frac{USL_i - \mu_i}{\sigma_i}\right) + \frac{1}{2}\Phi\left(\frac{\mu_i + LSL_i}{\sigma_i}\right)\right\}$$

$$S_{pki} = \frac{1}{3}\Phi^{-1}\left\{\frac{1}{2}\Phi\left(\frac{1-C_{dr}}{C_{dp}}\right) + \frac{1}{2}\Phi\left(\frac{1+C_{dr}}{C_{dp}}\right)\right\} \qquad (2.1)$$

where, $c_{dr} = \frac{(\mu_i - m_i)}{d_i}$; $C_{dp} = \frac{\sigma_i}{d_i}$;

$m_i = \frac{(USL_i + LSL_i)}{2}$; $d_i = \frac{(USL_i - LSL_i)}{2}$;

Process yield is recognized as the most fundamental and common criterion used in the manufacturing industry for measuring process performance. Process Yield is $= 2\,\Phi(3S_{PKA}) - 1$

Wang (2014a) suggested that a process yield for *simple linear profiles* is given as,

$$S_{PKA} = \frac{1}{3}\Phi^{-1}\left[\frac{1}{2}(1+P)\right] \qquad (2.2)$$

$$P = \frac{1}{n}\sum_{i=1}^{n} P_i = \frac{1}{n}\sum_{i=1}^{n}[2\Phi(3\,S_{pki}) - 1] \tag{2.3}$$

$$\hat{S}_{PKA} \sim N\left(S_{PKA}, \frac{\sum_{i=1}^{n}(a_i^2 + b_i^2)}{36n^2k[\Phi(3S_{PKA})]^2}\right) \tag{2.4}$$

Wang (2014b) further modified the above statistic as

$$\hat{S}_{PKA} \sim N\left(S_{PKA}, \frac{G^2[\phi(3G)]^2}{2n^2k[\phi(3S_{PKA})]^2}\right) \tag{2.5}$$

where, $G = \frac{1}{3}\Phi\left\{\frac{n[2\Phi(3S_{PKA})-1]-(n-2)}{2}\right\}$

In our study we consider the distribution of process yield expressed in step 2.5.

3. DESIGN OF PROPOSED PLAN

The working procedure of our proposed sampling plan is elaborated in the following steps:

Step 1: Select a random sample of size n from the product lot and compute $\hat{S}_{PKA}$.
Step 2: Accept the lot and stop the procedure if $\hat{S}_{PKA} >= ka$
Step 3: Reject the lot and halt the process if $\hat{S}_{PKA} < kr$
Step 4: Otherwise, repeat step 1 so that the lot sentencing decision can be carried out by taking random sample of n repeatdly.

Probability of Acceptance:

In order to evaluate the working procedure of the proposed sampling plan first we compute the probability of lot acceptance bases on the single random sample as

$$P_a = P\left(\hat{S}_{PKA} \geq k_a\right)$$

$$P_a = 1 - \Phi\left(\frac{k_a - S_{PKA}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2k[\phi(3S_{PKA})]^2}}}\right) \tag{3.1}$$

Probability of Rejection:

A lot will be rejected if the estimated value of $\hat{S}_{PKA}$ from a random sample of size n would be less than the k_r, thus the lot rejection probability under single sample is

$$P_r = P\left(\hat{S}_{PKA} < k_r\right)$$

$$P_r = \Phi\left(\frac{k_r - S_{PKA}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2K[\phi(3S_{PKA})]^2}}}\right) \tag{3.2}$$

The OC function in case of variable repetitive sampling is given by:

$$L(P) = \frac{P_a}{P_a + P_r} \tag{3.3}$$

The **average sample number (ASN)** of the plan is given by:

$$ASN = \frac{n}{P_a + P_r} \tag{3.4}$$

The plan parameters are estimated by satisfying the Producer's risk at Acceptance Quality Level (AQL) so that the it would greater than $1 - \alpha$:

$$L(p_{1)} = \frac{1-\Phi\left(\frac{k_a - S_{AQL}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2k\left[\phi\left(3S_{AQL}\right)\right]^2}}}\right)}{1-\Phi\left(\frac{k_a - S_{AQL}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2k\left[\phi\left(3S_{AQL}\right)\right]^2}}}\right) + \Phi\left(\frac{k_r - S_{AQL}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2k\left[\phi\left(3S_{AQL}\right)\right]^2}}}\right)} \tag{3.5}$$

The acceptance of lot for the consumer of the lots lot tolerance percent defective (LTPD) level should be smaller than β:

$$L(P_2) = \frac{1-\Phi\left(\frac{k_a - S_{LTPD}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2K[\phi(3S_{LTPD})]^2}}}\right)}{1-\Phi\left(\frac{k_a - S_{LTPD}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2k[\phi(3S_{LTPD})]^2}}}\right) + \Phi\left(\frac{k_r - S_{LTPD}}{\sqrt{\frac{G^2[\phi(3G)]^2}{2n^2k[\phi(3S_{LTPD})]^2}}}\right)} \tag{3.6}$$

The plan parameters are estimated by satisfying the two above stated risk by minimizing the average sample number (ASN) at LTPD level by simulation study under the following constraints:

Minimize ASN (P2)

$$\text{Subject to } L(P_1) \geq 1 - \alpha \text{ and } L(P_2) \leq \beta \tag{3.7}$$

where $0 \leq k_r \leq \mathrm{k_a}$

The plan parameters are determined and for various level of AQL and LTPD using R algorithm and tables are given

4. ANALYSIS AND DELIBERATIONS

The parameters of the proposed repetitive sampling plan (*n, ka, kr)* are obtained by means of the optimization procedure problem expressed in equation (3.7). Table 1 exhibits the parameters (*n, ka,* and *kr*) of the proposed repetitive sampling plan with different values of the risks (α, β). From table 1to 4, following trends were observed.

a. It is quite evident from the table 1 to 4 that with repetitive sampling plans sample sizes decrease as compare to single sampling plan with increasing values of risks (α, β) and for different values of k (2 or 4), S_{AQL}, S_{LTPD}. For instance from Table 1 with k=2(*levels of independent variable*), S_{AQL} =1.33, S_{LTPD} =1, α =0.10 and β = 0.10 the sample size for single sampling plan is 110, but for repetitive sampling plan the sample size is 32.
b. For fixed *levels of independent variable* (k=2), $S_{AQL}S_{LTPD}$ and with increasing values of the risks (α, β), ASN decreases. From table 1 with S_{AQL} =1.33, S_{LTPD}= 1, α = 0.01 and β =0.01, the value of ASN = 57.3761 and when β = 0.1 the value of ASN decreases to 34.4622.
c. For fixed values of the risks (α, β) and with an increase in the values of S_{AQL} and S_{LTPD}, ASN also increases. For example from table 1 the value of ASN = 57.3761 when S_{AQL} =1.33 and S_{LTPD} =1 with values of risks α=0.01 and β =0.01, but from table 3 when S_{AQL} =1.5 and S_{LTPD} =1.33 for the same values of the risks the value of ASN is 505.8677.
d. It was also observed other things remaining constant but if "k" number of *levels of independent variable* increases from 2 to 4, ASN decreases, For instance from table 1 if S_{AQL} =1.33, S_{LTPD} =1, α =0.01, β =0.010 the value of ASN is 57.3761 but from table 2 for k= 4, with other values remaining constant the value of the ASN = 42.5077.

4.1 The Power Curves for the Sampling Plans

The power curve is used in the direction to illustrate the discriminatory power for sampling plans, which plots the probability of rejecting a batch versus the range of process yield using simple linear profiles at various quality levels From the power curves shown in Figure 4.1 it is quite evident that the curve of the proposed plan for k=4 is below with the single sampling plan curve which indicates that the repetitive sampling plan has less probability of rejection than single sample plan.

5. PRACTICAL EXAMPLE

In order to demonstrate how the proposed repetitive sampling plan works real life example from the work of Wang (2014a) is used. The data given measures the worth of the laptops fan product at four levels of the pulse width modulated at some point in voltage test confidential using simple linear profiles. For determining the yield of the product, there are used 128 samples (n) and PWMK=4 (four levels of explanatory variable). In this study explanatory variable (revolution per minute) have four levels of the pulse width modulated. Specification limits are given below for each level of the explanatory variable.

j	X_j	LSL	USL	Target	Sample Means	S.D	S_{PKj}
1	0.2	1450	1850	1650	1582.13	36.03	1.2802
2	0.4	2300	2700	2500	2459.08	33.13	1.6533
3	0.7	3550	3950	3750	3759.07	27.86	2.3164
4	1.0	4800	5200	5000	4831.23	30.69	0.9882

Process yield is 99.9605659% and by using equations (2.2, 2.3) the value of S_{PKA} is 1.1813.

$$S_{PKA=\frac{1}{3}\Phi^{-1}\left[\frac{1}{2}(1+P)\right]} \tag{2.2}$$

$$P = \frac{1}{K}\sum_{j=1}^{K} P_j = \frac{1}{K}\sum_{j=1}^{K}\left(2\phi\left(3S_{PKj}\right) - 1\right) \tag{2.3}$$

In the characteristic from the consumer and producer the value of S_{AQL} =1.5 and S_{LTPD} = 1.33 for K=4 with α = 0.01 and β = 0.05, we ascertain the related parameters (*n*, *ka*, *kr*) are (103, 1.5156, 1.2852) form Table 4.

The 103 observations are in operation from the batch at random from the (Wang (2014a)). Since the estimated value of S_{PKA} is 1.1813 and is less than the critical value of 1.2852. So, the batch will be excluded or rejected by the consumer.

Table 1
k=2(Levels of Independent Variable) with S_{AQL}=1.33, S_{LTPD}=1

α	β	Single Sampling Plan	Repetitive Sampling Plans			
		N	n	ka	kr	ASN
0.01	0.01	110	32	1.3142	0.9141	57.3761
	0.025	96	27	1.3040	0.9036	45.9917
	0.05	85	24	1.2968	0.8818	39.7055
	0.075	78	21	1.3163	0.8411	38.8300
	0.1	73	20	1.2939	0.8525	34.4622
0.025	0.01	91	30	1.3255	0.9776	58.0303
	0.025	78	27	1.2808	0.9665	40.7789
	0.05	68	20	1.3176	0.8849	37.2868
	0.075	62	18	1.3171	0.8738	33.5144
	0.1	57	16	1.3266	0.8430	31.4010
0.05	0.01	75	27	1.3028	1.0136	45.4171
	0.025	64	24	1.2594	0.9684	34.4236
	0.05	55	19	1.2970	0.9530	31.8737
	0.075	50	15	1.3296	0.8852	29.7846
	0.1	46	14	1.3212	0.8786	26.6952
0.075	0.01	66	25	1.3114	1.0312	44.0456
	0.025	56	19	1.3236	0.9764	36.2375
	0.05	47	17	1.3122	0.9672	30.6307
	0.075	42	16	1.3118	0.9481	28.8959
	0.1	39	13	1.3208	0.9000	24.6473
0.10	0.01	60	23	1.3245	1.0229	43.7754
	0.025	50	19	1.3168	1.0043	34.6806
	0.05	42	17	1.2869	1.0097	27.0040
	0.075	37	13	1.3248	0.9411	24.8118
	0.1	34	12	1.3269	0.9053	23.2789

Table 2
k=4 (Levels of Independent Variable) with S_{AQL}=1.33 , S_{LTPD}=1

A	β	Single Sampling Plan	Repetitive Sampling Plans			
		n	n	ka	kr	ASN
0.01	0.01	87	25	1.3066	0.9118	42.5073
	0.025	76	23	1.2886	0.9008	35.5312
	0.05	69	21	1.2890	0.8696	32.8160
	0.075	63	20	1.2733	0.8860	29.1769
	0.1	59	16	1.3100	0.8171	28.5440
0.025	0.01	71	21	1.3142	0.9469	37.8212
	0.025	62	19	1.2965	0.9264	31.1529
	0.05	54	16	1.3108	0.8833	28.6401
	0.075	50	15	1.3015	0.8809	25.6906
	0.1	46	14	1.3176	0.8552	24.1124
0.05	0.01	59	20	1.3152	0.9623	36.8268
	0.025	51	17	1.2994	0.9556	28.4843
	0.05	44	15	1.2287	0.9431	23.9761
	0.075	40	13	1.3139	0.9003	23.8287
	0.1	37	11	1.3242	0.8574	21.3135
0.075	0.01	52	19	1.3236	0.9764	36.3300
	0.025	44	15	1.3284	0.9690	29.4947
	0.05	37	13	1.3111	0.9518	23.3693
	0.075	34	11	1.3288	0.9032	21.7147
	0.1	31	10	1.3231	0.8944	19.1934
0.10	0.01	47	18	1.3116	1.0368	31..6968
	0.025	39	15	1.3142	0.9865	27.1779
	0.05	33	12	1.3187	0.9455	22.3719
	0.075	29	10	1.3274	0.9255	19.4696
	0.1	27	9	1.3286	0..8975	17.6473

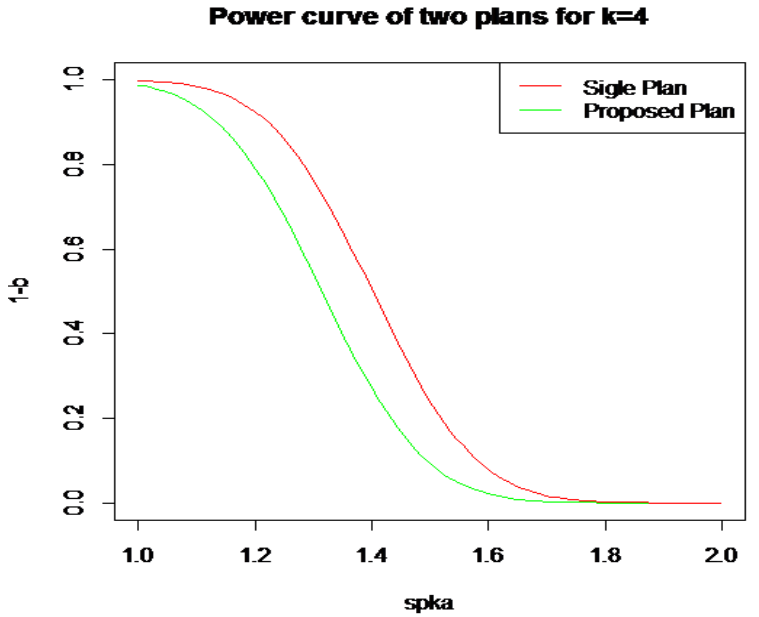
Table 3
k=2 (Levels of Independent Variable) with S_{AQL}=1.5 , S_{LTPD}=1.33

α	β	Single Sampling Plan	Repetitive Sampling Plans			
		n	n	ka	kr	ASN
0.01	0.01	649	143	1.5418	1.2629	505.8677
	0.025	557	130	1.5289	1.2646	368.4057
	0.05	485	116	1.5193	1.2561	285.4518
	0.075	439	103	1.5237	1.2406	262.9395
	0.1	407	90	1.5137	1.2303	242.1860
0.025	0.01	545	124	1.4919	1.2570	228.7276
	0.025	461	121	1.5249	1.2897	318.7260
	0.05	395	108	1.5223	1.2625	272.1728
	0.075	354	97	1.5150	1.2696	222.2832
	0.1	325	85	1.5199	1.2494	202.2832
0.05	0.01	462	141	1.5198	1.3276	350.3775
	0.025	385	112	1.5304	1.2912	310.3317
	0.05	325	93	1.5266	1.2799	237.9041
	0.075	288	90	1.5118	1.2820	196.6874
	0.1	261	69	1.5388	1.2515	187.7962
0.075	0.01	412	134	1.5238	1.3388	342.66365
	0.025	340	107	1.5266	1.3106	276.3590
	0.05	283	81	1.5366	1.2872	221.6467
	0.075	249	74	1.5406	1.2683	208.9088
	0.1	224	65	1.5321	1.2713	162.7559
0.10	0.01	375	132	1.5214	1.3513	309.8212
	0.025	307	104	1.5227	1.3286	249.4983
	0.05	253	75	1.5381	1.3001	200.2143
	0.075	221	70	1.5291	1.2782	183.9976
	0.1	197	56	1.5301	1.2911	159.3349

Table 4

k=4 (Levels of Independent Variable) with S_{AQL}= 1.5, S_{LTPD}=1.33

A	β	Single Sampling Plan	Repetitive Sampling Plans			
		n	n	ka	kr	ASN
0.01	0.01	556	140	1.5162	1.2906	345.2807
	0.025	478	121	1.5127	1.2779	280.4870
	0.05	416	103	1.5156	1.2582	244.2635
	0.075	378	92	1.5181	1.2447	221.9899
	0.1	350	86	1.5160	1.2367	201.5562
0.025	0.01	465	131	1.4928	1.3195	240.6680
	0.025	394	123	1.4982	1.3124	239.1915
	0.05	338	99	1.5135	1.2671	227.9003
	0.075	304	85	1.5067	1.2717	179.7834
	0.1	279	76	1.5143	1.2537	172.2547
0.05	0.01	394	124	1.5381	1.3062	389.2978
	0.025	329	104	1.5102	1.3105	228.5295
	0.05	278	99	1.5140	1.2954	222.1346
	0.075	247	82	1.5160	1.2678	185.7882
	0.1	224	76	1.5207	1.2633	178.3221
0.075	0.01	351	121	1.5392	1.3092	391.5963
	0.025	290	109	1.5208	1.3199	261.8156
	0.05	242	91	1.5209	1.2932	216.3930
	0.075	213	70	1.5354	1.2763	183.4733
	0.1	192	65	1.5321	1.2713	162.7559



6. CONCLUSION

In this papers a sampling plan for the process yield using the simple linear regression is proposed under the repetitive sampling scheme. The optimum plan parameters are estimated using the two point approach. The application of the proposed plan is discussed by using a real life example. The efficacy of the proposed repetitive sampling plan for linear profile is compared with the existing single plan in term of ASN. The proposed plan is more efficient in term of sample size and thus is more effective in term of cost, time and efficiency. Thus it advisable for the practitioners to use this plan as compared to single sampling plan for linear profile.

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