# INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION AND MANAGEMENT

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     INTRODUCTION

     REVIEW OF LITERATURE

     NEED/IMPORTANCE OF THE STUDY

     STATEMENT OF THE PROBLEM

     OBJECTIVES

     HYPOTHESES

     RESEARCH METHODOLOGY

     RESULTS & DISCUSSION

     FINDINGS

     RECOMMENDATIONS/SUGGESTIONS

     CONCLUSIONS

     SCOPE FOR FURTHER RESEARCH

     ACKNOWLEDGMENTS

     REFERENCES

     APPENDIX/ANNEXURE

     It should be in a 8 point Calibri Font, single spaced and justified. The manuscript should preferably not exceed 5000 words.

10.    **FIGURES &TABLES:** These should be simple, centered, separately numbered & self explained, and **titles must be above the table/figure**. **Sources of data should be mentioned below the table/figure**. It should be ensured that the tables/figures are referred to from the main text.

11.    **EQUATIONS:** These should be consecutively numbered in parentheses, horizontally centered with equation number placed at the right.

12.    **REFERENCES:** The list of all references should be alphabetically arranged. The author (s) should mention only the actually utilised references in the preparation of manuscript and they are supposed to follow **Harvard Style of Referencing**. The author (s) are supposed to follow the references as per following:

- All works cited in the text (including sources for tables and figures) should be listed alphabetically.
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**BOOKS**

- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio," Ohio State University.

**CONTRIBUTIONS TO BOOKS**

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

**CONFERENCE PAPERS**

- Garg Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

**UNPUBLISHED DISSERTATIONS AND THESES**

- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

**ONLINE RESOURCES**

- Always indicate the date that the source was accessed, as online resources are frequently updated or removed.

**WEBSITE**

- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on December 17, 2011 http://epw.in/user/viewabstract.jsp

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# FEASIBILITY STUDY OF E-SERVICING ON IRANIAN MUNICIPALITIES (G2C): A CASE STUDY OF AHWAZ MUNCIPALITY

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**IRAN**

## ABSTRACT

*Since the late 1990s, governments at all levels have launched electronic government projects aimed at providing electronic information and services to citizens and businesses. The objective of this study is to study the feasible and usage of public e-services to citizens in Ahwaz municipality .E-business has enabled the development of e-services and thus establishes a new service for citizens is needed and necessary. Thus, the purpose of the feasibility study is that Ahvaz Municipality can establish electronic service for its citizens. Data were collected from managers, experts and employees of Ahwaz municipality about e-service. The method of conducting the research is descriptive and for gathering data we used questionnaire. The results obtained from the data analysis show that all the relations are meaningful at the %5 of deviation using single sample T-test were confirmed in spectrum of the greatest possibility respectively in five operational, temporal, legal, Financial and economical, and technical variables and all hypothesizes are accepted. Also, using freedman test, the ideal position of variables in the given municipality from the managers' perspectives is as follows:1) Operational 2) temporal 3) legal 4) Financial and economical 5) technical.*

## KEYWORDS
E-Government, E-municipality, E-Services, E-city, Information technology (IT), E-citizen.

## INTRODUCTION

The necessity of saving time and expenses and also the inefficient handy service practices have motivated the city to mechanize the services, up to the point that the citizens won't see the necessity to attend the city in person and receive their documents automatically through their personal computers (The Ahwaz City Study Centre). The different urban services combine various existing system channels together, though improving the customer relation management and citizen's satisfaction, expense reduction and creating more revenue for the municipalities. Thus the establishment of the e-services is one of the key elements and a necessity, but considering the fact that the risk is a component of each project, so it must be managed to be minimized. By utilization of the feasibility study, we can reduce the risk of the establishment of electronic services (Hoffer, Jeffrey & Valacich, 2002, P.133). If the necessity of life in today cities are the focus of services and interaction of using new methods of interaction, utilizing the electronic services for innovation, development and improving the quality of municipal services have many advantages that in this case municipals as the main centers of municipal services can develop the dimensions of services in the frame of presenting electronic municipal services and use its advantages.(Bannister,2007,P184)

## REVIEW OF LITERATURE

In today`s world, by stepping toward industrialization, face to face and direct relations cannot solve our problems anymore. In today`s cities we are facing with increasing of population and the increase of urban traffic. Also, previous bureaucratic methods can be proper method in investigating citizens` paper work. Therefore, important organizations such as municipals are considered as the heart of city. They should avoid previous methods and enter electronic and virtual world.( *Reddick, C. G*,2005,P45)In the world in which the activities are done faster and safe and there is no need for population density in physical world, for decreasing many urban problems such as pollution and traffic, the municipal`s activities should be done through internet network and electronic database. These measures are one of steps toward e-government.( *Chen*,ET,2006, P98)

### AUTOMATION
The results of implementation of electronic municipal, is replacing computer systems instead of human element and some sections of municipal through automation arearithmetic operations, preparing reports, etc. This system can be replaced to some sections of municipals in some cases.(Elahi,shaban,2002,P171)

### GENERAL AND PROFESSIONAL TRAINING OF USERS
General training of computer along with professional trainings through mechanized systems and workflow and explaining new tasks to the municipal users are among the purposes of this project. (Lu, J.2001, P85)

### INFORMATION AND COMMUNICATION ASSESSMENT LIFE CYCLE
In following cycle, the updating the comprehensive information and communication project with the landscape of major goals has been presented. In this cycle with considering the landscape of realization of electronic municipal for the section of information and technology, the main landscapes are specified and then strategies, plans and programs are determined.(Heiner,2007,P12)

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**FIGURE 1: THE PERSPECTIVE FOR MUNICIPAL ICT**



The perspective for municipal ICT

Electronic municipality

Major goals

1. Development of the ICT accomplishments in the entire municipal system

   production and development of the

   system and providing online services by

Strategy, plan and program

1. Mechanization of the municipal services (#9)
2. Establishing and developing a data center and network (#13)
3. Promoting the internet sites and establishing portal (#17)
4. Establishing a committee in the form of assistance, management and FAVA organization (#1)

Updating
ICTMD

The evaluation plan of ICT

1. Evaluation of the electronic preparedness
2. Evaluation of the FAVA performance

Analysis of the strategies

1. Implementation of the strategies
2. Efficacy of the strategies
3.

Evaluation indexes

1- Municipal organizational preparedness
2- Preparedness of the infrastructure
3- Preparedness of the systems and services

## WHY MOVE TOWARDS AN ELECTRONIC MUNICIPALITY?

Significant reasons are needed in order to progress from the current status towards the new one, since these reasons will be the charter and perspective of our work. One of the most important reasons for moving towards e-municipality is the ever-increasing needs and requirements of businesses and citizens. In recent years, there's been an enormous flow of people into big cities and this has increased the need for municipality. .( Hanifi, M,2005,P35)

Therefore, providing services with desirable quality has become so much difficult, and thus, with respect to the growth of municipality services and the establishment of the ICT infrastructures, having e-municipality to provide services in short time and high quality will be a great success for the municipality. Another reason is the improvement of the government and the increase of its services to citizens, and finally, economic growth is a reason for establishing e-municipality.  (*Reddick, C*, 2005, P56)

## THE ADVANTAGES OF MUNICIPALITY E-ELECTRONIC

- Providing innovation background in presenting services
- Increasing the diversity and expansion of the domain of services to citizens
- Improving the quality of services and facility in processes
- Increasing the speed, accuracy and availability of citizen to the information of advertisement in any time and place
- Decreasing the problems of metropolises
- Decreasing the commuting and traffics and inappropriate advertisement on the urban environment(Van Brakel,2009,P71)

## E-SERVICES

E-services is focusing on the needs of citizens and firms and its purpose is creating interaction between them and governmental organization and their staff in easy, friendly, clear, cheap and effective conditions. This means that people are able to provide and supply their required services through e-government and they can be reached to their request through internet and other mechanized methods .This solution is providing the increasing demands of citizens in services that can provide interaction and unity of different common systems through utilizing of advanced internal and external facilities (ICT).(Chaudhury,A,2002,P36)
In fact, its general concept in form of urban e-services include the great domain of all governmental organization regarding different needs of citizens in different business, official, educational, cultural and recreational , tourism, etc. this concept is presented and investigated in  relation to e-government and e-cities and virtual cities.( *Centeno C*,2006,P61)

## CHARACTERISTIC OF E-SERVICES

- Giving services information (forms, processes, cost)
- Presenting interactional services with the capability of follow-up
- Conducting electronic inquiries
- Presenting combinational services
- Immediate monitoring of services
- Giving information through SMS regarding the price of services(Kessler,2003,P35)

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## QUALITY

The quality of the electronic services (e-services) has been defined as a seven-dimension phenomenon which is included in two scales: the high quality of the main electronic service scale and recovery scale.(Nissanof,D,2006,P84)

## SIX PHASE PROCESS FOR DESIGNING AN E-SERVICE

**FIGURE 2: PROCESS FOR DESIGNING AN E-SERVICE**
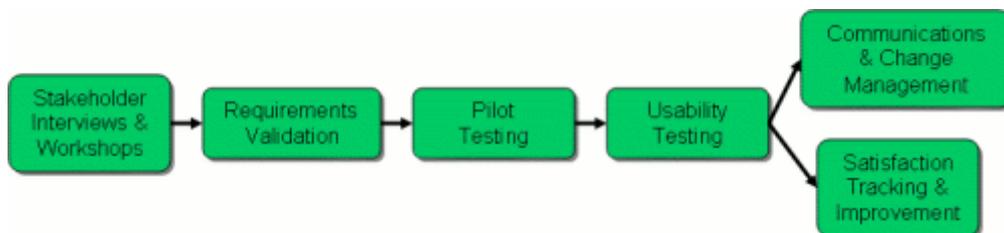


### 1- STAKEHOLDER INTERVIEWS AND WORKSHOPS

The purpose is to identify needs and expectations for the e-service from the perspective of key influencers to the process. The interviews and workshops are also used to provide input to the communications strategy and e-services design requirements. An added benefit of this step is achieving buy-in to the process from key stakeholders.( Hanifi, M,2005,P35)

### 2- REQUIREMENTS VALIDATION

At the onset of development, it is critical to validate the design requirements for the e-service from the end users' perspective. The requirements can be in the form of a concept description and feature list, storyboards, or a prototype site. We will often test the requirements in focus groups to ensure they meet users' needs and expectations from the e-service, and often, new or different requirements are uncovered in talking to users. This preliminary step saves programming time and money by preventing the development team from wasting resources on unnecessary functionality. It also helps set priorities by identifying which requirements are "core," that is, necessary to have in place at the time of launch for the e-service to be viable.(Elahi,A,2006,P58) In addition to validating the requirements, the research also gathers users' initial perceptions of the e-service to aid in communications strategy development. This is important since there are often a number of barriers to adoption of a new e-service. In many cases, new e-services are replacing a traditional process that many users are quite comfortable in using, and understanding the benefits of the new          e-service helps in communications and change management strategy planning.(Ibid,P36)

### 3- PILOT TESTING

Once the requirements are validated, the product development team designs a pilot of the e-service functionality for testing. Users are invited to review the pilot and provide feedback on the functionality through follow-up focus groups or depth interviews. This gives users a chance to see the execution of their requirements for the e-service and comment on how well it meets their needs and expectations. The look and feel, navigation, and content are included in the evaluation of the pilot. Users are able to experience the pilot on their own computers to mimic a real situation, which helps them provide feedback on how the system will affect their lives and current processes. As with the previous phases, this feedback can be helpful in communications efforts as well as design.(Grembergen,2001,P29)

### 4- USABILITY TESTING

From the feedback collected in the pilot testing, the product development team refines its plans and completes the build-out of the e-service. The full functionality undergoes final testing with users in the form of usability testing. The purpose of this stage is to make refinements that ensure maximum efficiency of use. Testing may identify minor changes, such as labeling, instructions, and navigational tools, to major issues in organization or positioning that can make or break the service.(Helbig,N,2009,P45)

The most common form of usability testing we utilize for clients consists of one-on-one interviews with users completing specific tasks using the new e-service. This is often followed by a group discussion with participants to uncover more strategic issues. After one or more rounds of revisions to the design and functionality, the e-service is ready for launch.

### 5- COMMUNICATIONS AND CHANGE MANAGEMENT

The availability of a new e-service and its benefits need to be communicated to key stakeholders and end-users through a comprehensive communications and change management plan. A new e-service requires users and stakeholders to embrace a new way of achieving a goal or doing business, which may be difficult if current processes work adequately. Therefore, the project team must work to change the mindsets of users and stakeholders to achieve adoption of the e-service. If they fail to do this, the e-service may never reach the critical mass that makes it worthwhile to visit the online storefront.

Through previous steps in designing an e-service, much information is gathered on users' perceptions and potential benefits to them. This information can be directly incorporated in the communications and change management strategy. To assist in developing and refining this effort, a communications tracking survey is useful to measure program success over time. The research helps the communications team set goals and address themes helpful in the communications and change management process.(Nile,J,2001,P71)

### 6- SATISFACTION TRACKING

The final phase in implementing an e-service is to monitor user satisfaction over time. The purpose is to troubleshoot problems and identify areas for improvement. One of the more common approaches we use is to capture users' experiences with the new e-service at the time of their visit to the site, collecting data through an intercept web survey. Areas to cover include reliability, perceived functionality, navigational ease, security and clarity of information .After an e-service is launched, management should monitor market perceptions and satisfaction over time, continually incorporating feedback into marketing and development efforts. Taking the time to complete these six phases when designing an e-service helps ensure that users and key stakeholders free themselves of their current processes and embrace a new way of doing business.( *Reddick, C*,2004,P56)

**FIGURE 3: SATISFACTION TRACKING**



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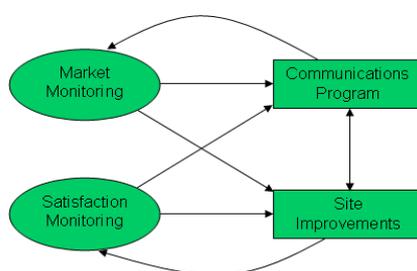
**E-CITY**

E-city is the city in which the affairs of citizens and presenting governmental and private organizations and generally speaking giving services to the citizens is done full-time and with high quality and safety. In these services the real and physical components such as paper and physical environment are replaced with virtual and subtle components and this replacement is done through utilizing information technology and its applications. .( *Ghaderi Kamran*,2000,P65)

Among the advantages of implementing e-city is reducing the cost of commuting, increasing the investment as result of world communication, saving in consumption of limited fuels, facility in doing economic affairs due to 24 hour services, etc. .(Seybold.P,2001,71)

**E-CITIZEN**

These citizens have particular knowledge and skills that help them in receiving electronic services, so one may define e-citizen as a person who has the ability and capability of fulfilling the daily duties of a citizen with all citizenship duties using electronic tools. In sum, an electronic citizen is a citizen who is able and enough skilled to use electronic services of the governments at a desirable level.( *Nath, V*,2005,P41)

**ELECTRONIC GOVERNMENT (E-GOVERNMENT)**

In a general definition, an electronic government can practically involve the beds and applications of ICT used by public sector in order to provide services to citizens (G2C, business (G2B) other governmental agents (G2G) and government employees (G2E). conventionally the interaction of citizens and or merchants occurs with a governmental agent and a governmental organization. By presence of ICT, the approaching the service centers to clients will be possible. Citizens can receive governmental information and services in a kiosk or separated internet room located at a governmental organization or near it through a laptop or personal computer (PC) from their home or workplace. It should be mentioned that e-government is not merely a huge information project but it is a multiple-part cultural organizational program based on the technology and transformer of [the shape] of business. However; the IT as well is a vital component of such a transformation and plays a fundamental role in it. in the recent few years, the number of evaluation and ranking models of the e- government have been increased. These models try to estimates the position of each country in attempt for reaching or achieving e-government. In a survey by the United Nations concerning the model, the countries of the world have been categorized based on the three criteria: IT infrastructures, internet presence and human asset. This model does not include cultural and legal infrastructures. In addition , the rate of using e-government by citizens has been neglected.( *K. Layne. and J. Lee*,2005,P124)s E-government is service-providing and information-providing for public by government using electronic tools. In other words, e- government utilizes the ICT to promote the government's efficacy by means of better access to information and making government more answerable before public [people].(*Sarpoulaki.M., Eslami*,2010,P36)

**E-GOVERNMENT MODELS**

Following the several research conducted on the developing trend of E-government and on the effect of electronic services in governmental organizations especially municipalities in the various parts of the world, some models have been introduces as follows: (*K. Layne. and J. Lee, 2005, P165*)

**TABLE 1: E-GOVERNMENT MODEL**

| Model's name | Stages of implementation |
|---|---|
| LAYNE.LEE | 1- Cataloguing  2- transaction  3- vertical merging  4- horizontal merging |
| United Nation's model | 1- Emergence  2- promotion  3- interaction  4- transaction  5- unity |
| Kartz group | 1- Advent  2- transaction  3- interaction  4- transfer |
| Dell oTTE Research | 1- Distribution and spread  2- two-way administrative transactions  3- multi-purpose portals  4- central portal privatization  5- public services' clustering  6- the unity of interaction and transfer [of the cluster] |

**THE ADVANTAGES OF E-GOVERNMENT**

1- Financial sector(Sharifi.H,2004,P32)
- Increased participation and collaboration with private sector
- Quick low-cost and certain provisions using electronic provisions or preparations
- Paving the ways for the electronic trade
2- Citizens
- Promoting the quality of governmental services
- Improving the condition of citizens due to the proper distribution of governmental services
- Increased variety in services
- Providing direct and immediate services for citizens
3- Government
- Reduced costs
- Reduced administrative violation and corruption
- Increased power of  answerability
- Increased public participation
- Strengthening of the democratic pillars

**THE VARIOUS ASPECTS OF THE ELECTRONIC TRADE IN GOVERNMENTAL SECTOR**

E-government and electronic service is the very electronic trade which has been useful in the public sector. E-government includes the exchange of costs, goods, services and information which is done via electronic media. In this regard, some functions can be mentioned including information giving, service providing improvement, financial discipline and clarification of political affairs. These definitions have often directed the e-government's functions in providing the electronic services and do not indicate even technical and telecommunicative infrastructures.( *Chen, ET.,2003,P94*)

**TABLE 2: THE VARIOUS ASPECTS OF THE ELECTRONIC TRADE IN GOVERNMENTAL SECTOR**

| | G | B | C |
|---|---|---|---|
| **G** | Information transmission | Receiving information<br>Monitoring and evaluation | Delivering the information of instructions and regulations |
| **B** | Providing services<br>Providing information | Transactions between economical agencies | Preparation and provision |
| **C** | Payment of the bills | Awareness of the price<br>Awareness of the services | Shopping markets |

1- Government to business model: in which the government provide the certain needs of the commercial society through internet, which include registration of the companies to the provision of electronic preparations, in which the government purchase the goods and services consumed required online from the commercial agencies. The services provided assist the development of the commercial agencies especially small and medium agencies through G2B exchanges.(www.mit.gov.in)

2- G2G model: these services are provided at two levels: local or national level and international level. G2G is the exchanges between local or central governments or in the form of exchanges between two governments of a country and the government of the other country which is an instrument for international and diplomatic relations.(Alipour.M,Kovaroee,2010,P240)

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3- G2C model: or government to citizen model: consists of transmission of information to the public, providing citizenship basic services like extending the certificate, filling the tax form and also assisting citizens concerning such services as instruction, treatment, library etc. this model is briefly called citizen model. This model is made available for citizens for establishing communication between governmental institutions and true individuals who consist the countries' citizens using this model of urban services online and electronically. The worth mentioning point is that all models one part of which is government and or governmental institutions are in the form of non-profit activities and most of these services have no income-making aspect and most cases governmental subsides are seen. Nevertheless, due to the fact that one of its parts is commercial institution or has a commercial nature, in the end it is consumer of the goods or services or information. This model is considered as a subcategory of the electronic business.(Farahmand.A,2008,P65)

4- G2E model: it has been designed to provide information for public sector staffs using internet or private network so that they could access human resources like personnel perquisites, retirement, latest news and the other applicative staff information and ultimately instruction and development of the human resources are presented to the staffs.(Castells.M,2003,P105)

5- B2B model: the major part of the electronic trade or business are purchases which are not done by consuming undertaking but the producers buy the brokering or intermediating goods from the other producers. In brief, using the B2B between two set of producers, one can increase the quality and speed as well as reducing the costs.(www.ebusiness.edu)

6- B2C model: in this method, companies are trying to sell their products to the final consumers through internet. Of course, in this model, the reliance of the buyers and their payments are through internet which have no need to extensive detail and physical observation, some affairs like travel services, book selling, music, sending a gift etc.( van Brakel,2009,p145)

## METHODOLOGY

The method of this study is of type surveying- descriptive and is an applicable research (Delavar,2007,P.89).There was used library and field method for collecting the information.

For data collection there was used books, papers, thesis, and domestic and foreign magazines as well as designing a proper questionnaire based on the spectrum of Likert. Population for this study includes superior managements, and sales and marketing experts as well as exports and after-sales services. Sampling method is of simple accidental type and size of sample was calculated according to the given size of population, i.e. 200 people from managers and obtained about 170 using following formula:

$$n = \frac{NZ^2pq}{(N-1)d^2 + Z^2pq}$$

The variables of this study defined as below:

Dependent variable: electronic services in municipality

Independent variable**:** Toles model whose factors are under investigation

Toles factors under investigation are as follows:

(Technical, economical, legal, chronological, operational)

In order for analyzing the information there was used descriptive statistics: central indices (mean and mode) and distribution indices (variance and standard deviation).

There was used inferential statistics (i.e. single sample t tests, and Freedman test) for determining the priority and importance of any test hypothesis.

The data analysis, as a stage of scientific method is fundamental in any study by which all researching activities are controlled to achieve related result.

Single sample t test for testing the hypothesis related to independent variables obtained by following table1:

**TABLE 3: THE STATISTICAL ANALYSIS AND TEST OF HYPOTHESES**

| Test / Hypothesis | Sample No. | Sample mean | SD | T test value | d.f | P-value | Result |
|---|---|---|---|---|---|---|---|
| Hypothesis I: It is theoretically possible for electronic service to be established at Ahvaz municipality network | 170 | 3,4422 | 0.5058 | 11.398 | 169 | 0.00 | Accepted |
| Hypothesis II: It is economically and financially possible for electronic service to be established at Ahvaz municipality network | 170 | 3,8980 | 0.4725 | 24.780 | 169 | 0.00 | Accepted |
| Hypothesis III: It is legally possible for electronic service to be established at Ahvaz municipality network | 170 | 4,1055 | 0.4528 | 31.842 | 169 | 0.00 | Accepted |
| Hypothesis IV: It is temporally possible for electronic service to be established at Ahvaz municipality network | 170 | 4,2662 | 0.4284 | 38.535 | 169 | 0.00 | Accepted |
| Hypothesis V: It is operationally possible for electronic service to be established at Ahvaz municipality network | 170 | 4,2853 | 0.4405 | 38.046 | 169 | 0.00 | Accepted |

Because practical mean of all hypothesis is greater than theoretical mean of Likert spectrum (3), therefore, in 5% error level with p-value=0, all hypothesizes are accepted.

In order for prioritizing and determining the importance of any hypothesis, there was used Freedman test .As indicated, in the 5% significant level, it is accepted/ rejected the hypothesis with the same rank. Therefore, five variables may not possess the same importance. Following table indicates the rank of variables in table 2

**TABLE 4: TEST RESULT SUMMERY TO PRIORITIZE RESEARCH THEORIES**

| Sample value | test statistic value | Freedom degree | P-value | Test Result |
|---|---|---|---|---|
| 170 | 320.304 | 5 | 0.000 | rejecting Hypothesis of Zero |

**TABLE 5: INDICATING GRADES OF FIVE VARIABLES OF RESEARCH IN MEASURING POSSIBILITY OF APPLICABILITY**

| Mean of grades | Variable titles |
|---|---|
| 1.95 | Technical |
| 3.48 | Financial and economical |
| 3.99 | Legal |
| 4.56 | Temporal |
| 4.66 | Operational |

Prioritization of research variables from the viewpoints of respondents based on Freidman test is as following:

1- Operational
2- temporal
3- legal
4- Financial and economical
5- technical

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## CONCLUSION

Every advanced technology creates new opportunities and threats for organizations. Changes in technology impose changes in the commercial laws of corporations and transform the social and organizational systems .According to studies, the need for change in traditional methods in municipality is essential. Electronic municipality provides the possibility of rendering information using information technology and relying on the Internet, faster with higher speed and quality and decreases the costs. Advantages like quick access to information, coordination between different organizations, promotion of tourism, possibility of creating more centralized management and more control and supervision and as a result, reduced corruption and time, money, energy and paper saving as well as the possibility of providing municipal services to citizens at any time and any place, is the indication of the importance and necessity of creating an electronic municipality that its necessity is to create a required cultural space for acceptance of electronic municipality for social and economic development and employment of specialists and efficient forces .The results of chapter V confirm the research hypotheses which examined from directors and employees point of views .Also Friedman test is ranking favorable conditions for each variable as follow: operational, temporal, legal, economic, financial and technical ranking that in this study, in implementation of electronic rendering systems of civil services, municipality has the most favorable and unfavorable situation in operational and technical variables respectively.

It is explicit that the most unfavorable situation in the municipality, according to acquired ranking, can be improved easily by attraction of human resources' practical participation as well as call for private sector investment and take necessary actions toward implementation of civil services electronic rendering systems.

In the permanent interpretation of the electronic services' systems following the advanced world, today the satellite networks for the most poor people at the far distant place of the earth that in addition to its wideness and extension due to the prevalence of citizens and rural people of its networks are visible and are welcomed and required by them, it is necessary that in a perfect vital form for country, exert their attempt for creating the electronic infrastructures and subsystems in order to providing urban and rural electronic services.

But particularly, the priority of the variables in this study indicate that, in spite of the necessity for implementation of the electronic services systems, it is necessary that the Ahwaz municipality attempts to bringing about these sorts of systems with the help and support of the government and private sector at the earliest convenience.

Operationally, the condition is completely prepared for implementation and delay is in no way justifiable.

- Moreover, of legal view, the condition is fully ready for implementation of the systems for providing electronic urban services and not only there is no restraint but also the additional condition on the diagnosis and encouraging have an emphasis state as well.
- The economical and financial complicated condition is associated in such a way that merely lower than 50% of the participants evaluated the possibility of the implementation of the urban electronic providing services' systems using financial resources of Ahwas to be favorable. It is recommended that the necessary cooperation be made by municipality in the execution of electronic services' intelligent systems of the economical and financial power of the private section including Ahwazi citizens or outside Ahwaz by summoning the capital absorption and in economical view as well, the capital participation or cooperation absorption is one of the serious and approved needs of the government especially with regard to the economical jihad (campaign) year.
- Is related to the technical field in the feasibility assessment in this research that like the obtained results, namely more than 70% of the subjects evaluated the municipality power for bringing about the electronic systems to be poor technically, it is completely true and this weakness can be removed and promoted by absorbing the cooperation and participation of the private sector of the government especially the private sector.

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# ANALYSIS OF MOBILE AGENT BASED E-SUPPLY CHAIN MANAGEMENT SYSTEM USING QUEUING THEORY: A COMPARATIVE STUDY BETWEEN M/M/1 AND M/D/1 MODELS

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## ABSTRACT

*The product reaches at dispense of consumer through diverse segments. The amalgamation of all these phases is often being phrased as Supply Chain. Effective and Efficient utilization of these phases assists an organization to optimize the overall outlay of production activities. SCM utilizes technology to manage these supply chain in a methodical approach resulting in enhanced deployment of resources thereby improved operational efficiency and effectiveness. Advent of Internet technologies added a new aspect to SCM, by connecting the enormous network of supply chain through Internet, often being referred to as e-SCM. e-SCM initiated the notion of "anyone, anything, anywhere", which influences a product's time-to-market, price, quality, information exchange, delivery, amid other activities of SCM. In this manuscript, a Mobile Agent based Electronic Supply Chain Management (e-SCM) is being proposed. The anticipated model consists of a set of mobile agents functioning cooperatively to uphold supplying, manufacturing, inventory and distributing. Another imperative task performed in the manuscript is to uncover the relevancy of the proposed architecture using Queuing theory. The complete model is being tested on M/M/1 and M/D/1 Queuing models and the comparative study is being conducted based on four queuing parameters, namely, waiting time for customer request in the system, number of customers in the system at a time, time for each customer in the queue, and, total number of customers waiting. Finally, the associated simulations and numeral results are provided to appraise the queuing parameters.*

## KEYWORDS
Mobile Agents, e-SCM, Queuing Theory, M/M/1, M/D/1.

## INTRODUCTION

With the intensification of markets, escalation in information technology, and the curbing life cycle of products, many IT applications have been employed to rationalize and optimize supply chains [1]. One of the most complicated but a vital issue in SCM is to perk up the competence of supply chains from the perspective of the complete supply chain, not individual companies. More explicitly, the configuration, optimization and minimizing the bullwhip effect [2] are considered critical issues for efficient supply chain management [3], [4]. Advent of Mobile Agents added additional prospects for the management of supply chain. As the complication and extent of supply chains amplify, companies are finding it thornier to assemble systems sustaining the dexterity of activities executed by the autonomous supply chain members. Agent-based Supply Chain Management system could endow with an elucidation to this quandary, as they present the prospects to assemble a large, multifaceted system out of relative simple, autonomous parts [5].

The attempt of this manuscript is twofold:

1. to blueprint a mobile agent based e-SCM, thereby, improving the synchronization within a supply chain and gratifying the organizational requirements, and
2. to evaluate the complete system using two different queuing models, M/M/1 and M/D/1 and then selects the preferable model.

The e-SCM model is developed using Mobile Agents because of its following characteristics [6]:

1. Intelligence: Mobile agents utilize techniques from the field of artificial intelligence, which empower Mobile Agents with intelligence and common sense. This feature helps the Mobile Agents based e-SCM with the decision making capabilities as supply chain consists of autonomous cooperating systems. Decision-making capabilities require multiparty negotiation and coordination.
2. Autonomy: Mobile Agents can self decide the sequence of actions to be performed to achieve the give task. This autonomy enables Mobile Agents to operate without requiring human involvement. This characteristic helps to manage the interactions between humans and humans and information systems.
3. Responsiveness: Mobile Agents perceive their environment (which may be the Internet, a collection of other agents, etc.) and respond in a timely fashion to changes that occur in it. At the same time, agents should not simply act in response to their environment; they should be able to exhibit opportunistic, goal-oriented behavior and take the initiative when appropriate.
4. Communicative Ability: Mobile agents provides user friendly interface so that the end user can easily interact with the agent. Agents are social entities and often communicate and collaborate with one another in order to complete their tasks. For example, the mobile agent can communicate with other mobile agents and act accordingly.
5. Adaptability: Mobile Agents learn about the user's behavior and adapt themselves to suit the user. A supply chain is adaptive and changes over time. New organizations might become involved and other might disappear.

The proposed Mobile Agent based e-SCM architecture was tested systematically on M/M/1 and M/D/1 queuing models respectively. The vital divergence amid the two models is the methodology espoused for servicing of the requests. In M/M/1 queuing model, the service distribution varies with respect to the type of request, whereas, in M/D/1 queuing model, the service distribution relics constant irrespective of the type of requests. Preference between the models is being recommended in the conclusion component of the manuscript.

The manuscript is divided into following sections: Section 1 of the paper describes the proposed architecture for Mobile Agent based e-SCM. Section 2 elaborates the working steps of the proposed architecture. Section 3 mentions the complete working model using UML 2.0 diagrammatic technique, called, Sequence Diagram. Section 4 depicts the flowchart of the proposed system and elaborates the basic difference between M/M/1 and M/D/1 queuing model. Section 5 demonstrates the findings of four queuing parameters being worn in the design. Section 6 illustrates the result analysis and the relative study of the model among M/M/1 and M/D/1 queuing system. Section 7 concludes the paper.

## ARCHITECTURE OF MOBILE AGENT BASED e-SCM

The proposed architecture is alienated into three stages, Z, Y and X correspondingly. At stage Z, there are two Mobile Agents $[BA_Z]$ and $[SA_Z]$. $BA_Z$ is the end-customer, who actually gives the order to the suppliers. The mobile agent for suppliers is represented by $[BA_Z]$. $[BA_Z]$ amasses the information from inventory of $[SA_Z]$, and transfers the requests to Production Agent, $[PA]$. Upon getting the requests, $[PA]$ frontwards the requests to Buyer Agent at Stage X, represented as $[BA_X]$, who process the requests and relocates it to Supplier Agent at Stage X $[SA_X]$.

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Figure 1 gives the complicated and multifarious analysis of e-SCM architecture. Each node specified in the architecture symbolizes supplier of some type. So, Seller Agent $\left(S_A\right)$ at stage X will be able to sell to Buyer Agent $\left(B_A\right)$ at stage Z. This case is valid for all the stages.

The simplified structure of Supply Chain as mentioned in Figure 1 is depicted in Figure 2, which is 1-node architecture of Supply Chain.

**FIGURE 1: 1-NODE e-SUPPLY CHAIN ARCHITECTURE**
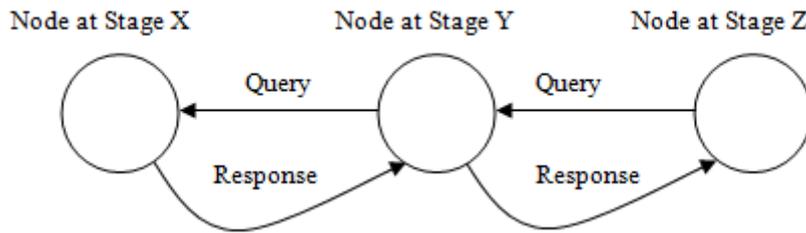


There are two important facts that have to be considered from Figure 7 and Figure 8 respectively.

***Fact 1:*** Buyer Agent $\left(B_A\right)$ initiates the process at Stage $Z$ and Seller Agent $\left(S_A\right)$ at Stage $X$ completes the cycle.

***Fact 2:*** It is assumed that:

Stage X is the stage of procuring raw materials.

Stage Y is the stage of production.

Stage Z is the stage wherein the end customer enquiries for the product.

These mobile agents are alienated into three phases as given in Figure 1. It is assumed that each node is represented by one mobile agent. It is also presumed that each stage X and Z has "n" number of suppliers and buyers, as illustrated in Figure 2.

**FIGURE 2: 3-NODE n-TIER SUPPLY CHAIN ARCHITECTURE**

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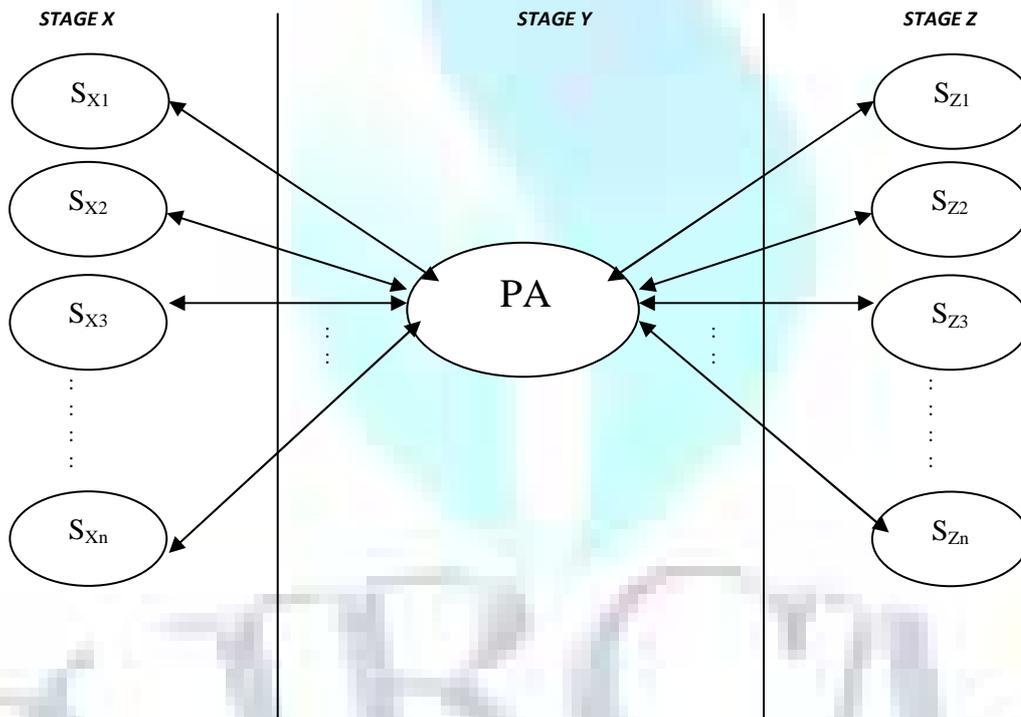
## WORKING STEPS OF SUPPLY CHAIN USING MOBILE AGENT

The elaborated version of proposed architecture is given in Figure 3.

**FIGURE 3: COMPLETE ARCHITECTURE OF IMPLEMENTATION OF MOBILE AGENTS BASED e-SCM**
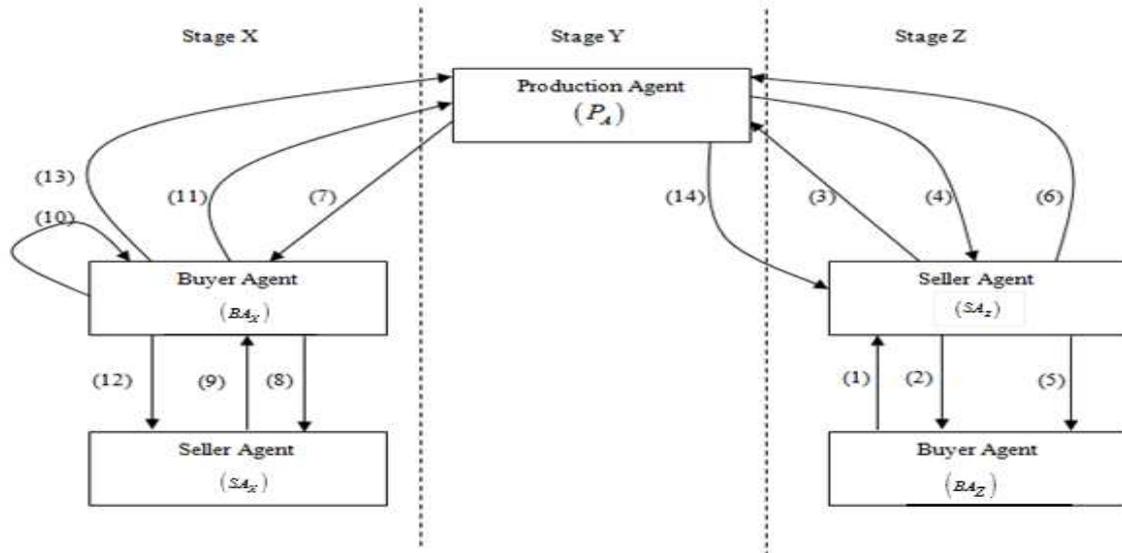


The working steps are as follows:

**Step 1:** The Buyer Agent at this stage $\left(Stage\ Z\right)$ is the end customer. Number of Buyer Agents can be mathematically represented as

$$BA_{Z[i]} = \left\{ BA_{Z[1]}, BA_{Z[2]}, \ldots\ldots\ldots\ldots\ldots BA_{Z[n]} \right\}\ \forall i = 1\ldots\ldots.n \tag{1}$$

The demand for each of these Buyer Agents $\left(BA_x\right)$ are

$$D_{Z[i]} = \left\{ D_{Z[1]}, D_{Z[2]}, \ldots\ldots\ldots\ldots, D_{Z[n]} \right\}$$

Maximum prices which a buyer can pay are

$$MP_{Z[i]} = \left\{ MP_{Z[1]}, MP_{Z[2]}, \ldots\ldots\ldots\ldots\ldots, MP_{Z[n]} \right\}$$

Expected price from the seller can be denoted as

$$EP_{Z[i]} = \left\{ EP_{Z[1]}, EP_{Z[2]}, \ldots\ldots\ldots, EP_{Z[n]} \right\}$$

Cost price for the buyers

$$CP_{Z[i]} = \left\{ CP_{Z[1]}, CP_{Z[2]}, \ldots\ldots\ldots, CP_{Z[n]} \right\}$$

**Step 2:** Upon receiving the Buyer Agents $\left[ BA_{Z[i]} \right]$, the number of Seller Agents are generated as

$$SA_{Z[i]} = \left\{ SA_{Z[1]}, SA_{Z[2]}, \ldots\ldots\ldots, SA_{Z[n]} \right\} \tag{2}$$

Each of these agents has the following data

- Price that will be offered $\left( OP_Z \right)$
- Capacity $\left( CAP_Z \right)$
- Lead Time $\left( TL_Z \right)$
- Delivery Date $\left( DD_Z \right)$
- Cost of Product $\left( CP_B \right)$
- Weight of each customer $W_{B_Z}$

Each of the Seller Agent $\left[ SA_{Z[i]} \right]$ then ranks all by the buyers by comparing expected price from each buyers with the maximum price.
Selection Criteria:

$$\left( MP_{Z[i]} > EP_{Z[i]} \right) \forall i = 1\ldots\ldots\ldots.n \tag{3}$$

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Rank Criteria:

$$Rank = DESC\left(MP_{Z[i]} - EP_{Z[i]}\right)\forall i = 1.........n \tag{4}$$

where, $DESC$, is the Descending Sorting.

**Step 3:** The Seller Agent $\left[SA_{Z[i]}\right]$ receives the orders to fulfill as per the demands from different buyers, but has the limitation of Capacity

Capacity Criteria:

$$CAP_Z >= Selected\ buyers\ from\ D_{Z[i]} = \left\{D_{Z1} + D_{Z2} + ............... + D_{Zn}\right\} \tag{5}$$

The demands from the selected number of buyers are added and taken into consideration.

It must be noted that the Production Agent $\left(P_A\right)$ does not have capacity to fulfill all the orders. So, $P_A$ requests $\left[SA_Z\right]$ to rank them according to their weights.

Rank criteria of the Buyers by the Seller Agent $\left[SA_Z\right]$ is called Buyer Weights.

**Step 4:** The Buyer Weight $W_{B_{Z[i]}}$ is based on the two assumptions:

Assumption 1: If the Buyer has earlier bought the products from the seller, the weight are assigned as

$$W_{B_{Z[i]}} = W_{B_{Z[i]}} + 1 \tag{6}$$

When, Buyers buy for the first time, then

$$W_{B_{Z[1]}} = 0$$

Assumption 2: Apart from the weight, the total quantity is also a must, and is given by $TQ_{B_{Z[i]}}$.

$$\text{If,}\ W_{B_{Z[i]}} = 0,\ TQ_{B_{Z[i]}} = 0 \tag{7}$$

$\left[SA_Z\right]$ will respond to $P_A$ about $\left\{W_{B_{Z[i]}}, TQ_{B_{Z[i]}}\right\}$ of the Buyer.

**Step 5:** In this step, the seller acknowledges its decisions to all the buyers. The rejected buyers can make their submissions again depending on their demand requirements. If the seller agent $\left[SA_Z\right]$ gets an order with a better price from any of the rejected buyers, it has two options:

Option 1: It can prefer this customer, but due to capacity constraint it has to reject one or more of the already selected buyers. In such a case, the rejected buyer will list the seller in the defector list and its weight will go down.

$$W_{S_{Z[i]}} = W_{S_{Z[i]}} - 1 \forall i = 1..n \tag{8}$$

Option 2: The second option for the seller is to reject the profitable offer from the buyer and stick to its original generated buyer list and thereby avoiding the reduction of its weight in the selected buyers list.

Such a selection between any of the above-mentioned two options is called Negotiating Criteria and is given by Mathematical formula as stated

$$Negotiating\ Criteria = DESC\left[\left(CP_{B_1} - CP_{S_1}\right),....................,\left(CP_{B_n} - CP_{S_n}\right)\right] \tag{9}$$

It must be noted that the initial price from all the buyers will be the Current price of the Seller $\left(CP_{S_i}\right)$ only. It is only after rejection, the buyer may submit a new price by adding an additional amount to buy the product depending on their demand requirements.

$$CP_{B_i} = CP_{S_i} + x \tag{10}$$

where, $x$ is the added amount to the product purchase, which is based on price being offered to the seller.

**Step 6:** The Seller Agent $\left(SA_Z\right)$ now forwards all the accepted orders (as mentioned from Step 1- Step 5) along with the Delivery deadlines $\left(DD_{Z[i]}\right)\forall i = 1.......n$ to the Production Agent $P_A$.

**Step 7:** The Production Agent $\left(P_A\right)$ gets all the information as required from the Seller Agent $\left(SA_Z\right)$. Now $P_A$ starts communication from Buyer Agent $\left(BA_X\right)$ of Stage $X$. From $BA_X$, $P_A$ gets the information about holding cost $\left(H_C\right)$ and Lead Time $\left(T_L\right)$ to evaluate the following

Maximum Price of Buyers ➜ $\left[MP_{BA_{X[i]}}\right] >= Current\ price\ of\ Seller - H_C - PE_B$

$$= CP_{S_{X[i]}} - H_C - PE_B \tag{11}$$

Delivery Deadline

$$DD_{X[i]} >= T_L + DD_{Z[j]} \forall i = 1....n\ and\ j \in \left\{selected\ buyers\ at\ stage\ Z\right\} \tag{12}$$

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**Step 8:** The Buyer Agent $\left[BA_{X[i]}\right]$ asks for the current price $\left(CP_{B_X}\right)$, capacities of the seller $\left(CAP_{B_X}\right)$ and Demand Deadlines of the item $\left(DD_{B_X}\right)$.

**Step 9:** The Seller Agent $\left[SA_{X[i]}\right]$ upon receiving this, sends current price $\left(CP_{B_X}\right)$, capacities of the seller $\left(CAP_{B_X}\right)$ and Demand Deadlines of the item $\left(DD_{B_X}\right)$ as response.

**Step 10:** The Buyer Agent $\left[BA_{X[i]}\right]$ then ranks all the sellers based on the condition (as given in Step 2).

Selection Criteria:

$$MP_{BA_{X[i]}} > EP_{BA_{X[i]}} \quad \forall i = 1....n \tag{13}$$

Rank Criteria:

$$Rank = DESC\left(MP_{X(i)} - EP_{X(i)}\right)\forall i = 1.........n \tag{14}$$

**Step 11:** The Buyer Agent $\left[BA_{X[i]}\right]$ then selects the preferred Sellers based on the comparison of their expected price with its maximum price.

**Step 12:** The Buyer Agent $\left[BA_{X[i]}\right]$ submit the offers to the Sellers. It must be noted that the offer is being made through rank criteria as described in Step 10. If the seller rejects the offer, Buyer Agent has two options:

Option 1: $\left[BA_{X[i]}\right]$ can submit the request to the next ranked seller. This is performed by scanning through the list generated by rank criteria.

Option 2: $\left[BA_{X[i]}\right]$ can again the offer to the same seller with the better price $\left(B_P\right)$ option.

**Step 13:** Out of any of two options being selected from Step 12, the Buyer Agent $\left[BA_{X[i]}\right]$ informs the $P_A$ and waits for the response to be received. After $\left[BA_{X[i]}\right]$ gets the response, it evaluates the $\left(DD_{B_X}\right)$. If $\left(DD_{B_X}\right)$ goes beyond the expected date, it will put the sellers in the defectors list and its weight goes down. The updated information is being informed to $P_A$. After this, $\left[BA_{X[i]}\right]$ activates the payment process.

**Step 14:** The final step activates after the production is completed. $P_A$ informs $\left[SB_{Z[i]}\right]$ to finally deliver the goods to the buyers and communicate the payment process to the Buyer. $P_A$ also starts to monitor the payment from the buyer. If the buyer does not pay for the goods received on or before the Deadline, it puts the buyer in the defector list and its weight in both $P_A$ and $SA_z$ goes down.

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## BUSINESS PROCESS USING SEQUENCE DIAGRAM

Figure 4 elaborates the complete business process for execution of Supply Chain process using mobile agents. The Figure defines all the 14 steps used for execution of the complete design mechanism.

FIGURE 4: SEQUENCE DIAGRAM FOR THE PROPOSED MODEL

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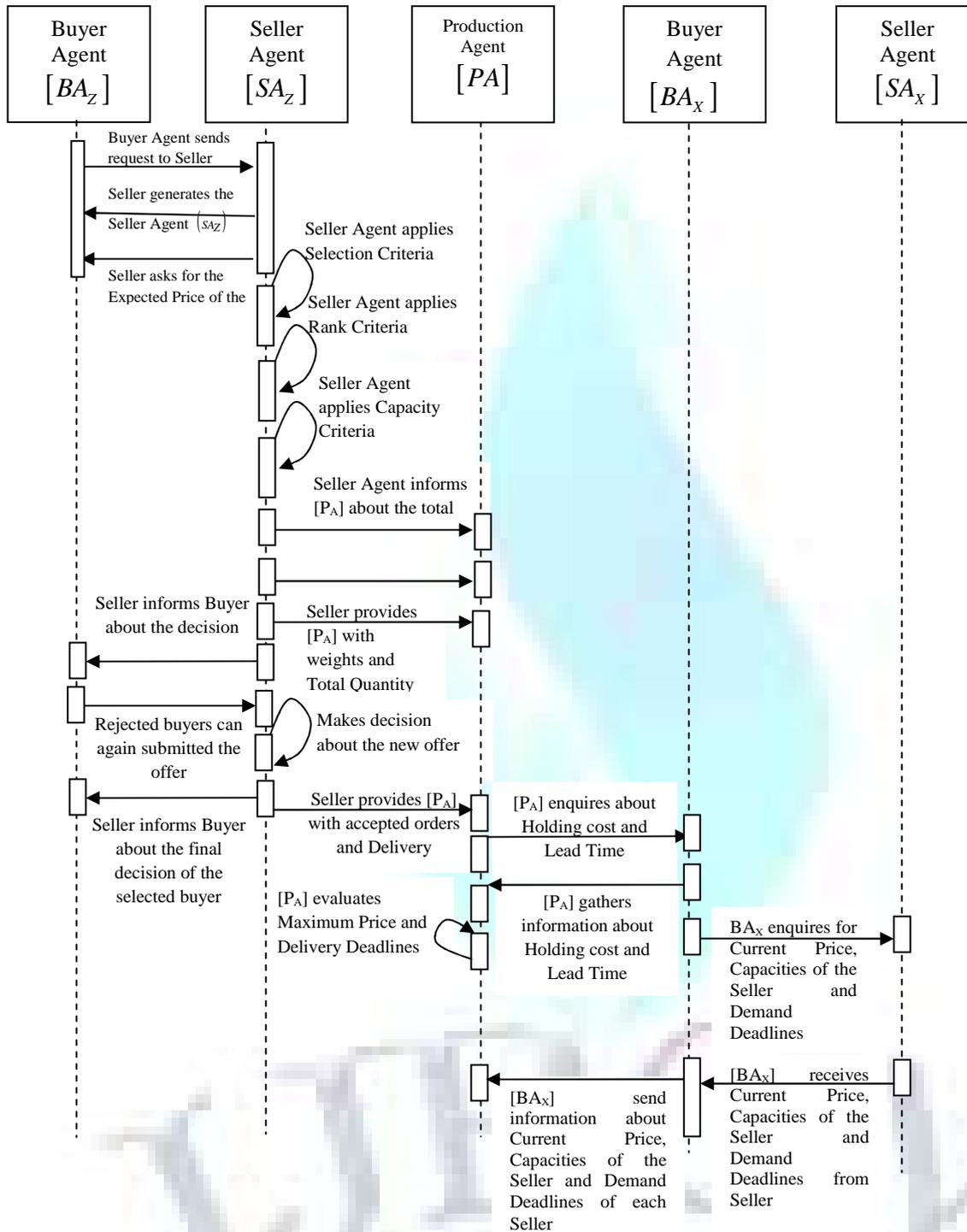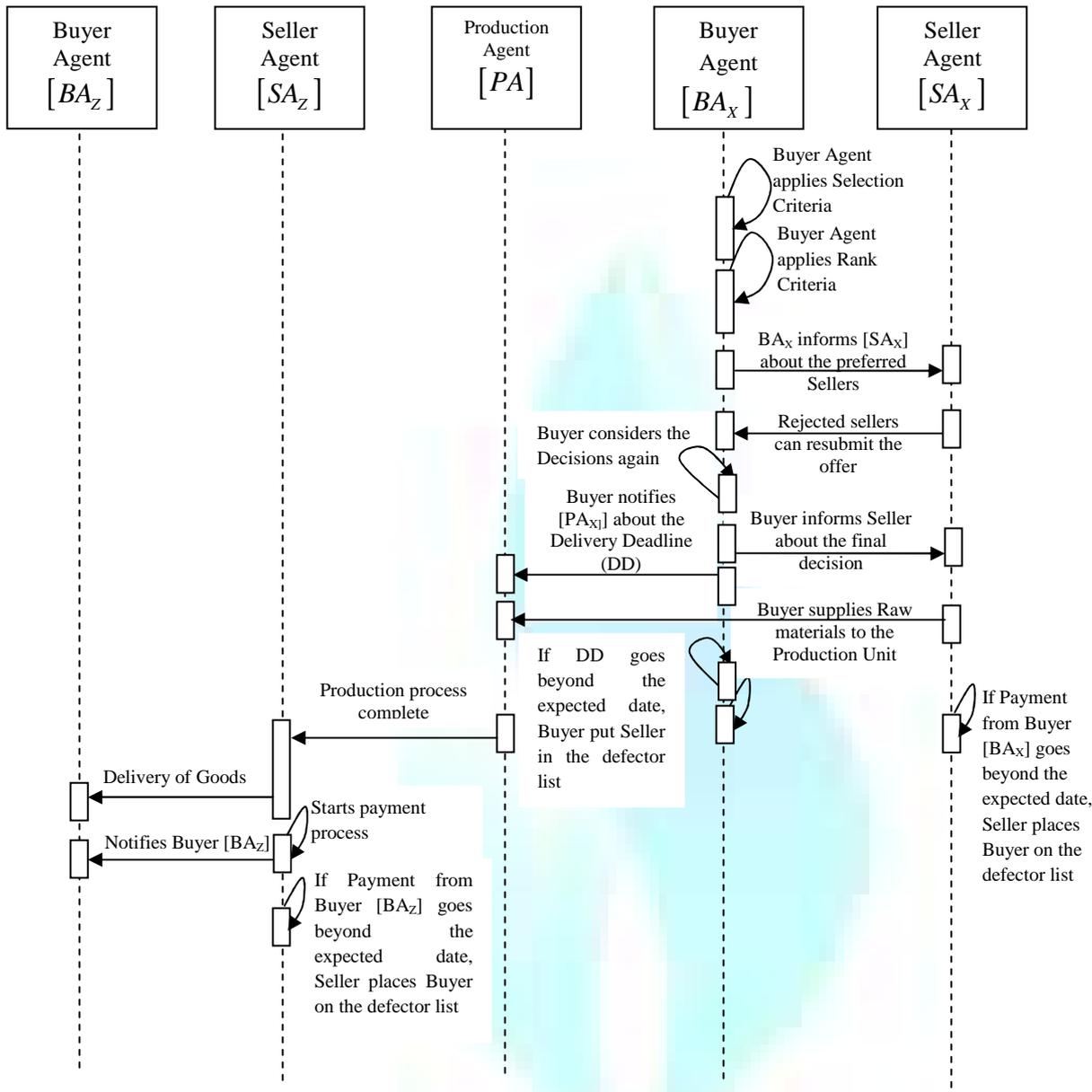
## QUEUING MODELS: M/M/1 AND M/D/1

Queuing models have been established to be incredibly valuable in many practical applications in business such as, e.g., production systems, inventory systems and supply chain management. These applications apprehension in particular design problems, where we necessitate answering difficulties like:

1. Is the system competent to knob the requests?
2. What should be the layout of the system?
3. How do we have to divide work among several capacities?

In countless applications the unpredictability in the arrival and service processes are critical to the performance of the system. Queuing models help us to appreciate and enumerate the effect of variability.

The projected architecture of performance of e-SCM via Mobile Agents was tested based on two different types of Queuing models, namely, M/M/1 and M/D/1. The basis for evaluating the system on queuing strictures is that in M/M/1 model, the service time amends with respect to the number of requests being expected by the model, whereas, in M/D/1 model, the service time vestiges stable irrespective of the requests being received by the system.

The software code was developed using Java 2.0 using Mobile Aglets code and executed considering the number of requests being acknowledged. The software program evaluated the queuing models based on four parameters, specifically,

1. *Average waiting time each request is in the system, $T_q$*
2. *Average of total number of requests in the system, Q*
3. *Average time each request waits in the queue, $T_w$*
4. *Average number of requests waiting, W*

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**4.1 FLOWCHART FOR IMPLEMENTATION OF RESULTS USING M/M/1 QUEUING MODEL**
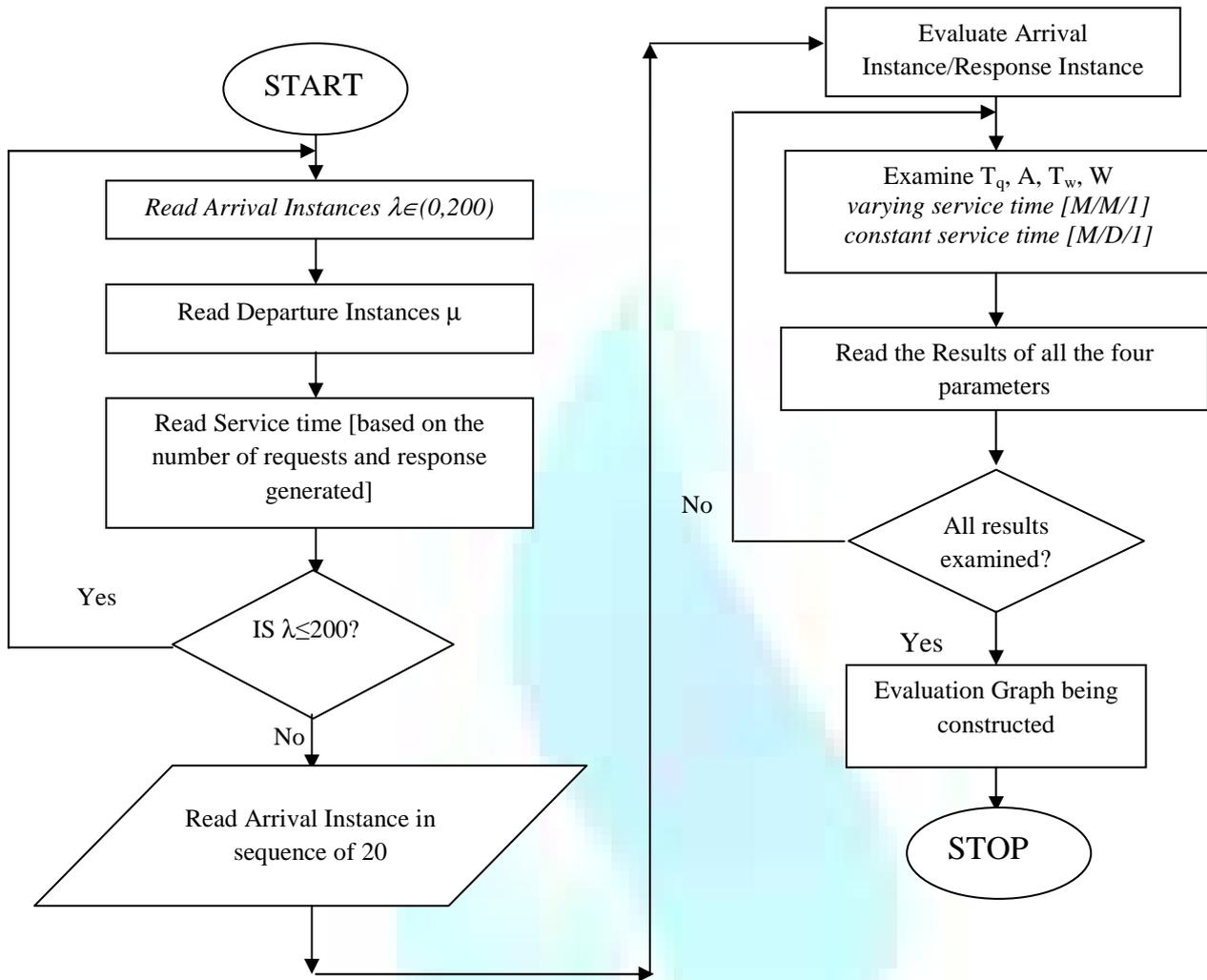


## PERFORMANCE MEASURES

The evaluation of the architecture is being judged using four different parameters (discussed in Section 4). The comprehensive architecture is developed by evaluating the requests acknowledged at the rate of 20 requests and response being generated. The imperative point of concern here is that the response may include the set of requests still not processed from the previous sequence and is added in the next array of requests received by the system. This increases the service time for M/M/1 queuing model affecting the overall performance of the projected architecture. The service time is maintained at constant to numeral value 3.00 in M/D/1 queuing model and the result is being analyzed accordingly.

**TABLE 1: AVERAGE WAITING TIME FOR EACH REQUEST IN THE SYSTEM**

| | | M/M/1 Queuing Model | | M/D/1 Queuing Model | |
|---|---|---|---|---|---|
| Number of requests arriving/sec | Number of responses generated/sec | Service Time/sec (Varying for M/M/1 model) | Average waiting time each request is in the system | Service Time/sec (Fixed for M/D/1 model) | Average waiting time each request is in the system |
| $\lambda$ | $\mu$ | S | $T_q$ | s | $T_q$ |
| 20 | 21 | 0.66 | 13.86 | 3.00 | 33 |
| 40 | 55 | 0.89 | 3.263333 | 3.00 | 7 |
| 60 | 77 | 0.99 | 4.484118 | 3.00 | 8.294118 |
| 80 | 91 | 1.12 | 9.265455 | 3.00 | 13.90909 |
| 100 | 129 | 2.07 | 9.207931 | 3.00 | 8.172414 |
| 120 | 151 | 3.29 | 16.02548 | 3.00 | 8.806452 |
| 140 | 169 | 4.11 | 23.95138 | 3.00 | 10.24138 |
| 160 | 179 | 5.05 | 47.57632 | 3.00 | 15.63158 |
| 180 | 211 | 5.23 | 35.59774 | 3.00 | 11.70968 |
| 200 | 246 | 6.13 | 32.78217 | 3.00 | 9.521739 |

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**TABLE 2: AVERAGE OF TOTAL NUMBER OF REQUESTS IN THE SYSTEM**

| | | M/M/1 Queuing Model | | M/D/1 Queuing Model | |
|---|---|---|---|---|---|
| Number of requests arriving/sec | Number of responses generated/sec | Service Time/sec (Varying for M/M/1 model) | Average of total number of requests in the system | Service Time/sec (Fixed for M/D/1 model) | Average of total number of requests in the system |
| $\lambda$ | $\mu$ | s | Q | s | Q |
| 20 | 21 | 0.66 | 20 | 3.00 | 10.52381 |
| 40 | 55 | 0.89 | 2.666667 | 3.00 | 1.969697 |
| 60 | 77 | 0.99 | 3.529412 | 3.00 | 2.375095 |
| 80 | 91 | 1.12 | 7.272727 | 3.00 | 4.196803 |
| 100 | 129 | 2.07 | 3.448276 | 3.00 | 2.336541 |
| 120 | 151 | 3.29 | 3.870968 | 3.00 | 2.538133 |
| 140 | 169 | 4.11 | 4.827586 | 3.00 | 2.999592 |
| 160 | 179 | 5.05 | 8.421053 | 3.00 | 4.763599 |
| 180 | 211 | 5.23 | 5.806452 | 3.00 | 3.476686 |
| 200 | 246 | 6.13 | 4.347826 | 3.00 | 2.767409 |

**TABLE 3: AVERAGE TIME EACH REQUEST WAITS IN THE QUEUE**

| | | M/M/1 Queuing Model | | M/D/1 Queuing Model | |
|---|---|---|---|---|---|
| Number of requests arriving/sec | Number of responses generated/sec | Service Time/sec (Varying for M/M/1 model) | Average time each request waits in the queue | Service Time/sec (Fixed for M/D/1 model) | Average time each request waits in the queue |
| $\lambda$ | $\mu$ | s | $T_w$ | s | $T_w$ |
| 20 | 21 | 0.66 | 13.2 | 3.00 | 30 |
| 40 | 55 | 0.89 | 2.373333 | 3.00 | 4 |
| 60 | 77 | 0.99 | 3.494118 | 3.00 | 5.294118 |
| 80 | 91 | 1.12 | 8.145455 | 3.00 | 10.90909 |
| 100 | 129 | 2.07 | 7.137931 | 3.00 | 5.172414 |
| 120 | 151 | 3.29 | 12.73548 | 3.00 | 5.806452 |
| 140 | 169 | 4.11 | 19.84138 | 3.00 | 7.241379 |
| 160 | 179 | 5.05 | 42.52632 | 3.00 | 12.63158 |
| 180 | 211 | 5.23 | 30.36774 | 3.00 | 8.709677 |
| 200 | 246 | 6.13 | 26.65217 | 3.00 | 6.521739 |

**TABLE 4: AVERAGE NUMBER OF REQUESTS WAITING**

| | | M/M/1 Queuing Model | | M/D/1 Queuing Model | |
|---|---|---|---|---|---|
| Number of requests arriving/sec | Number of responses generated/sec | Service Time/sec (Varying for M/M/1 model) | Average number of requests waiting | Service Time/sec (Fixed for M/D/1 model) | Average number of requests waiting |
| $\Lambda$ | $\mu$ | s | W | s | W |
| 20 | 21 | 0.66 | 19.04762 | 3.00 | 9.52381 |
| 40 | 55 | 0.89 | 1.939394 | 3.00 | 0.969697 |
| 60 | 77 | 0.99 | 2.750191 | 3.00 | 1.375095 |
| 80 | 91 | 1.12 | 6.393606 | 3.00 | 3.196803 |
| 100 | 129 | 2.07 | 2.673082 | 3.00 | 1.336541 |
| 120 | 151 | 3.29 | 3.076266 | 3.00 | 1.538133 |
| 140 | 169 | 4.11 | 3.999184 | 3.00 | 1.999592 |
| 160 | 179 | 5.05 | 7.527198 | 3.00 | 3.763599 |
| 180 | 211 | 5.23 | 4.953371 | 3.00 | 2.476686 |
| 200 | 246 | 6.13 | 3.534818 | 3.00 | 1.767409 |

## RESULT ANALYSIS

The comparison between M/M/1 and M/D/1 queuing models is being conducted by using both simulation and queuing model based on four stated parameters and the study was undergone with the observation of minimum number of 200 customer requests at a time. Due to restricted time, the research had been conducted with minimum volume, this research can be extended with larger number of requests per unit time and more days of surveillance, it paves the way to give more precise results. The graph(s) in Figure 6 (a)-(d) is depicts the results obtained.

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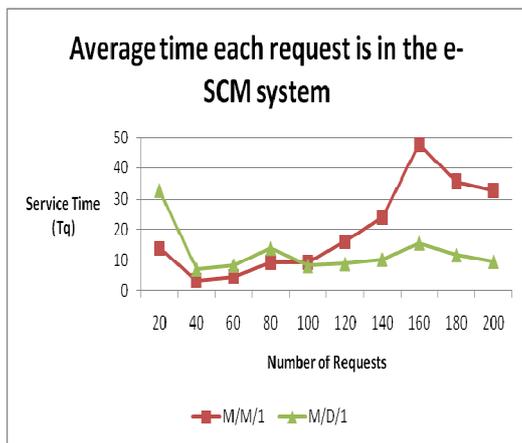
**Figure 6(a):** Evaluation of $T_q$
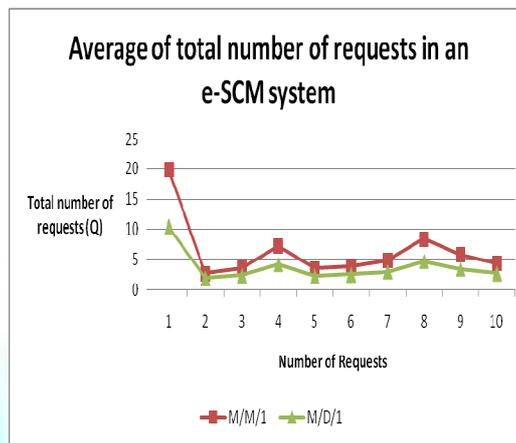


**Figure 6(b):** Evaluation of Q
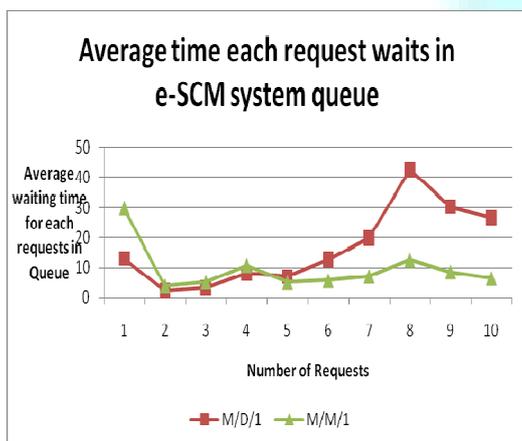


**Figure 6(c):** Evaluation of $T_w$
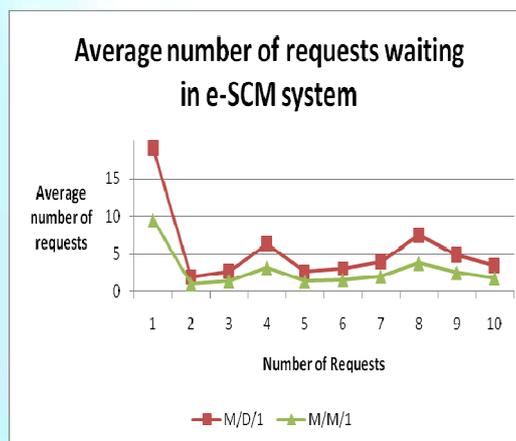


**Figure 6(d):** Evaluation of W

The analysis of the results gives the following result:

1. For lesser number of requests (in range of 20-60 requests) being acknowledged by the system, the suitable adopted model would be M/D/1, keeping the service time constant for dispensation the requests from $BA_z$.
2. For larger number of requests (>60 requests) , the apposite adopted model would be M/M/1, varying the service time with respect to the requests being received by the scheme.

## CONCLUSION

The paper is an attempt to integrate mobile agents and supply chain and evaluate the same by comparing the execution steps using M/M/1 and M/D/1 queuing model. In this work, first study on supply chain, SCM, software agent, mobile agent and mobile agent environment is performed. Then the conceptual model for supply chain using mobile agents is proposed. In this model, almost all the functionalities of supply chain are performed using five different mobile agents. Also, almost all activities of supply chain being performed intelligently and automatically by these agents. Further researches are expected to enhance the agent capability with a perfect knowledge base and enforce its security to protect the sensitive information. However, in all the study conducted earlier, the performance analysis of the complete system was missing. The mathematical analysis of the proposed e-SCM model using Mobile agents is an attempt in the direction and the study will be continued even further with larger number of requests being received and evaluated.

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# PREPARING PRE-SERVICE TEACHERS TO INTEGRATE EDUCATIONAL TECHNOLOGY IN THE COLLEGES OF EDUCATION CURRICULUM IN THE CENTRAL REGION OF GHANA

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## ABSTRACT

*The enclave of education through educational technology continues to raid the whole wide world with its attendant benefits. If how 21st century classroom pre-service teachers in the colleges of education teach with educational technology is our bother then how teacher educators prepare pre-service to teach with technology should be the utmost concern. Recent changes in basic qualifications for teacher educators to teach in Ghanaian colleges of education as well as the acceptable qualification for teachers who wish to teach at the basic school level has necessitated an assessment of teacher know-how on technology integration. This study used survey method to explore 128 out of 140 teacher educators' (tutors) opinion on how they go about integrating educational technology in their pre-service teacher preparation. The findings of the study suggest that little or nothing is being done to teach pre-service teacher candidates how to integrate technology in their classroom practices. It was consequently recommended that policy makers, researchers, curricula developers and other policy publics must take advantage of the high awareness of the usefulness of educational technology to proliferate this ubiquitous tool to education's advantage.*

## KEYWORDS
Educational Technology, Integration, Pre-service Teachers, Teacher Educators

## INTRODUCTION
The use of computer technology and the internet in education, especially in the teaching and learning process has resulted in academic improvements globally (Butzin, 2000; Sivin-Kachala & Bialo, 2000). As a result, there is an emerging concern for training teacher educators who have no background in Educational Technologies (ET) in developing countries (Cawthera, 2003), such as Ghana, to learn from countries that have already taken the lead in integrating educational technology into teaching and learning. An examination of the use of computer technology in Ghanaian schools indicates that computers and the internet for educational purposes are used more in urban than rural secondary schools (Parthermore, 2003).

The term *educational technology*, also referred to as learning technology is the study and ethical practice of facilitating learning and improving performance by creating, and managing appropriate technological processes and resources (Laurillard, 1993). The term educational technology is often associated with instructional technology theory and practice. While instructional technology covers the processes and systems of learning and instruction, educational technology includes other systems used in the process of developing the human capability to use technology in teaching. Laurillard further stressed that educational technology includes, software, hardware, as well as internet applications and resources. Other technologies commonly available to the mass of the population like television and mobile phones are also counted among educational technology tools.

Teacher preparation in the 21st century has never been demanding like it is today, because according to Gold (1996), it has sought to engage stakeholders involved in teacher preparation in the world to develop strategies to aid technology use in the classrooms. The level of impact of educational technology on an educational system depends on the context and the stage of educational development, readiness of the economy and availability of seasoned literature in the local context besides other factors (Yackulic & Noonan, 2001).

Addo (2001) agreed with the argument that that ICT is changing how we work, play, learn, travel and govern. Addo further concurred that throughout the world, information and communication technologies are generating a new industrial revolution already as significant and far-reaching as those of the past. Addo further stated "It is a revolution based on information, which is itself the expression of human knowledge. Technological progress now enables us to process, store, retrieve and communicate information in whatever form it may take, unconstrained by distance, time and volume."(p. 144).

## BACKGROUND
Teaching is one of the most challenging professions in the society where knowledge is expanding rapidly and modern technologies are demanding teachers to learn how to use educational technologies in teaching. According to Jonassen (1999), while new technologies increase teachers' training needs, they also offer part of the solution to quality teacher production for the 21st century classroom. Information and Communication Technology (ICT) has the potential of providing more flexible and effective ways of professional development for teachers, improve pre- and in-service teacher training, and connect teachers to the global teacher community. The teacher quantity is important to all meaning persons but teacher quality is not just important but also considered essential.

Pupils learn better with the use of educational technology (Haughey & Anderson, 1998; Shutte, 1999). The extent of flexibility, accessibility, increasing communications and interactions in terms of teaching and learning that educational technologies afford make them desirable in preparing quality teachers in the various sub-sectors of the technical and vocational training programmes for Ghana. Today, educational technology has contributed to the teaching and learning efforts and the advantages that come along with it are further strengthened by the contributions of these tools in effective teacher training programmes (Reynolds, 1989).

Advances in computer technology together with the increasing complexity of an evolving global society have had an enormous effect on education and have produced serious contemplation of some manner of educational reform. Of course, it is difficult to talk about educational change without inviting resistance. The education system in Ghana in the first one and half decades after independence had been described as one of the best in Africa (Akyeampong, 2004; World Bank, 2004). However, Akyeampong further points out that in the 1970s the education system began to slip slowly into decline and prompting several commissions of inquiry, notably the Dzobo Education Review of 1973 (formed to determine the causes and way forward for recovery). Thus, the subsequent restructuring that has plagued education ever since are bound to be the source of today's educational cynicism (Akyeampong, 2001; Kelceoglu, 2006).

At the planning stage for integration of educational technology and other eLearning tools in teacher preparation, priority is given to strategizing, initiating, sustaining, monitoring and evaluation. Haddad (2002) was of the view that work sharing and work scheduling needs to be done which could only happen if the key role of all the players in the integration (implementation) process are identified and noted. There are unanticipated changes in knowledge, methodologies, pedagogical issues, students, school culture – all of which a teacher is bound to deal with alone. Haddad further relates that educational technology can break the professional isolation by permitting, among educators, communication, and exchange of information, chat rooms, bulletin boards, discussion forums, and virtual conferences.

The basis of educational technologies that apply in schools in the 21st century in Ghana hangs on two policy documents. The two policies that were identified to affect the design, development, utilization, management, and evaluation of educational technology according to the Ministry of Education (2009) are:
1. the ICT for education policy and
2. ICT for Accelerated Development (ICT4AD).

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The methodology courses at the College of Education institutions in Central Region of Ghana have Introduction to ICT as a course. The course on introduction to ICT touches on fundamentals in computing as it relates to knowledge and its application to Microsoft Word and Excel. The content of this course does not focus on integration of technology in teaching and learning at the College of Education level in Ghana (Course Syllabus, 2005). Since technology is

The commitment of Ghana at integrating educational has been expressed in a report to UNESCO (Benneh, 2006). Benneh, the national coordinator of the Teacher Training Initiative for Sub-Saharan Africa (TTISSA) programme, highlighted strategies as the assigned reasons why Ghana Education Service (GES) through the Teacher Education Division should be particular about integrating technology as:

1. New breed of teachers could be produced; that is e – teachers who are well – vested in electronic teaching and learning approaches.
2. New technologies syllabuses can be drawn for teacher professional development
3. A regional online teacher resource base and offline net work for teacher training institutions could be established to share teacher – developed education course wares and innovative pedagogies.
4. Country specific ICT pedagogies and models of different learning environments and teacher – developed e – lesson plans and educational software could be achieved.
5. ICTs as pedagogical tools and educational resources could be used to link pre-service teacher training and in-service teacher professional development.
6. More trained teachers in ICT pedagogies should be produced from colleges to take advantage of e-learning (p. 9-10).

Benneh (2006) stated on the occasion of inauguration of TTISSA that, "(a) More curriculum specialists and technicians need to be trained to provide the range of skills necessary for quality IT-based teaching materials, (b) Educational facilities in schools and community libraries should be made available, (c) There should be a total commitment from governments, communities and other stakeholders in education to support ICT-enhanced Open Distance Learning (ODL) programmes for teachers, (d) There should be Higher Education research support in the use of ICTs in teaching and learning at all educational levels, (e) ICT forms part of TTC (CoE) curriculum. The infrastructure will continually be deployed until each institution has enough of such facilities. Training of curriculum leaders is ICT education is on-going" (p. 9-10).

Notably, the concerns and strategies enumerated by Benneh (2006) did not deviate from ICT4AD policy which spelled out the general strategy of government integrating technology but rather she selected as her focal agenda the teacher preparation aspect. Other researchers point to strategies and actions that could lead to successful ends in integrating teaching technology in the Ghanaian context (Mangasi, 2007, Yidana, 2007). This study, however, is aimed at breaking the grounds for posterity in terms of technology adoption at the Colleges of education in Ghana. The suggested model for educational technology integration follows the framework Figure 1 proposed by Pi-Sue (2004).

**FIGURE 1: FRAMEWORK FOR INTEGRATING TECHNOLOGY IN EDUCATIONAL SETTINGS**
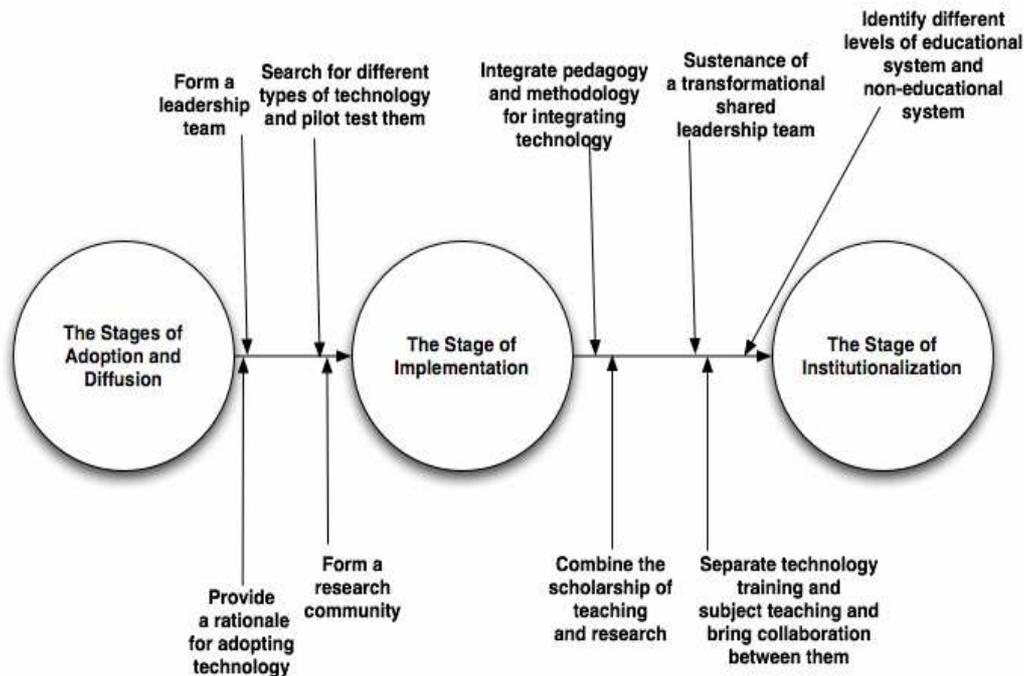


*Source: Adopted from Pi-Sui (2004: 153).*

The comprehensive framework designed by Pi-Sue (2004) supports an educational system grounded in educational technology. In a related strategy, Pi-Sue reflects on a simplified model for the adoption of educational technology. Figure 2 shows the reflection model for educational technology integration proposed by Pi-Sue (2004).

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**FIGURE 2: TECHNOLOGY INTEGRATION: THE REFLECTIVE MODEL**
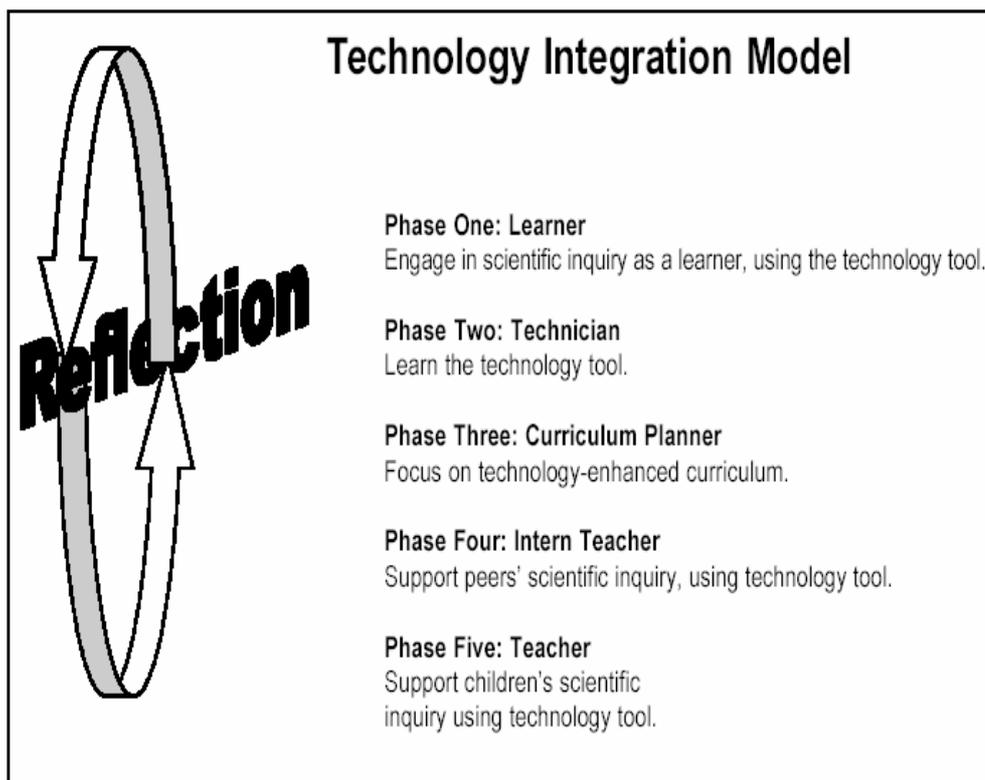


*Source: Adopted from Pi-Sui (2004, p 81).*

## STATEMENT OF THE PROBLEM

The recent change of minimum requirement for teachers from certificate in teaching to Diploma in Basic Education has increased the depth of details of taught courses in the Ghanaian Colleges of education (Abreh, 2010). The Republic of Ghana produced an ICT for Accelerated Development and ICT for education policies to provide direction for ICT integration in school curriculum. Despite the new provision that the changes in teacher education and training provides there has not been corresponding strategies that provide detail on what integration model that the system provides. In an attempt to understand the variables that work for and those that work against development of models of technology integration, it has become crucial to explore how pre-service teachers in Ghanaian Colleges of education are prepared to make use of these ubiquitous tool for quality education delivery to take place.

## METHOD

The study employed descriptive survey research. The survey design was considered apparent for a couple of reasons. In the first place, exploratory data was sought from respondents who work closely with Colleges of education curriculum. Secondly, since the study used descriptive survey the study is unable to uncover other related details in unparallel ways. The research data collection tools were basically questionnaire and interviews. Questionnaires have the potential to collect original data from study participants and additional value of eliciting data through face to face mode. Also, interviews were employed to probe and garner data that collaborate the information collected through questionnaire.

In all, 128 of the 140 tutors in the Central Region colleges participated in the study. The opinions of these total participants were sought on some variables that are believed to impact on the curriculum's permissiveness for educational technology integration. Additionally, six (6) tutors were selected from the three colleges (two tutors per college) who are known for integrating technology in their teaching. The data gathered has been summarized under Table 1. Descriptive research involves describing an issue, event, or situation (Gall, Borg, & Gall, 1996), however ethical considerations requires that actual names of study subject are not exposed and as such, pseudonym were employed to introduce the responses gathered from the interviewees.

## RESULTS AND DISCUSSIONS

The Research Question dwelt on how the curriculum for pre-service teachers' preparation permits the integration of educational technology at the Colleges of education level in the Central Region of Ghana. Table 1 depicts the use of educational technology in their professional practice by 127 of the 128 tutors in the Central Region colleges.

**TABLE 1: RESPONDENTS' USE OF EDUCATIONAL TECHNOLOGIES**

| Rate of Use | Number of respondents (N) | Percentages (%) |
|---|---|---|
| Very Often | 17 | 13.4 |
| Often | 33 | 26.0 |
| Not Often | 54 | 42.5 |
| I do not use it at all | 23 | 18.1 |
| **Total** | **127** | **100.0** |

*Source: Field Data, 2010*

Most (42.5%) respondents rated themselves as those who do not use educational technologies often. Furthermore, 60.6% stated that they either did not use ET often or not at all. Nonetheless, it could be inferred from the Table 13 that a cumulative proportion (81.9%) of the respondents use educational technologies although at different rate of usage. The use of educational technology was also reported on by age, and sex.

The Figure 3 shows the use of educational technology by teacher educators in Central Region Colleges of education by gender. Among the male users of educational technology those who fell in the "*often*" and "*not often*" categories outweighed those in the "*very often*" category. A similar pattern emerged for the females but the proportion of female tutors in the region was less compared to their male counterpart. Overall, the males were more frequent users in terms of user strength compared to females.

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**FIGURE 3: GENDER AND EXTENT OF USE OF EDUCATIONAL TECHNOLOGY**
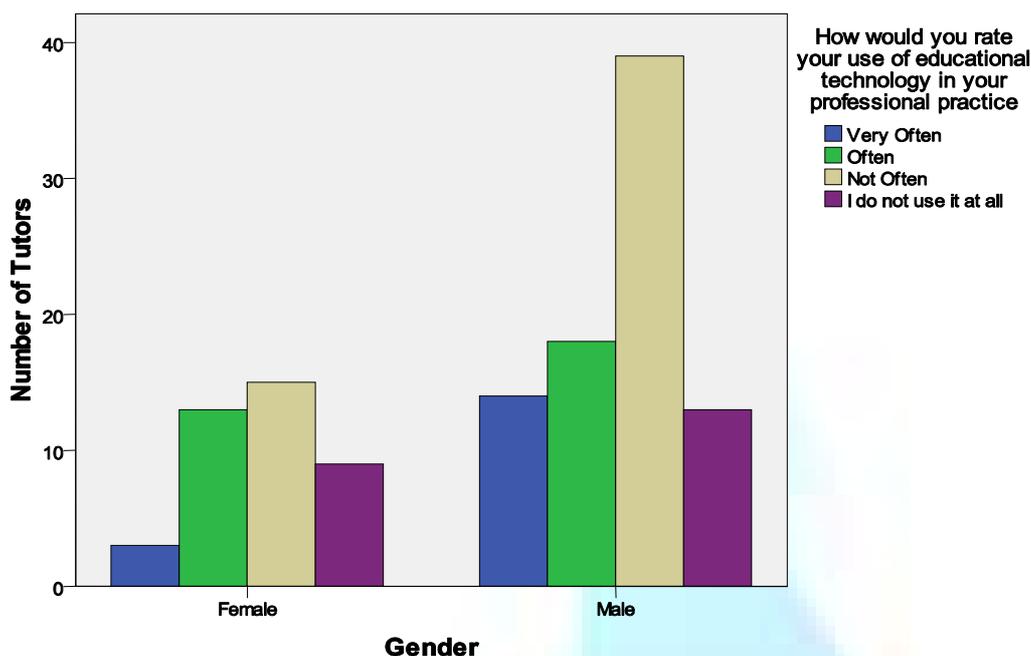


The appendix reports how pre-service teachers are prepared to integrate technology in their teaching. The teacher educators reported varying degree of agreement on whether they model technology use to the teacher trainees. However, the study exposed that at least more than half (52%) the number of study participants agreed that they use educational technology in the day-to-day modeling of technology integration.

Besides modeling, the tutors related in item 2 of the Appendix that they show trainees how to use educational technologies. The majority of the tutors (48.0%) *"disagreed"* about putting in such efforts. Nevertheless, 55 (43.3%) *"agreed"* that they engage their trainees on how to use and a further 11 (8.7%) registered their indecision on the item. That item was followed by yet another (Item 3) on whether they model a positive attitude towards the use of educational technology in the teaching endeavour. Most of the respondents 80 (64.0%) *"agreed"* that they model positive attitude toward use of educational technology, also 33 (25.8%) *"disagreed"* that they model positive attitude whereas the remaining 12 (9.6%) said that they are" *undecided".*

The tutors were asked whether they feel competent to model use of educational technology to their trainees. Item 4 revealed that 40 (32.3%) tutors" *disagreed*" about their competence in modeling educational technology use to their trainees. Secondly, 65 (52.4%) *"agreed"* that they feel competent to model use of educational technology to their trainees while the remaining 19 (15.3%) were "*not sure to agree"* or *"disagree".*

Item 5 also revealed the perceptions of the tutors on the extent of adequacy that the training teachers receive is to enable them integrate educational technology during their practice. Most (53.5%) tutors "*agreed"* while the proportion who" *disagreed*" were 33.1% and the remainder of the 127 respondents (13.3%) said that they were "*undecided"* over the issue of adequacy of the training to aid educational technology integration in schools. reveal

 Item 6 reflects the tutors' perceptions that students are taught how to use educational technology.  Almost ¾ "*disagree"* with this statement in contrast to their report regarding their own teaching of educational technology previously reported in Item 2 of the Appendix.  Item 7 supports respondents' use of methodology classes to integrate technology. Apart from the respondents who "*disagreed"* (representing 19.7%) and the 19 (15.0%) who were "*undecided"* the rest, 83 (65.4%) of the 127 respondents indicated their agreement with the use of methodology classes to expose students to ways in which educational technology can be used as teaching tools.

One explanation for this seeming inconsistency between Items 2 and 6 may lie in the responses to Item 8 which shows that most tutors (61.1%) "*agreed"* that there were courses designed specifically to teach trainees how to integrate educational technology in their classes. However, the remaining respondents were not in agreement that their colleges have specific courses designed to teach trainees how to use educational technology in their classes. These represent 22.2% who "*disagreed"* and 16.7% who were "*undecided".*

Item 10 made it evident that students generally are not required to use projectors for class presentations. Whereas, 74 (58.7%) "*disagreed",* 23 (18.3%) indicated that they were "*undecided"* and a further 29 (23.0%) *"agreed"* that they require their students to use projectors for classroom presentation. In Item 11 respondents said that they encourage their trainee teachers to use educational technology in the form of the internet (e.g., e-mail, blog) to communicate with tutors and peers. The majority of the respondents, 77 (61.1%) *"agreed"* that they  encourage their teachers to communicate by means of internet technologies.

In Item 12, 38 (29.9%) of the respondents "*agreed"* that during teaching practice they require teachers to use computer to prepare lessons, whereas 24 (18.9%) were "*undecided",* but, 65 (51.2%) representing the biggest proportion of respondents  "*disagreed".* Further, in Item 13, 67 (52.8%) respondents did not ask teachers to use computers to complete classroom related activities like record keeping. Also, 24 (18.9%) tutors were "*undecided"* and the 36 (28.3%) tutors said that they "*agree"* that during teaching practice, they ask their students to use computers to complete classroom related activities (e.g., keep records, presentations)

Six faculties at the Colleges of education in Central Region were engaged on a structured interview which revealed that the integration of educational technology into the teaching curriculum is not mandatory, as it is not grounded in the syllabus. However, five out the six interviewees (80%) pointed out that, they are very much prepared to integrate educational technology in the teaching and learning process in the college. Despite the assertion of the five, *Alice* related the extent to which she integrates technology in teaching, she says,

*I present lessons with PowerPoint and also teach students [trainees] how to go online to harvest resources for their lessons (personal communication, 5th April, 2010).*

*Felix, Charles* and *Dan* related that they integrate only educational technologies with which they are familiar. Moreover, apart from *Alice*, the remaining five tutors told the researcher that they are aware of the software to use depending on the study objectives. *Alice,* however, indicated that, she goes to the internet to look for the type of software to use. All the interviewees were able to give evidence of how to conduct a search on the internet.

The interviewees said that it was not crucial at the time they received training at the university on the use of computers and the internet for communication. The tutors further pointed out that it was not critical to use computers for conducting assignments and class presentations. The interview responses provided activities that interviewees make use of the computer. The common use of computers was for surfing the internet, storage of data files, secretarial duties and research purposes. However, other uses include social uses (like watching TV, videos, music), presentation of lessons, and lesson note preparation.

It could be inferred from the data in the Appendix and the structured  interviews conducted on the six tutors that educational technology is not getting the attention it deserves because is not mandatory in the teacher training syllabi. Studies conducted by renowned educational technologist seem to suggest that

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there are enormous benefits to could be gleaned from using educational technology in the 21st century classrooms which by extension means using technology in educating and training of the teachers who occupy these classrooms (Baylor & Ritchie, 2002, and Di Benedetto, 2005; Russell, Bebell, O'Dwyer, & O'Connor, 2003:).

## CONCLUSIONS

The role of teacher educators in preparing teachers to be functional in the 21st century classrooms cannot be overemphasized. Especially, the situation exposed by the data gathered from teacher educators in the Central Region makes it parameters of which areas in pre-service teacher preparation needs much attention using the educational technology lense. The findings of this study imply that little or nothing is done to teach teacher candidates how to integrate technology in classroom practice. The fact that respondents were giving conflicting responses only indicates much needs to done in translating the awareness that these teacher educators have (Abreh, 2010) into useful modeling and other user strategies that could best fit the needs of the teacher educators at first stage and pre-service teachers at the ultimate stage.

## RECOMMENDATIONS

It was consequently recommended that policy makers, researchers, curricula developers and other policy publics must take advantage of the high awareness of the usefulness of educational technology to proliferate this ubiquitous tool to education's advantage. Further, pre-service teachers could better be prepared to integrate technology if their teacher educators themselves are groomed through content knowledge and practice in the use of such technologies in their teaching. A systemic model for teacher professional development in the use of educational technology should be designed and implemented.

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**APPENDIX**

RESPONDENTS' BY HOW THEY PREPARE PRE-SERVICE TEACHERS TO INTEGRATE EDUCATIONAL TECHNOLOGY

| Preparing Pre-Service Teachers to Integrate Educational Technology | Response type | | |
|---|---|---|---|
| | Disagreement N (%) | Indecision N (%) | Agreement N (%) |
| 1)In my teaching, I model ways in which educational technologies can be used as teaching tools | 49 (38.6) | 12 (9.4) | 66 (52.0) |
| 2)I show my students how to use educational technology in their classes | 61 (48.0) | 11 (8.7) | 55 (43.3) |
| 3)I model a positive attitude towards the use of educational technology | 33 (25.8) | 12 (9.6) | 80 (64.0) |
| 4)I feel competent to model the use of educational technology to my students | 40 (32.3) | 19 (15.3) | 65 (52.4) |
| 5)The training students receive at my college adequately prepares them to teach with educational technology during their practice as teachers | 42 (33.1) | 17 (13.3) | 68 (53.5) |
| 6) Students in my college are taught how to teach using educational technologies | 21 (16.5) | 12 (9.4) | 94 (74.0) |
| 7) Methodology classes expose students to ways in which educational technology can be used as teaching tools | 25 (19.7) | 19 (15.0) | 83 (65.4) |
| 8) At my college, there are courses specifically designed to teach students how to integrate educational technology in their classes | 28 (22.2) | 21 (16.7) | 77 (61.1) |
| 9) I require my students to make use of computers to complete course assignments | 34 (27.2) | 12 (9.6) | 79 (63.2) |
| 10) My students are required to use projectors for class presentations | 74 (58.7) | 23 (18.3) | 29 (23.0) |
| 11) I encourage my students to use the internet (e.g., e-mail, blog) to communicate with tutors and peers. | 33 (26.6) | 14 (11.3) | 77 (62.1) |
| 12) During teaching practice, I require my students to use computers to prepare their lessons | 65 (51.2) | 24 (18.9) | 38 (29.9) |
| 13) During teaching practice, I ask my students to use computers to complete classroom related activities (e.g., keep records, presentations) | 67 (52.8) | 24 (18.9) | 36 (28.3) |

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# THE RELATIONSHIP BETWEEN THE INFORMAL AND FORMAL FINANCIAL SECTOR IN NIGERIA: A CASE STUDY OF SELECTED GROUPS IN LAGOS METROPOLIS

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## ABSTRACT

*This paper investigates the links between the informal and the formal financial sectors in Nigeria. The objectives are two folds. The first is to ascertain the deposit and credit links between the informal and the formal financial sectors of the economy. The second objective is to determine the strength and significance of such links between informal and formal financial institutions with respect to saving mobilization and the process of credit dispersion in the informal sector. To realize these twin objectives, the study focused on moneylenders and savings & credit associations in the informal and semi-formal financial sectors in Nigeria. The study employed primary data, which is obtained through random sampling of the various association and groups in the informal financial sector of the economy such as moneylenders, rotational savings and credit associations, traditional mutual aid groups, credit & thrift societies and semiformal savings organizations within Lagos metropolis. The data was analyzed using descriptive and analytical techniques. We find that there is a strong link between the formal and the informal financial sector on the savings side but there is a weak link between the formal and the informal financial sectors on the credit side in Nigeria. We recommend government should put policy measure in place that will ensure their access to more capital as this will assist to facilitate rapid industrialization of the nation. And banks should remove the stringent conditions and excessive documentation that discourage operators in the informal sector to seek for loans in the bank.*

## KEYWORDS
Informal sector, Moneylenders, microfinance, ROSCA.

## INTRODUCTION

It is an accepted fact that the Nigerian informal financial sector contributes immensely to financial intermediation considering its critical role in provision of funds to the small and micro enterprise in Nigeria. Though the extent of its contribution to the economy has remained largely unquantifiable because of the problem of measuring their performances but there is no doubt that they contribute to the GDP of the Nation. In Nigeria and in many developing countries around the world a lot of economic activities take place outside the purview of government regulations. These activities are in most times not recorded or mis-recorded or even deliberately omitted by the regulatory authorities. The total membership of Informal Financial Institutions in Nigeria is estimated at about 20 million, of an eligible adult population of approximately 50 million. In peasant societies, such as exist in rural Nigeria, between 30-90% of craftsmen and market-women and between 20% and 50% of industrial workers in urban centres still use informal financial markets. (Letvisky, 2000)

The 1973 report of International Labour Organization (ILO) employment mission to Kenya was the first to recognize the significant role of the informal sector in the development of the economy of developing Nations. Prior to this time, little or no account had been taken of the informal sector. The sector accounts for over 50% of operations in most developing countries, they operate in form of micro enterprises, such as artisans, cottage industries, household businesses and self-employed persons.

The informal sector in Nigeria refers to economic activities in all sectors of the economy that are operated outside the purview of government regulation. This sector may be invisible, irregular, parallel, non-structured, backyard, under-ground, subterranean, unobserved or residual. Informal economic activities in Nigeria encompass a wide range of small-scale, largely self-employment activities. Such financial and economic endeavours of subsistence nature include retail trading, local transport, restaurant management, repair services, financial intermediation and household or other personal services (Adamu, 1996). Activities in the informal sector in Nigeria are difficult to measure; they are highly dynamic and contribute substantially to the general growth of the economy and personal or household income (cited in Ekpo and Umoh 2003).

The unwillingness of the formal financial sector to provide financial services to the urban and rural poor, coupled with the unsustainability of government sponsored development financial schemes contributed to the growth of informal financial sector in Nigeria. Informal financial institutions in Nigeria pre-dates modern banking era. They exist in form of traditional groups that work together for the mutual benefits of their members. These groups provide savings and credit services to their members, operating under different names in different part of the country. It is known as 'esusu' among the Yorubas of Western Nigeria, 'etoto' for the Igbos in the East and 'adashi' in the North for the Hausas (CBN, 2000). The key features of these informal schemes are in savings and credit intermediation. Their operations are usually informal and they charge higher interest rates compare to the formal banking sector.

The demand for financial services in Nigeria is high and increasing especially in the informal sector. The continuous lay-off of labour from both the public and private sectors since the introduction of the structural adjustment programme in 1986 and the growing number of school leaver without readily available employment is pushing a large proportion of the population into informal sector activities. Many micro enterprises are, therefore, springing up but without bank financial support. Also the domestic market is large, with over 140 million people in need of various goods and services, including financial services (Anyanwu, 2004).

It is a known fact in Nigeria that the formal financial system provides services to about 35 percent of the economically active population, while the remaining 65 percent are excluded from access to formal financial services (CBN, 2005). The nation is characterized by low banking population density of 1: 30,432 before the bank consolidation in 2005, Soludo (2007). The majority of the active population access financial services through informal arrangement which are usually very exploitative. The objective of this research is to establish the linkages between the formal and the informal financial sector in Nigeria and if there are linkages how strong is the relationship. The remaining part of the paper is divided into four parts. Part II deals with theories on informal financial market and literature review, Parts III – V deals with the research methodology, the analysis of result and the recommendation and conclusion respectively.

## LITERATURE REVIEW
### Theories on informal financial sector
The theoretical analysis of financial markets in developing countries has been transformed through the application of the theory of economic behavior under conditions of incomplete markets and imperfect information. A large number of theoretical papers have explored the implications of imperfect information and incomplete markets for contractual forms in credit markets in low-income rural settings. These theories is directly relevant to informal financial transactions in Africa but the extent to which these theories can provide insight into informal finance in Africa is not yet determined, however, the theories have the potential of illuminating the salient features of many informal financial markets in Africa( Arteerey, 1995).

The pioneering work of Stiglitz and Weiss (1981) marks the beginning of attempts in explaining credit rationing in credit markets. According to them, interest rates charged by a credit institution are seen as playing dual role of sorting potential borrowers (leading to adverse selection), and affecting the actions of

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borrowers (leading to the incentive effect). Both effects are seen as a result of the imperfect information inherent in credit markets. Adverse selection occurs because lenders would like to identify the borrowers most likely to repay their loans since the banks' expected returns depend on the probability of repayment. In an attempt to identify borrowers with high probability of repayment, banks are likely to use the interest rates that an individual is willing to pay as a screening device. However, borrowers willing to pay high interest rates may on average be worse risks; thus as the interest rate increases, the riskiness of those who borrow also increases, reducing the bank's profitability. The incentive effect occurs because as the interest rate and other terms of the contract change, the behaviour of borrowers is likely to change since it affects the returns on their projects.

Analyzing the rationale for interventions in rural credit markets in the presence of market failure, Besley (1994) commented that since credit markets are characterized by imperfect information and high costs of contract enforcement, an efficiency measure as exists in a perfectly competitive market will not be an accurate measure against which to define market failure. The problem that exists in imperfect market situation leads to credit rationing, adverse selection and moral hazard in the credit markets. Adverse selection arises because in the absence of perfect information about the borrower, an increase in interest rates encourages borrowers with the most risky projects, and hence least likely to repay, to borrow, while those with the least risky projects cease to borrow. Interest rates will thus play the allocative role of equating demand and supply for loanable funds, and will also affect the average quality of lenders' loan portfolios. Lenders will fix the interest rates at a lower level and ration access to credit. Imperfect information is therefore important in explaining the existence of credit rationing in rural credit markets. Moral hazard occurs basically because projects have identical mean returns but different degrees of risk, and lenders are unable to discern the borrowers' actions (Stiglitz and Weiss, 1981; Besley, 1994).

Besley (1994) state further major features of rural credit markets that can be used to explain the existence of formal and informal credit markets in Africa. Among these are the existence of collateral security and covariant risk. Collateral security is often beyond the reach of many borrowers in rural areas. But even where this is not the case, the ability of the lender to foreclose is often limited, making enforcement of loan repayment difficult. Such difficulties help to explain the use of informal financial markets, which use social sanctions to ensure enforcement. In rural areas, shocks in incomes that create borrowers' potential to default will affect the operation of credit markets. In most rural economies, borrowers are faced with risks arising from uncertainties about their incomes. By diversifying their loan portfolios, lenders can avert such risks. However, credit markets in rural areas are segmented, with lenders' loan portfolios being concentrated on borrowers facing common shocks to their incomes.

Another important factor of both formal and informal markets relates to penalties. In the absence of formal contract enforcement mechanisms, both formal and informal institutions rely on lending practices that emphasize loan screening rather than monitoring, which appears to suggest more concern with adverse selection than moral hazard. Differences emerge in the methods used by formal and informal institutions. Where formal lenders rely more on project screening, informal lenders rely more on the character and history of the borrower, particularly on personal knowledge of the borrower. Loan monitoring is rarely done by informal lenders due to the lenders' knowledge of borrowers, while in the formal market it is mainly due to lack of facilities. Transaction costs are generally lower in informal markets than in formal ones. One of the issues that emerge from this market structure is which financial institutions are accessible to the rural poor, and which factors determine their demand for credit from the different sources as determined by their participation decisions (Atieno, 2001).

Credit markets in Africa have mainly been characterized by the inability to satisfy the existing demand for credit in rural areas. Arteerey (1995) propose two theories to explain Africa informal financial market. The first is a credit transaction when information is incomplete. This is a situation where lenders do not have complete information with respect to the characteristics of potential borrowers. The second is a credit transaction when contracts are not perfectly enforced, that is, when there is no external contract enforcement agency (such as the legal system) which forces borrowers to repay their loans. He opined that credit markets in Africa are characterized by information asymmetry, agency problems and poor contract enforcement mechanisms. Africa financial markets are fragmented because different segments of the credit market serve clients with distinct characteristics. This is because lending units are unable to meet the needs of borrowers interested in certain types of credit. This result in credit gap that captures those borrowers who cannot get what they want from the informal market yet they cannot gain access to the formal sources. African economy is filled with enterprises that want to expand beyond the limits of self-finance but lack access to bank credit, yet the informal sector is unable to satisfy them.

Investigating factors that motivate the private sector to conduct financial transactions in the informal financial sectors Aryeetey and Gockel (1991), argued that the informal sector derives its dynamism from developments in the formal sector as well as from its own internal characteristics. The informal and formal sectors offer similar products that are not entirely homogeneous, implying that both sectors cater to the needs of easily identifiable groups of individuals and businesses, but at the same time serve sections of the total demand for financial services. However, participants from either sector may cross to the other depending on factors like institutional barriers, availability of credit facilities and the ease of physical access.

The foregoing literature review shows that financial markets in African countries are characterized by imperfect and costly information, risks, and market segmentation, resulting in credit rationing. This is one of the underlying factors in the coexistence of both formal and informal credit markets serving the needs of the different segments of the market. On the other hand, policy-based and structural-institutional explanations attempt to explain the coexistence of both segments of the market as a result of policy and structural-institutional rigidities. This review provides a theoretical and conceptual background for the existence of formal and informal financial markets coexistence in Africa financial market.

Also, imperfect information emerges as an important explanation for credit rationing. This is because, due to information asymmetry, loan terms and conditions are used affect the behaviour of borrowers. The literature shows that formal interest rate is not the reason why borrowers do not use formal credit market. Rather, the unique characteristics of credit services explain segmentation in the credit market. Lack of effective contract enforcement and the consequent default risk are important in loan rationing. With the literature review, there is no doubt that the African financial market is fragmented but the major question is if there are linkages between the segments of the market. An empirical investigation will help to explain the strength and the significance of the relationship that exists between the formal and informal financial market in Africa.

## LINKAGES BETWEEN THE FORMAL AND INFORMAL FINANCIAL SECTOR

The linkages between the formal and the informal financial sector could be described as being complimentary and not competitive where they exist (Ojo 1996). Most writers believe that positive relationship exit between the formal and the informal financial sectors. Knowledge of the level of interaction between the two sectors will provide useful guide to understanding the efficacy of development policies for improving the performances of both sectors. Without such information, it is quite possible that a policy targeted at improving the performance of the formal financial sector may lead to surprising and disappointing development. The omission of the activities of the informal financial sector in the official statistics calls for serious concern because the level of economic development in most developing nation depends on the size of its informal sector. In many developing countries especially in Africa the informal sector is larger than the formal sector that generates the data that formed the basis of macroeconomic policies. Economic policy relies on data compiled from the activities of the formal sector may not be appropriate and may, in fact, be unfavourable to the larger informal sector. (see Ajakaye and Akerele, 1996 and Oresotu, 1996)

Oresotu (1996) concluded that there is a strong link between macroeconomic policy environment and the informal sector. The link is provided by the activities of the informal financial agents that rely on loans taken from the formal financial intermediaries to relend to borrowers in the informal financial market. The informal financial agents render valuable financial services by financing production activities through the extension of loans to micro enterprise and peasant farmers who ordinarily are not considered in the scheme by formal sector because of their inability to provide suitable collateral.

Soyibo (1996) opine that the informal sector indicates the failure of the modern market economy to provide jobs and livelihoods for large sections of the population. It consist of the individuals and groups left out of the development of the modern economy, in an effort to survive, develop entrepreneurial initiatives in traditional forms but on a small scale and it keeps expanding on a daily basis as people loss their job in the formal sector. Growth of the formal sector had been sluggish in many developing economy while the government have to cope with a dual economy in order to foster economy development. The formal financial system in most developing countries is inadequate to meet the total needs of all and sundry in their pursuit of economic activities. As a result

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economic development is hampered, the bulk of the rural population and the urban poor, in particular, and sometimes the lower middle class have no access to banks or other official credit institutions so they resort to getting their financial needs met in the informal sector.

In a study carried out by the World Bank on four African countries in 1997, it was discovered that

*A financial gap remains for small businesses, which generally need larger loans at lower rates than informal agents can provide but lack the track record and collateral necessary to access bank loans. However, some new financial institutions are beginning to emerge with the potential to respond to excess demand for credit that is being satisfied by neither formal nor informal sectors. In Ghana and Nigeria, in particular, there has been a steady emergence of formal non-bank financial intermediaries-discount houses, leasing companies, finance companies. It is important both to include informal institutions in financial development strategies and to link them more closely with the formal financial system in order to both increase savings mobilisation and make more funds available to high-return investments in informal activities.*

Many of the informal financial intermediaries that operate as self-help organizations tried to establish linkages with the formal institutions in their local settings so as to help small entrepreneur to have access to bank loan. The banks may not be big commercial banks but a non-banking formal savings and credit cooperative that metamorphose from self help organizations. It is the formal savings and credit institutions that in turn set up linkages with development banks because they are registered and recognized than individual rotational savings and loan groups. Banks often find it difficult to deal directly with groups that do not have legal status. This is because banks rely heavily on legal contracts to function. Informal groups without legal status are generally not allowed to open saving accounts and cannot obtain group loans. That is why attempt are made to transmute self-help organizations to formal groups to give them legal status so that they can link directly with the banks.

Chipeta and Mkandawire (1992) confirmed the existence of links between the Informal Financial Sector and the Formal Financial Sector.

*Moneylenders, indigenous bankers and cooperative savings society are known to be depositing surplus funds with Formal Financial Institutions. Similarly, customers of formal financial institutions have lines of credit with informal financial institutions. These links establish the channel through which credit control and monetary policies targeted at the formal financial sector affect the volume of resources and credit in the informal financial sector and hence the overall effectiveness of financial policies. Both indirect and direct credit and deposit links exist. The indirect credit and deposit linkages are significant. The direct credit links are insignificant, but the direct deposit links with moneylenders are significant.*

(Ojo, 1996) believes that linkages between the formal and the informal financial sector exist in both side of the market, in savings mobilisation as well as in credit administration. There are occasions the informal groups save with the banks as a group and at time they share the same client. Informal groups are even encouraged to have a legal status that will give them stronger front to obtain loan from the formal sector. It is no doubt that informal credit markets are generally complementary to the formal market but there is still a large and unsatisfied demand for credit by informal and small borrowers mainly because over zealousness of the formal financial sector and poor integration between the formal and informal financial system. But the formal sector could make fund available to the informal sector for onward lending to the small entrepreneur.

Thillairajah (1995), suggested three types of institutions in a properly functioning financial market, which would ideally play the roles of, wholesaler, intermediary, *and* retailer, of financial services to the ultimate customers at the grassroots, according to him,

1. The *retailers* would cope with the rurality of the small scattered customers and minimize the cost of collecting information on credit-worthiness, as well as loan recovery and savings mobilization.
2. The *intermediary role* of the semi-formal sector would enable the informal and semi-formal customers to earn interest by depositing their savings in the formal sector. This would assist the mobilization of savings and help the formal sector to create more money. The intermediaries would also save the formal sector the extra cost of dealing with small deposit and loan accounts. The same intermediaries would pass on loanable funds to the retailers, relieving the excess demand for credit at the grassroots. And lastly,
3. The *wholesaler* formal sector intermediaries would be able to meet cash shortages and utilize idle funds. These operations would be crucial in meeting the problems of seasonality and mitigating co-variant risk.

It is obvious from the literature search that Nigeria has to put a system in place that would enhance integration of the informal sector into the formal financial sector and improve access to finance.

## RESEARCH METHODOLOGY
### RESEARCH DESIGN

In an attempt to obtain the sample upon which this study is based, the population for this study is defined as the total collection of various informal financial groups such as rotational savings and credit association (RSCA), mutual aid group (MAG), credit and thrift society (CTS) and semiformal savings organizations (SSO) within Lagos metropolis. The informal groups in various market places in Lagos metropolis, the credit and thrift societies in small business organization as well as semi-formal organizations were targeted. However, since focusing on the whole population will take time as well as huge cost, a sample of the entire population was selected. In deriving a representative sample from the population of various informal groups, all the informal groups were given equal chances of being selected in the survey. The main research instruments used to elicit data in this study was a well structured questionnaires designed by the researcher. A random sampling technique was employed. Using this procedure a sample of 350 questionnaires was sent out for the study but only 200 was usable out of the questionnaires returned. The questionnaire was filled by executive member of the groups. The questionnaire is made up of twenty items and centres on three point criteria. These criteria include the saving and lending behaviors as well as the relationship of various informal groups with formal financial sector. To ensure the reliability of the instrument used, the split-halves method was used. To use the split-halves method, the sample was randomly divided into two halves and alternate form of reliability measure were estimated for half of the group. Results from the two halves are then compared. The alpha (α) reliability coefficients for the first and second halves of questionnaire are 0.7905 and 0.7890 respectively. This indicates that the research instruments are quite reliable.

## ANALYSIS OF RESULTS AND DISCUSSION
### PROFILE OF RESPONDENTS

The sample selected for this study, as seen in Figure 1(a) is made up of 93 males executives, representing 46.5% of the total respondents and 107(53.5%) female executives. Figure 1(b) and 1(c) show the age distribution and educational qualifications of respondents. With respect to age, Fig. 1(b) indicates that 122 (61%) of respondents are within the ages of 20 and 40, while 72(36%) are within the age of 40 and 50. The remaining 6 (3%) of the respondent are within the age bracket of 50 years and above. Fig. 1(c) also shows that out of two hundred respondents, 5 (representing 2.5% of total respondents) had no formal education (NFE), 9(4.5% possessed) primary school leaving certificate (PLS), 29(14.5) were West African School Certificate holder and 89(44.5%) holds either national diploma (OND) or National Certificate in Education (NCE). Out of the remaining 68 respondents, 64(32%) and 4(2%) of the respondents had first degree (B.Sc/B.A/B.Sc & HND) and postgraduate degrees respectively. The implication of this sample is that our respondents are of mature age and majority of them also have adequate educational background to be able to provide logical answers to questions in the questionnaire drawn.

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Fig. 1(a) Sex distribution of respondents



Fig. 1(b) Age distribution of Respondents



Fig. 1(c) Educational Qualif. of Respondents



Fig.(1d) Profession of members



Fig. 1(e) Informal group



Fig. 1(f) Range of membership of IG



Figure 1(d) and 1(e) reveals the distribution of respondents according to their various professions and the informal groups they belonged. As regards the profession of members, it is apparent in Figure 1 panel (d) that 117 and 23 respondents representing 58.5% and 11.5 % of the total sample are retail traders and farmers respectively. In the same vein, 35 (17.5%) and 9(4.5%) of members are artisans and entrepreneurs respectively. Other sixteen (16) respondents representing 8% of respondents belong to other professions. Fig. 1(e) indicates that 60(30%) of respondents belong to Rotational Saving and Credit Institutions (RSCA), the same number belong to mutual aid group (MAG), 50(25%) belong to credit and thrift society(C&T), while the remaining 50 members belong to semi formal savings organization. The implication of all these is that the sample of respondents used for the study is very ideal and they could be relied upon for making valuable inference about the link between formal and informal financial sectors in Nigeria.

**LINKS BETWEEN FORMAL AND INFORMAL FINANCIAL SECTORS IN NIGERIA**

For the purpose of investigating the links between formal and informal financial sectors in Nigeria, the study examines the saving and credit link of sampled respondents. In this respect, the numbers of respondents that saved with and obtain credit from the formal financial institutions are investigated.

Fig. 2(a) and 2(b) investigates whether respondents save their taking in the bank and if not where they maintain their saving. In Fig. 2(a), 155 respondents representing 77.5% of the sample affirmed that they save their surplus funds with bank. Forty-five (45), representing 22.5% of all the respondents sampled however maintained that they do not keep their takings in the bank. A proper investigation revealed in Figure 2(b) shows that out of these 45 respondents, 9(4.5%) keep their money at home, 4(2%) save with other groups, while the remaining 32(16%) respondents save with cooperatives. The main implication of Fig. 2(a) and 2(b), therefore is that majority of respondents indicated that they save with banks. This means that these informal groups have a strong savings link with formal sector of the economy.

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Fig. 2(a) Saving with banks?


Fig. 2(b) Safekeeping of Money


Fig. 2(c) Do you borrow from banks?


Fig. 2(d) Preference for sources of credit
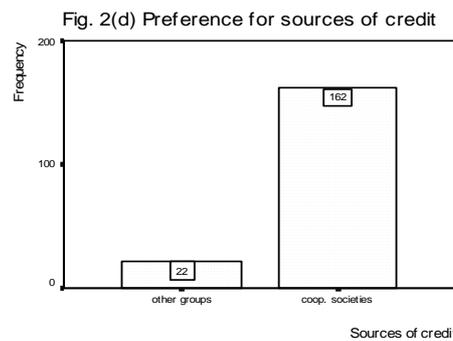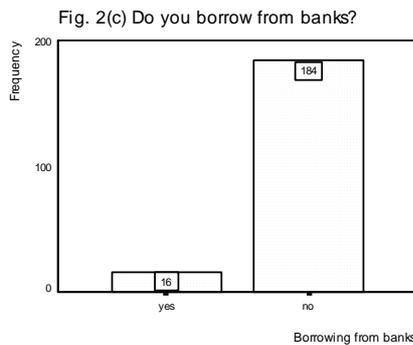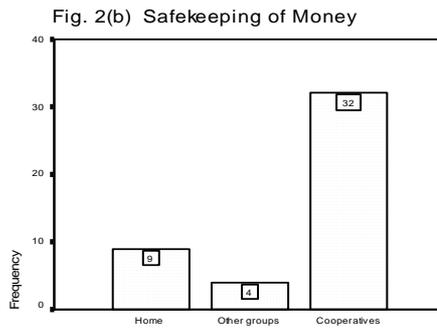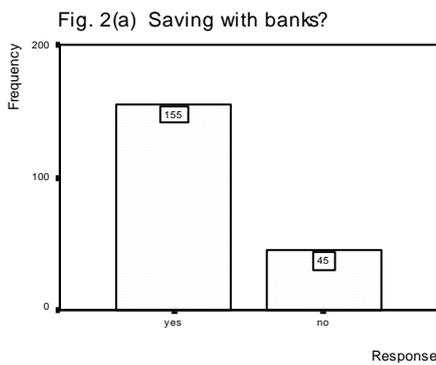
Having examined the savings link between formal and informal sector, we further investigate their credit link. Fig. 2(c) shows that 16 (8.0%) of respondents do obtain credit from the bank. However, 184(92%) of the sampled respondent maintained that they do not obtain credit from the bank at all. The reason for this may not be unconnected with some stringent requirement for obtaining credit from banks in Nigeria. In sampling the preference of respondent concerning various sources of credit, Fig. 2(d) revealed that majority of respondents (162 respondents) preferred cooperative societies as a source of credit to banks and other groups. It becomes glaring at this juncture that though the informal sector appreciate the importance of saving may be as a result of fear of loosing the money if they keep it with them (see Figure 2e) and their link with formal sectors is a strong one, the empirical evidence emerging from this study indicate that the credit link between these sectors is still somehow very weak.


Fig. 2(e). Importance of Savings


Fig. 2(f) Relationship with formal sector
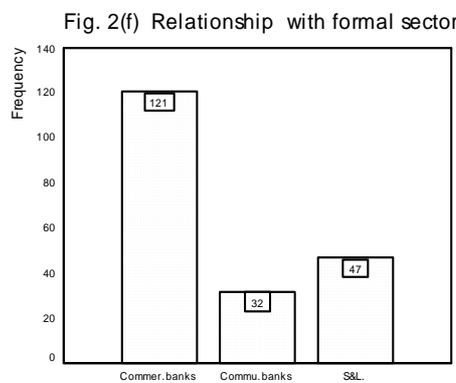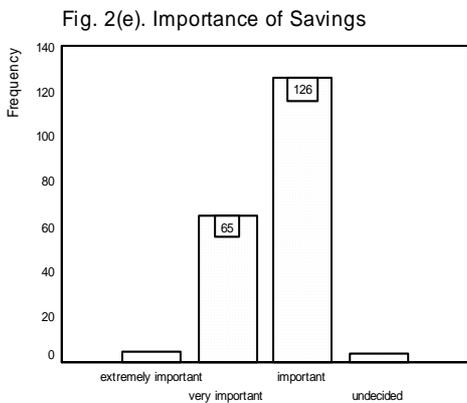
To further examine which financial institution(s) the informal groups relate mostly with, Figure 2(f) revealed that majority of responds prefer to deal with commercial banks than with community or savings and loans institutions.

**TEST OF HYPOTHESIS**
The null hypothesis earlier specified in this study is that there is no relationship between formal and informal financial sectors in Nigeria. To test this hypothesis, the cross tabs procedure, which provides a variety of tests and measures of association for two-way tables, is adopted. Having carried out a cross tabulation of essential variables necessary for the test of our hypothesis, Table 1(a) shows the proportion of the sampled population that saved with formal financial sector. It could be observed that more than 70% of each informal group agreed that they save with banks, while less than 30 % save elsewhere. To test whether there is a significant difference in the number of respondents that save with banks and those that save elsewhere we adopt the Chi-Square ($\chi^2$) statistics reported in Table 1(b).

**TABLE 1(A): INFORMAL AND FORMAL SECTORS' SAVINGS LINK**

|  | Saving with Banks |  |  |
| --- | --- | --- | --- |
|  | **Yes** | **No** | **Total** |
| **ROSG** | **44** | **16** | **60** |
| **MAG** | 47 | 13 | 60 |
| **C&T** | 36 | 14 | 50 |
| **SSO]** | 28 | 2 | 30 |
| **TOTAL** | 155 | 45 | 200 |

Source: Field Survey (2009)

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**TABLE: 1(B)**

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 5.802[a] | 3 | .122 |
| Likelihood Ratio | 6.966 | 3 | .073 |
| Linear-by-Linear Association | 2.245 | 1 | .134 |
| N of Valid Cases | 200 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.75.

From Table 1(b), it is apparent that the computed value of χ2 is 5.802.  At 0.05 level of significance and with 3 degree of freedom, the critical value of $\chi^2$ is 7.81. Since the critical value is greater than the computed value, then the number of members that maintained savings in the banks is very significant relative to those who do not. We therefore reject the null hypothesis that there is no savings link between formal and informal financial sectors in Nigeria.

Table 2(a) also tests the credit link between the formal and informal financial sector in Nigeria. The table indicates that majority of members of various informal groups indicate that they do not obtain credit from banks. To test whether there is significant difference in responses we also adopt the $\chi^2$ statistics, which is reported in Table 2(b)

**2(A): INFORMAL AND FORMAL SECTORS' CREDIT LINK**

| | Saving with Banks | | Total |
|---|---|---|---|
| | Yes | No | |
| ROSG | 4 | 56 | 60 |
| MAG | 0 | 60 | 60 |
| C&T | 9 | 41 | 50 |
| SSO | 3 | 27 | 30 |
| TOTAL | 16 | 184 | 200 |

Source: Field Survey (2009)

**TABLE: 2(B)**

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 12.319[a] | 3 | .006 |
| Likelihood Ratio | 15.472 | 3 | .001 |
| Linear-by-Linear Association | 3.046 | 1 | .081 |
| N of Valid Cases | 200 | | |

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 2.40.

Table 2(b), shows that the computed value of χ2 is 12.319.  At 0.05 level of significance and with 3 degree of freedom, the critical value of $\chi^2$ is also 7.81. Since the critical value is less than the computed value, then those who obtained credit from formal sector are not significant in essence we accept the null hypothesis that there is no credit link between the formal and informal groups in Nigeria.

This study has revealed that while there is a saving link between formal and informal financial sector in Nigeria, the credit links between these two groups have been absent. Several reasons may be suggested for this, which among others include: lukewarm attitudes of banks to lend to informal group in absence of collaterals, preferential treatment to prime customers of banks, credit rationing in banks and unfavourable terms of credit. It therefore implies that more needs to be done in order to improve the credit link between the two sectors.

**CROSS TABULATION OF SOME OF THE VARIABLES**

**TABLE 3(A): EDUCATIONAL QUALIFICATION & THE USE OF BANK**

**Crosstab**

Count

| | | Do you save your takings in the bank? | | Total |
|---|---|---|---|---|
| | | yes | no | |
| Educational Qualification | No formal educ. | 1 | 4 | 5 |
| | primary schl. leaving cert. | 7 | 2 | 9 |
| | WAEC | 24 | 5 | 29 |
| | OND/NCE | 67 | 22 | 89 |
| | B.Sc/B.A/B.Eng/HND | 54 | 10 | 64 |
| | PGD | 2 | 2 | 4 |
| Total | | 155 | 45 | 200 |

Source: Field Survey (2009)

To analyze the impact of education on the use of banks, it was observed that the higher the level of education of the respondents the more they save with the banks. 0.6% of the respondents with no formal education save their deposit in the bank, 4.5% of the respondents with first school leaving certificate save with the bank, while, 15%, 43%, 34% and 1.2% of the respondents with WAEC, OND, B.sc and Post graduate respectively save their deposit with the bank. The reason for the low percentage of the postgraduate is because they are not many among the respondents.

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**TABLE 3(B): EDUCATIONAL QUALIFICATION AND HOW RESPONDENT KEEP THEIR SAVINGS**

**Crosstab**

Count

|  |  | If no, how do keep your money safe? | | | Total |
|---|---|---|---|---|---|
|  |  | keeping it in the house | save with another group | save with cooperatives |  |
| Educational Qualification | No formal educ. | 2 |  | 2 | 4 |
|  | primary schl. leaving cert. |  |  | 2 | 2 |
|  | WAEC | 1 | 1 | 3 | 5 |
|  | OND/NCE | 4 | 3 | 14 | 21 |
|  | B.Sc/B.A/B.Eng/HND |  |  | 11 | 11 |
|  | PGD | 2 |  |  | 2 |
| Total |  | 9 | 4 | 32 | 45 |

Source: Field Survey (2009)

It was observed even among those that do not save with the bank, as their level of education increased they save with other organizations such as cooperative societies but not banks.

**TABLE 3 (C): EDUCATIONAL QUALIFICATION AND SOURCE OF BORROWING**

**Educational Qualification And Source of borrowing**

|  |  |  | Source of borrowing | | Total |
|---|---|---|---|---|---|
|  |  |  | other groups | cooperative societies |  |
| Educational Qualification | No formal educ. | Count | 2 | 3 | 5 |
|  |  | % within Source of borrowing | 9.1% | 1.9% | 2.7% |
|  | primary schl. leaving cert. | Count | 3 | 6 | 9 |
|  |  | % within Source of borrowing | 13.6% | 3.7% | 4.9% |
|  | WAEC | Count | 7 | 20 | 27 |
|  |  | % within Source of borrowing | 31.8% | 12.3% | 14.7% |
|  | OND/NCE | Count | 4 | 76 | 80 |
|  |  | % within Source of borrowing | 18.2% | 46.9% | 43.5% |
|  | B.Sc/B.A/B.Eng/HND | Count | 6 | 53 | 59 |
|  |  | % within Source of borrowing | 27.3% | 32.7% | 32.1% |
|  | PGD | Count |  | 4 | 4 |
|  |  | % within Source of borrowing |  | 2.5% | 2.2% |
| Total |  | Count | 22 | 162 | 184 |
|  |  | % within Source of borrowing | 100.0% | 100.0% | 100.0% |

Source: Field Survey (2006)

Considering the impact of the level of education on the source of borrowing, it was observed that the respondents with higher level of education borrow from cooperative societies instead of other informal groups. Meaning that if the conditions in the banks were favourable they would have borrowed from the banks.

**TABLE: 3 (D)**

**Profession of members & Informal group**

Count

|  |  | Informal group | | | | Total |
|---|---|---|---|---|---|---|
|  |  | Rotational savings& credit institutions (Esusu) | Mutual Aid group(Ajo) | Credit & thrift society | semiformal savings orgs. |  |
| Profession of members | Retail traders | 38 | 48 | 16 | 15 | 117 |
|  | farmers | 5 | 5 | 10 | 3 | 23 |
|  | Artisans | 14 | 6 | 12 | 3 | 35 |
|  | Entrepreneurs | 2 | 1 | 2 | 4 | 9 |
|  | others | 1 |  | 10 | 5 | 16 |
| Total |  | 60 | 60 | 50 | 30 | 200 |

Source: Field Survey (2009)

A further analysis of group members by trade and vocation revealed that retail traders form the majority in all the informal groups; this may be due to the fact that most of the questionnaires are filled in market palaces, then the artisans and farmers followed respectively.

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**TABLE: 3 (F)**

**Do you save your takings in the bank And the  formal sector respondents relate**

Count

| | Which of these formal sector do you relate mostly? | | | |
|---|---|---|---|---|
| | commercial banks | community banks | savings & loans institutions | Total |
| Do you save your takings      yes in the bank? | 95 | 23 | 37 | 155 |

Source: Sample Survey (2009)

Among the groups that save with the banks it was revealed that 95(61.2%) relate with commercial banks, 37(23.8%) relate with savings and loans institutions, while 23(14.8%) relate with community banks. The credit side of the market will have to be improved as many of the groups in the informal sector are in dare need of credit facilities for expansion and growth.

## RECOMMENDATIONS

1.   The fact that there are no credit link between the formal and informal financial sectors of the economy implies that the informal sector depend only on the capital they can generate in their business for growth and expansion. That is why they remain small and mostly insignificant. The government should bridge this gap by ensuring that informal financial market operators are link up with formal financial sector operator so that they can access more credit. They can be service through the microfinance banks.
2.   The banks should remove the stringent conditions and excessive documentation that discourage operators in the informal sector to seek  bank loans.  The commercial/Universal banks can use the informal financial service provider to mobilize funds in the rural area and reach out to many other in need of credit to close the finance gap in the rural areas.
3.   The semi formal groups such as cooperative societies and rotational savings and loan group should endeavour to develop their cooperative finance activities so that they can pool resources and operate as a formal institution but with very close links with the informal groups. This will increase the outreach level of these groups.
4.   Although there is a strong linkage between the formal and informal savings institutions in Nigeria more effort should be made to mobilize savings in the rural areas because of the need to channel fund into agricultural business that exist in that part of the nation.
5.   Other forms of formal non-bank financial intermediaries such as discount houses, leasing companies, finance companies, etc should be encouraged to operate in the rural areas providing other forms financial services along with the microfinance institutions to increase sources of finance in the rural areas. Since most of the people with financial constraints dwell in the rural areas.
6.   It is important both to include informal institutions in financial development strategies and to link them more closely with the formal financial system in order to both increase savings mobilization and make more funds available to high-return investments in informal activities.
7.   An adequate process should be put in place to monitor and record activities in the informal sector of the economy both financial and otherwise. The CBN and other relevant body should ensure that reliable data are scientifically collected to have a basis for policy formulation.
8.   Favourable macroeconomic policy, especially in the area of favourable legislative framework, access to credit and favorable economic environment should be made available for the progress of the informal sector. The idea is not to eliminate the informal groups because that is not possible but to help them link up with the formal groups that have larger funds especially now after the bank consolidation for on-lending to microentrepreneurs.
9.   The informal financial intermediaries that intend to carry on re-lending in the informal financial market should be encourage and properly package to access development finance loan which are given at concessionary interest rate.
10.  The government should make more credit available to development banks and cooperative banks since they have objective of penetrating and developing the small and informal businesses in the country.

## CONCLUSION

These is no doubt that a financial gap continue to exist for small businesses, which generally need larger loans at lower rates than informal agents can provide but they lack proper record and collateral necessary to access bank loans. However, it is important to include informal financial institutions in financial development strategies and to link them with the formal financial system in order to increase savings mobilization and increase their access to credit. The omission of the informal financial sector in the main stream of the economy call for concern as it is obvious that the informal sector represents a large section of the economy.

The weak credit link between the formal and the informal financial agents suggest that few informal financial intermediaries were successful in getting loan from the formal financial intermediaries to onward lending to borrowers in the informal financial market. The outcome of this study agrees with the experience documented by the studies on Sub Sahara Africa, by Aryeetey (1992), Hyuha (1993), Chipeta and Mkandawire (1992) and Aredo (1993) sponsored by the African Economic Research Consortium (AERC) which addressed the problem of financial sector integration by investigating whether there are links between the formal, semi-formal, and informal financial sectors. Though most commercial banks will not want to lend funds to the informal sector but government policy such as imposition of credit ceiling and strict open market operation will further reduce availability of credit to informal agents or make the cost of borrowing very high and out of reach of the informal sector agents.

Though the neoclassical logical argument that once the returns on assets in rural institutions are positive, the entire financial sector would integrate itself for funds to flow to the most profitable enterprises, urban and rural. This is yet to be seen in Nigeria's case, which means that deliberate effort has to be made by Nigerian government through its regulatory authority to integrate informal financial sector into the mainstream formal financial sector and improve access to finance for micro and small business operators in Nigeria.

Informal institutions use specialized techniques to address the problems of information, transaction costs and risks in serving households and micro businesses that prevent banks from serving these market segments in African countries. But the high localization of informal agents and lack of access to formal finance limits the extent of financial intermediation by informal agents. Hence it is important both to include informal institutions in financial development strategies and to link them more closely with the formal financial system in order to both increase savings mobilization and make more funds available to high-return investments in informal activities.

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# AN APPRAISAL OF SERVICE QUALITY MANAGEMENT IN MANAGEMENT EDUCATION INSTITUTIONS: A FACTOR ANALYSIS

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## ABSTRACT

*LPG (Liberalization, Privatization, and Globalization) has brought phenomenal transformation in all sectors of the economy especially service sector. Among Services, Education is one of the fastest growing industries. Education is a powerful instrument of social, economic and political change. Service quality is new area that interests the scholars, service providers, and researchers as service is different form of the product than that of the goods. All the economy of the world either developing of developed is basically dominated by the service sectors. This paper attempt to find out the Service Quality dimensions related to the Management Education Institution in Delhi which not only satisfy the students but also important for the service provider for the long time sustainability and success of the institutions. A comprehensive scale /questionnaire were designed to evaluate the service quality with respect to management education institutions. The questionnaire was pre tested and pilot test was carried out with the sample size of 52 students in the west Delhi from two institutes offering two year full time PGDM programme. The pilot test was analyzed using SPSS 17.0 for factor analysis. Twelve factors are derived through factor analysis that is categorized as the parameter of service quality. The Service quality is very important. There is general acceptance that quality is the most important for the customer satisfaction and provider competitive advantage in this competitive world of market.*

## KEYWORDS

Education, Perception, Service, Quality, Quality Dimensions.

## INTRODUCTION

L PG (Liberalization, Privatization, and Globalization) has brought phenomenal transformation in all sectors of the economy. Service industry is growing very rapidly and Higher education is fast growing industry **(Damme, 2001; O'Neil & Palmer, 2004)**. Service quality is new area that interests the scholars, service providers, and researchers as service is different form of the product than that of the goods. All the economy of the world either developing of developed is basically dominated by the service sectors.

The National Policy on Education, 1968 laid emphasis on education. Education has always been accorded an honoured place in the Indian society. The great leaders of Indian freedom movement realised the fundamental role of education and throughout the national struggle for independence stressed its unique significance for national development. The development of education in India during the post- Independence period has been guided by the national goals and aspirations as embodied in the Indian Constitution. Education being a powerful instrument of social, economic and political change, its broad principles and objectives are related to the long-term national goals, the programme of national development on which the country is engaged and the complex short term problems it is called upon to solve

Management education providers are now working hard towards understanding the needs, perceived and expected service quality of their stakeholders viz. primarily students, parents, employers, etc. In the cut throat competition and quality conscious's customers the survival of the service provider only depends upon the satisfaction of the students.

**Hennig-Thurau et.al. 2001**, has also emphasized that educational services **'fall into the field of services marketing'**. So the most conceptual frameworks for measuring service quality are based on marketing concepts **(Gummesson, 1991)**.

Service being intangible is not easy to assess. Service is the core of any product so it can not be simply ignored. Service quality promotes customer satisfaction, stimulate intention to return, encourage recommendation and bring business **(Nadiri & Hussain, 2005)**. Management education system improve the service quality to have competitive advantage as customer satisfaction is the key to survival in the competitive world it increases profitability, market share and return on investment **(Barsky & Labagh,1992; Fornell, 1992; Hackl & Westlund, 2000; Halstead & Page, 1992; LeBlanc,1992; Legoherel, 1998; Stevens et. al, 1985).**

## THEORITICAL BACKGROUND

### MANAGEMENT EDUCATION IN INDIA

Management education in India is barely 60 years old. It began in the 1950s as a part-time education for practicing executives, and full-time management degreed offered by a few universities. Later in 1961, the government of India established the Indian Institute of Management at Calcutta and Ahmadabad in collaboration with the Sloan School of management (MIT), the Ford Institute, and the Harvard Business School respectively. Soon several commerce departments in universities repacked their curriculum to offer an MBA degree. By 1990, 82 university based department and schools of management were functioning in the country. Another IIM was established at Banlgore in 1973, and later at Lucknow, Kozhikode, Indore and Shilong. As in, 2006-07 there were over 1100 business schools in the country. Of these, 5 were private aided institutions, 903 were private unaided and 149 were government aided (NKC Report 2003-09). As of now, the number of business schools has risen to approximately 1817 (www.aicte-india.org). To meet the growing demand of schools in the 11th five year plan of India proposed 7 new IIMs by the end of 2012. The three IIMs are operational from session 2010-11 at Ranchi, Raipur and Rohtak. Rest will come up in the cities/ states of Tiruchirapalli, Jammu and Kahsmir, Rajasthan and Uttrakhand. (www.wikipedia.com)

Management education courses provide basic knowledge about management concepts and business structure and follow semester/tri-semester examination systems. This is followed by two year PG MBA/PGDM programme.

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## INDIAN BUSINESS/MANAGEMENT SCHOOLS ARE BROADLY CLASSIFIED AS:

1. Autonomous schools which are affiliated to Ministry of Human Resources Development (MHRD) and All India Council for Technical Education (AICTE) (Under Ministry of Human Resource Development) such as, Indian Institute of Management (Presently 10 IIMs), XLRI, etc. to create professional managers for the corporate world.
2. Management schools and department in universities come under purview of National University Education system. These departments are regulated and monitored by the University Grant Commission. Central universities are wholly funded by the UGC, while state universities are funded by the state government and may partly by the UGC.
3. University affiliated colleges are also guided substantially by the process and rules of the universities.
4. Private universities/Institutions which are sponsored by various societies/trusts/corporate bodies interested in promoting educational venture in the country are playing an increasing role in management education.

## CHARACTERISTICS OF SERVICE

Service is different from the goods as there is nothing tangible to show when money is spent on them. **Berry** defines Services as "acts, deeds, and performance". **(AMA) American Marketing Association** defines services as "activities, benefits, or satisfaction that are offered for sale, or provided in connection with the sale of goods." This has identified two types of services viz. pure services and services provided along with the product. The characteristics of Services in the context of education as follows:

1. **INTANGIBILITY**
Services are activities or performance executed by the providers. Services are intangible offerings which can't be touched, smelt, seen or tasted. In services, the performance is supported by a tangible element, but one should keep in mind that what is purchased by the customer is a performance **(Verma,2008)**. It is the process of delivering a service which comprises the product **(McLuhan, 1964)**.
Customer considers tangible cues particularly before using or buying the services. So the service provider tangibilse the intangible services. In case of education institution,, service provider tangibilse through infrastructures (building, campus, canteen, class rooms, promotional and communication materials, etc.)

2. **INSEPARABILITY**
Unlike goods, services are produced and consumed simultaneously. It tends to be performed in real time in which customer- provider's interaction and cooperation is a must. For instance, professor delivering lectures must need the presence (interaction) of students otherwise it is a waste.
Customer interaction with the service provider may be different types. In some case such as classroom lecture students need to be present during the entire course of service delivery. While in some cases (repair, etc.) contact may be in two stages that is at the beginning and end. But, where some media is used then it is reduced in case of online /distance education yet, mental presence of the customer is sought.
They help to create and improve service delivery through continuous feedback but for this we must have right customer mix.

3. **INCONSISTENCY**
Unlike goods, services suffer from lack of standardization. The customer experience services with the provider tend to vary though the service product remains the same. For example the two students find different experience from the same professor. This element of service makes a service buyer uncertain about what is in store for him even if the service bought is not for the first time.
In service humans are involved in both as service provider and service recipient and their performance can not be controlled as it is the most complex and dynamic element of the universe. The behaviors and knowledge of human aspects by the service provider helps in delivering the service and increases the customer satisfaction and profitability of the service provider. Customer involvement can be increased by giving more active role and greater flexibility in controlling the outcome.

4. **PERISHABILITY**
Services can not be stored like goods can be. Services go waste if they are not consumed along with creation so motivation, behavior, cooperation, customer mix, etc are very important area of concern. Services are available locally as it can not be transported like goods. Service must be the 'best the first time' as there is no other chance of correction if goes wrong the first time.

## SERVICE MARKETING MIX

The traditional marketing mix comprises of 4 P's viz. Product, Price, Place and Promotion. Since the services are different from the goods. It has total seven P's (4 P's of marketing and 3 additional P's) that forms the service marketing mix. The Service marketing mix is as follows.

1. **PRODUCT:** A product is anything that can be offered to a market to satisfy a need or want. The products, which can be marketed, include physical goods, services, persons, places, organizations, and ideas.
2. **PRICE:** Monetary price implies the payment of certain sum by the customer, and the social price refers to the additional effort that the customer must make in order to obtain access to a product.
3. **PLACE:** It represents distribution. When, 'Where' and 'How' service is made available for the user. 'When' implies the time period in which information is provided. 'Where' indicates the location of the services provides and How constitutes the type of distribution
4. **PROMOTION:** It involves the communication that marketer engages in while the customers in order to acknowledge the product.
5. **PEOPLE:** All human actors who play a part in service delivery and thus the buyer's perception, namely, the firm's personnel, the customers, and other customer in the services environment. E.g., students and faculty, etc.
6. **PHYSICAL EVIDENCE:** The environment in which the service is delivered and where the firm and customer interest, and may tangible components that facilitate performance or communication of the services. E.g., brouchers, letter head, business card, signage, equipment, mark sheet, etc.
7. **PROCESS:** The actual procedures, mechanism, and flow of activities by which the service is delivered – the service delivery and operating system.

## REVIEW OF LITERATURE

### QUALITY: CONCEPTS

Quality is much debated term. Quality means different to different people. For 'relativists' it is like 'beauty', that lies in the eye of the beholder. Whereas, 'objectivists' believe quality can be specific attributes that can be identified. The word quality derived from Latin word 'qualitas' (property, quality, value, characteristic, features and ability) which refers to 'quails' meaning 'what kind of'. Quality with a variety of meaning and connotations, it has been referred to as 'slippery concept' **(Pfeffer and Coote, 1991)**. Many authors **(Nigvekar, 1996; Warren et at, 1994; Sallis, 1996)** have referred to the highly cited words of **Pirsig (1974)**.

Quality...... you know what it is, yet you don't know what it is. But some things are better than others, that is, they have more quality. But when you try to say what the quality is, apart form the things that have it, it all goes pool! There's nothing to talk about. But if you can't say what quality is, how do you know what it is, or how do you know that it even exists? If no one knows what it is, then for all practical purposes, it doesn't exist at all. But for all practical purposes it really does exist.... So round and round you go, spinning mental wheels and nowhere finding any place to get traction. What the hell is Quality? What is it?

### QUALITY: DEFINITION

Quality has different meaning to different people. Some of the definition covering the broader aspects of quality is being discussed below.
The British Standard Institution (BSI) defines quality as "the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs" **(BSI, 1991)**.

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Many scholars have defined quality in different ways:

**Crosby (1979)** defines quality as 'conformance to requirement'.

**Juran and Gryna (1980)** define quality as "Fitness for use".

**Deming (1980)** defines quality as "predicable degree of conformance to a standard" later they defined in terms of "customer focus".

**Delmore & E Shaker (2002)** defined quality "as the degree of excellence of entire educational experience".

**Harvey and Green (1993)** in their seminal work "Defining quality, assessment and Evaluation in Higher Education" have pointed out that quality is a relative concept. They have provided five discrete but interrelated notion of quality. As cited in **Watty (2003)** key aspects of each of these categories can be summarized as follows:

i) **Exception:** distinctive, embodies in excellence, passing a minimum set of standards.

ii) **Perfection or consistency:** zero defects, getting things right the first time (focus on process as opposed to inputs and outputs).

iii) **Fitness for purpose:** relates quality to a purpose, defined by the provider.

iv) **Value for money:** a focus on efficiency and effectiveness, measuring outputs against inputs. A populist notion of quality (government).

v) **Transformation:** (in term of qualitative change); education is about doing something to the student as opposed to something for the consumer includes concepts of enhancing and empowering, democratisation of the process, not just outcomes.

These different notions of quality have lead **Reeves and Bedner (1994)** to conclude "The search for a universal definition of quality and a statement of law like relationship has been unsuccessful". According to **Gummesson (1990)** it might be useful to create an insight into the many dimensions that from a fuzzy entity referred to as quality through social consensus rather that defining it. **Garvin (1988)** classified the various definitions of quality into five major groups, viz. Transcendent definition, product-based definition, user-based definition, manufacturing-based, and value-based definitions.

Quality has a few central ideas around which the whole concept revolves: Quality as absolute, Quality as relative, Quality as a process, and Quality as culture. According to **Mukhopadhyay (2005),** the adherence to "product specification is actually the minimum conditions for quality, but not the sufficient condition".

## QULAITY: IN HIGHER EDUCATION CONTEXT

There is a considerable debate about the best way to define service quality in higher Education **(Becket and Brookes, 2006)**. The concept of quality is not well defined in higher education **(Cheng and Tam, 1997; Pounder, 1999)**.Quality in Education has been defined variedly as, excellence in education **(Peters and Waterman,1982)** fitness for purpose, fitness of educational outcome and experience for use **(Juran and Gryna,1988)**, "value addition in education" **(Feigenbaum, 1951)**, conformance of education output to planned goals, specifications and requirements **(Crosby 1979)** defect avoidance in education process **(Crosby 1979)** and meeting or exceeding customer's expectation of education **(Parasuraman *et. al.,* 1985)**. **(Sahanye *et. al.,* 2006)** in their research defined that quality in Education is a multiple concept which includes within its ambit the quality of inputs in the form of students, faculty, support staff and infrastructure; the quality of processes in the form of the learning and teaching activity; and the quality of outputs in the form of the enlightened students that move out of the system. In fact, it is all permeating covering all the aspects of academic life. **Allen and Davis (1991)** and **Holdford and Patkar (2003)** defined educational service quality as a student's overall evaluation of services received as part of their educational experience. Therefore, a single definition of education quality is not possible, rather, it would be more appropriate to define education quality based on the criteria that stakeholders used to judge quality, and also to consider the competing views when assessing the education quality **(Green, cited in Sahney et al., 2004).**

**Barnett (1992)** quotes a 'suggestive definition by **Barrow (1991)** to define 'quality' in higher education:

…. a high evaluation accorded to an educative process, where it has been demonstrated that, through the process, the students' educational development has been enhanced…. not only have they achieved the particular objectives set for the course but, in doing so, they have also fulfilled the general educational aims of autonomy of the ability to participate in reasoned discourse, of critical self evaluation, and of coming to a proper awareness of the ultimate contingency of all thought and action.

**Watty (2003)** suggests that the dimension of quality as perfection can be removed, since higher education does not aim to produce defect-free graduates. **Lomas (2001)** suggests that fitness for purpose and transformation seem to be the two most appropriate definitions of quality, according to small-scale research with a sample of senior

**Cheng (1995) argues**, "Education quality is the character of the set of elements in the inputs, process and output of the education system that provides services that completely satisfy both internal and external strategic constituencies by meeting their explicit and implicit expectations". There is also an increasing expectation by students that they should have choices in terms of subjects, modes of delivery, methods of assessment and time spent on campus.

## DIMENSIONS OF QUALITY

Service quality is an abstract and elusive construct because of three features unique to the service: intangible, heterogeneity and inseparability of production and consumption **(Parasuramn, Zeithaml and Berry, 1985).**

Among the various service quality models, the Service Quality Gap Model, also known as SERVQUAL model **(Parasuraman, Zeithaml, & Berry, 1985)** is the most commonly quoted service quality models. In their exploratory research which dates back to 1985 they revealed that the criteria used by customers in assessing service quality fit in ten, potentially overlapping dimensions viz. tangibles, reliability, responsiveness, competence, courtesy, credibility, security, access, communication and understanding the customer. The authors **(Parasuraman, Zeithaml, & Berry, 1988)** extended their research in 1988 and reduced the list to five attributes (**reliability, assurance, tangibles, responsiveness and empathy**) to form the basic structure of the well-know SERVQUAL, which is considered to be a useful tool to determining service quality. There are five key dimensions of the SERVQUAL model which can be used by consumers to evaluate perception of the perceived service quality. The five generic dimensions are:

i) **Tangibles** the physical surroundings represented by the objects.

ii) **Reliability** the service provider's ability to provide accurate and dependable services.

iii) **Responsiveness** a firm's willingness to assist to customer by providing fast and efficient service performance.

iv) **Assurance** diverse features that provide confidence to customers such as specific service knowledge; polite and trustworthy behavior form employees.

v) **Empathy** service provider's readiness to provide each customer with personal service.

Generally there are eight dimensions or attributes which characterize quality of product or services for the use **(Garvin, 1987)** These are:

i) **Performance** Concerned with the primary operating characteristics of a product.

ii) **Reliability** can be considered as to what extent the knowledge gained is correct, and up-to-date.

iii) **Durability** is the product's assumed life to perform satisfactorily. It can be defined as the depth of the learning.

iv) **Aesthetics** concerned with the design, looks, color and presentation and how the customer views it.

v) **Futures** are the characteristics that supplement the basic performance functions. Flexibility of course offering could be a future.

vi) **Conformance** extent of meeting the established specification/ standard.

vii) **Serviceability** concerned with the repair and field service of the product. In services it is concerned with handling of complaints form the service recipient and stakeholders.

viii) **Perceive Quality** the experience of the service or the brand image of the service created in the mind of the customer through communication, word-of-mouth, etc.

In the study **The development of HEdPERF (F.Abdullah,2006)** suggested the quality dimension related to the higher education as:

i) **Access-** the factors consists of items that relate to such issues as approachability, ease of contact, availability and convenience.

ii) **Reputation-** factors suggest the importance of higher learning institutions in projecting a professional image.

iii) **Programme issue-** offering wide range and reputable academic programmes with flexible structure and syllabus.

iv) **Understanding-** understanding students' specific need in terms of counseling, etc.

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v)    **Academic Aspects-** factors responsible for the academics.

vi)    **Non-academic Aspects-** enables students fulfill their study obligations and it relates to duties carried out by non- academic staff.

## OBJECTIVE

The research attempts to draw a set of service quality parameters, drawn from students' (defined as customers) perceptions about service quality. These service quality parameters have been used in the context of Management Education Institution in Delhi & NCR.

The objectives of the study are as follow:

1.    To measure service quality dimensions in Management Education Institution.
2.    To validate the instrument to measure service quality in Management Education Institution
3.    To measure the service quality perception of the students in Management Education Institution.

A statistical approach "Factor Analysis" will be used for the study.

## RESEARCH METHODOLOGY

Following research stages is used for this study

**STAGE 1: IDENTIFICATION OF CRITICAL FACTORS OF SERVICE QUALITY**

This involved in-depth searching of the literature to ascertain the determinants of service quality. A total 15 students from PGDM institutes in Delhi were selected to identify a series of relevant service quality evaluation criteria or critical factors.

**STAGE 2: DEVELOPMENT OF RESEARCH INSTRUMENT**

The literature review and focus group interview provided the basis for generating items for draft questionnaire. The draft questionnaire consisted of three sections A, B and C Section. Section A contained 70 items related to different aspects of management education institution's service quality. The items were presented randomly as statements on the questionnaire, with the same rating scale used throughout. The items were measured on a 5-point Likert-type scale that varied from 1= strongly disagree to 5= strongly agree. In addition to the main scale addressing individual items, respondents were asked in Section B to provide an overall rating of the quality services, satisfaction level and suggestion to improve the service quality. Whereas section C contained 9 questions pertaining to respondents profile. The developed questionnaire was of pre-tested on 30 respondents in order to check accuracy, rephrasing of questions, and eliminating items that fails to measure the any variation. The cronbach's alpha value for reliability of 70 items was 0.877. After making the necessary changes (rephrasing and deletion) 43 items were retained for the final instrument with the cronbach's alpha value for reliability was 0.909, which is excellent **(Nunnally, 1978).**

**STAGE 3: PILOT TESTING**

The draft questionnaire was eventually subjected to pilot testing with a total of 52 representative students drawn from management education institutions in Delhi, and subsequently submitted to experts (academician, practitioners) for feedback. They were asked to comment on any perceived ambiguities, omissions or errors concerning the draft questionnaire, and consequently changes were made accordingly.

SPSS 17.0 for windows was employed in order to access the particular results required for the scale measurement.

**DATA ANALYSIS**

Multivariate normal distribution can serve as an approximate sampling distribution for many statistics, namely, factor analysis, which was used extensively in this study.

**THE SAMPLE**

Demographic profile of the respondents in **Table 2** shows that 44.20 % of the respondents were males. As for the age distribution, the majority of respondents fall between the age group below 23 years (61.50 %). With the respect to the semester 57.7 % respondents were from II-semester. 34.60 % students are having Human Resource Management and Finance as a major specialization respectively and 30.8 % has marketing as a major specialization. As for annual house hold income majority or respondent belong to below 10 lakh (88.50 %). Majority of respondent (78.80 %) paid fee from themselves/ parents, while 21.20 % respondent had availed education loan for the same. About 53.80 % respondents had percentage marks in previous semester/ qualifying exams were 60.75 %. Since, the pilot study is carried out in west Delhi so 100 % respondents belong to west zone only. In terms of student status majority 76.90 % of respondent were traditional student means that there were no education gap after the graduation.

**RELIABILITY ANALYSIS**

In this study, two internal consistency estimates of reliability, namely, coefficient alpha and split-half coefficient expressed as Spearman-Brown corrected correlation were computed for the service quality constructs. An alpha value of 0.7 and above is considered to be the criteria for demonstrating internal consistency of new scales and established scales respectively **(Nunnally).** For the split-half coefficient, each construct was split into two halves such that the two halves would be as equivalent as possible, and Cronbach's study in 1943 **(cited in Wagner *et. al.*)** stated that'….the split yielding the highest correlation ordinarily gives the most nearly comparable halves'. The values of both coefficient alpha and split-half coefficient for all the construct or factors are shown in **Table 1** All the values meet the required prerequisites, thereby demonstrating that all the construct or factors are internally consistent.

**TABLE 1**: **RELIABILITY FOR THE SERVICE QUALITY CONSTRUCTS**

| Dimensions | Cronbach alpha (α) | Split-half coefficient (r) |
|---|---|---|
| 42 | 0.909 | 0.900 |

**FACTOR ANALYSIS**

Factor analysis was used to identify the dimensional structure of service quality within management education sector. One critical assumption underlying the appropriateness of factor analysis is to ensure that the data matrix has sufficient correlations to justify the application **(Hair *et al.,*).** A first step is visual examination of the correlations, identifying those that are statistically significant. Inspection of the correlation matrix reveals that practically all correlations are significant at $P = 0.01$, **(Table 4)** and this certainly provides an excellent basis for factor analysis.

The next step involves assessing the overall significance of the correlation matrix with Bartlett test of sphericity **(Table 3)**, which provides the statistical probability that the correlation matrix has significant correlation among at least some of the variable. The results were significant $\chi^2$ (42, n=52) =1351.22 (*P = 0.00*), a clear indication of suitability for factor analysis. Finally, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was computed to quantify the degree of inter-correlations among the variables, and the results indicate an index of 0.551, a 'adequate' sign of adequacy for factor analysis (Kaiser, 1970) since the sample size is very small.

All the 42 items from section A of the questionnaire were subjected to a factor analysis utilizing the principal components procedure, which was followed by a varimax rotation **(Table 7)**. The decision to include a variable in a factor was based on factor whose eigen values was greater than 1.0 were retained in the factor solution **(Tabachnick and Fidell)**. The choice regarding factor loading greater than ± 0.5 was not based on any mathematical proposition but relates more to practical significance. According to **Hair *et.al.*** factor loading of 0.5 and above are considered significant at P = 0.05 with a sample size of 50 respondent. From **Table 5**, twelve factors were extracted which is named as under.

The first factor (eigenvalue= 10.250) was labeled **Reputation** for 8.63 % of the covariance. The four items defining this factor, with loading ranging from 0.798 to 0.527 includes good teacher-student relationship, willingness to help, availability of faculties, etc.

The Second factor (eigenvalue= 3.198) was labeled **Performance** for 7.78 % of the covariance. The three items defining this factor with loading ranging from 0.777 to 0.595 includes course curriculum and the reorganization of intellectual efforts.

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The third factor (eigenvalue= 2.805) was labeled **Futures** for 7.46 % of the covariance. The four items defining this factor with loading ranging from 0.733 to 0.509 includes electives, industrial interaction plateform, quality of guest lectures and promotional material.

The fourth factor (eigenvalue= 2.399) was labeled **Assurance** for 6.72 % of the covariance. The two items defining this factor with loading ranging from 0.760 to 0.620 it includes feedback and inculcation of interest.

The fifth factor (eigenvalue= 2.15) was labeled **Understanding** for 6.52 % of the covariance. The two items defining this factor with loading ranging from 0.845 to 0.673 includes summer training and complain handling within time frame.

The sixth factor (eigenvalue= 1.873) was labeled **Reliability** for 5.73 % of the covariance. The two items defining this factor with loading ranging from 0.835 to 0.708 includes knowledgeable faculties, and attitude of director.

The seventh factor (eigenvalue= 1.81) was labeled **Support Service** for 5.71 % of the covariance. The four items defining this factor with loading ranging from 0.641 to 0.590 includes usage of teaching methods, individual attention.

The eighth factor (eigenvalue= 1.765) was labeled **Durability** for 5.70 % of the covariance. The two items defining this factor loading ranging from 0.717 to 0.700 includes course curriculum and theory related to business realities.

The ninth factor (eigenvalue= 1.460) was labeled **Responsiveness** (prompt service) for 5.65 % of the covariance. There is only one item with loading 0.798

The tenth factor (eigenvalue= 1.402) was labeled **Conformance** for 5.46 % of the covariance. The three items defining this factor loading ranging from 0.782 to 0.582 includes meeting schedule deadlines, economic value by the course, motivation to attend conferences.

The eleventh factor (eigenvalue= 1.273) was labeled **Dark Sides** for 5.15 % of the covariance. The two items defining this factor loading ranging from -0.727 to 0.662 includes faculties taking revenge and feel secure and confident in the institute.

The twelfth factor (eigenvalue= 1.202) was labeled **Suitable Environment** for 4.65 % of the covariance. There is only one item with loading 0.789.

## CONCLUSION

The study was focused on the students of (PGDM) Post Graduate Diploma in Management to measure the perception towards the service quality being offered to them by the institutions. Management Education is highly demanding course and institutions are feeling pressure from various customers group namely students, parents, and the industry. The liberalization in education policy and private partnership programme to make the nation educated society is posing greatest challenge for the sustainability of the institutions.

This is pure service industry where quality, customer service is the key to success. The paper attempted to evaluate the SERVQUAL model and designed a comprehensive scale /questionnaire in order to evaluate the service quality with respect to management education institutions. Nine factors has been evolved about as important criteria of service quality in context of management education. The pre test and pilot test reveal the important aspect of service quality that must be addressed by the institutions.

The pilot study is limited to small sample size and area. Further research may examine which of the factors discriminate most significantly among the institutions from the perspective of different customer group viz. parents, owner, employer and various governing authorities.

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## APPENDIX

**TABLE 2: DEMOGRAPHIC PROFILE OF THE RESPONDENTS**

| Demographic Factors | Number of Respondents | Percentage |
|---|---|---|
| **GENDER** | | |
| Male | 23 | 44.20% |
| Female | 29 | 55.80% |
| **Total** | **52** | **100%** |
| **AGE** | | |
| Below 23 | 32 | 61.50% |
| Over 23 | 20 | 38.50% |
| **Total** | **52** | **100%** |
| **SEMESTER** | | |
| II-Semester | 30 | 57.70% |
| IV-Semester | 22 | 42.30% |
| **Total** | **52** | **100%** |
| **SPECIALIZATION** | | |
| Marketing | 16 | 30.80% |
| HRM | 18 | 34.60% |
| Finance | 18 | 34.60% |
| **Total** | **52** | **100%** |
| **INCOME (Rs.)** | | |
| Below 10 Lakh | 46 | 88.50% |
| Over 10 Lakh | 6 | 11.50% |
| **Total** | **52** | **100%** |
| **ZONE** | | |
| West | 52 | 100.00% |
| **Total** | **52** | **100%** |
| **MODE OF FINANCE** | | |
| Self/ Parents | 41 | 78.80% |
| Bank | 11 | 21.20% |
| **Total** | **52** | **100%** |
| **MARKS %** | | |
| Below 60 % | 7 | 13.50% |
| 60- 75 % | 28 | 53.80% |
| 75-80 % | 17 | 32.70% |
| **Total** | **52** | **100%** |
| **STUDENT'S STATUS** | | |
| Traditional | 40 | 76.90% |
| Non-Traditional | 12 | 23.10% |
| **Total** | **52** | **100%** |

**TABLE 3: KMO AND BARTLETT'S TEST**

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .551 |
|---|---|---|
| **Bartlett's Test of Sphericity** | **Approx. Chi-Square** | 1351.217 |
| | **Df** | 861 |
| | **Sig.** | .000 |

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| TABLE 4 : COMMUNALITIES | | |
|---|---|---|
| Variables | Initial | Extraction |
| V_1 | 1.000 | .736 |
| V_2 | 1.000 | .705 |
| V_3 | 1.000 | .774 |
| V_4 | 1.000 | .784 |
| V_5 | 1.000 | .685 |
| V_6 | 1.000 | .768 |
| V_7 | 1.000 | .724 |
| V_8 | 1.000 | .847 |
| V_9 | 1.000 | .726 |
| V_10 | 1.000 | .653 |
| V_11 | 1.000 | .803 |
| V_12 | 1.000 | .724 |
| V_13 | 1.000 | .847 |
| V_14 | 1.000 | .801 |
| V_15 | 1.000 | .725 |
| V_16 | 1.000 | .671 |
| V_17 | 1.000 | .725 |
| V_18 | 1.000 | .733 |
| V_19 | 1.000 | .743 |
| V_20 | 1.000 | .798 |
| V_21 | 1.000 | .751 |
| V_22 | 1.000 | .733 |
| V_23 | 1.000 | .792 |
| V_24 | 1.000 | .724 |
| V_25 | 1.000 | .750 |
| V_26 | 1.000 | .737 |
| V_27 | 1.000 | .707 |
| V_28 | 1.000 | .838 |
| V_29 | 1.000 | .637 |
| V_30 | 1.000 | .767 |
| V_31 | 1.000 | .858 |
| V_32 | 1.000 | .812 |
| V_33 | 1.000 | .736 |
| V_34 | 1.000 | .697 |
| V_35 | 1.000 | .834 |
| V_36 | 1.000 | .769 |
| V_37 | 1.000 | .787 |
| V_38 | 1.000 | .759 |
| V_39 | 1.000 | .724 |
| V_40 | 1.000 | .833 |
| V_41 | 1.000 | .727 |
| V_42 | 1.000 | .638 |

Extraction Method: Principal Component Analysis.

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**TABLE 5: TOTAL VARIANCE EXPLAINED**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 10.250 | 24.404 | 24.404 | 10.250 | 24.404 | 24.404 | 3.625 | 8.631 | 8.631 |
| 2 | 3.198 | 7.614 | 32.018 | 3.198 | 7.614 | 32.018 | 3.267 | 7.778 | 16.409 |
| 3 | 2.805 | 6.679 | 38.697 | 2.805 | 6.679 | 38.697 | 3.134 | 7.461 | 23.871 |
| 4 | 2.399 | 5.711 | 44.408 | 2.399 | 5.711 | 44.408 | 2.840 | 6.762 | 30.633 |
| 5 | 2.145 | 5.107 | 49.514 | 2.145 | 5.107 | 49.514 | 2.738 | 6.519 | 37.152 |
| 6 | 1.873 | 4.460 | 53.975 | 1.873 | 4.460 | 53.975 | 2.405 | 5.725 | 42.878 |
| 7 | 1.810 | 4.309 | 58.283 | 1.810 | 4.309 | 58.283 | 2.397 | 5.706 | 48.584 |
| 8 | 1.765 | 4.202 | 62.485 | 1.765 | 4.202 | 62.485 | 2.393 | 5.699 | 54.282 |
| 9 | 1.460 | 3.477 | 65.962 | 1.460 | 3.477 | 65.962 | 2.374 | 5.652 | 59.934 |
| 10 | 1.402 | 3.339 | 69.301 | 1.402 | 3.339 | 69.301 | 2.293 | 5.459 | 65.393 |
| 11 | 1.273 | 3.030 | 72.331 | 1.273 | 3.030 | 72.331 | 2.163 | 5.151 | 70.544 |
| 12 | 1.202 | 2.863 | 75.194 | 1.202 | 2.863 | 75.194 | 1.953 | 4.650 | 75.194 |
| 13 | .949 | 2.259 | 77.453 | | | | | | |
| 14 | .862 | 2.052 | 79.505 | | | | | | |
| 15 | .799 | 1.902 | 81.407 | | | | | | |
| 16 | .784 | 1.866 | 83.273 | | | | | | |
| 17 | .739 | 1.760 | 85.033 | | | | | | |
| 18 | .671 | 1.598 | 86.630 | | | | | | |
| 19 | .607 | 1.445 | 88.076 | | | | | | |
| 20 | .571 | 1.359 | 89.435 | | | | | | |
| 21 | .530 | 1.262 | 90.697 | | | | | | |
| 22 | .484 | 1.153 | 91.850 | | | | | | |
| 23 | .425 | 1.011 | 92.861 | | | | | | |
| 24 | .401 | .954 | 93.815 | | | | | | |
| 25 | .350 | .834 | 94.649 | | | | | | |
| 26 | .301 | .718 | 95.367 | | | | | | |
| 27 | .297 | .707 | 96.074 | | | | | | |
| 28 | .268 | .638 | 96.712 | | | | | | |
| 29 | .224 | .534 | 97.245 | | | | | | |
| 30 | .197 | .468 | 97.713 | | | | | | |
| 31 | .176 | .420 | 98.133 | | | | | | |
| 32 | .160 | .382 | 98.515 | | | | | | |
| 33 | .136 | .324 | 98.839 | | | | | | |
| 34 | .094 | .224 | 99.063 | | | | | | |
| 35 | .086 | .205 | 99.267 | | | | | | |
| 36 | .081 | .193 | 99.460 | | | | | | |
| 37 | .063 | .149 | 99.609 | | | | | | |
| 38 | .049 | .118 | 99.727 | | | | | | |
| 39 | .037 | .088 | 99.815 | | | | | | |
| 40 | .033 | .078 | 99.892 | | | | | | |
| 41 | .026 | .061 | 99.953 | | | | | | |
| 42 | .020 | .047 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis.

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**TABLE 6: COMPONENT MATRIX[A]**

| | Component | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **V_1** | .400 | .233 | .065 | -.488 | -.048 | .277 | -.240 | .345 | .030 | -.130 | .064 | .036 |
| **V_2** | .400 | -.012 | -.294 | -.133 | .206 | -.293 | -.441 | -.112 | -.135 | -.007 | -.294 | -.033 |
| **V_3** | .409 | .116 | -.100 | .449 | .208 | -.002 | -.151 | .149 | .106 | -.420 | .235 | .224 |
| **V_4** | .768 | -.116 | -.215 | .000 | .142 | .226 | -.092 | -.057 | .101 | .157 | -.058 | .119 |
| **V_5** | .343 | -.486 | -.074 | .088 | -.165 | .069 | .212 | -.289 | .174 | -.155 | .000 | .321 |
| **V_6** | .420 | .486 | -.308 | -.313 | .093 | .187 | -.023 | -.086 | .087 | -.232 | .201 | -.095 |
| **V_7** | .373 | -.048 | -.051 | -.104 | -.155 | -.650 | -.039 | .266 | .152 | .080 | -.130 | .065 |
| **V_8** | .630 | .011 | -.383 | .049 | -.243 | .189 | .257 | .055 | -.142 | .231 | .183 | .175 |
| **V_9** | .561 | -.158 | -.379 | -.114 | -.150 | .281 | .264 | .011 | .095 | -.044 | -.081 | .201 |
| **V_10** | -.382 | .063 | .052 | .407 | .189 | .168 | -.031 | -.040 | .492 | .127 | .028 | -.096 |
| **V_11** | .341 | -.373 | .069 | -.395 | .450 | -.233 | -.052 | -.118 | -.073 | -.012 | .305 | .119 |
| **V_12** | .325 | -.370 | -.180 | -.219 | .301 | -.329 | .274 | -.120 | .331 | -.036 | .039 | -.010 |
| **V_13** | .350 | -.021 | .256 | -.232 | -.181 | .149 | .414 | -.336 | -.080 | -.286 | -.041 | -.419 |
| **V_14** | .244 | -.001 | .691 | -.052 | .025 | .194 | .144 | .374 | .111 | .218 | .019 | -.043 |
| **V_15** | .440 | .033 | .024 | .079 | .429 | -.277 | .343 | .244 | -.094 | -.064 | .232 | -.139 |
| **V_16** | -.047 | .453 | .472 | -.086 | .254 | .084 | .109 | -.100 | -.225 | .237 | .019 | .180 |
| **V_17** | .427 | -.034 | .223 | -.005 | -.192 | -.251 | -.022 | -.508 | -.174 | .105 | .073 | .294 |
| **V_18** | .580 | -.376 | .138 | -.128 | -.207 | .042 | .021 | .069 | -.273 | .283 | .037 | -.118 |
| **V_19** | .416 | .304 | .451 | .094 | -.215 | -.197 | .249 | .221 | .206 | -.048 | .154 | .026 |
| **V_20** | .533 | -.054 | -.001 | .571 | -.004 | -.165 | -.035 | .067 | -.134 | -.200 | .303 | -.043 |
| **V_21** | .422 | -.222 | .203 | .624 | -.114 | .193 | -.075 | .003 | -.022 | .004 | -.131 | -.140 |
| **V_22** | .358 | .642 | .218 | -.153 | .006 | .057 | -.109 | -.184 | -.144 | -.088 | .032 | -.207 |
| **V_23** | .427 | .412 | -.054 | .243 | .283 | -.223 | .389 | .079 | -.253 | -.034 | -.134 | .083 |
| **V_24** | .479 | .438 | -.291 | .054 | -.123 | -.184 | .175 | .118 | .204 | .261 | -.102 | .036 |
| **V_25** | .520 | .465 | -.200 | -.188 | -.096 | -.011 | .128 | .110 | .105 | .331 | -.049 | .164 |
| **V_26** | .449 | -.324 | -.127 | -.172 | .300 | .259 | -.117 | .312 | .147 | .233 | -.110 | -.170 |
| **V_27** | .391 | -.371 | -.220 | -.202 | .156 | .297 | .122 | .368 | -.080 | -.235 | .047 | -.013 |
| **V_28** | .446 | -.203 | -.020 | .159 | .500 | .111 | .427 | -.156 | -.147 | -.010 | -.223 | -.181 |
| **V_29** | .636 | -.221 | .096 | -.024 | -.283 | -.091 | .006 | -.036 | .150 | -.181 | -.153 | -.069 |
| **V_30** | .537 | .045 | .026 | .202 | .162 | .156 | -.082 | .020 | -.067 | -.011 | -.601 | .104 |
| **V_31** | .450 | .582 | -.313 | .077 | .273 | .119 | -.147 | -.170 | -.070 | -.229 | -.128 | .003 |
| **V_32** | .687 | -.057 | -.137 | .143 | -.405 | -.093 | -.136 | -.092 | .047 | -.047 | -.006 | -.304 |
| **V_33** | .318 | .064 | .493 | -.154 | .360 | -.066 | -.249 | -.031 | .400 | -.079 | -.031 | .000 |
| **V_34** | .653 | -.066 | .011 | -.082 | -.144 | -.166 | -.355 | .043 | -.086 | -.040 | -.011 | -.271 |
| **V_35** | .446 | -.330 | .283 | .135 | .259 | .190 | -.386 | -.074 | -.269 | .146 | .191 | .199 |
| **V_36** | .587 | -.076 | .371 | -.221 | .048 | -.183 | -.018 | -.235 | .231 | -.109 | -.226 | .157 |
| **V_37** | .670 | .105 | .212 | .399 | .012 | .136 | -.065 | -.047 | .282 | .123 | .046 | -.042 |
| **V_38** | .474 | -.069 | .305 | .048 | -.129 | -.171 | .006 | .417 | -.360 | -.149 | -.209 | .137 |
| **V_39** | .695 | .087 | -.272 | .097 | -.120 | -.078 | -.243 | .124 | .021 | .057 | .227 | .009 |
| **V_40** | .587 | -.036 | -.135 | .043 | .159 | -.109 | -.021 | -.259 | -.032 | .439 | .192 | -.363 |
| **V_41** | .680 | -.021 | .263 | -.270 | -.213 | .163 | .068 | .000 | .027 | -.198 | .068 | .021 |
| **V_42** | .598 | .165 | .136 | -.032 | -.100 | .278 | -.022 | -.304 | .044 | .075 | .105 | .186 |

Extraction Method: Principal Component Analysis.

a. 12 components extracted.

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**TABLE 7: ROTATED COMPONENT MATRIX[A]**

| | Component | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| V_1 | .042 | .157 | **.509** | -.019 | .255 | .001 | .121 | .447 | .068 | -.290 | .285 | .008 |
| V_2 | .284 | .162 | .158 | -.147 | -.458 | .038 | .377 | .066 | .173 | .013 | .230 | .332 |
| V_3 | .032 | .054 | .167 | .104 | -.002 | **.835** | .084 | .090 | .037 | .043 | -.038 | .121 |
| V_4 | .263 | .376 | .183 | .355 | -.039 | .141 | .166 | .342 | .388 | .117 | -.025 | .289 |
| V_5 | .112 | -.024 | -.204 | **.760** | -.059 | .127 | .140 | .015 | .094 | .039 | .010 | .048 |
| V_6 | .061 | .285 | **.765** | .096 | -.111 | .116 | .070 | .194 | -.057 | .050 | -.008 | -.123 |
| V_7 | .308 | .425 | -.239 | -.076 | .041 | .104 | .465 | -.046 | -.179 | -.029 | .349 | .010 |
| V_8 | .211 | **.595** | .087 | .434 | -.020 | .135 | -.281 | .201 | .235 | .155 | .177 | -.062 |
| V_9 | .118 | .368 | .110 | **.620** | -.077 | .040 | -.050 | .371 | .007 | .086 | .111 | .113 |
| V_10 | -.141 | -.089 | -.178 | -.150 | .091 | .103 | -.045 | -.047 | -.111 | -.065 | **-.727** | .054 |
| V_11 | -.032 | -.088 | .033 | .119 | -.090 | .031 | **.590** | .197 | .443 | .255 | .230 | -.263 |
| V_12 | .092 | .131 | -.144 | .309 | -.136 | -.014 | **.598** | .194 | -.052 | .373 | -.048 | -.156 |
| V_13 | .349 | -.247 | .398 | .400 | .263 | -.274 | -.024 | -.067 | -.156 | .391 | .127 | -.052 |
| V_14 | .005 | .002 | -.044 | -.070 | **.845** | -.074 | .067 | .166 | .169 | .046 | .047 | .095 |
| V_15 | .046 | .183 | .047 | -.104 | .178 | .339 | .225 | .166 | .032 | **.637** | .163 | -.134 |
| V_16 | -.412 | .062 | .275 | -.219 | .373 | -.142 | -.027 | -.315 | .287 | .143 | .049 | .097 |
| V_17 | .189 | .125 | .071 | .373 | .026 | .012 | .202 | -.516 | .398 | .032 | .247 | .033 |
| V_18 | .471 | .124 | -.117 | .213 | .215 | -.156 | -.020 | .202 | .417 | .142 | .362 | .017 |
| V_19 | .167 | .271 | .121 | .065 | **.673** | .256 | .136 | -.196 | -.150 | .068 | .127 | -.063 |
| V_20 | .404 | .059 | -.028 | .085 | .075 | **.708** | -.073 | -.078 | .168 | .260 | .090 | .015 |
| V_21 | .461 | -.097 | -.176 | .170 | .244 | .336 | -.219 | -.002 | .196 | .129 | -.127 | .422 |
| V_22 | .158 | .121 | **.733** | -.167 | .208 | -.007 | .003 | -.234 | .068 | .076 | .098 | .096 |
| V_23 | -.104 | .397 | .190 | -.056 | .077 | .301 | -.020 | -.161 | -.068 | **.582** | .228 | .257 |
| V_24 | .182 | **.776** | .164 | .024 | .053 | .084 | .045 | -.038 | -.151 | .110 | -.017 | .114 |
| V_25 | .041 | **.777** | .312 | .073 | .130 | -.052 | .047 | .048 | .046 | .018 | .093 | .084 |
| V_26 | .211 | .156 | -.038 | .007 | .068 | -.082 | .201 | **.700** | .263 | .124 | -.063 | .192 |
| V_27 | .052 | -.037 | .038 | .268 | -.004 | .139 | .012 | **.717** | .042 | .172 | .255 | -.002 |
| V_28 | .051 | -.029 | .034 | .226 | .001 | .013 | .076 | .189 | .143 | **.782** | -.040 | .326 |
| V_29 | **.527** | .076 | .046 | .407 | .176 | .094 | .242 | .072 | -.050 | .010 | .210 | .188 |
| V_30 | .127 | .163 | .108 | .131 | .041 | .096 | .065 | .119 | .099 | .149 | .107 | **.789** |
| V_31 | .019 | .281 | **.686** | -.035 | -.256 | .302 | .012 | -.007 | .007 | .164 | -.034 | .348 |
| V_32 | **.798** | .226 | .150 | .238 | .003 | .159 | .002 | .008 | .016 | .014 | .105 | .094 |
| V_33 | .037 | -.107 | .243 | -.072 | .389 | .094 | **.641** | .040 | .158 | -.040 | -.159 | .188 |
| V_34 | **.659** | .108 | .208 | -.030 | .019 | .118 | .219 | .126 | .186 | -.024 | .282 | .115 |
| V_35 | .122 | -.162 | -.019 | .078 | .108 | .250 | .110 | .125 | **.798** | .008 | .121 | .181 |
| V_36 | .191 | .050 | .177 | .353 | .272 | -.028 | **.604** | -.119 | .112 | .046 | .162 | .285 |
| V_37 | .391 | .261 | .143 | .186 | .386 | .353 | .085 | -.014 | .253 | .105 | -.267 | .291 |
| V_38 | .170 | .055 | -.085 | -.007 | .343 | .238 | .029 | .076 | .040 | .071 | **.662** | .306 |
| V_39 | .457 | .455 | .196 | .084 | -.055 | .392 | .071 | .171 | .231 | -.047 | .128 | -.013 |
| V_40 | **.524** | .341 | .127 | -.016 | -.065 | -.068 | .134 | .020 | .446 | .413 | -.153 | -.071 |
| V_41 | .304 | .063 | .369 | .426 | .393 | .045 | .161 | .154 | .115 | -.002 | .306 | .034 |
| V_42 | .157 | .232 | .408 | .419 | .213 | .070 | .027 | -.085 | .376 | -.020 | -.019 | .134 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 22 iterations.

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**TABLE 8: FACTORS**

| Factor 1:Reputaion | |
|---|---|
| V_29 | Faculties are available regularly for students' consultation |
| V_32 | There is good Teacher-Student relation at your institute. |
| V_34 | Staffs in your institute are willing to help you. |
| **Factor 2: Performance** | |
| V_8 | Faculties at your institute appreciate/ recognize intellectual efforts. |
| V_24 | The course provides primary knowledge required by you. |
| V_25 | Course and curriculum of your institute stimulate you intellectually. |
| **Factor 3: Futures** | |
| V_1 | Informational/ promotional material associated with the service provided by your institute such as pamphlets, brochures, flyers, etc., are visually appealing. |
| V_6 | Your institute arranges for high quality visiting faculty / guest lectures. |
| V_22 | You are free to opt for electives in your Institutes. |
| V_31 | Your institute Provide Platform for Industrial interaction. |
| **Factor 4: Assurance** | |
| V_5 | Your institute has faculties who can inculcate interest in the subject among students. |
| V_9 | Faculties at your institute encourage feed back in the class. |
| **Factor 5: Understanding** | |
| V_14 | Summer training is well planned and managed at your institute. |
| V_19 | Your complaints are constructively handled within a reasonable time frame at your institute. |
| **Factor 6: Reliability** | |
| V_3 | Faculties at your institute are knowledgeable. |
| V_20 | The attitude of your institute's Director is positive and helpful. |
| **Factor 7: Support Service** | |
| V_11 | Faculties at your institute use modern teaching methods viz. Case Study, Role play, Simulation. |
| V_12 | The faculty provides the chance to develop students' abilities and preparing them for their career. (i.e., students activities and students society-Co-curriculum). |
| V_33 | When the institute promises to do something by certain time, it does so. |
| V_36 | Your institute gives individual attention. |
| **Factor 8: Durability** | |
| V_26 | Course and curriculum of your institute help shape the requisite professional skills. |
| V_27 | Theory taught in courses is related with business reality. |
| **Factor 9: Responsiveness** | |
| V_35 | Academic staff provides prompt services. |
| **Factor 10: Conformance** | |
| V_15 | Your institute motivates you to participate in conferences (national / international). |
| V_23 | Courses provide extended economic knowledge to make you employable. |
| V_28 | Your institute meets scheduled deadlines for classes, examination and result posting, etc. |
| **Factor 11: Dark Side** | |
| V_10 | Faculties at your institute tend to take revenge on students. |
| V_38 | You feel secure and confident in your institute. |
| **Factor 12: Suitable Environment** | |
| V_30 | Faculties at your institute create a challenging supportive and learning environment. |

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# AN EFFECTIVE TOOL FOR BETTER SOFTWARE PRODUCT

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## ABSTRACT

*Metrics are more accurate when they are derived from well defined completion criteria for software products and their intermediate modules. Product metrics are also known as quality metrics and are used to measure the properties of the software. Weighted defect are derived from defect information. Weighted defects are calculated with the help of severity of errors found in the software. Each open defect is associated with a number as its severity.*

## KEYWORDS
Software Testing Metrics, Software Testing Product Metrics, Weighted Defect.

## INTRODUCTION

Measurement activities must be designed and targeted to support the business goals and they must provide effective and economical information for decision making . Technology or software product per se can neither be effective nor practical without measurements. We analyze the software in order to understand its behavior with respect to both time and space to improve, if derived so. Software metrics are used to quantify software products, software development resources, and/or the software development process. This includes items which are directly measurable, such as lines of code, as well as items which are calculated from measurements, such as software quality. Metrics must have well defined goal and must be reviewed regularly and acted upon. Metrics will be maintained and not perceived as a burden when the raw data, used to construct the metrics, are recorded as a natural part of work/process. In the field of software development, software metrics are collected at various stages in the development cycle, and utilized to evaluate the quality of a software product. They are also considered as the most critical factors to identify potentially error-prone modules in software systems, so that extra development and maintenance effort can be measured in those modules.

## METRICS

### A. DEFECT FIXED % METRICS (DF%)
It shows the relation between the defects which are Fixed with respect to the total number of defects in the project. The relation is expressed as
DF%=((TD - TDNF) / TDNF)*100
Where TD stands for Total Number of Defects and TDNF stands for Total Number of Defects Not fixed.

### B. CHANGED OR ADDED CODE METRICS (COAD)
It shows the relation between the actual numbers of SLOC changed or added with respect to the total number of SLOC in the project. The relation is expressed as
COAD = TCAC / (TCAC – TBLC)
Where TCAC stands for Total Changed or Added Code and TBLC stands for Total Blank Line of Code.

## WEIGHTED DEFECTS

Weighted defect data are derived from defect information. Through real life explanation, it is found that the severity of defects (i.e. how important or serious the defect is) is a very important factor for software quality. When a defect is opened, it is associated with a number as its severity. This number is an integer between one to five, one corresponds to the most serious defects whereas five for the least serious defects. We define each and every severity in Table 1.

**TABLE 1: DESCRIPTION OF EACH SEVERITY**

| SEVERITY | WHAT IT MEANS |
|---|---|
| 1 | The basic product functionality failing or product crashes. |
| 2 | Unexpected error condition or a functionality not working. |
| 3 | A minor functionality is failing or behaves differently than expected. |
| 4 | Cosmetic issue and no impact on the users. |
| 5 | Least Serious Defects |

To incorporate this aspect, weighted defect numbers instead of merely defect numbers were used. A weight to each severity is assigned, i.e., weight of severity level one is 5, weight of severity level two is 4, weight of severity level three is 3, weight of severity four is 2, and weight of severity five is 1 .The weighted defect number W is the sum of number of defects multiplied by associated weights for each severity level. Table 2 contains the data to explain how to calculate W. For example, assume the product has the following distribution of defects:

**.TABLE 2: EXAMPLE OF WEIGHTED DEFECT NUMBER**

| Severity Level | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Weighted Assigned | 5 | 4 | 3 | 2 | 1 |
| Number of Defects | 20 | 18 | 25 | 12 | 65 |

The calculated value of weighted defect number W based on the above Table 2, is:
W = (5*20) + (4*18) + (3*25) + (2*12) + (1*65) =336

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## THE METRICS

Proposed Metric:

Definition: It is the metrics that captures the relation between the total number of weighted defects that are fixed and the total number of weighted defects.

The relation may be expressed as $[W_p/(W_p+W_v)]*100$

Where $W_p$ denotes the number of weighted defects that are fixed and $W_v$ denotes the number of weighted defects that are not fixed. Above relation shows the formula about 'How Defects Found and Fixed'.

Calculation of $W_p$ and $W_v$ are as follow:

For $W_p$

Fieldname Used: DEFECT_ID, SEVERITY

        CLOSE_REASON, HOW_FOUND

(i)     Find the number of fixed defects for each severity level ($X_i$)

(ii)    Multiply $X_i$ with weights (assigned on the basis of severity) $W_i$

(iii)   Calculate $W_p = \sum X_i W_i$

For $W_v$

Fieldname Used: DEFECT_ID, SEVERITY

        CLOSE_REASON, HOW_FOUND

(i)     Find the number of defects for each severity level which are not fixed ($Y_i$)

(ii)    Multiply $X_j$ with weights (assigned on the basis of severity) $W_j$

(iii)   Calculate $Wv = \sum Y_j W_j$

There are three major phases in our project: (i) data collection phase, (ii) metrics calculation phase, and (iii) result analysis phase.

### (i) DATA COLLECTION

Based on the definitions of the metrics, a list of variables has been derived for which the collection of data is required in this phase. They have been extracted from the website of NASAs Metric Data Program — Repository access where data for certain projects are available. The Metrics Data Repository has been used for three projects i.e. KC 1, KC3 and KC4 for the calculation and analysis of the proposed metrics. KC1, KC3 and KC4have been used to represent thousands of source line of codes written in C++, JAVA and PERL respectively. KC1 denotes43 thousands line of source code in C++, KC3 denotes 18 thousands line of source code in JAVA where as KC4 denotes 25 thousands of source code in PERL.NASA use KSLOC to denote thousands source line of codes to explain KCs.

### (ii) METRIC CALCULATION

In the data collection phase, we have collected information for all the variables required to calculate the metrics. After all the metrics have been calculated, Table 3 created as below represents the values obtained for all the three projects

**TABLE 3: PROPOSED METRICS RESULT**

| Name of Proposed Metric | | | |
|---|---|---|---|
| Defect How Found and Fixed Percentage = $[W_p/(W_p+W_v)]*100$ | | | |
| **HOW FOUND** | **Project KC 1 (%)** | **Project KC 3 (%)** | **Project KC 4 (%)** |
| a)    Acceptance Test | 78.51 | -------- | 100 |
| b)    Analysis | 86.39 | 97.43 | 97.14 |
| c)    Customer Use | 67.79 | 62.82 | 73.91 |
| d)    Demo | 100 | -------- | ------ |
| e)    Engineering Test | 85.69 | 36.36 | 95.45 |
| f)    Inspection | 88.01 | 0 | ------ |
| g)    Mission(Critical, Success, Essential) | 86.95 | -------- | ------ |
| h)    Planned Test | 82 | 51.21 | 99.05 |
| i)    Regression Test | 80.58 | 100 | 93.02 |
| j)    Release_I&T | 85.71 | 100 | 88.88 |

The graphical presentation shown in Figure 1 represents the 'Defect How Found and Fixed Percentage' of three projects according to 'How Found Defects':

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**FIGURE 1: DEFECT HOW FOUND AND FIXED PERCENTAGE**



DEFECTS HOW FOUND AND FIXED PERCENTAGE
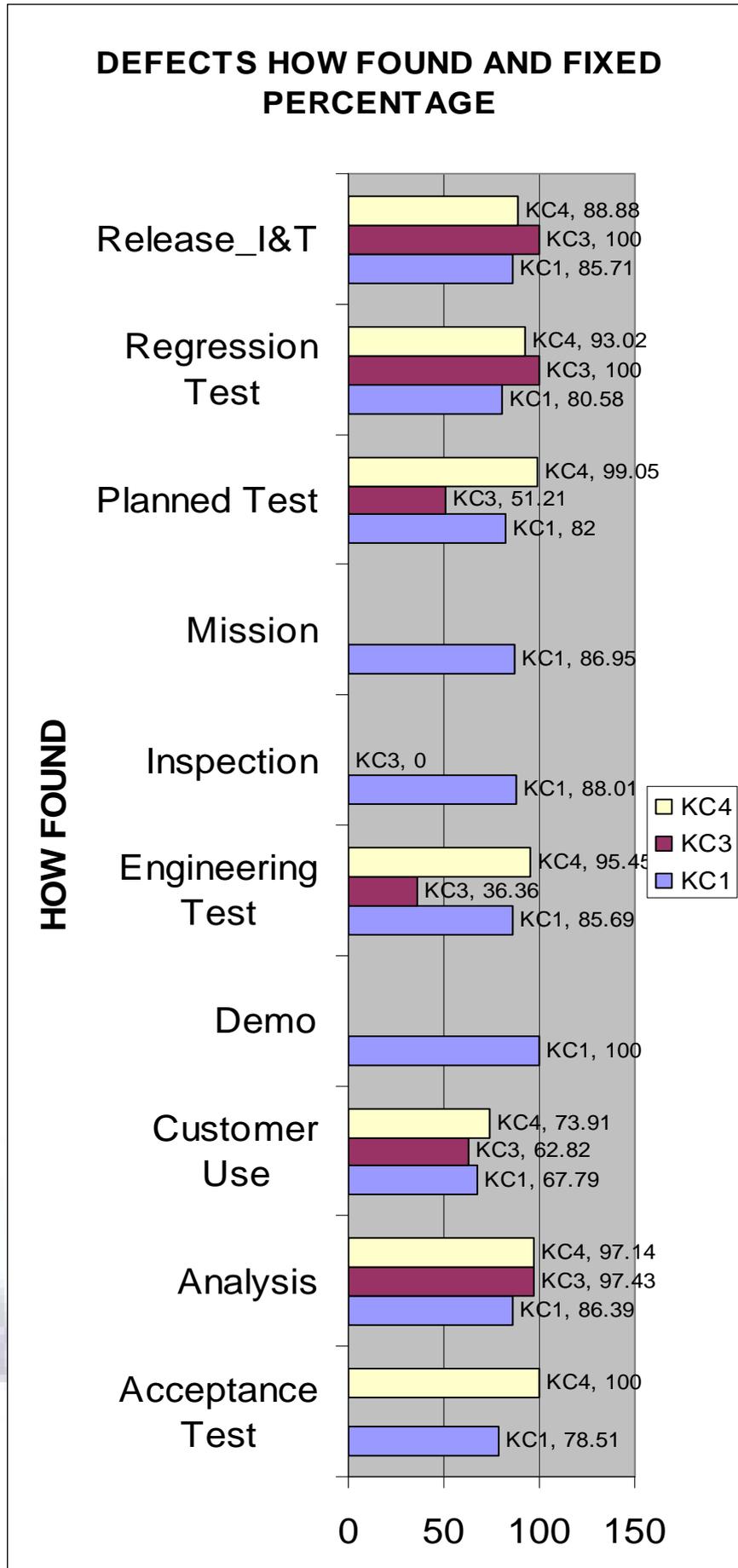
The graphical presentation shown in Figure2 represents the 'Defect How Found and Fixed Percentage' of three projects according to projects:

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FIGURE 2: DEFECT HOW FOUND AND FIXED PERCENTAGE

## DEFECTS HOW FOUND AND FIXED PERCENTAGE
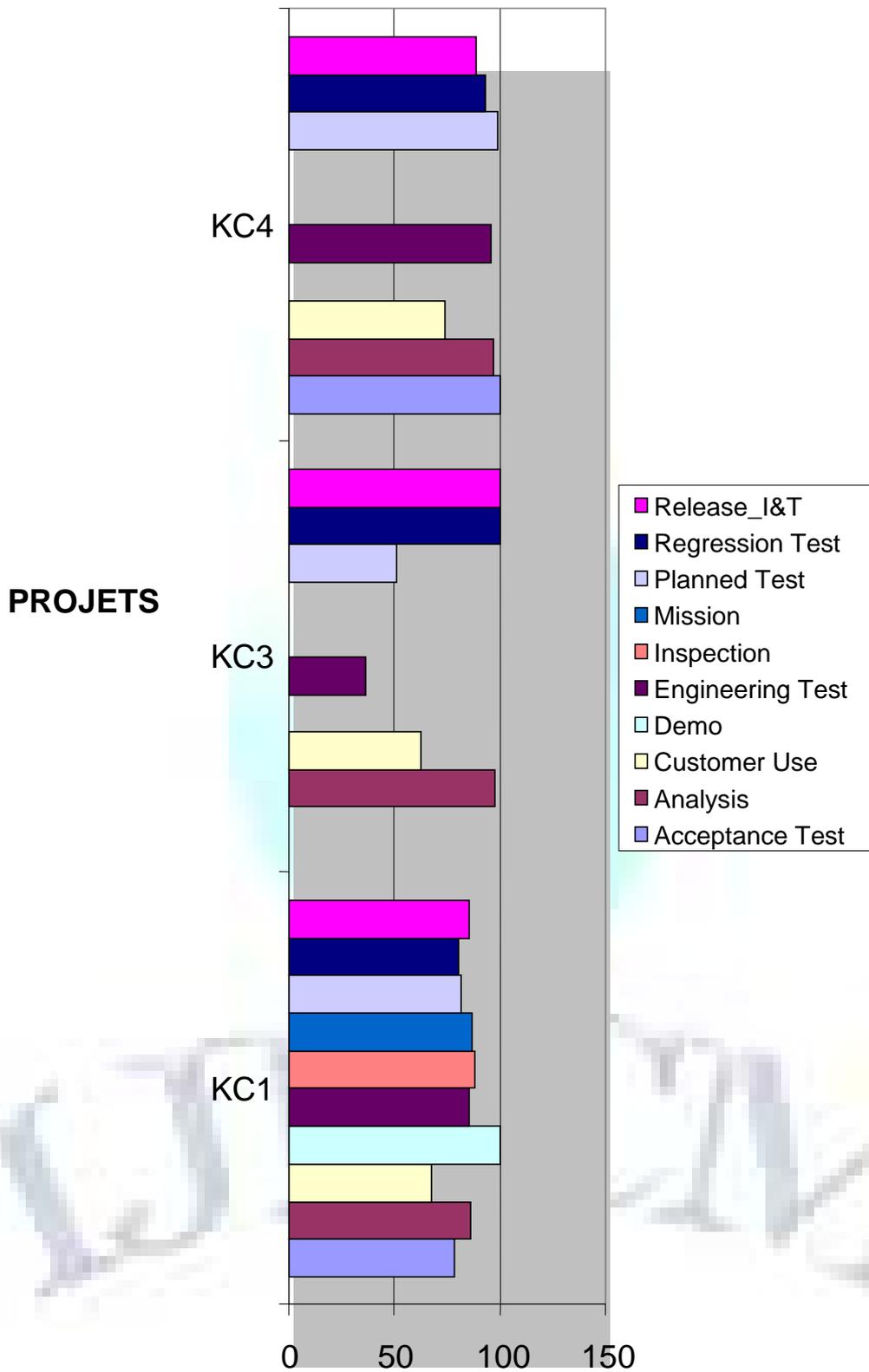


**(iii) RESULT ANALYSIS**

The above metric states that value of the percentage is proportionate to the ratio of defects fixed. That is higher the percentage, we have higher ratio of defects fixed. Amongst the three projects i.e. KC1, KC3 and KC4 on C++, JAVA and PERL respectively, project KC4 has the maximum defects removed.

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# HUMAN RESOURCE MANAGEMENT ISSUES FOR IMPROVING THE QUALITY OF CARE IN HEALTH SECTOR: AN EMPIRICAL STUDY

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## ABSTRACT

*Several studies have highlighted the relationship between health sector reform and human resources issues arising in that process. These studies have concentrated on the method adopted by new processes to modify the manner of interaction between health workers. Yet, few studies have given sufficient considerations to the ways in which workers have influenced the reforms. Crucial facets of the health workforce, such as labor conditions, extent of decentralization of management, needed expertise and the overall system of wages and incentives have been altered by the impact of the health sector reform. Human resources in health, are vital in realizing alterations in the delivery system, have expressed their opinion in several indirect and direct manner, retorting to changes, supporting, stopping and deforming the proposed ways of action. This article has inspected the facts related to shaping of health reforms by individual or combined actions of human resources, emphasizing the reform activity, workforce counteraction and the factors deciding effective human resources contribution. Provision of a more robust way of anticipating the effects of diverse "technical designs" has been attempted when they interact with the human resources they affect.*

## KEYWORDS

Health Care, Human Resource Management, Health Services, Human Resources For Health.

## INTRODUCTION

In 1990s, the health sector reform emerged as a global event. There is a basic perception that drastic changes are essential in providing health care for achieving worldwide capability for health improvement, since the processes differs from country to country. On account of the increasing political pressure, this identification has come into being and it is growing. Stress has been given to governments to bring enhanced health care, at the same time they are encountering economic restrictions on their health service funded by the public. Their observed failure happens from: increasing expectations for health and health care across the world; the presence of a fast increasing type of technical interventions prevention, control and treatment; of diseases and several countries are unable to utilize these new interventions by means of conventional methods to the provision of health care, which are found to be under the dictation bureaucracy.

Throughout the world, increased attention has been focused on human resources management (HRM) inside several health care systems. One of three principles of health system inputs is human resources where the other two major inputs are physical capital and consumables. Human resources, related to health care, can be described as the different types of clinical and non-clinical staff responsible for public and individual health intervention. Knowledge, expertise and motivation of those individuals accountable for providing health services mostly influence the most significant of the health system inputs, the performance and the benefits that can be provided by the system. A specific focus on planning, training, staff retention, scopes of practice of the staff and human resources management leads to the increasing recognition of the central role of human resources in the improvement of the health sector.

Exploring the effect of human resources on health sector reform is both valuable and important when investigating global health care systems. Some trends can be identified though the specific health care reform process differs by country. Efficiency, equity and quality objectives are the three major trends. Efficiency increase is attempted by employing diverse human resources initiatives. Fixed labor expenditures are converted into variable costs using outsourcing of services as a means for improving efficiency. Improvement of the quality of services and satisfaction of patients is also attempted by human resources in health sector reform. Technical quality and socio-cultural quality are two general measures for the quality of health care: Here we reviews the proof for the shaping of health reforms due to individual or collective actions of human resources, emphasis of the reform process, workforce reactions, quality health care and the issues determining effective human resources involvement. Understanding the human resource issue and challenges faced by the department and employees as whole will be of great importance to design the strategies and handle the issue for improving the Human resource in health care industry in Uttrakhand. Accessibility of researchers with the employees of health care department of Uttrakhand state has motivated him to select them as a sample of study.

## REVIEW OF RELATED RESEARCHES

Over a period of time a large number of literatures have been developed by the researchers engaged in the field of health care management and its related field. Marge Berer have discussed the significance of health care providers for well-functioning of the health services in a well-expressed manner determined by means of their training and skills grade, the level of managerial assistance given to them, the salary and remunerations given to them, their career improvement prospects, the environment in which they are likely to work and the facilities provided to them for their work.

Martinez and Collini have solved the significant issues, potential solutions and upcoming challenges encountered by HR staff working in the health sector. Enhancing efficiency in the use of HR; enhancing equity in the distribution of HR; enhancing motivation and performance of staff; and enhancing HR strategic planning and capacity in Ministries of Health have been described as the four equalized effort essential in four areas of human resource. In addition, they have made several suggestion for enhancing HR management; they are i) several efforts like reducing number of staff, altering the skill mix of staff, and more adaptive employment arrangement could cause improvements in HR efficiency ii) Development of training curricula or employment of primary care specific professionals and thereby improve the training given to health personnel iii) Improvement staff performance where the necessary requirements of staff are met, and

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compensations are introduced. But, financial restrictions might hinder such approaches. iv) Ability to plan strategically and develop policy is vital to improve HR management of the health sector. Good leadership, staff capacity and collaboration with other sectors and professional bodies are essential to achieve this. Yet, the human resource management of health sector in developing countries continues to be poor. The development of health sector is continues to be hindered by the lack of sufficient training, low capacity and underfunding. But, improved HR management is widely recognized as an essential step for enhancing overall performance of health sectors in both poor and rich countries.

Jack Duncan et al. have prepared a chapter managing customer relations which provide a framework that will assist health service practitioners to develop their own customer relations programs according to a market orientation and relationship marketing techniques. Initially, they have given customer relations in accordance with the weight of the evidence in the literature and in practice. Also they detailed the key constructs involved in an organization's relationship with its customers and how components of an organization relate with its customers to interact to form desirable judgments, attitudes and behaviors.

Sharma and Goyal have introduced the evolution of human resource management and the need of it in the hospital. Human resource management in hospitals have become a necessity and it has to achieve (a) effective utilization of human resources; (b) desirable working relationships among all employees; (c) maximum employee development; (d)high morale in the organization; and (e) continuous development and appreciation of human assets.

Mary O'Neil has presented an analytical study about competency gaps in Human Resource management in the Health Sector of countries like Ethiopia, Kenya, Tanzania, and Uganda. Their study has been intended to detail the function and experience of health managers having HRM responsibilities, find out their challenges, recognize supplementary skills and knowledge required for encountering these challenges, and seek suggestion to improve HR management. Quantitative and qualitative data has been gathered by conducting a survey with 96 participants using a cross-sectional study design with the development of Management Sciences for Health (MSH) and African Medical and Research Foundation (AMREF). HR managers of the government health sector or administrators of chosen hospitals have been the respondents.

Gilles Dussault and Felix Rigoli have analyzed the facts related to separate or unified actions of human resources that influence the development of health reforms, emphasizing the reform procedure, workforce reactions and the aspects influencing effective human resources involvement. It has tried to obtain a more potent method of anticipating the consequences and interactions in which diverse technical designs" functions, when they interact with the human resources they influence. In addition, the dialectic type of the relationship between the targets and policies of reforms and the targets and policies of those that have to employ them have also been described.

Ala Alwan and Peter Hornby have argued that unless a process of combined health and human resources development is incorporated in the health sector reform ''health for all'' is not attainable in majority of the countries. The conditions in Eastern Mediterranean Region countries of the World Health Organization have been analyzed. Even though progress has been achieved, the narrow adjustment of conventional health service framework and methods in a number of these countries have inhibited further improvement. National reform strategies are necessary and they need the dynamic involvement of health professional groups and academic training organization and also health service managers. A few of the essential initiatives have been signified besides suggesting that a thorough assessment of the recent state of human resources development in health should be the starting point for several countries.

Human resource management is necessary for all organizations, importantly so when public health problems collide with workforce deficiency as it happens presently in several parts of the developing countries. Mary O'Neil and Steve Reimann have analyzed the ways of improving human resource practices by individual managers in terms of five critically important questions about their staff. Assessment of the present state of HRM potential of organizations has been permitted by the HRM rapid assessment tool proposed by them. In addition, the manner in which management customs and HRM systems could be linked with missions and objectives of organizations has been discussed and role as HRM leader has been encouraged.

Stefane M Kabene et al. have dealt with the health care system from a universal point of view and the significance of human resources management (HRM) in enhancing general patient health results and provision of health care services. They have demonstrated the necessity of human resources management to health care system and the manner in which it can progress health care models. The problems in health care systems of Canada, the United States of America and diverse developing countries have been analyzed and recommendations have been provided for subduing these problems with appropriate employment of human resource management techniques.

Samuel Girma et al. have performed an analysis of diverse documents on human resource for health. Documents from Ethiopia have been given special consideration. Special policies to human resource development (HRD) for health and suitable techniques to handle the present health workforce are not available. Several steps have been taken to lessen these difficulties. The enrollment of students has improved in diverse categories and modern trainings have been introduced in occupations like dentistry. The course of action for creating policies and tactics for handling human resource for health has been started.

Uta Lehmann has analyzed the development accomplished in recent times to improve human resources to provide health care inside a Primary Health Care process. Particularly, the existence and readiness of old and new groups of health workers, their existence in the South African health system, in addition to their training and development have been focused. It has examined the factors that must be considered for improving human resources for health (HRH) for health care provision inside a PHC process and investigates the presence of old and new groups of health workers, their deployment and their training and development.

Provision of effective, efficient, accessible, viable and high-quality services by personnel, existing in adequate numbers and properly distributed throughout diverse occupations and geographical areas are highly important in achieving objectives of health. Gilles Dussault and Carl-Ardy Dubois have discussed that imbalances that threaten the ability of health care systems to achieve their targets are created in most countries by the lack of explicit policies for HRH development. Special features that cannot be neglected exist in the health sector workforce. The external pressures encountered by health organization cannot be successfully satisfied without proper adjustments to the workforce. Therefore, the improvement of the workforce seems to be a vital part in the health policy development method. Elucidating objectives and priorities in this area to gather all sectors related to these targets, and promote a more widespread and systematic method to HRM is performed by developing precise HRH policies and placing workforce problems on the political agenda.

Ramesh Bhat and Sunil Kumar Maheshwari have especially concentrated on dedication and expertise of medical doctors working in public health facilities and its significance for health sector reform and analyzed the challenges of human resources in health sector. This has been analyzed by performing this in one of the newly constituted state of Chhattisgarh in India. They have concluded that health sector reforms would have to focus on human resource problems and customs more than ever before in near future because the development oriented HR practices (HRD) is a robust tool for motivating people working in health sector to improve the quality of care. They have tried to analyze the following questions: (i) what is the condition of professional dedication, organizational dedication and technical proficiency of health officials? (ii) what are the features of human resource management traditions in the health sector of the state? and (iii) in what way these management traditions are connected with professional and organizational dedication? In the end the consequences of these to health sector reform process have been discussed.

Aleksanderpur *et al.* have concentrated on the Slovenian national health- care system, sub-system comprising a health-care professional's network at the basic care level. Improvement of the observation of human resource of their network by construction and employment of intelligent data analysis, decision support and visualization methods has been the issue addressed by this. Consequently, data analysis and visualization modules constructed for the observation of quantification, age, workload and dispersion of physicians have been used by their model to facilitate enhanced planning and management.

There have been comparatively few efforts to evaluate the implications of the effects of HRM on organisational performance even though there is restricted but increasing evidence base for this. James Buchan has analyzed this wider evidence base on HRM in other sectors and investigates few of the fundamental problems associated with "good" HRM in the health sector. He has discussed that organizational context is not the only factor that distinguishes the health sector from several other sectors, with respect to HRM. Several of the measures of organizational performance have also been distinct. Indicators that are sector-specific are the only means by which "performance" in the health sector could be completely evaluated. Bridging the present knowledge gap between the knowledge from common evidence base on HRM inputs and performance, and the knowledge from health-specific evidence base concentrating on sector-specific outcome measures has been the challenge for researchers and policy analysts in the health sector.

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Judith Schiffbauer et al. have discussed that HR leaders informed by experience about what works, demonstrate the way by means of their dedication and creativity. The HR leaders have prevailed in extremely diverse settings in Afghanistan, South Africa, and Southern Sudan by using few ordinary strategies: a multisectoral method and all-inclusive planning; formation of a HR policy; erection of a committed HR unit and training of HR managers; augmented recruitment and training, testing, and certification of health workers; review of pre-service training program; and a HR information system encompassing the entire country.

Peter Hornby and Paul Forte have analyzed support of management-led initiatives using human resource indicators (HRI) for enhancing efficiency and effectiveness of health service which comprise 1. Recognizing and incorporating preferred enhancements in the service performance and 2. Forming an atmosphere where managers in the service feel attaining these improvements desirable and worthwhile. For the continuation of the use of indicators, perception of some personal and professional benefit in its use by managers in health system is a must. Indicators cannot make any change by themselves. This happens only through action taken by managers. The manner in which indicators is used differ considerably between users and will signify distinct interest, available management methods and the organizational pressures and compensations for good management. The authority and accountability which managers have over the resources at their control has also been signified by them. The choice and utilization of indicators cannot be separated from the managerial environment in which they are employed.

Don Bandaranayake has concentrated on performance management and has attempted to set up connections between the criterion and quality assurance with specific concern to developing countries in south-east Asia. As it belongs to recognized systems in developed countries, it has tried to examine the status of performance management and its ability for improving provision of high quality service. This has emphasized on individuals in both service and academic sectors instead of on teams, though most health care processes are team-based.

Human resources for health (HRH) have a central role in increasing the accessibility to services and quality of care. Marjolein Dieleman et al. have defined the factors motivating and demotivating health workers in Mali and match the motivators with the implementation of performance management. Thus the study exposed that the chief motivators of health workers were related to responsibility, training and recognition, next to salary. The outcomes proved the significance of adapting or improving upon performance management strategies to influence staff motivation. This can be achieved by matching performance management activities to motivators recognized by operational research.

A pleased human resource is treasured and has no substitute. Human beings' wants are dynamic and hence, to meet that health care organization has to be think dynamically. Only then our principal customer, the patient, can get his fair need be satisfied. Ray has offered the planning of human resources to health care provision. The aim of human resource (HR) policy is to a) attract, recruit, retain and develop competent personnel and b) produce a continuously learning health care organization.

Neeru Gupta et al.have developed an international comparison of the health workforce in accordance with skill mix, socio demographics and other labour force characteristics, for establishing an evidence base for monitoring and evaluation of human resources for health. Consequently the evidence recommended that gender inequity in the workforce resides a significant deficiency of many health systems. Some unexpected patterns of occupational distribution and educational attainment detected may be attributable to differences in health care delivery and education systems; though, definitional inconsistencies in the categorization of health occupations across surveys were also obvious.

Núria Homedes and Antonio Ugalde have devoloped an article on the basis of fieldwork and a literature review. It studies the reasons which led health workers to resist reform; the institutional and legal constraints to applying reform as originally designed; the difference between the types of staff needed for reform and the accessibility of professionals; the lack of the reform implementation process; and the regulatory weaknesses of the region. They provided workforce techniques that the reforms could have incorporated to achieve the desired goals, and the desires to consider the values and political realities of the countries. They also insisted that autochthonous solutions are more possible to succeed than solutions imported from the outside.

One of the most significant constituents determining the performance of public health system is Human resource (HR). Mamuka Djibuti et al., [31] have presented a review to evaluate the sufficiency of local public health agencies to satisfy the demands arising from health care reforms in Georgia. The Human Resources for Health Action Framework which they have used contains six components; they are HR management, policy, finance, education, partnerships and leadership. The establishment of the school of public health is one of the solutions to effectively deal with these problems. Sufficient planning for the number and category of staff to be created by this organization and scheming proper bonus for staff retention and motivation, as well as enhanced HR should accompany this.

In the works on human resource management (HRM) interventions to develop health workers' performance in Low and Middle Income Countries (LMIC), there has not been  much attention given to the query how HRM interventions will yield the  results  and in which circumstances. This info is very important to assess the transferability of results. Marjolein Dieleman *et al.* [34] have targeted to find the realist assessment of published primary research which gave an improved understanding into the working of HRM interventions in LMIC. A realist review inquires if an intervention has shown to be effective and also enquires which mechanisms in intervention yield results and which contextual factors seem to be of high influence.

The prime hindrance to the realization of health related targets for the Millennium Development Goals is the human resource crisis in health care. Ben Rolfe *et al.* [35] have listed the findings on the drivers and inhibitors acting upon the expansion of one novel portion of nongovernment endowment in Tanzania where the moderate self-governing midwifery practice and studies what involvement this sector may be estimated to make to the MDG target of growing skilled attendance at delivery. A multiple case analysis over nine districts revealed their characteristics, and the drivers and inhibitors performing upon their improvement since permitted by legislative change.

## OBJECTIVE OF THE STUDY AND METHODOLOGY

The present project has been taken up with the following objectives into consideration.

- To explore the concept of HRM in health care sector in Uttrakhand
- To study the employees perception towards Human resource issues in health care sector in Uttrakhand
- To suggest the strategies for successful implementation of HRM policies for improving the quality of health care sector industries in Uttrakhand state.

In the present study the population consisted of doctors, nursing staff, technical staff   and support staff working  in all of the units/wards/departments health care department in different hospitals of Uttrakhand. The respondents were scattered in all units/wards/departments already stated at various hospitals. Because the nature of work of the doctors it made difficult to conduct face interviews and a questionnaire was ideal as the respondents used their own time and pace to complete the questionnaire. Judgment sampling was used for the selection of the doctors and support staff which was found to be a convenient and economical method. two hundred and fifty (250) questionnaires were distributed to the respondents and Two hundred and thirteen (213) questionnaires (duly completed) were received back from the respondents. This means that about 84.5% of the questionnaires (duly completed) were returned. To measure the intensity of parameters open ended and close ended questionnaire was used. To test the hypothesis, Mean Standard deviation ,   ANOVA and $\chi^2$ tests were applied. Table 1 indicates the profile of respondents.

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**TABLE 1: DEMOGRAPHIC CLASSIFICATION OF RESPONDENTS**

|  | Categories | Count | Percentage |
|---|---|---|---|
| Age | Upto 25 years | 103 | 48.4 |
|  | From 25 to 35 years | 97 | 45.5 |
|  | from 35 to 50 Years | 13 | 6.1 |
| Gender category | Male | 67 | 31.5 |
|  | Female | 146 | 68.5 |
| Marital Status | Married | 64 | 30.0 |
|  | Unmarried | 149 | 70.0 |
| Education Level | Under Graduate | 10 | 4.7 |
|  | Graduate | 107 | 50.2 |
|  | Post Graduate | 27 | 12.7 |
|  | Professionals | 69 | 32.4 |
| Monthly Income | Upto Rs15000PM | 158 | 74.2 |
|  | From Rs15001 to Rs30000PM | 54 | 25.4 |
|  | Above Rs50000PM | 1 | .5 |
| Area of Specilisation | Medical | 30 | 14.1 |
|  | Administration | 13 | 6.1 |
|  | Nursing | 158 | 74.2 |
|  | Others | 12 | 5.6 |
| Area of Work | Rural | 76 | 35.7 |
|  | Urban | 100 | 46.9 |
|  | Semi Urban | 37 | 17.4 |

This section analyses demographic profile of hospital employees. Demographic profile of the health care employees has been studied based on their age, gender category, marital status, education level , monthly income , area of specialization and area of work (Rural semi Urban and urban). **Table I** shows that sample is dominated by those respondents (48.4%) who are in the young age ranging upto 25 years. Majority of the employees belongs to male category and unmarried. Majority of the respondents fall in the nursing cadre. Having graduation degree and earning upto Rs15000PM. Majority of the sample of employees are from urban as well as semi urban area.

**TABLE 2: PERIOD OF ASSOCIATION**

| Sl. No. | Years | No. of respondents | Percentage |
|---|---|---|---|
| a | Upto 3 years | 106 | 49.8 |
| b | From 04-5 Years | 63 | 29.6 |
| c | from 6 to 10 years | 44 | 20.7 |
| d | Total | 213 | 100.0 |

The impact of turnover has received considerable attention by senior management, human resources professionals, and industrial psychologists. It has proven to be one of the most costly and seemingly intractable human resource challenges confronting organizations. It is seen that length of association with the organization develop the bninding of employees in the organization and help management to solve number of HR related issues. Data presented in the above table 2 indicates that 49.8%, respondents belong to those categories who are associated with their present organisation from 0 to 3 years only. 29.6% respondents are associated from 4 to 5 year. 20.7% are associated from 6 to 10 years. Thus sample indicates that most of the respondents are having short term association from their present organisation as it was indicated by almost 49.8% respondents in the sample.

**TABLE 3: NATURE OF PRESENT JOB**

| Sl. No. | Classification of job | No. of respondents | Percentage |
|---|---|---|---|
| a | Challenging in nature | 67 | 31.5 |
| b | Routine in Nature | 53 | 24.9 |
| c | Risky in Nature | 27 | 12.7 |
| d | Normal and Enjoyable | 66 | 31.0 |
|  | Total | 213 | 100.0 |

The employees effectiveness toward job and his profession can be enhanced substantially by making the job interesting, creative, challenging and enjoyable. In this context an attempt was directed to know the employees perception towards their job. Analysis of the data indicates that 31.5% respondents in the sample indicates that their job is challenging in nature. 24.9% indicated that their job is of routine in nature. 12.7 % feel that it is tedious and risky in nature and only 31% feels that their job is normal and enjoyable. Thus sample is dominated by those respondents who feel that their job is more challenging and risky in nature.

**TABLE 4: DUTY HOURS IN THE PRESENT ORGANISATION**

| Sl. No. | Duty hours in a day | No. of respondents | Percentage |
|---|---|---|---|
| A | From6 to 8 Hours | 182 | 85.4 |
| B | From 9to 10 Hours | 15 | 7.0 |
| C | From 11 to 12 hours | 16 | 7.5 |
| D | Total | 213 | 100.0 |

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Length of duty hours and Flexibility is a critical ingredient to overall workplace effectiveness. Companies use it as a tool for improving recruitment and retention, for managing workload, and for responding to employee diversity. Analysis projects that 85.4 % respondents in the sample are from those category who works 6-8 hours in a day. 7 % respondents work 8-10 hours in day. 7.5 % respondents indicated that they work 10-12 hrs in a day Thus sample is dominated by those respondents who work more 6-8hours in a day. Thus it can be inferred that majority of the work force in the health care sector industry is having an ideal working hour.

**TABLE 5: EXTENT TO WHICH PROFESSIONAL PROBLEMS COULD BE DISCUSSED WITH SENIORS**

| Sl. No. | | No. Of respondents | Percentage |
|---|---|---|---|
| A | To a great extent | 108 | 50.7 |
| B | To Some Extent | 64 | 30.0 |
| C | To a little extent | 28 | 13.1 |
| d | Not at All | 13 | 6.1 |
| | Total | 213 | 100.0 |

One of the most significant developments in the field of organization in recent times is the increasing importance given to human resources. More and more attention is being paid to motivational aspects of human personality, particularly the need for self-esteem, group belonging, and self-actualization.. Empirical evidences and various researches on the topics indicate that freedom to discuss professional problem with their seniors boost the confidence of employees in the organization and make the job easy and colleagues in the organisation. Keeping this into consideration an attempt was made to know that how for employees are free to discuss their problems with their seniors. In this respondents are asked as to what extent they are free to discuss their professional problems with their seniors. It was found that more than half (50.7%) in the sample feels that they are free to a great extent to discuss their professional problems with their senior. 30% feels that they are free to some extent in discussing their problem with senior. 13.1% respondents indicated that they are free to a little extent in discussing their problem. 6.1 expressed that they are not at all free to discuss their problem with their seniors. Thus analysis indicates that there is mixed response in this case.

**TABLE 6: MEAN AND STANDARD DEVIATION OF DIFFERENT HR CHALLENGES AS PERCEIVED BY THE EMPLOYEES OF HEALTH CARE SECTOR IN UTTRAKHAND**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Lack of consensus around the organization's strategy/direction | 213 | 2.4742 | 1.05756 |
| Driving cultural and behavioral change in the organization | 213 | 3.0563 | .94998 |
| Managing human capital during organization expansion | 213 | 2.9249 | 1.27531 |
| Measuring the contribution of human capital to business performance | 213 | 3.1925 | 1.11826 |
| Implementing people changes resulting from changes due to operational performance | 213 | 3.0000 | 1.26267 |
| Increasing line manager capability to handle people management responsibilities | 213 | 2.5399 | 1.24179 |
| Encouraging organizational innovation | 213 | 3.0329 | 2.38586 |
| Increasing the return on investment in remuneration | 213 | 3.1455 | 1.06949 |
| Succession planning | 213 | 2.8122 | 1.20629 |
| Resourcing and managing HR issues in "new geographies" for the company | 213 | 3.1174 | 1.10758 |
| Building leadership capability | 213 | 3.0798 | 1.40693 |
| Workforce planning | 213 | 2.8545 | 1.24098 |
| Retaining key talent | 213 | 2.7465 | 1.10383 |
| Acquiring key talent/lack of available talent | 213 | 2.9718 | 1.09422 |
| Constraints on headcount ("making do with less") | 213 | 3.2019 | .94749 |
| Coping with an aging workforce | 213 | 3.0141 | 1.03468 |
| Valid N (listwise) | 213 | | |

The mean and standard deviation of different variable increasing Human resource challenges as perceived health care employees as presented in the above table indicates that Constraints on headcount ("making do with less") has scored highest mean. where as Encouraging organizational innovation are seems to have diverse opinion as it scored highest standard deviation.

Understanding the human resource challenges and different factors promoting it has been of a major interest for academia, researchers and many more. From an administrative perspective, the focus is now on a strategic outlook where talent HR professionals look at improving the work environment and plan out human resource needs The empirical study indicates that there are many challenges and HR Issues like Increasing line manager capability to handle people management responsibilities, Increasing the return on investment in remuneration, Acquiring key talent/lack of available talent, Resourcing and managing HR issues in "new geographies" for the company, Lack of consensus around the organization's strategy/direction, Measuring the contribution of human capital to business performance, Building leadership capability, Succession planning, Constraints on headcount ("making do with less"), Managing human capital during organization expansion , Retaining key talent, Driving cultural and behavioral change in the organization, Encouraging organizational innovation, Coping with an aging workforce, Implementing people changes resulting from changes due to operational performance, and designing of organization structure and building proper climate.

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**TABLE 7: PRINCIPAL COMPONENT ANALYSIS WITH ROTATED COMPONENT**

| | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Communality |
|---|---|---|---|---|---|---|
| Workforce planning | .869 | | | | | .896 |
| Increasing line manager capability to handle people management responsibilities | .865 | | | | | .849 |
| Increasing the return on investment in remuneration | .779 | | | | | .913 |
| Acquiring key talent/lack of available talent | .794 | | | | | .839 |
| Resourcing and managing HR issues in "new geographies" for the company | .724 | | | | | .817 |
| Lack of consensus around the organization's strategy/direction | .710 | | | | | .787 |
| Measuring the contribution of human capital to business performance | | .864 | | | | .756 |
| Building leadership capability | | .690 | | | | .562 |
| Succession planning | | .570 | | | | .955 |
| Constraints on headcount ("making do with less") | | | .770 | | | .734 |
| Managing human capital during organization expansion | | | .688 | | | .823 |
| Retaining key talent | | | .580 | | | .826 |
| Driving cultural and behavioral change in the organization | | | | .847 | | .873 |
| Encouraging organizational innovation | | | | .662 | | .529 |
| Coping with an aging workforce | | | | | .869 | .821 |
| Implementing people changes resulting from changes due to operational performance | | | | | .694 | .849 |
| *Eigen Values* | 5.238 | 3.250 | 1.932 | 1.297 | 1.110 | |
| % of Variation | 32.735 | 20.314 | 12.074 | 8.104 | 6.939 | |
| Cumulative % of Variation | 32.654 | 53.050 | 65.124 | 73.228 | 80.167 | |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

A Rotation converged in 9 iterations.

For this respondent were asked to rate their views on the following important statement related to human resource issues as perceived by them. These are Workforce planning, Increasing line manager capability to handle people management responsibilities, Increasing the return on investment in remuneration, Acquiring key talent/lack of available talent, Resourcing and managing HR issues in "new geographies" for the company, Lack of consensus around the organization's strategy/direction, Measuring the contribution of human capital to business performance, Building leadership capability, Succession planning, Constraints on headcount ("making do with less"), Managing human capital during organization expansion , Retaining key talent, Driving cultural and behavioral change in the organization, Encouraging organizational innovation, Coping with an aging workforce, Implementing people changes resulting from changes due to operational performance, on a scale of 1 to 5 in order of their preference. The exploratory factor analysis was used in order to identify the various factors of HR Challenges. Principal Component analysis was employed for extracting factors and orthogonal rotation with Varimax was applied. As latent root criterion was used for extraction of factors, only the factors having latent roots or Eigen values greater than one were considered significant; all other factors with latent roots less than one were considered insignificant and disregarded. The extracted factors along with their Eigen values are shown in table 7. The factors have been given appropriate names on the basis of variables represented in each case. The names of the factors, the statements, the labels and factor loading have been summarized in Tables 7. There are five factors each having Eigen value exceeding one for occupational stress factors. Eigen values for five factor are 5.238, 3.250, 1.932, 1.297, 1.110, respectively. The index for the present solution accounts for 80.167% of the total variations for the perceived HR Challenges in the organization. . It is a pretty good extraction because we are able to economise on the number of choice factors (from 16 to 5 underlying factors), we lost 19.833 % of information content for choice of variables. The percentages of variance explained by factors one to seven are 32.735, 20.314, 12.074, 8.104, and 6.939, respectively. Large communalities indicate that a large number of variance has been accounted for by the factor solutions. Varimax rotated factor analysis results for motivational factors are shown in table 13 which indicates that after 5 factors are extracted and retained the communality is.896 for variable1, .849 for variable 2, 0.913 for variable 3 and so on. It means that approximately 89.6 % of the variance of variable1 is being captured by extracted factors together. The proportion of the variance in any one of the original variable which is being captured by the extracted factors is known as communality (Nargundkar, 2002).

**TABLE 8: MEAN OF DIFFERENT HR CHALLENGES AS PERCEIVED BY THE EMPLOYEES ACROSS DIFFERENT PROFESSION**

| Specialisation | Workforce Planning and retention | Leadership and succession planning issue | Talent Retention and Sustainability | Innovation and Managing change | Copying with ageing workforce |
|---|---|---|---|---|---|
| Medical | 2.1667 | 2.1667 | 2.1667 | 3.7500 | 2.5000 |
| Administration | 3.3333 | 2.3333 | 3.0000 | 2.5000 | 3.0000 |
| Nursing | 2.9515 | 3.2637 | 3.2848 | 3.0348 | 3.1899 |
| Others | 2.7083 | 1.2500 | 2.1667 | 2.0000 | 1.8750 |
| Total | 2.8505 | 2.9390 | 3.0469 | 3.0446 | 3.0070 |

As is evident from the mean ratings of various human resource challenges across different professional categories of health care employees Organisation ability to optimize human resources have found highest mean score among physician. Work overload seems to be most important reason of occupational stress among the technical staff working in different hospital of Dehradun area.

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**TABLE 9: ANOVA OF MEAN OF DIFFERENT HR CHALLENGES AS PERCEIVED BY THE EMPLOYEES ACROSS DIFFERENT PROFESSION**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Workforce Planning and retention | Between Groups | 18.913 | 3 | 6.304 | 7.902 | .000 |
| | Within Groups | 166.746 | 209 | .798 | | |
| | Total | 185.659 | 212 | | | |
| Leadership and succession planning issue | Between Groups | 73.556 | 3 | 24.519 | 57.089 | .000 |
| | Within Groups | 89.762 | 209 | .429 | | |
| | Total | 163.318 | 212 | | | |
| Talent Retention and Sustainability | Between Groups | 41.514 | 3 | 13.838 | 27.864 | .000 |
| | Within Groups | 103.795 | 209 | .497 | | |
| | Total | 145.308 | 212 | | | |
| Innovation and Managing change | Between Groups | 31.893 | 3 | 10.631 | 5.655 | .001 |
| | Within Groups | 392.934 | 209 | 1.880 | | |
| | Total | 424.826 | 212 | | | |
| Copying with ageing workforce | Between Groups | 28.373 | 3 | 9.458 | 11.501 | .000 |
| | Within Groups | 171.866 | 209 | .822 | | |
| | Total | 200.239 | 212 | | | |

After comparing the mean one way ANOVA was carried out to test the hypothesis that HR challenges of the employees does not differ significantly across the different employees at different profession. A one-way ANOVA was calculated comparing different factors of HR Challenges and nature of job profession in which an employee is engaged. A significant difference was found between the factors $(F(3,212)=7.902, p<.05)$. From the table it is clear that calculated value of F is greater than the tabulated value of F (2.37) at $(p< 0.05)$ level of significance. Hence null hypothesis is rejected indicating that there is significant difference in the mean of different factor of HR challenges across the different level of employees like Workforce Planning and retention , Leadership and succession planning issue, Talent Retention and Sustainability, Innovation and Managing change, Copying with ageing workforce, .  ,

## CONCLUSION

The human resource crisis facing the world health sector has potential to derail existing health programs including millennium development goals. Though advances have been made, further progress is inhibited by the limited adaptation of traditional health service structures and processes in many of these countries. Human resources in health care system are generally picturing a lack of adequacy between expected skills from the professionals and health care needs expressed by the populations. It is, however, possible to analyze these various lacks of adequacy related to human resource management and their determinants to enhance the effectiveness of the health care system.

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# THE EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON THE MARKETING PERFORMANCE OF MEDIUM AND LARGE FINANCIAL SERVICE ENTERPRISES IN ETHIOPIA

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## ABSTRACT

*Despite the increased interest in e-marketing, there is limited data in the literature explaining its link to marketing performance and so remains an unexplored field in scientific literature. The study, thus, aims to investigate the effect of e-marketing and its environment, as measured by internal and external related factors to the firms, on the marketing performance of medium and large financial service enterprises (MLFSEs) in Ethiopia. Accordingly, data were generated from a randomly selected sample of 200 middle and top-level managers in financial service enterprises with stratified random sampling method. The approach of the study is analytical survey method. The collected data are examined and analyzed by using multiple regression method. The results suggest that the environmental factors as measured by internal and external variables along with e-marketing implementation have a positive significant impact on the overall and six amalgam measurement dimensions of marketing performance. Of interest is the e-marketing implementation's highly significant impact on marketing performance than antecedents do. These findings also establish the need for both researchers and practitioners to be aware of the leveraging influence of e-marketing when it is well integrated in to a firm's marketing activities Therefore, the researchers' hypotheses have support from the findings and are consistent with the preceding research findings in similar areas. Finally, conclusions, managerial implications along with future research directions are presented here thereof.*

## KEYWORDS

E-marketing, E-marketing environment, Financial Service, Marketing performance.

## INTRODUCTION

Today, e-marketing decisions more and more often are treated not as a competitive advantage, but as a necessity, which helps to avoid the lagging behind competitors (Barsauskas et al, 2008). E-marketing has a potential benefit and impact on business enterprises. The benefits provided by e-marketing are many; with the most important the reduction in costs and transaction times, when a company goes online. To benefit totally from the available opportunities, companies must be to adopt and develop suitable electronic strategies of conducting business, changing or abandoning their traditional businesses. The e-marketing strategy must be proper for the relevant industry, it must be innovated and it should create value and competitive advantages (Baourakis et al, 2002)

The contemporary knowledge economy is also characterized as 'network economy' where the impact of ICT (information and communication technology) plays an important role. The infrastructure of ICTs is increasingly binding together the economic and social actors of the 21st century. It facilitates the links between suppliers and firms, between firms and clients, between governments and constituents, and binds them together into a network economy. ICT offers a powerful tool for communication and knowledge exchange and provide new forms of value formation (Benbya et al, 2004; Mason & Castleman, 2008).

Therefore, it is possible to say that ICT, which is the tool of e-marketing, can boost the efficiency and effectiveness of almost all firm operations and can speed up the innovation process of firms. But here we have to consider not only the possible productivity growth through ICT, but rather the interplay between many other environmental and internal factors, for example, competitors' situation, telecommunication infrastructure, qualification of employees etc., which are influencing companies and its competitiveness (Koutsoutos, 2003).

However, having had these much immense values of e-marketing within business enterprises, there is no empirical research findings especially in the Ethiopian context. It is, thus, from this point of view that the researchers would like to conduct research on the effect of e-marketing implementation and its environment on the marketing performance of medium and large financial service enterprises (MLFSEs) in Ethiopia. These research findings will give enormous value for marketing practitioners and managers in the field to improve the marketing performance of their respective enterprises in this competitive marketing environment.

## REVIEW OF RELATED LITERATURE

The wide spread electronic linking of individuals and businesses around the world has created an economic environment in which time and space are no longer limiting factor. The business values of information is more important than before and information itself is more accessible; traditional business intermediaries are being replaced by new business intermediaries, and buyers are growing more powerful, (Napier et al, 2006). It is therefore imperative to examine the e-marketing environments along with the marketing performance literatures in the following sections.

## FACTORS INFLUENCING E-MARKETING IMPLEMENTATION

To remain competitive in global markets, e-marketing has become imperative and encompasses activities such as electronic data interchange, having a web site that is linked with key business processes, and capabilities to buy online (Watson et al., 2008; Fillis et al., 2004). The ability to assess the opportunities to adopt or intensify the use of internet-based technologies (IBTs) will depend primarily on the firm's endowment with human capital and its innovative activity (Cohen & Levinthal, 1989). Besides the general tendency to adopt IBTs earlier or later in the diffusion process, firms may differ in how they prioritize the innovation on their "must do" list. It is implied that productivity gains and scale economies may be concentrated on the use of existing business systems (that may or may not include the use of technology) that "work well" and, therefore, provide no incentive to "unlearn" and "relearn" using new technologies (Ramsey & McCole, 2005).

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Therefore, the decision to adopt IBTs will not only be governed by a "yes" or a "no" decision, but will be guided by a continuum, which ranges from a situation where it is very easy, to adopt the technology to one where it is very difficult. Factors such as awareness and understanding, availability, cost, technical compatibility and complexity of the technology may influence positively or negatively on the adoption process (Jeon et al, 2006). A review of the literature reveals different factors that seem to affect the adoption of new technologies (McCole et al, 2001, Zhu et al, 2002; Jeon et al, 2006). These include, negative mindsets regarding the technological or regulatory environment, the nature of the services, staff development or human resource issues, market-orientation, the environmental, technological and Organizational contexts.

Lawson et al. (2003:266) suggested that the "barriers to do business online can be categorized as having a technical or a social perspective". Technical barriers include inadequacy of a telecommunication structure and security of transactions. Social barriers range from generally not trusting information technology, lack of knowledge about conducting business online and lack of IT skilled staff through to lack of awareness about possible uses of the internet (Lawson et al., 2003; Cameron & Clarke, 1996).

Firm size is also considered an important factor that is used to explain adoption behavior. Some studies have argued that organizational size has been a poor indicator with inconclusive and/or inconsistent findings relating to the adoption of "new" technologies (Brynjolfsson et al, 1994; Grover & Teng, 1992). However, it is argued that larger firms have a higher propensity to adopt IBTs due to, for example, their ability to absorb risks related to technological development. Small and medium enterprises (SMEs) on the other hand have (among other things) less human, financial and technological resources and this may reduce their capacity to innovate (Raymond, 2001). Indeed an examination of small firm adoption patterns confirms that the smaller the enterprise the less likely they are to adopt IBTs (Durkan et al. 2003). The researchers, thus, excluded the small and micro financial enterprises from the target population due to their technical and technological incompetency vis-à-vis to MLFSEs in the Ethiopian business environment.

The external as well as the internal environment would play significant role in the adoption of new technologies. Different researchers (Fink & Kazakoff, 1997; Hart & Saunders, 1994; Iacovou et al, 1995) provide an excellent discussion on some of the external or macro-environment factors likely to influence the adoption of e-marketing. These include environmental uncertainty; pressure from trading partners as well as other industry-specific competitive pressures; government influences; critical mass issues related to infrastructure; and technological standards.

Moreover, Scupola (2009) summarized factors those influence the adoption and implementation of e-commerce and e-marketing as external environmental factors, the technological and organizational factors. External environmental factors include pressures from trading partners (such as suppliers and customers), competitive pressures, role of governments, and technology support infrastructure. Organizational environment context represents the factors internal to an organization influencing an innovation adoption and implementation, which includes CEOs 'characteristic and top management support, employees', IS (information system) knowledge and attitude, and resource constraints. The technological-environment context represents the pool of technologies available to a firm for adoption. These can be both the technologies available on the market and the firms' current equipment. The decision to adopt a technology depends not only what is available on the market, but also on how such technologies fit with the technologies that a firm already possesses (Jeyaraj et al, 2006).

Zhu et al (2002) developed the technology-organization-environment framework, which identified three contexts that influence the process by which the firm adopts and implements technological innovation. These are technological contexts (IT infrastructure, IT experts and e-business know-how), organizational contexts (firm scope and firm size), and environmental context (consumer readiness, competitive pressure and trading partners readiness).

Rashid and Al-Qirim (2001) still classified the essential influencing factors and factors leading to adoption of information technology business enterprises as technological or innovation factors, organizational factors (such as size of the firm, quality of IS and capabilities, information intensity, specialization, and top management supports), and environmental factors (such as competitive pressures, suppliers/buyers pressure, public policy and government's role). In relation to these factors, Poon and Swatman (1997) emphasized the importance of the CEO's role on e-marketing technology adoption and implementation; and individual characteristics of the CEO's such as education, age, experience and psychological traits have been found strongly influence innovation adoption.

A firm's environment is, therefore, one of these contexts and consists of competitors; access to resources supplied by others; and dealings with government. Experience tells us that technology adoption is primarily market-driven, either by competition or by the availability of new technologies and the search for new industrial applications (Porter, 2001). In those markets where competition is intense, demand elasticity are expected to be higher because of the existence of close substitutes and this has the potential to drive innovative behaviors within the firm (Majumdar & Venkataraman, 1993). Low entry barriers or other market characteristics implying intensive competition (such as pace of change, use of technology in the industry) may also drive firms to adopt or intensify their use of IBTs. Cetindamar (2001) reported that there are at least three models of technology adoption:

*One model of technology diffusion is the epidemic model, indicating that the lack of information available about the new technology can limit the diffusion of technology. Another model, the probit model, suggests that different firms adopt new technology at different times due to their differences in goals and abilities. An alternative model is related to density dependence that considers diffusion as the result of legitimating and competition (PP. 186-7).*

The epidemic model of technology diffusion stresses information spillover from users to non-users (Canepa & Stoneman, 2004). Thus, a firm's propensity to adopt a technology at a certain point is positively influenced by the present level of adoption and diffusion in the economy as a whole, or by the proportion of adopters in the industry or sector to which the specific firm is affiliated.

Furthermore, Chong (2008) identified several factors that inhibit or foster e-commerce and e-marketing adoption. These factors are classified as internal and external environmental factors. The internal environmental factors include organization (such as firm size, firm age, management support, perceived readiness and international orientation), innovation (such as perceived relative advantage, complexity, compatibility, trial-ability and observable), and communication (such as information sources, communication channels and communication amount). The external environmental factors include industry (such as pressures from trading partners, competitive pressures, relevant environmental participation, and non-trading institutional influences), and national (such as perceived governmental support). Another recurring observation is that e-marketing adoption seems to be more of a management issue than a technical one. Many researchers have found that if there is a lack of support amongst top executives, technology cannot be successfully adopted (Grandon & Pearson, 2003). It is therefore reasonable to assume that management support is a critical factor to the successful adoption of e-marketing in the financial firms of Ethiopia.

To sum up, it is argued that negative mindsets, specifically regarding the technological or regulatory environment may be an important barrier to e-marketing adoption in MLFSEs in Ethiopia. In addition, Temesgen and Shekhar (2011) in their study summarized the e-marketing environment, which influence the implementation of e-marketing in the financial service enterprises in Ethiopia. The environmental factors in the Ethiopian context, which influence e-marketing implementation, are grouped in to two groups, namely internal and external related factors. They have also examined the interrelationships between these environmental factors with e-marketing implementation and found a positive significant between them. The summary of factors and their relationships with e-marketing are presentedin the following diagram. Moreover, the researchers argued that though the antecedent factors influence e-marketing implementation, they have also direct impact on the marketing performance within the financial enterprises. This is because the internal strength of the firm as well as the nature of the macro e-marketing environment has direct impact on the company's marketing profitability and success.

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**FIG 1: SUMMARY OF ANTECEDENTS TO E-MARKETING IMPLEMENTATION (TEMESGEN & SHEKHAR, 2011)**
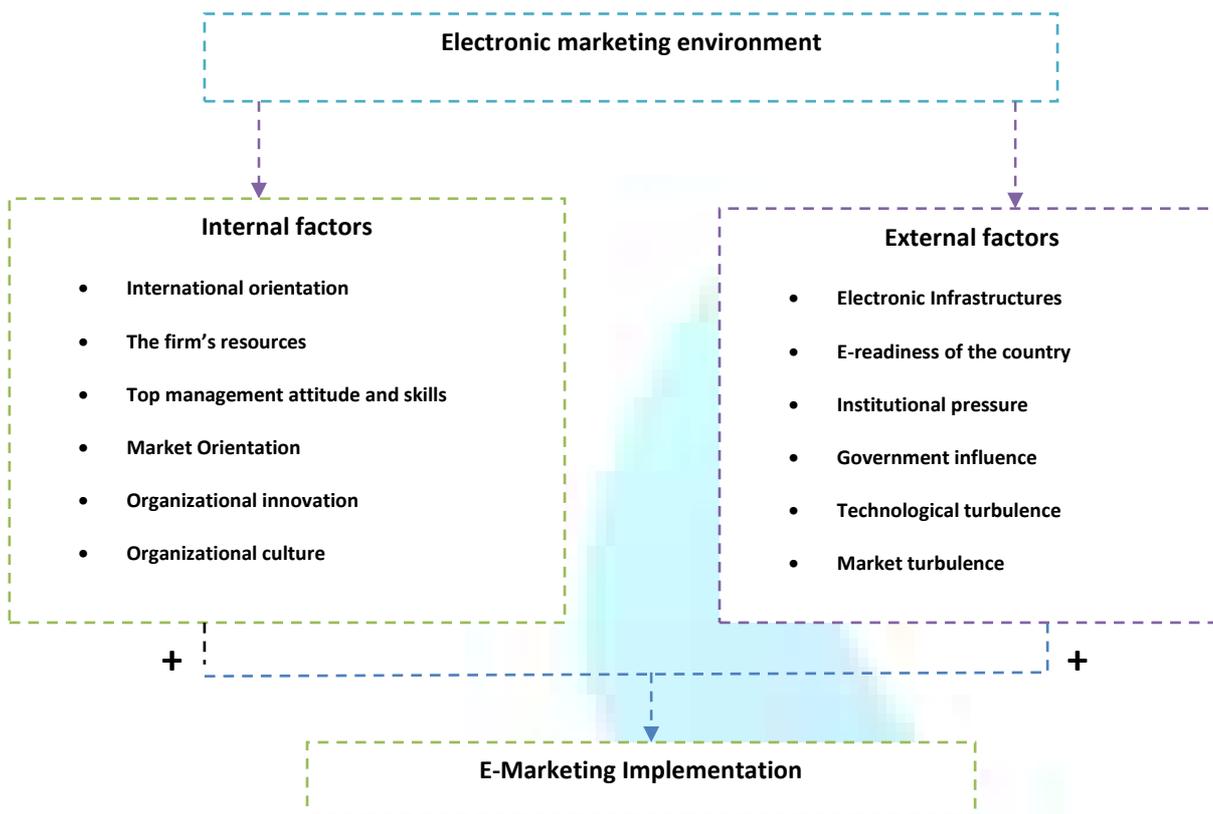


## MARKETING PERFORMANCE

Marketing performance measurement has, of course, been practiced and studied for decades. A review of this history suggests marketing performance measures have moved in three consistent directions over the years: first, from financial to non-financial output measures; second, from output to input measures; and third, from one-dimensional to multidimensional measures (Clark, 1999).

Firstly, there was a move from the use of financial to nonfinancial measures of output. Early work on the measurement of marketing performance focused mainly on the financial measures of profit, sales (unit and value) and cash flow (Bonoma & Clark, 1988). However, there is some unease about the use of financial measures to assess business performance (Eccles, 1991). The main criticism of traditional performance measurement, is basically centered on its over-reliance on cost information and other financial data which are short-term in nature, while no or less emphasis is given on long-term value creation activities which are intangible in nature that generate future growth to the organization Jusoh et al (2008). Newer, nonfinancial measures of output, such as customer satisfaction, customer loyalty, and brand equity have attracted considerable research interest (Clark, 1999). Davidson (1999) also recognized the growing importance of nonfinancial measures of performance in his emphasis of the fact that intangible assets, such as brand, technology, competence and customer loyalty, have gradually become more important measures of corporate performance than ever before.

Secondly, there has been an expansion from the measurement of just the output yielded by marketing to measuring the marketing input as well. Marketing activities (input) such as marketing audit, marketing implementation, and market orientation lead to intermediate outcomes such as customer satisfaction, customer loyalty, and brand equity, which in turn lead to financial output. The intermediate outcomes may therefore be considered as marketing assets (Srivastava et al, 1998) that may be used to produce superior financial performance.

Thirdly, there has been a gradual change in emphasis from the use of one dimensional to the use of multidimensional measures of performance. Walker and Ruekert (1987) suggested that the measurement of marketing performance should include the assessment of both marketing efficiency and marketing effectiveness. More researchers now agree that marketing performance is multidimensional (Ambler et al, 2004; Vorhies & Morgan, 2003). As a result of this requirement, the number and variety of measures that are available has increased. It has been suggested that marketing researchers should develop sets of measures that are small enough to be manageable but comprehensive enough to give an accurate evaluation of performance (Clark, 1999).

Thus, when looking to the marketing performance and success measures, it is noticed that traditional marketing performance measures such as profits, sales and cash flow were insufficient for decision making, planning and controlling operations in today's rapidly changing and hyper-competitive environment (Jusoh et al, 2008). The traditional performance measurement system is under serious challenge since its emphasis is on financial measures in order to satisfy the regulatory and accounting reporting requirements. According to Jusoh et al (2008), traditional financial measures are criticized because they are short-term rather than long-term focus, measuring the past rather than future. Besides, they tend to be obsolete and easily manipulated by managers. Recently, Kokkinaki and Ambler (1999) have summarized marketing metrics in six categories: financial, competitive market, consumer behavior, customer intermediate, direct customer and innovativeness measures. Therefore, the researchers depend on these six categories of marketing performance measures in the Ethiopian financial service enterprises. In relation to e-marketing-performance relationship, the researchers contend that the implementation of e-marketing technology within the financial enterprises affects the marketing performance and this idea is substantiated by previous researchers in the field.

## STATEMENT OF THE PROBLEM AND RESEACH GAP

Electronic Marketing (EM) research has long been an area of interest for researchers as it started evolving as a discipline with its own identity, since the late 20th century. E-marketing scholars had been researching a set of diverse topics associated with electronic marketing, internet marketing, SMS marketing, electronic commerce, information technologies, IT infrastructures and IT-enabled business solutions, and the immediate antecedents and consequences of electronic marketing (Temesgen & Shekhar, 2011).

Though specific factors have been identified across different studies, the researchers developed a conceptual model for this research based on factors influencing e-marketing implementation as identified by Temesgen and Shekhar (20011) as follows. In the conceptual model, the researchers viewed these

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variables as internal related and external related factors within the organizations. It can be argued that the micro and macro environmental factors are considered as external factors while the internal to the company related factors are considered as internal factors to the firm.

As shown in the conceptual model below, Temesgen and Shekhar (2011) in their studies have already tested the interrelationship between internal and external factors with e-marketing implementation and found a positive significant relationship between them in the Ethiopian context. Therefore, the researchers in this paper would like to test the uncovered areas' interrelationship such as environmental factors as measured by internal and external variables, and e-marketing implementation with marketing performance variables within the MLFSEs in Ethiopia.

**FIG. 2: CONCEPTUAL MODEL OF THE STUDY**
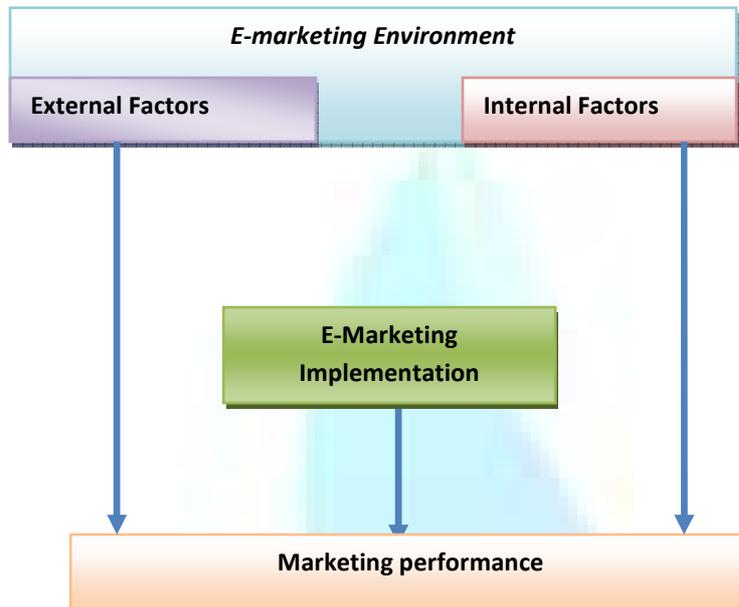


Based on this research gap, conceptual model and objectives of the study, the researchers have developed the following hypotheses.

H1: There is a direct positive significant impact of e-marketing environment as measured by internal and external factors on the marketing performance of MLFSEs in Ethiopia.

H2: There is a positive significant effect of e-marketing implementation on the marketing performance of MLFSEs in Ethiopia.

## METHODOLOGY OF THE RESEARCH

From the researcher point of view, generally there is no optimal research methodology or method. According to Yin (1994), research strategy should be chosen as a function of the research situation. Each research strategy has its own specific approaches to collect and analyze empirical data, and thus each strategy has its own advantages and disadvantages. Therefore, based on the research questions, objectives of the research, the hypotheses to be tested, and aims as well as the methodologies and methods used in the other similar studies in the field, the researchers adopted an analytical survey method.

The researcher identified the medium and large financial service enterprises as a target of population. Proportionate stratified random sampling technique was employed in selecting the respondents of the study. This is because the study population is somewhat heterogeneous namely, banks and insurance companies (Temesgen & Shekhar, 2011). For heterogeneous population with appropriate lists, the stratified random sampling is appropriate technique to increase the sample's statistical efficiency and representativeness for a given sample size (Krishnaswami & Ranganatham, 2010). To determine the desired sample size, the researchers assumed 95% level of confidence, 5% level of precision and 50 % variability (maximum variability) with respect to the nature of the population being studied. Accordingly, 200 randomly selected middle and top-level managers are included based on Yeman's (1976) simplified formula in the study.

$$n = \frac{N}{1 + N(e)^2}$$

Where N -the target population, n- sample size and e-level of precision

**QUESTIONNAIRE DESIGN PROCEDURE**

For investigating the effect of e-marketing and its environment on the marketing performance of medium and large financial service enterprises in Ethiopian (MLFSEs), a cross-section of stratified randomly selected enterprises is used in generating the intended data. The structured questionnaires are administered personally for the middle and top-level managers of the sample unit companies. To get the intended data from these managers, the researchers adopted the existing scales with modification for measuring the market turbulent, technological turbulent, organizational innovativeness, institutional pressure, top management attitude and skills', and market orientation constructs.

Moreover, for the performance of marketing measures, the researchers depend on the six categories of marketing performance measures developed by Kokkinaki and Ambler (1999) which are summarized as follows:

❖ Financial measures ( as turnover, contribution margin and profit)
❖ Competitive market measures ( as market share, advertising and promotional share)
❖ Consumer behavior measures ( as consumer penetration, loyalty and customer gained)
❖ Consumer intermediate measures ( as brand recognition, satisfaction and purchase intention)
❖ Direct costumer measures (as distribution level, profitability of intermediaries and service quality); and
❖ Innovativeness measures (as products launched and their revenue).

Scales for the other constructs were not available in the literature. The researchers developed new scales for the remaining constructs as follows. First, the researchers independently generated a large pool of items for each of the constructs included in the study. Care was taken to tap the domain of each construct as closely as possible. Next, items were tested for clarity and appropriateness in personally administered pre-tests with the selected sample units of middle and above level managers, research scholars and academicians in the area. They were asked to critically evaluate the items from the standpoint of domain representativeness, items specificity and clarity of construction.  Based on the detailed critique that was received, some items were eliminated, revised and others maintained to improve their specificity and precision.

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The researchers have taken a pilot survey on twenty randomly selected banking and insurance company managers. The reliability of each scale was estimated with the coefficient of Cronbach's alpha (which gave α >0.86 each). After that, structured questionnaire were personally administered for a total sample of 200 respondents with randomly selected managers, vice presidents, officers and business development planners of banking and insurance companies at Addis Ababa, Ethiopia.

## RESULTS OF THE STUDY

In this section, the findings of the study are presented in the forthcoming tables. Marketing performance is measured by an amalgam of six dimensions, namely: financial measures, competitive measures, consumer behavior measures, consumer intermediate measures, direct customer measures and innovativeness measures. The antecedents of e-marketing implementation are grouped and measured as internal and external factors, (Temesgen & Shekhar, 2011) while e-marketing implementation is measured with fifteen items construct. Accordingly, the multiple regression equation was estimated and presented in table 1 through 7 by incorporating the overall and different marketing performance dimensions as dependent variables and e-marketing implementation, internal and external factors as independent variables. The following estimated regression model is applied:

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e_1$

Where $\alpha$ is the constant, $\beta_1$, $\beta_2$ and $\beta_3$ are the linear coefficients of external, internal and e-marketing implementation variables respectively. While Y stands for marketing performance in the financial service enterprises with its different dimensional measures and $e_1$ stands for error term. In order to apply this regression model, the auto-correlation (with Durbin-Watson) and multicollinearity (with condition Index, VIF and Tolerance level) are examined and found no problems.

Several factors have been examined and hypothesized in the literature as antecedents of e-marketing penetration and adoption. The results indicated that there is a positive significant relationship between antecedents of e-marketing implementation and e-marketing implementation within the Ethiopian financial service enterprises context (Temesgen & Shekhar, 2001). Therefore, in the forthcoming tables the impacts of the antecedent variables namely internal and external factors and e-marketing implementation on the marketing performance measures are examined and presented.

**TABLE 1: EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON MARKETING PERFORMANCE-FINANCIAL MEASURES**

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients | t value | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | Beta | Std. Error | Beta | | | Tolerance | VIF |
| (Constant) | 2.417 | .283 | | 8.543 | .000 | | |
| External Factors | .173 | .048 | .244 | 3.618 | .000 | .309 | 3.234 |
| Internal Factors | .150 | .039 | .212 | 3.814 | .000 | .456 | 2.194 |
| E-marketing | .470 | .067 | .555 | 7.039 | .000 | .226 | 4.429 |
| Model summary | | | | | | | |
| Model | R | R2 | Adj. R2 | St. Error Est. | Durbin Watson | | |
| Sig .000 | .852 | .725 | 721 | .37480 | 1.014 | | |

The results obtained in table 1 above shows that 72.5% of the variations of marketing performance as measured by financial terms are explained by the independent variables identified in the multiple regression equation. Moreover, as the table indicates there is a positive significant impact of external, internal and e-marketing variables ($\beta_1$ = .244, $\beta_2$ = .212, $\beta_3$ = .555 respectively) on the financial measures of marketing performance within the Ethiopian financial service enterprises. E-marketing has more predictive power than others.

Table 2 below indicates that 86.3% of the variations of marketing performance as measured by competitive market measures is explained by the independent variables and the remaining is attributed to the unexplained variables in the estimated regression equation. Moreover, it is found that external, internal and e-marketing implementation within the financial service enterprises in Ethiopia have a positive significant impact on the competitive market measures of marketing performance as indicated in table 2 below (with estimated beta values of $\beta_1$ = .152, $\beta_2$ = .179, $\beta_3$ = .721). Further, the result also shows that e-marketing has a more significant impact over performance measures than others do.

**TABLE 2: EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON MARKETING PERFORMANCE-COMPETITIVE MEASURES**

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients | t value | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | Beta | Std. Error | Beta | | | Tolerance | VIF |
| (Constant) | 1.624 | .205 | | 7.924 | .000 | | |
| External Factors | .110 | .035 | .152 | 3.188 | .002 | .309 | 3.234 |
| Internal Factors | .130 | .029 | .179 | 4.557 | .000 | .456 | 2.194 |
| E-marketing | .626 | .048 | .721 | 12.945 | .000 | .226 | 4.429 |
| Model summary | | | | | | | |
| Model | R | R2 | Adj. R2 | St. Error Est. | Durbin Watson | | |
| Sig .000 | .929 | .863 | .861 | .27145 | 1.601 | | |

**TABLE 3: EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON MARKETING PERFORMANCE-CONSUMER BEHAVIOR MEASURES**

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients | t value | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | Beta | Std. Error | Beta | | | Tolerance | VIF |
| (Constant) | 1.756 | .199 | | 8.806 | .000 | | |
| External Factors | .122 | .034 | .170 | 3.634 | .000 | .309 | 3.234 |
| Internal Factors | .130 | .028 | .180 | 4.685 | .000 | .456 | 2.194 |
| E-marketing | .611 | .047 | .709 | 12.979 | .000 | .226 | 4.429 |
| Model summary | | | | | | | |
| Model | R | R2 | Adj. R2 | St. Error Est. | Durbin Watson | | |
| Sig .000 | .932 | .868 | .866 | .26407 | 1.577 | | |

Consumer behavior dimensions as a marketing performance measures is presented in table 3 above. As the result shows, 86.8% of the variations of consumer behavior dimensions are explained by the independent variables while the remaining 13.2% is attributed to the error term in the estimated regression equation. Moreover, the results indicated ($\beta_1$ = .170, $\beta_2$ = .180, $\beta_3$ = .709) that there is a positive significant impact of exogenous variables on the consumer behavior marketing performance measures. From this one can deduce that still e-marketing implementation has a profound significant impact over consumer behavior measures than what external and internal variables do.

Table 4 below indicates the consumer intermediate measures of marketing performance. Accordingly, the estimated regression results show that 90.3% of the variations are explained by the independent variables. Furthermore as referred from the same table, it is found that there is a positive significant impact of the identified independent variables over the consumer intermediate marketing performance measures (with estimated beta values of $\beta_1$ = .163, $\beta_2$ = .189, $\beta_3$ = .728). Here also e-marketing is more powerful predictor than others.

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**TABLE 4: EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON MARKETING PERFORMANCE-CONSUMER INTERMEDIATE MEASURES**

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | Beta | Std. Error | Beta | value | | Tolerance | VIF |
| (Constant) | 1.629 | .174 | | 9.361 | .000 | | |
| External Factors | .120 | .029 | .163 | 4.089 | .002 | .309 | 3.234 |
| Internal Factors | .139 | .024 | .189 | 5.747 | .000 | .456 | 2.194 |
| E-marketing | .639 | .041 | .728 | 15.570 | .000 | .226 | 4.429 |
| **Model summary** | | | | | | | |
| Model | R | R2 | Adj. R2 | St. Error Est. | | Durbin Watson | |
| Sig .000 | .950 | .903 | .902 | .23046 | | 1.204 | |

Table 5 below indicates that 83.9% of the dependent variable variations as measured by direct customer dimensions of marketing performance are explained by the identified independent variables. Further, it is found that there is a significant impact ($\beta_1$ = .174, $\beta_2$ = .162, $\beta_3$ = .701) of environmental and e-marketing variables on the marketing performance as measured by direct consumer measures.

Innovativeness as a marketing performance dimensions is presented in table 6 below. As the results prevail, 84.9% of the dependent variations are explained by the independent variables. In addition, there is a positive significant impact of environmental and e-marketing variables on the innovativeness marketing performance dimensions as evident in the table below.

**TABLE 5: EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON MARKETING PERFORMANCE-DIRECT CUSTOMER MEASURES**

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients | t value | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | Beta | Std. Error | Beta | | | Tolerance | VIF |
| (Constant) | 1.647 | .231 | | 7.124 | .000 | | |
| External Factors | .132 | .039 | .174 | 3.376 | .001 | .309 | 3.234 |
| Internal Factors | .123 | .032 | .162 | 3.817 | .000 | .456 | 2.194 |
| E-marketing | .634 | .055 | .701 | 11.618 | .000 | .226 | 4.429 |
| **Model summary** | | | | | | | |
| Model | R | R2 | Adj. R2 | St. Error Est. | | Durbin Watson | |
| Sig .000 | .916 | .839 | .836 | .30617 | | 1.043 | |

**TABLE 6: EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON MARKETING PERFORMANCE-INNOVATIVENESS MEASURES**

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | Beta | Std. Error | Beta | value | | Tolerance | VIF |
| (Constant) | 1.403 | .241 | | 5.828 | .000 | | |
| External Factors | .154 | .041 | .189 | 3.777 | .000 | .309 | 3.234 |
| Internal Factors | .154 | .033 | .189 | 4.602 | .000 | .456 | 2.194 |
| E-marketing | .660 | .057 | .679 | 11.618 | .000 | .226 | 4.429 |
| **Model summary** | | | | | | | |
| Model | R | R2 | Adj. R2 | St. Error Est. | | Durbin Watson | |
| Sig .000 | .921 | .849 | .846 | .31887 | | 1.027 | |

**TABLE 7: EFFECT OF E-MARKETING AND ITS ENVIRONMENT ON OVERALL MARKETING PERFORMANCE**

| Independent variables | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | Beta | Std. Error | Beta | value | | Tolerance | VIF |
| (Constant) | 1.746 | .165 | | 10.557 | .000 | | |
| External Factors | .135 | .028 | .189 | 4.840 | .000 | .309 | 3.234 |
| Internal Factors | .138 | .023 | .192 | 5.983 | .000 | .456 | 2.194 |
| E-marketing | .607 | .039 | .709 | 15.543 | .000 | .226 | 4.429 |
| **Model summary** | | | | | | | |
| Model | R | R2 | Adj. R2 | St. Error Est. | | Durbin Watson | |
| Sig .000 | .953 | .908 | .906 | .21906 | | 1.032 | |

Finally, the researchers hypothesized that (H1) There is a direct positive significant impact of e-marketing environment as measured by internal and external factors on the marketing performance of MLFSEs in Ethiopia. (H2) There is a positive significant effect of e-marketing implementation on the marketing performance of MLFSEs in Ethiopia. To test these hypotheses, the external and internal factors along with e-marketing implementation as independent variables and overall marketing performance as dependent variable are incorporated. The estimated regression equation results, as shown in table 7 above, indicated that there is a significant positive impact of environmental factors and e-marketing implementation on the overall marketing performance within the Ethiopian financial service enterprises.

Moreover, the result shows that e-marketing implementation has more significant influence on marketing performance than environmental factors do. 90.8% of the variations are explained by the independent variables while the remaining variations are attributed to the unexplained variables in the estimated regression equation.

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## DISCUSSIONS AND INTERPETATIONS

This study constitutes a first attempt to investigate the nexus of relationships between e-marketing antecedent factors, e-marketing, and marketing performance. The findings confirm that antecedent factors to e-marketing and e-market implementation determine marketing performance in the financial service enterprises. The present study generally, thus, supports the researchers' hypotheses.

The findings have support from previous research findings. For instance, Tsiotsou and Vlachopoulou (2011) studied the effects of market orientation and e-marketing on service performance and found a positive relationship among them. Wu et al (2003) studied four types of technology-based industries in the USA and reported a positive effect of e-business intensity on firm performance expressed as business efficiency, sales performance, customer satisfaction, and relationship development. Moreover, Ordanini and Rubera (2007) reported that internet resources exhibit an indirect effect on performance mediated by customer orientation. Brodie et al (2007) also found that the adoption of e-marketing is positively associated with marketing performance and specifically on customer acquisition and retention. Therefore, the present study is in line with the preceding findings in related areas of study.

The outcomes indicate that the antecedents of e-marketing implementation namely internal and external factors constitute the foundation and the catalyst that boosts the effects of other marketing resources within the financial firms such as e-marketing. That is, marketing resources do not act only in isolation but complement each other to achieve marketing performance. The results designate that academics and managers should consider the inter-relationships between multiple sources of competitive advantage when looking for explanations of services performance and particularly, financial services.

In line with preceding research on financial service in Ethiopia (Temesgen & Shekhar, 2001), the findings indicate that the internal and external factors constitute a significant determinant of e-marketing implementation. Thus, they are the constituting necessary elements for financial firms in order to incorporate new technologies into their marketing activities and exploit them for marketing purposes. Research in financial services has shown that the web site design and internet marketing features are significant predictors of message delivery, corporate brand image, and quality of products and services, which are the core of marketing performance measurement elements.

Furthermore, the current findings provide several managerial implications to all the Ethiopian medium and large financial service enterprises because our sample consisted mainly of MLFSEs. MLFSEs in developing countries like Ethiopia are struggling to survive within a fierce competitive environment where developed nations' medium and large financial service enterprises are increasing constantly their negotiation power and control a large portion of the economic exchanges in the industry. In order for developing countries' like Ethiopian MLFSEs to compete effectively in this turbulent environment, they need to develop skills and strategies that will assist them in gaining competitive advantage over giant financial enterprises. Developing marketing, and e-marketing capabilities and adopting an e-marketing strategy constitute managerial avenues that MLFSEs could take in order to increase their marketing performance and survival. To secure their existence, MLFSEs must continuously upgrade on-line business systems so that they keep distribution costs low and offer added value to their customers. However, first, they need to invest in resources (human and technological) that will qualify them in changing their business culture to a market-oriented environment that puts the customer's interests first, respond to competitors actions, and secure intelligence dissemination and coordination of resources throughout their firm where e-marketing and internet technologies are the basic tools of all these activities.

## CONCLUSIONS AND MANAGERIAL IMPLICATIONS

This study is among the first to investigate the relationship between the four key concepts- external and internal antecedent factors of e-marketing implementation, e-marketing implementation, and marketing performance. The results suggest that the environmental factors as measured by internal and external variables along with e-marketing implementation have a positive significant impact on the overall and six amalgam marketing performance dimensions. The study's central hypotheses, that there is a significant impact of e-marketing environment and e-marketing implementation on the marketing performance of MLFSEs in Ethiopia, are generally supported.

These findings establish the need for both researchers and practitioners to be aware of the leveraging influence of e-marketing when it is well integrated in to a firm's marketing activities. The results also further demonstrate that e-marketing environment as measured by external and internal variables influence marketing performance through e-marketing adoption and implementations too. This is because the internal and external factors are considered by several researchers as an antecedent of e-marketing implementation and thus has a direct impact on the marketing performance within the financial enterprises. The findings of the study are summarized in the following diagram:
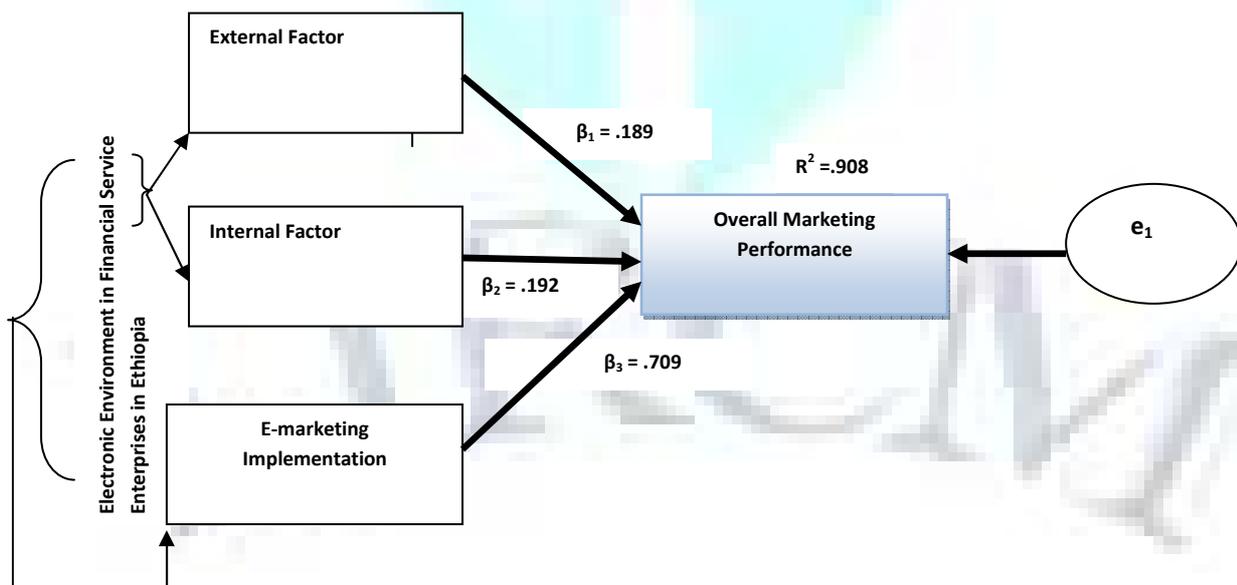


As the diagram reflects, 90.80% of the variations of overall marketing performance are explained by the e-marketing implementations and its antecedent factors. The remaining is attributed to the error term in the estimated equation. Of interest is the e-marketing implementation's highly significant impact on marketing performance than antecedents do.

## MANAGERIAL AND PUBLIC POLICY IMPLICATIONS

The findings of the study are of significance to financial firms' executives who are responsible for the technology, research and development programs. By demonstrating the linkage of e-marketing implementation along with its antecedents, this study underscores that e-marketing implementation in the competitive marketing environment is an organizational imperative that applies to traditional marketing activities to up left the marketing performance. The

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dynamism, complexity and competitive intensity of today's financial marketing trends provide an added rationale in this regard. Marketing managers should also take note of the "leveraging" influence of e-marketing in building marketing competencies that are superior to competitors' in market and service oriented organizations.

Customer service managers, marketing manager and officers of the financial service enterprises should be proactive in securing senior management's commitment to devote the necessary resources, in terms of both technology and the necessary technology management skills for effectively integrating the e-marketing technology in to internal and external marketing activities and processes pertinent to the firm's marketing activities success. The focus of such technology integration efforts is to enhance marketing competencies that yield a sustained competitive advantage in financial markets arena.

For firms that are smaller and / or have only limited e-marketing technology involvement, public policy makers should focus on motivating them as to the importance and need of embracing the technology in their marketing activities to realize the superior marketing competencies and higher marketing performance. Especially, for micro, small as well as for non-adopters of medium and large financial service enterprises, government policy makers should encourage them to invest in appropriate Internet infrastructures and applications through a variety of incentives and initiatives at macro level.

## SCOPE FOR THE FURTHER RESEARCH

Further research designed to replicate or extend this study should also examine ways to improve measurements of the e-marketing implementation construct as well as antecedent variable measures. The present study focuses on only on financial service enterprises. However, given the dominating role of other service sectors in growing economies and the growing use of e-marketing technologies in internationalization of services, it is important that the study be replicated with other service sectors in the future. It should also be noted that the present study's findings are based on cross-sectional data analyses, which do not enable us to make any causal inferences or identify any possible time-lag effects of the research constructs. Thus, future researchers can consider time series data whenever possible to overcome the pitfalls.

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# ERGONOMICS RELATED CHANGES ON TRADITIONAL BANKS IN KERALA CONSEQUENT ON CHANGES IN TECHNOLOGY AND ITS IMPACT ON EMPLOYEES

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## ABSTRACT

*Advent of computer technology has meant greater flexibility and increased efficiency for office workers. The widespread use of computers has contributed to an exponential rise in the number of injuries owing to its user interfaces. This paper discussed the way in which the office computer monitors, keyboard, mouse etc. are arranged, lighting facilities in the office, disturbance by the sounds from IT devices, employee free time to stand up and relax, employee experience on colour combination of the office, eye problems and headache as they look long hours at computer monitor etc. The main Objective of this study is to understand employees' perception on ergonomics related changes to accommodate technological transformation of traditional banks. All traditional banks with more than hundred branches in Kerala are taken for the study. The Statistical tools of Percentage analysis, Chi-Square Test, Arithmetic Mean are used for analysis of the data. Most of the respondents have positive perception on ergonomically friendly environment of the office in which they work.*

## KEYWORDS

Computer technology, ergonomically friendly environment.

## INTRODUCTION

Ergonomics deals with a system of interacting components which includes the worker, the work environment both physical and organizational, the task and the workspace. The goal of ergonomics is to ensure a good fit between the workers and their job, thereby maximizing worker comfort, safety, productivity and efficiency.

Banking and financial systems have been revolutionized by the ongoing progress of information and communications technology on a global scale. The twin pillars of modern banking development today are Information technology and Electronic funds transfer systems. Even though this phenomenon has largely permeated throughout the Indian banking system, technologies suitable for Indian conditions have also been introduced.

Public sector banks and the existing private sector banks (old private sector banks) faced challenges in the form of competitive pressures and changing customer demands both from foreign banks and new private sector banks. Most of the public sector and old private sector banks (classified as traditional banks) had a number of legacy issues to tackle in their existence of more than a century. While the new private sector banks could adopt the best practices and implement the latest technology in their operations, the foreign banks acquired the practices and technology akin to their host countries within the regulatory framework of India. Influenced by the varied practices and culture of host countries, this segment of banks operating in India was found to be quite heterogeneous in their operations and performance.

Faced with the threat of competition from the foreign and new private sector banks (classified as modern banks), the traditional banks employed a number of measures to improve their operational efficiency, meet customer expectations and reduce operating costs. These included going for fully automated systems (Core Banking Solution based operations) preceded by business process reengineering (BPR), offering VRS to its employees, training and retraining of staff, lateral recruitment of specialists, emphasis on marketing, advertising, customer relationship management and improving brand image, diversification of activities, introduction of electronic based multiple service delivery channels, setting up of back offices and data centers, business process outsourcing. Some of these banks have undergone rigorous restructuring exercises with the involvement of international consulting agencies to adopt the best international practices and remove bottlenecks in their operations.

## BANKING STATISTICS OF KERALA

As on 31 March 2007 there were 51 Commercial Banks with 3667 Branches in the State. This is including 6 State Bank group, 19 Nationalised Banks, 24 other commercial Banks and 2 Regional Rural banks (RRBs). As on 31 March -2007, a total of 43454 employees work in commercial banks in Kerala of which 15211 belong to officer category and 19671 to the clerical cadre. The rest are subordinate staff.

## OBJECTIVES OF THE RESEARCH

Objective of the research is to study Employees' perception on ergonomics related changes to accommodate technological transformation of traditional banks**.**

## ERGONOMICS RELATED CHANGES CONSEQUENT ON CHANGES IN TECHNOLOGY

Mohsen Attaran and Brian D. Wargo (1999) and Marilyn P. Rowan and Phillip C. Wrigh (1994) point out that the advent of computer technology has meant greater flexibility and increased efficiency for office workers. However, automation does not eliminate human role but rather changes it, often in unforeseen ways and with unanticipated consequences. The continuous use of computers in the workplace means increasingly sedentary jobs. Employees are moving less as they work. The widespread use of computers has contributed to an exponential rise in the number of injuries owing to its user interfaces—video display terminal (VDT), keyboard and mouse. The recent influx of health problems such as carpel tunnel syndrome, cumulative trauma disorders, and repetitive strain injuries caused by inadequate design of the workplace environment has militated against the increased levels of office productivity originally anticipated. This will individually influence the employees. There is no serious research nor are discussions widely conducted in these areas in the Indian context.

This study examines the employees' experience on changed office layout of banks due to automation. The following elements are taken into consideration to examine the same.

1. Office seating arrangements and its comfort
2. The way in which the office computer monitors, keyboard, mouse etc. are arranged.
3. Lighting facilities in the office
4. Disturbance by the sounds from IT devices like printer, Computer, Mobile phone etc.
5. Employee free time to stand up and relax
6. Employee perception on neatness of office cabin and premises
7. Employee experience on colour combination of the office.
8. Eye problems as they look long hours at computer monitor.
9. Headache as they look long hours at computer monitor.

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## UNIVERSE OF THE STUDY

All employees belonging to clerical and above categories in the banking sector of Kerala constitute the Universe of the study.

## SAMPLING DESIGN

All public and private sector banks with more than a hundred branches in Kerala are taken for the study. The researcher uses 'Stratified random sampling method' to determine the sample size for the current research .Total sampling size is 250.

## SURVEY QUESTIONNAIRE

Primary data was collected from 350 employees belonging to officer and clerical cadres of Traditional banks through a Survey questionnaire.

## ANALYSIS OF DATA

The data collected is further classified on the basis of age, experience, educational qualification, gender, ownership, and area of the bank for further analysis. The Statistical tools of Chi-Square Test, Percentage analysis, Arithmetic Mean are used for analysis of the data5.

## ANALYSIS AND DISCUSSION

### TABLE I.I: EMPLOYEES' PERCEPTION OF ERGONOMICALLY FRIENDLY ENVIRONMENT

| perception of ergonomically Friendly environment | Frequency | percentage |
|---|---|---|
| Low | 37 | 14.8 |
| Medium | 70 | 28.0 |
| High | 70 | 28.0 |
| Very High | 73 | 29.2 |
| Total | 250 | 100 |

14.8 % of the respondent s expressed the opinion that Employees' perception of ergonomics in new techno savvy environment is low while 28% of the sample opined that Employees' perception on ergonomically Friendly environment is at a medium **level.**

### FIG I.I: EMPLOYEES' PERCEPTION OF ERGONOMICS IN A TECHNO SAVVY ENVIRONMENT
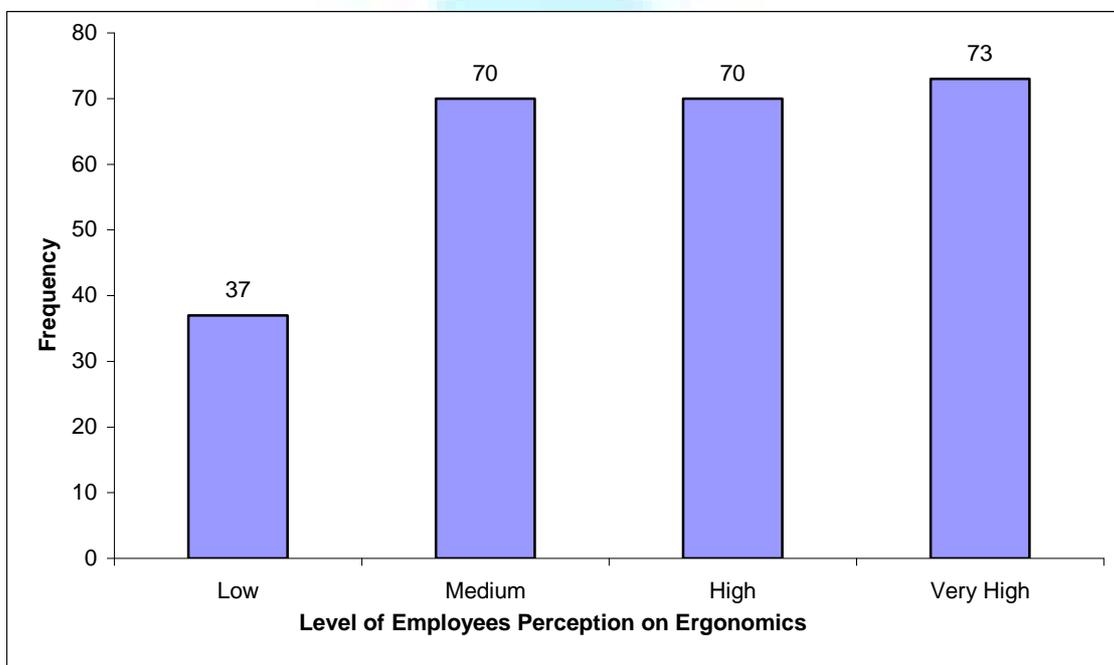


### TABLE 1.2: EMPLOYEES' PERCEPTION ON CHANGING OFFICE LAYOUT OF BANKS TO ACCOMODATE TECHNOLOGICAL TRANSFORMATION

| Sl.no | Indicators | Total Score | Mean | SD |
|---|---|---|---|---|
| 1 | Conformability of office seating arrangements. | 1275 | 5.1 | 1.6 |
| 2 | An office computer monitor where , key board, mouse etc… are arranged in a most comfortable way | 1233 | 4.9 | 1.6 |
| 3 | Sufficient lighting facilities in the office. | 1318 | 5.3 | 1.6 |
| 4 | Disturbance from the sounds from IT devices like printer, Computer, Mobile phone etc. not felt. | 1318 | 5.3 | 1.6 |
| 5 | Availability of enough time to get up and relax in the office. | 1018 | 4.1 | 2.1 |
| 6 | Neatness of the office cabin and premises | 1210 | 4.8 | 1.8 |
| 7 | Colour combination of walls providing Calm and Cool ambience in the office. | 1173 | 4.7 | 1.9 |
| 8 | Absence eye problems related with spending long hours in front of computer monitor. | 1100 | 4.4 | 2.0 |
| 9 | Absence of other ailments as a result of  spreading long hours spending in front of computer monitor | 1100 | 4.4 | 2.0 |
|  | Average | 1194 | 4.8 | 1.8 |

A seven point Scale is used to understand ergonomic related issues of employees in a technology dominated environment. Seven represents for a strong positive perception on changes and one represent s a strong negative perception on changes. Nine indicators are used to measure the influence.

Overall ergonomic friendly environment score is 1194, which indicates that employee's are positive perception on ergonomic friendly environment. Mean and Standard deviation are 4.8, 1.8 respectively.

Employees are satisfied with lighting facilities and noise free environment in the office compared to the other indicators with a total score of 1318 with a Mean and S.D of 5.3 and 1.6. There is moderate satisfaction with seating arrangements in the office and armaments of computer monitor, keyboard, mouse and neatness in the office cabin with total score of 1275, 1233 and 1210 respectively. Employees are not fully free from ailment as they are spending long hours before computers in the office, total scores is 1100 for the same mean and S.D of 4.4, 2.0 respectively**.**

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## ERGONOMIC FRIENDLY ENVIRONMENT AND DEMOGRAPHIC VARIABLES

**TABLE I.3: RELATIONSHIP BETWEEN ERGONOMICS FRIENDLY ENVIRONMENT AND DESIGNATION**

| n (%) | Total 250(100.0) | Low 37(100.0) | Medium 70(100.0) | High 70(100.0) | Very High 73(100.0) |
|---|---|---|---|---|---|
| Employees Designations | | | | | |
| Officer | 133(53.2) | 18(48.6) | 41(58.6) | 43(61.4) | 31(42.5) |
| Clerk | 117(46.8) | 19(51.4) | 29(41.4) | 27(38.6) | 42(57.5) |

NS-Not Significant

Chi-square test is used to test the association with employees' ergonomically friendly environment and Employees designation. The chi-square value is 6.401, which is not significant at 0.05 levels. From this can be inferred that the ergonomic friendly environment and Employees designations are not associated.

**TABLE I.4: RELATIONSHIP BETWEEN INFLUENCES OF ERGONOMICS RELATED CHANGES AND OWNERSHIP OF BANK**

| n (%) | Total 250(100.0) | Low 37(100.0) | Medium 70(100.0) | High 70(100.0) | Very High 73(100.0) |
|---|---|---|---|---|---|
| Ownership of bank[NS] | | | | | |
| Public Sector | 132(52.8) | 20(54.1) | 39(55.7) | 40(57.1) | 33(45.2) |
| Private Sector | 118(47.2) | 17(45.9) | 31(44.3) | 30(42.9) | 40(54.8) |

NS-Not Significant

Chi-square test used to know the association between employees' perception on ergonomically friendly environment and ownership pattern of the bank. The chi-square value is 2.48, which is not significant at 0.05 levels. From this it is inferred that the employees' perception on ergonomically friendly environment and ownership of the bank are not associated.

**TABLE I.5: RELATIONSHIP BETWEEN INFLUENCES OF ERGONOMICS RELATED CHANGES AND AGE**

| n(%) | Total 250(100.0) | Low 37(14.8) | Medium 70(28.0) | High 70(28.0) | Very High 73(29.20) |
|---|---|---|---|---|---|
| Age* | | | | | |
| Upto 25 | 25(10.0) | 9(24.3) | 8(11.4) | 5(7.1) | 3(4.1) |
| 26-35 | 27(10.8) | 6(16.2) | 8(11.4) | 10(14.3) | 3(4.1) |
| 36-45 | 59(23.6) | 5(13.5) | 18(25.7) | 18(25.7) | 18(24.7) |
| 46-55 | 139(55.6) | 17(45.9) | 36(51.4) | 37(52.9) | 49(67.1) |

**\*p-value < 0.5**

Chi-square test used to test the employees' perception on ergonomically friendly environment and age. The chi-square value is 20.26, which are significant at 0.05 levels. Hence it is inferred that the employees' perception on ergonomically friendly environment in the banks and age of employees are associated in Kerala as an impact of technological transformation.

**TABLE I.6: RELATIONSHIP BETWEEN INFLUENCES OF ERGONOMICS RELATED CHANGES AND LEVEL OF EDUCATION**

| n (%) | Total 250(100.0) | Low 37(100.0) | Medium 70(100.0) | High 70(100.0) | Very High 73(100.0) |
|---|---|---|---|---|---|
| Level Of Education[NS] | | | | | |
| Degree | 127(50.8) | 18{48.6) | 39(55.7) | 32(45.7) | 38(52.1) |
| Post Graduate | 96(38.4) | 13(35.1) | 23(32.9) | 31(44.3) | 29(39.7) |
| Others | 27(10.8) | 6(16.2) | 8(11.4) | 7(10.0) | 6(8.2) |

NS-Not Significant

Chi-square test used to asses the employees' perception on ergonomically friendly environment and level of education. The chi-square value is 3.59, which is not significant at 0.05 levels. It reveals that employees' perception on ergonomically friendly environment and level of education are not associated.

**TABLE I.6: RELATIONSHIP BETWEEN INFLUENCES OF ERGONOMICS RELATED CHANGES AND GENDER**

| n (%) | Total 250(100.0) | Low 37(100.0) | Medium 70(100.0) | High 70(100.0) | Very High 73(100.0) |
|---|---|---|---|---|---|
| Gender Difference[NS] | | | | | |
| Male | 170(68.0) | 24(64.9) | 52(74.3) | 42(60.0) | 52(71.2) |
| Female | 80(32.0) | 13(35.1) | 18(25.7) | 28(40.0) | 21(28.8) |

NS-Not Significant

Chi-square test used to test employees perception on ergonomically friendly environment and Gender difference. The chi-square value is 3.85, which are not significant at 0.05 levels. It indicates that employees' perception on ergonomically friendly environment and Gender differences are not associated on employees of SCBs in Kerala as an impact of technological changes.

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**TABLE I.7: RELATIONSHIP BETWEEN INFLUENCES OF ERGONOMICS RELATED CHANGES AND WORK EXPERIENCE**

| n (%) | Total | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| | 250(100.0) | 37(100.0) | 70(100.0) | 70(100.0) | 73(100.0) |
| Work Experience* | | | | | |
| <5 years | 63(25.2) | 15(40.5) | 20(28.6) | 14(20.0) | 14(19.2) |
| 5-10 | 58(23.2) | 3(8.1) | 17(24.3) | 21(30.0) | 17(23.3) |
| 10-15 | 94(37.6) | 13(35.1) | 19(27.1) | 29(41.4) | 33(45.2) |
| 15-20 | 35(14.0) | 6(16.2) | 14(20.0) | 6(8.6) | 9(12.3) |

**\*p-value< 0.5**

Chi-square test is used Test the ergonomic related changes and work experience. The chi-square value is 17.68, which is significant at 0.05 levels. It indicates that employees' perception on ergonomically friendly environment and work experience are associated.

**TABLE I.8: RELATIONSHIP BETWEEN INFLUENCES OF ERGONOMICS RELATED CHANGES AND TYPE OF BRANCH**

| n (%) | Total 250(100.0) | Low 37(100.0) | Medium 70(100.0) | High 70(100.0) | VeryHigh 73(100.0) |
|---|---|---|---|---|---|
| Type of Branch[NS] | | | | | |
| Urban | 72(28.8) | 8(21.6) | 25(35.7) | 22(31.4) | 17(23.3) |
| Semi Urban | 153(61.2) | 24(64.9) | 41(58.6) | 41(58.6) | 47(64.4) |
| Rural | 25(10.0) | 5(13.5) | 4(5.7) | 7(10.0) | 9(12.3) |

NS-Not Significant

Chi-square test is used to test the employees' perception on ergonomically friendly environment and the type of branch. The chi-square value is 5.26, which is not significant at 0.05 levels. It reveals that the employees' perception on ergonomically friendly environment and location of branch [Urban, Semi Urban, and Rural] are not associated.

## FINDINGS AND CONCLUSIONS

Percentage analysis clearly indicates that most of the respondents have positive perception on ergonomically friendly environment of the office in which they work. Only a limited number of respondents have negative view points.

Overall ergonomic friendly environment score is 1194, with Mean and Standard deviation at 4.8, and 1.8 respectively.

Employees are satisfied with lighting facilities and noise free environment in the office. Employees are not fully free from ailment as they are spending long hours before computers in the office.

Employees' perception on ergonomically Friendly environment is high.

Ergonomics has no association with Employees designation, Ownership, level of education, and Gender differences are not associated on employees of SCBs in Kerala as an impact of technological transformation.

Employees' perception of ergonomically friendly environment, and their work experiences and age are associated.

Employees' perception of ergonomically friendly environment with respect to type of branch [Urban, Semi Urban, and Rural] is not associated.

Management may ensure Office Cabin arrangements including seating arrangement, table, arrangement of computer monitor, keyboard, mouse and lighting and color combinations of walls and curtains etc. in the most ergonomic way.

Management may ensure that the employees get enough time to relax during hours of work and provide periodical medical check-up as they are spending long hours in front of computer monitor.

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# MODERN FACES OF FINANCIAL CRIMES IN ELECTRONIC BANKING SYSTEM

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## ABSTRACT

*The globalisation and liberalization of Indian Economy during 90s has forced the traditional Indian Banks to change their legacy face with deployment of numerous Information Technology enabled banking products and service delivery channels. For banks, the electronic banking (eBanking) is consolidation and accessibility of transactional database at a central location but for general customers; it is accessibility of banking services at their doorstep, 24 hrs a day and 7 days in a week. This paper discusses that the increasing dependence on Information Technology has significantly enhanced the risks of financial crimes (FCs) in addition to the traditional ones. The FCs include unauthorised access and alteration of information, changing of information path in middle way, cheating, frauds, money laundering, virus attacks, denial of services, email threats, etc. There is a need to deploy secure computing and communication infrastructure, controlled accessibility, maintaining of confidentiality & integrity of customers' information against unauthorised usage within the internal as well as external network environment as well as to enhance awareness among customers for safe and secure eBanking.*

## KEYWORDS

Denial of Service, Financial Crimes, Hacking, Information and Communication Technology, PKI, Viruses, Worm.

## INTRODUCTION

The banks play very vital role for development of any nation. The bank is a financial organisation that controls, influences and manages finance, which in turn facilitate in development of nation's economy. It provides an environment that is helpful for the social and economic development of the nation (Sharma, 2008). The globalisation of Indian Economy has forced the Indian Banks to equip themselves with modern banking technologies to compete in the domestic as well in the international level market. The Information and Communication Technology has become the state-of-the-art technology for the banks to manage their resources, reduce operational cost, enhance efficiency and productivity and provide banking services to their customers at their doorsteps, 24 hrs in day and 7 days a week. To meet the current challenges of this open economy, the banks have been preparing themselves to harness the opportunities that globalisation and financial liberalisation provided through extensive use of IT (RBI, 1999). But ICT is also like a naked wire where majority of banks all over the world have been struggling to protect their valuable assets i.e. information from the internal as well as external threats. Internet being a public network has been in use by the banks for flow of data / information. This is also the channel used by the unauthorised persons to get admission, alter and damage data (RBI, 2005). The banks as a finance-dealing agency attract many intruders internally as well as externally to commit frauds. These persons generally shift the actual route of information (data/information) flow and get unauthorized access to commit huge financial loss to the organisation. Thus, access control is of paramount importance in banking environment. Attackers could be hackers, unscrupulous vendors, disgruntled employees or even pure thrill seekers. It is therefore, necessary that banks should have secure access control measures in place to avoid any unpleasant incident (RBI, 2005). In addition to external attacks, the banks are exposed to security risk from internal sources e.g. frauds by employee. Employees being familiar with different systems and their weaknesses are potential security threats in a loosely controlled environment (RBI, 2005). Many banks have tied up with outside service providers to implement, operate and maintain their eBanking systems because these don't have expertise. This adds the operational as well as security risks. The over dependencies on third parties/vendors should be avoided as far as possible (RBI, 2005).

## FINANCIAL INFORMATION SECURITY- A CHALLENGE

The characteristics of computer crime are different from that of conventional crime in that it is relatively easy to commit, difficult to detect and even harder to prove. It is a 'low risk, high reward' venture for the criminals (Talwar, 1999**).** The computers are able to store huge volume of data in small space. It is difficult to transfer one lac rupees physically from a bank's vault than to transfer digital information on money by breaking into the bank's server (Delhi Police, "Cyber Crimes", 2003). In the financial service industry alone, the spending on security related products and service was expected to rise from $ 848 million in 2000 to 2.2 billion by 2005. Thus, there is a sizable requirement of cyber security products and services (CEDTI, 2005). In India, the spending by companies on Information Security ranges from 5% to 15% of the IT budget (Gupta, et. al., 2004). In cyberspace, there is no policemen to patrol/monitor the information superhighway, leaving it open to everyone (Vaidya-Kapoor, 2004). The criminals find banks to be a profitable target. Nearly 39 per cent of cyber crime cases in India are related to banks and Financial Institutions excluding those of the government (O'BRIEN, 2003). In 66 % cases of data theft employees or former employees were evolved. The employees are reported as the one of the biggest vulnerable of security elapses (ASCL, 2003). With the growing popularity of ATMs, Debit, Credit Cards and Internet Banking in India, the customers have been becoming the maximum victims of cyber crimes. Plastic cards have given rise to frauds such as alteration of signature on the cards, forgery of signature to match the signature on the card, collusion with retailers using genuine cards, counterfeit of entire cards, etc. (Hussain, 1988). A survey from Gartner Banks reveal that banks lost over USD 2 billion to fraudsters in the year 2003, with nearly 2 million Americans had been losing funds from their cheque accounts at an average of USD 1,200 per incident (ePaynews, "Accounts Robbed", 2004). The ongoing investigations in Southwest Florida revealed biggest-yet credit card fraud ring. The identities of up to 1,400 individuals have been stolen, although not all were used to make false credit cards (ePaynews, "Stole Identities", 2004). Similarly in New York, Credit Cards holders' data was stolen from clothing retailer the Polo Ralph Lauren Corp. This incident forced the banks and credit cards issuers to warn thousand of consumers that their credit-card information might have been exposed and needed to be replaced immediately. This incident affected almost 180,000 card holders (Associated Press, 2005) Earlier, the London-based Reed Elsevier Group PLC, which owns LexisNexis, disclosed that criminals might have breached computer files containing the personal information of 310,000 people since January 2003 (Associated Press, 2005). Instead of using ICT for the well beings of society and the national development, it is being in use to do cyber crimes, defaming persons and anti national activities.

## CATEGORIES OF FINANCIAL CRIMES

The Information Technology has been in use to commit Financial Crimes (FCs). The FCs include unauthorised access and alteration of information, changing of information path in middle way, cheating, frauds, money laundering, virus attacks, denial of services, email threats, etc. The financial crimes can be committed in numerous following forms.

### HACKING

This is unauthorized access to computer systems or networks. It is a kind of access without the permission of rightful owner or the person in charge of computer. In other words it is a criminal activity to enter into the territory of third party without its permission or desire and gain access of computer resources. Here are

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some types of unauthorized access (Delhi Police, "Cyber Crimes", 2003): a) Packet Sniffing is a technology used by the crackers to get in the access of information that is being transferred during communication by two parties. It is used to check the messages that are being transmitted in the form of small packets during transmission. b) Tempest Attack is a technique to monitor electromagnetic emissions from computers in order to reconstruct the data. This allows remote monitoring of network cables or remotely viewing monitors. c) Password Cracking is a technique used by the hacker to gain access to the systems by using Password Cracking utilities. d) Buffer Overflow is probably the most common way of breaking into the computer. It involves input of excessive data into a computer. The excess data "overflows" into other areas of the computer's memory. This allows the hacker to insert executable code along with the input, thus enabling the hacker to break into the computer.

## DATA THEFT

This includes theft of information stored in computer hard disks, removable storage media, etc. Here are few cases of data theft incidents occurred in India (O'BRIEN, 2003):

- An employee of the Bank of India trapped his organisation's computer network and gathered data on all keys pressed, including passwords, by monitoring the CCTV.
- GS Bhatnagar, a resident of South Delhi, realised that Rs 10,000 had been withdraw from his account at SBI through his ATM card. This happened, when Bhatnagar had never used his card in any banking operation.
- A MBA graduate Akaash Singh hacked into an ATM while using a metallic sleeve to wash up several lakhs of cash from a Canara Bank Branch in Chennai. The first data theft (credit card information) case registered in India in 2002, in which a person Arif Azim, who had been working at a call centre in Nodia gained access to a credit card number of an American National while performing his official duties (Kaur, 2004).

## SALAMI ATTACKS

An employee of a bank in USA was dismissed from his job. Disgruntled at having been mistreated by his employer the man first introduced a logic bomb (LB) into the bank's systems. The LB is a computer programme that activates on the occurrence of a particular predefined event. The logic bomb was programmed in such a way to take ten cents from all the accounts in the bank and put them into the account of the person whose name was alphabetically the last in the bank's rosters on every Saturday. The disgruntle employee opened an account in the bank with name of Ziegler. The withdrawn amount was so insignificant that neither any of the account holders nor the bank officials noticed the fault. It was brought to their notice when a person by the name of Zygler opened his account in that bank. He was surprised to find a sizable amount of money being transferred into his account on every Saturday. This was because; his name (Zygler) came to the last in bank's rosters instead of Ziegler (Delhi Police, "Cyber Crimes", 2003).

## DENIAL OF SERVICE ATTACK

Denial-of-service (DoS) attacks are usually launched to make a particular service unavailable to someone who is authorized to use it. These attacks may be launched using one single computer or many computers across the world. In the latter scenario, the attack is known as a distributed denial of service attack. Denial-of-Service tools allow the attackers to automate and preset the times and frequencies of such attacks so that the attack is launched and then stopped to be launched once again later. This makes it very difficult, in fact almost impossible, to trace the source of the attack. The above tools also facilitate the hackers to automatically change the source addresses of the systems randomly, thereby making it seem as if the attack is originating from many thousands of computers while in reality there may be only a few. The victims of such types of attack have been like the Amazon, CNN, Yahoo and eBay etc. (Delhi Police, DOS, 2003).

## VIRUS ATTACKS

Viruses are programs that attach themselves to a computer or a file and then circulate themselves to other files and to other computers on a network. They usually affect the data on a computer, either by altering or deleting it. The Virus can cause severe damage to the victim's assets- "the information" (ASCL, 2003). The VBS_LOVELETTER virus (better known as the Love Bug or the I LOVE YOU virus) was reportedly written by a Filipino undergraduate student. In May 2000, the Melissa virus became the world's most prevalent virus. It corrupted one in every five personal computers in the world. The Losses incurred during this virus attack were pegged at US $ 10 billion (Delhi Police, "Cyber Crimes", 2003). "I LOVEYOU" virus created havoc in the United States after crippling government and business computers in Asia and Europe. The victim organisations were American State Department, CIA and major companies like Ford and Time-Warner. Love Bug e-mail appeared on computer screens in both houses of Congress in the Washington, the White House, the FBI and at the Pentagon. Trend Micro, a Computer security firm says that some 1.27 million computer files were infected worldwide, with nearly 1m in the US. Experts say the Love Bug is much more serious than Melissa as it overwrites audio and picture files, replacing them with its own code. The virus is reactivated if one of these files is subsequently opened (Delhi Police, **"**'Viruses", 2003). Viruses are very dangerous; they spread faster than they are stopped.

## WORMS

These are malicious codes just like Viruses. But, unlike Viruses they do not need the host to attach themselves. They travel through holes in the network i.e. open/ unguarded ports. They merely make functional copies of themselves and do this repeatedly till they eat up all the available space on a computer's memory (Delhi Police, "Cyber Crimes", 2003).

## TROJANS

These are unauthorized programs which functions from inside what seems to be an authorized program, thereby concealing what it is actually doing. It installs client-server architecture on the victim's and hacker's computers respectively and the hacker gains full control of the victim's computer. A report on a website owned by Consumers' Institute of New Zealand, Inc., says a man from Auckland had his bank account robbed through the Internet in April 2004. The $20,000 was transferred from his BNZ business account to a bank in Estonia. This transfer reportedly happened at 7.30 pm and was cleared and gone by midnight. On inquiry, it found that victim's laptop was infected by a Trojan Horse program. The program may have come in as an email attachment or website advertisement. The program read the keystrokes, which were recorded and transmitted back to the fraudsters, giving them access to conduct online banking transaction (Infotech, 2004).

## WEB JACKING

It is a type of cyber crime where someone forcefully takes control of a website by cracking its administrative password and later changing it. The actual owner of the website does not have any more control over it. The hacker changes the contents of web site as per his interests and demands ransom in huge amount of money. In a recent incident in USA where the owner of a hobby website for children received an e-mail informing her that a group of hackers had gained control over her website. They demanded a ransom of 1 million dollars from her. (Delhi Police, "Cyber Crimes", 2003).

## E-MAIL RELATED ATTACKS

Email has fast emerged as the world's most preferred form of communication. Billions of email messages traverse the globe daily. Email is also misused by criminal elements. Some of the major email related crimes are: a) Email Spoofing, b) Sending Malicious Codes through email, c) Email Bombing, d) Sending Threatening emails, e) Defamatory emails, and f) Email Frauds (Delhi Police, 'e-mail", 2003).

- A spoofed email is one that appears to originate from one source but has actually emerged from another source. Falsifying the name and/or email address of the originator of the email usually does email spoofing. The criminal can send viruses, Trojans, worms etc to victims system who in turn at the other end can open it by trusting that the sender is the original creator of the message. Email spoofing is very often used to commit financial crimes. In a recently reported case, a Pune based businessman received an email from the Vice President of the Asia Development Bank (ADB) offering him a lucrative contract in return for Rs 10 lakh. The businessman verified the email address of the Vice President from the web site of the ADB and subsequently transferred the money to the bank account mentioned in the email. It later turned out that the email was a spoofed one and was actually sent by an Indian based in Nigeria.
- Email is in use to propagate malicious code over the Internet. The Love Bug virus, for instance, reached millions of computers within 36 hours of its release from the Philippines. Hackers often attach Trojans, viruses, worms and other computer contaminants with e-greeting cards. Sometimes the computer

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contaminants may contain software that appears to be an anti-virus patches. The victim downloads these by trusting that it is an anti virus software etc. but in originality, it is malicious code.

– Email bombing is a process to send a large amount of emails to the victim's system which may result in crashing. It is due to intentionally subscribing the victim's email address to a large number of mailing lists. The mailing lists generates lots of messages daily which inturn increase large traffic to victims account and it may full. The service provider will probably delete his/her account (Delhi Police, "Cyber Crimes", 2003).

## CONCLUSION AND RECOMMENDATIONS

The deployments of eBanking solutions have enhanced the overall financial crime profile of banks in addition to the traditional crimes. It is the responsibility of the bank management to analyse not only the traditional risks but also the newly emerged risks. It is very difficult to achieve absolute security in this vulnerable digital world. To protect our banks against financial crimes, there are only two options- either shut down all doors from outer world or implement strong security controls. No doubt, the first option may provide us hundred percent secure environment but the biggest question is "Can we survive like this?" Certainly the answer is "no" because we are living in an open world economy and applications of ICT are just like veins to carry blood in present banking system. So there is a need to implement safe and sound infrastructure, security policies and their periodic review to check for vulnerabilities. The safe and sound infrastructure includes deployment of firewalls, instruction detection systems (IDS), limited access rights to the employees/customers, public key infrastructure, digital signatures, etc. Incidents of data thefts, unauthorized data alteration, unauthorized access, etc. can be mitigated by proper use of Public Key Infrastructure (PKI) and Digital Signatures. The PKI is also helpful to maintain integrity, confidentiality and non-repudiation of message. To meet the internal security threats within the organisation, there is a need to provide limited accesses to the users, segregation of their roles and duties, etc.

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# QUALITY OF SERVICE (QOS) BASED SCHEDULING ENVIRONMENT MODEL IN WIMAX NETWORK WITH OPNET MODELER

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## ABSTRACT

*The name "WiMAX" was created by the "WiMAX Forum", which was formed in June. WiMAX (Worldwide Interoperability for Microwave Access) standards define formal specifications for deployment of broadband wireless metropolitan area networks (wireless MANs).Wireless MANs as needed in WiMAX standards provide wireless broadband access anywhere, anytime, and on virtually any device. Introducing the various type of scheduling algorithm, like FIFO,PQ,WFQ, for comparison of four type of scheduling service, with its own QoS needs and also introducing OPNET modeler support for Worldwide Interoperability for Microwave Access (WiMAX) network. The simulation results indicate the correctness and the effectiveness of theses algorithm. This paper presents a WiMAX simulation model designed with OPNET modeler 14 to measure the delay, load and the throughput performance factors.*

## KEYWORDS

WiMAX, Load, Delay, Throughput, OPNET etc.


## INTRODUCTION

IEEE 802.16 [1] is a very promising system enabling broadband wireless access (BWA). IEEE 802.16 standard also known as worldwide interoperability for microwave access (WiMAX) defines two modes to share wireless medium: point-to-multipoint (PMP) mode and mesh mode. In the PMP mode, a base station (BS) serves several subscriber stations (SSs) registered to the BS. In IEEE 802.16, data are transmitted on the fixed frame based. The frame is partitioned into the downlink subframe and the uplink subframe. Frame duration and the ratio between the downlink subframe and the uplink subframe are determined by the BS. In the PMP mode, the BS allocates bandwidth for uplink and downlink. The BS selects connections to be served on each frame duration [2]. The IEEE 802.16 standard [3] defines four types of service flows, each with its own QoS needs. Each connection between the SS and the BS is coupled with one service flow. The Unsolicited Grant Service (UGS) transmit constant bit rate (CBR) flows of CBR like applications such as Voice over IP. The real-time Polling Service (rtPS) is considered for applications with real time needs which produce variable size data packets regularly, such as MPEG video streams. In this class, QoS guarantees are given in the form of restricted delay with minimum bandwidth guarantees. The non real-time Polling Service (nrtPS) is adequate for better than- best-effort services such as FTP services. Similar to rtPS, minimum bandwidth guarantees are also given to nrtPS connections. The Best Effort service (BE) is used for best-effort traffic such as HTTP[4]. For years, the IEEE has devoted continuous efforts to develop the wireless metropolitan area network (MAN) 802.16 standard, streamlined as the Worldwide Interoperability for Microwave Access (WiMAX) by the WiMAX Forum. This standard has since attracted a great deal of attention in both the research and industry communities, and is touted as the next killer technology that promises to offer *multiplay* services in the future wireless multimedia marketplace. The main advantages of WiMAX lie in its cost-competitive deployment and comprehensive quality of service (QoS) support for large numbers of heterogeneous mobile devices with high-datarate wireless access. Since 2004, WiMAX has established its relevance as a wireless extension (or alternative) to conventional wired access technologies, such as T1/E1 lines, cable modems, and digital subscriber line (xDSL), extending the reach to remote areas. Mobile WiMAX, based on the IEEE 802.16-2004 and IEEE 802.16e amendment [5], fills the gap between the wireless local area network (WLAN) and third-generation (3G) cellular systems with respect to their data rate and coverage trade-offs, and acts as a strong competitor to the current 3G Partnership Project (3GPP) long-term evolution (LTE) on the road to 4G wireless broadband markets [6]. There are huge and different kinds of videos streaming from different users which may influence each other and thus, it is essential to enforce a scheduling policy designed for suitable video metrics and efficient network utilization, preferably in a distributed manner [7].


## HISTORY OF SCHEDULING ENVIRONMENT

Many papers have been proposed new packet scheduler environment for 802.16 network, in order to provide different levels of QoS guarantees for various applications. This is driven by the lack of standardisation for the Admission Control and Uplink Scheduling algorithm for rtPS, nrtPS and BE service flows in the 802.16 standard. [8] Proposes an architecture that introduces a framework for the scheduling algorithm and admission control policy for 802.16. They also suggest system parameters that may be used, and define traffic characteristics for which the network can provide QoS .[9] provides a detailed description of the proposed architecture and more background on the 802.16 standard. Authors in [10] Presents a scheduler where the priority is based on the channel and service quality. Huei-Wen Ferng and Han-Yu Liau[11] has proposed how to simultaneously achieve fairness and quality-of-service (QoS) guarantee in QoS-oriented wireless local area networks (LANs) is an important and challenging issue. Targeting at this goal and jointly taking priority setting, fairness, and cross-layer design into account, four scheduling schemes designed for the QoS-oriented wireless LAN mainly based on concepts of deficit count and allowance are proposed in this paper to provide better QoS and fairness. Bader Al-Manthari, et al.[12] has proposed a novel downlink packet scheduling scheme for QoS provisioning in BWASs. The proposed scheme employs practical economic models through the use of novel utility and opportunity cost functions to simultaneously satisfy the diverse QoS requirements of mobile users and maximize the revenues of network operators. Liang Zhou, et al.[7] has proposed important issue of supporting multi-user

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video streaming over wireless networks is how to optimize the systematic scheduling by intelligently utilizing the available network resources while, at the same time, to meet each video's Quality of Service (QoS) requirement. In this work, they proposed the problem of video streaming over multi-channel multi-radio multihop wireless networks, and developed fully distributed scheduling schemes with the goals of minimizing the video distortion and achieved certain fairness. HONGFEI DU, et al.[6] has proposed the design issues and the state of the art of multimedia downlink scheduling in the multicast/broadcast-based WiMAX system. This proposed a viable end-to-end framework, connection-oriented multistate adaptation, by considering cross-layer adaptations in source coding, queue prioritization, flow queuing, and scheduling. Its performance is confirmed by simulations on important metrics, showing that the framework can effectively accommodate heterogeneity in link variations, queue fluctuations, and reception diversities.

## WIMAX ARCHITECTURE

Broadband wireless architecture is being standardized by the IEEE 802.16 Working Group (WG) and the Worldwide Interoperability for Microwave Access (WiMAX) forum [9]. The basic IEEE 802.16 architecture consists of one Base Station (BS) and one or more Subscriber Stations (SSs) [7]. Figure (1) shows a typical IEEE 802.16 network in PMP mode comprising a Base Station (BS) that communicates with one or more Subscriber Stations (SS) known as Customer Premises Equipment (CPE) [4][10]. IEEE 802.16 specifies the following modes of deployment architectures [11]:

- **Point-To-Point (PTP):** A connection between one BS and one SS. The PTP mode extends the range over the PMP mode.
- **Point-to-MultiPoint (PMP):** A connection between one BS and multiple SS nodes. The BS always coordinates the uplink and downlink transmission. This mode supports multicast communication.
- **Point-To-Consecutive Point (PTCM):** It involves the creation of a closed loop through multiple PTP connections.
- **Mesh:** SSs can communicate with each other without the coordination of a BS. Both BS and SS are stationary while clients connected to SS can be mobile. BS acts as a central entity to transfer all the data from SSs in PMP architecture. Two or more SSs are not allowed to communicate directly. Transmissions take place through two independent channels downlink channels (from BS to SS) and uplink channel (from SS to BS). The uplink channel is shared among all the SSs while the downlink channel is used only by BS.

**FIGURE 1: MESH AND POINT-TO-MULTIPOINT (PMP) MODE**
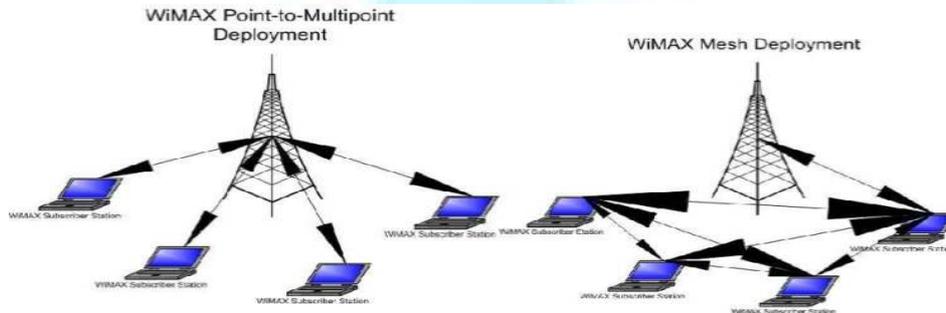


## WHY USE OPNET

A good modelling tool should closely reflect the true behaviour of a network or computer system. It should support a wide range of network protocols and applications. It must be easy to use and master, especially for beginners. On the other hand, a good modelling tool should provide comprehensive technical support and maintenance assistance. In summary, we believe that a good modelling tool should have the following properties:

- **Versatile:** able to simulate various network protocols/applications under a wide range of operating conditions.
- **Robust:** provide users with powerful modelling, simulation and data analysis facilities.
- **User Friendly:** easy to use and master.
- **Traceable:** easy to identify modelling problems and simulation faults . OPNET is hailed by network professionals because it has all these properties. OPNET is a software package that has been designed with an extensive set of features. It can be tailored to suit almost every need of network protocol designers, network service providers, as well as network equipment manufacturers. OPNET supports most network protocols in existence, both wire line and wireless. It can be used to model and analyse a complex system by performing discrete event simulations.

## SIMULATION METHODOLOGY WITH OPNET MODELER

OPNET Modeler 14.0 is a powerful discrete-event simulation tool with an easy and convenient development environment and GUI I used an OPNET modeler 14.0 with WiMAX Wireless Advanced Module to develop a simulation for this paper. The key parameters that are provided here are: delay, network load, throughput and application response time. A snap shot of the system simulation model is captured in figure (5).The proposed scenario consists of a wireless Network implemented as a WiMAX network, which was modeled within an area of 10km x 10km.

**FIGURE 5: WIMAX NETWORK SCENARIO WITH QOS**



A WiMAX Configuration Node (WiMAX_config) is used to store profiles of PHY and Service Class which can be referenced by all WiMAX nodes in the network.

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**FIGURE 6: APPLICATION CONFIGURATION**
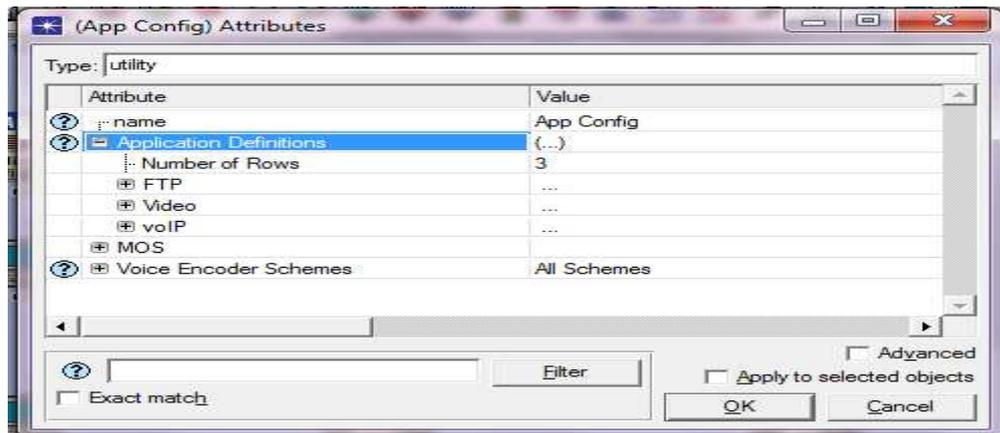


To support the VoIP ftp and video application, the application definition has to be configured.

**FIGURE 7: PROFILE CONFIGURATION**
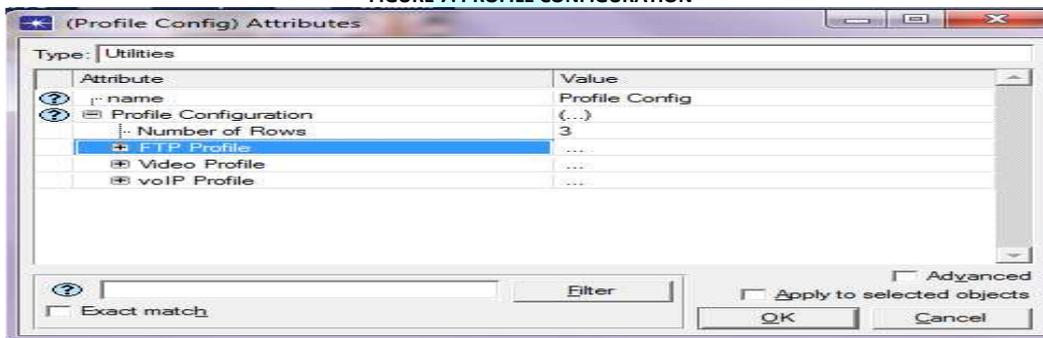


Once the application configuration has been set, the profile would be ready to be configured since the profile definition was built upon the VoIP, ftp and Video application.

**FIGURE 8: QUEUE ATTRIBUTE**
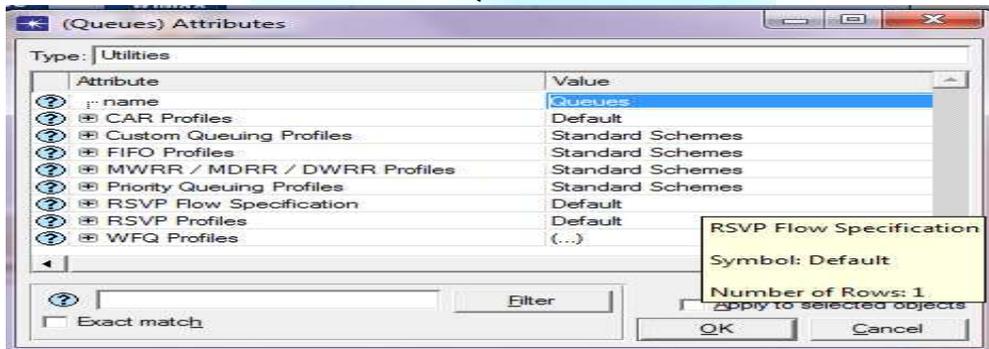


Queue attribute show the different parameter of FIFO, PQ and WFQ algorithms.

## SIMULATION RESULTS

WiMAX is often compared with Wi-Fi and existing 3G technologies, such as UMTS and CDMA2000. With Wi-Fi's advantage in speed and 3G's advantage in mobility, WiMAX sits between the two in data transfer rate and coverage range. The duration of the simulation for all four scenarios was 200 seconds. In all simulated results, dark blue line indicates the FIFO scenario, red line represents the PQ scenario, green line indicates the WFQ scenario. In case video traffic, Average bytes per second forwarded to all video conferencing applications by the transport layers in the network.

**FIGURE 9: VIDEO CONFERENCE TRAFFIC (SENT BYTE/SEC)**

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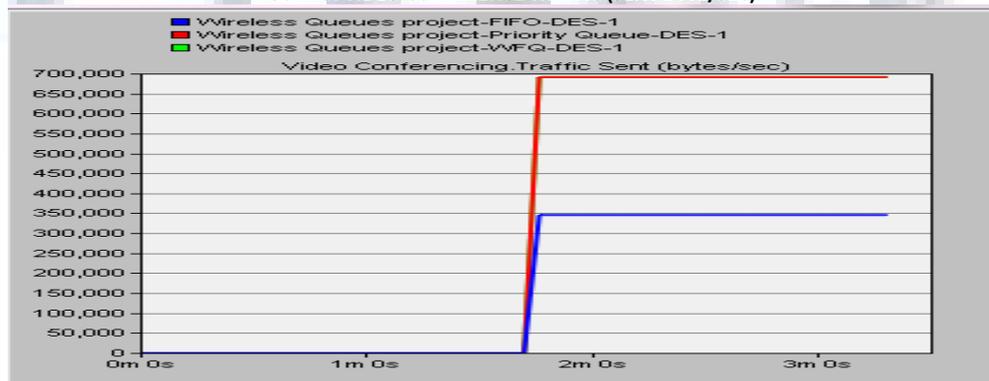
In case FIFO (for the video traffic) number of transmitted byte is less (350,000 byte/sec) but in case of PQ and WFQ In which green lines are underneath the dark red line, number of transmitted byte is 700,000 byte/sec as shown in figure 9.Thus for the Video conference traffic FIFO traffic is less as compared to the PQ and WFQ traffic.

**FIGURE 10: VIDEO CONFERENCE RECEIVED (SENT BYTE/SEC)**
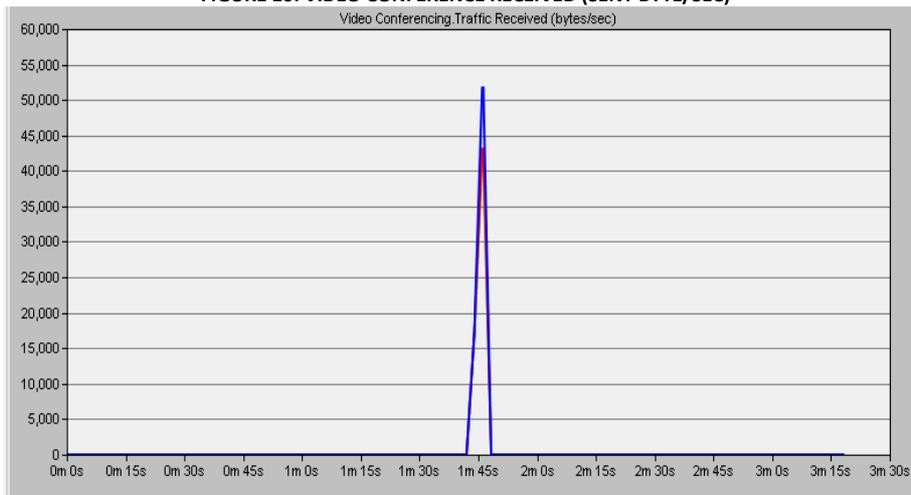


In FIFO number of received byte is 53,000 byte/sec but in case of PQ and WFQ In which green lines are underneath the dark red line, number of received byte is 43,000 byte/sec as shown in figure 10. Thus in this scenario result of FIFO is better than result of PQ and WFQ.

In the scenario of voice traffic (shown in figure 11) number of transmitted byte is 32,000 byte/sec in FIFO, PQ and WFQ algorithms in which green lines line are underneath the dark blue line.

**FIGURE 11: VOICE TRAFFIC SENT (BYTE/SEC)**
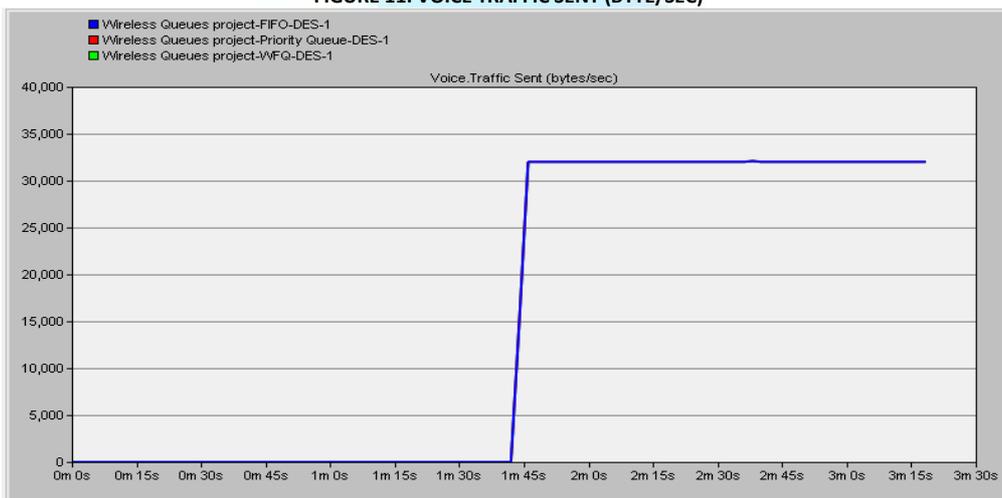


After the transmission of voice traffic, number of received byte/sec is varried with time,as shown in figure 12.In this scenerio, in the case of WFQ, at the time 1m 45s,number of received byte is 41,000 and in the case of FIFO, at the time 2m 0s,number of received byte is 64,000 and and in the case of PQ, at the time 2m 8s,number of received byte is 64,000.Thus traffic is varied at every instant of time at all.

**FIGURE 12: VOICE TRAFFIC RECEIVED (BYTE/SEC)**

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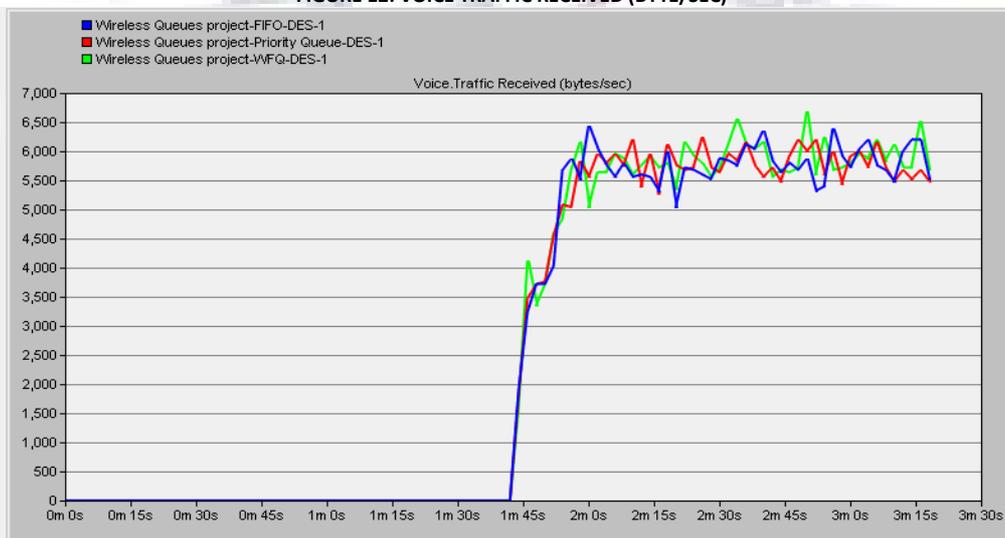
The total voice packet delay, called "analog-to-analog" or "mouth-to-ear" delay = network_delay + encoding_delay + decoding_delay + compression_delay + decompression_delay. In the scenario of voice traffic (shown in figure 13) packet end to end delay.

**FIGURE 13: VOICE PACKET END TO END DELAY (SEC)**
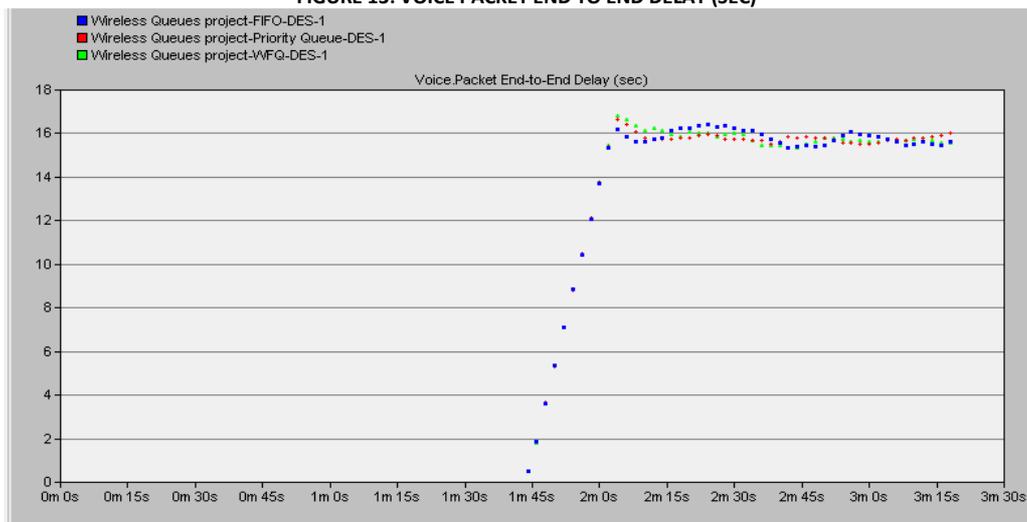


Varied every instant of time at all in FIFO, PQ & WFQ algorithms.

## CONCLUSION

The purpose of the paper is to demonstrate the comparative study of different queuing algorithms, implementation in WiMAX network with OPNET modeler. The factors that were studied in the simulation are the end to end delay traffic sent and traffic received. The introduction of an queue will not add more hardware since its elements will be deleted once it is extracted from the original queue. If there are connections with different service levels in the network, the scheduler allocates enough slots for each connection, so that the QoS requirements are supported.

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# A DECENTRALIZED INDEXING AND PROBING SPATIAL DATA IN P2P SYSTEM

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## ABSTRACT

*Peer-to-peer (P2P) networking technologies have gained popularity as a mechanism for users to share files without the need for centralized servers.In existing, research focused on P2P systems that host 1D data. At present, the need for P2P applications with multidimensional data has emerged, motivating research on P2P systems that manage such information. Our focus is on structured P2P systems that share spatial information. We present SPATIALP2P, a totally decentralized indexing and searching framework that is suitable for spatial data. SPATIALP2P supports P2P applications in which spatial information of various sizes can be dynamically inserted or deleted, and peers can join or leave.Our goal is to create from scratch a technique that is inherently distributed and also maintains the multidimensionality of data. Our focus is on structured P2P systems that share spatial information. The proposed technique preserves well locality and directionality of space and also it maintains the security while showing the information. We discuss cryptography techniques can be used to address the security issues.*

## KEYWORDS

Spatial Data, Security, Cryptography techniques, Peer-to-Peer,structured overlays, distributed hash tables.

## INTRODUCTION

Peer-to-peer systems, beginning with Napster, Gnutella, and several other related systems,became immensely popular in the past few years, primarily because they offered a way for people to get music without paying for it. However, under the hood, these systems represent a paradigm shift from the usual web client/server model, where there are no "servers;" every system acts as a peer, and by virtue of the huge number of peers,objects can be widely replicated, providing the opportunity for high availability and scalability, despite the lack of centralized infrastructure.

Until recently, research has focused mostly on P2P systems that handle 1D data such as strings and numbers. However, the need for P2P applications that manage multidimensional data has emerged. These systems pose additional requirements that stem from the particularities of such data. In centralized multidimensional applications, information is stored according to its multidimensional extent using an indexing structure.

Making these systems "secure" is a significant challenge. In general, any system not designed to withstand an adversary is going to be broken easily by one, and P2P systems are no exception. If p2p systems are to be widely deployed on the Internet (at least, for applications beyond sharing "pirate" music files), they must be robust against a conspiracy of some nodes, acting in concert, to attack the remainder of the nodes.Attackers might have a number of other goals, including traffic analysis against systems that try to provide anonymous communication, and censorship against systems that try to provide high availability.

So, with all of that in mind, here are four key points to consider when using P2P networks to try use them as securely as possible:

### I. DON'T USE P2P ON A CORPORATE NETWORK

At least, don't ever install a P2P client or use P2P network file sharing on a corporate network without explicit permission- preferably in writing. Having other P2P users downloading files from your computer can clog the company's network bandwidth. That is the best-case scenario. You may also inadvertently share company files of a sensitive or confidential nature. All of the other concerns listed below are also a factor.

### II. BEWARE THE CLIENT SOFTWARE

There are two reasons to be cautious of the P2P network software that you must install in order to participate on the file-sharing network. First, the software is often under fairly continuous development and may be buggy. Installing the software might cause system crashes or problems with your computer in general. Another factor is that the client software is typically hosted from every participating user's machine and could potentially be replaced with a malicious version that may install a virus or Trojan on your computer. The P2P providers do have security safeguards in place which would make such a malicious replacement exceptionally difficult though.

### III. DON'T SHARE EVERYTHING

When you install P2P client software and join a P2P network like BitTorrent, there is generally a default folder for sharing designated during the installation. The designated folder should contain only files that you want others on the P2P network to be able to view and download. Many users unknowingly designate the root "C:" drive as their shared files folder which enables everyone on the P2P network to see and access virtually every file and folder on the entire hard drive, including critical operating system files.

### IV. SCAN EVERYTHING

You should treat all downloaded files with the utmost suspicion. As mentioned earlier, you have virtually no way of ensuring that what you downloaded is what you think it is or that it doesn't also contain some sort of Trojan or virus. It is important that you run protective security software such as the Prevx Home IPS and/or antivirus software. You should also scan your computer periodically with a tool such as Ad-Aware to ensure you haven't unwittingly installed spyware on your system. You should perform a virus scan using updated antivirus software on any file you download before you execute or open it. It may still be possible that it could contain malicious code that your antivirus vendor is unaware of or does not detect, but scanning it before opening it will help you prevent most attacks.

## RELATED WORK

### EXISTING SYSTEM

Existing works first, order multidimensional data using a space-filling curve and, then, define a distance according to this ordering. The main challenge of these approaches is to preserve the important properties of multidimensional space (i.e., locality and directionality). Unfortunately, space-filling curves do not always preserve locality and directionality. For instance, two multidimensional regions that are close in the original space are not necessarily close in the z-ordering curve. The searching strategy of the P2P network inherits these locality problems of the 1D ordering.

### LIMITATIONS OF EXISTING SYSTEM

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- Low space and time complexity.
- To handle only 1D data such as strings and numbers.
- Information in a centralized manner.
- There is no proper load balancing and do not maintains the security.

## PROPOSED SYSTEM

We propose SPATIALP2P, a totally decentralized framework for spatial (i.e., 2D) data that conforms to the autonomy principle of P2P networks. SPATIALP2P provides storing, indexing, and searching services for spatial data in a P2P network. SPATIALP2P exploits existing experience in the field of DHTs and can be built on top of any 1D DHT. Thus, SPATIALP2P distributes the spatial information to peers and guarantees the retrieval of any spatial area that exists in the system with low space and time complexity. Additionally, SPATIALP2P efficiently handles changes in the spatial information and in the network structure caused by joining or leaving peers without the need of load balancing or restructuring.

The Proposed System uses three techniques they are properly distributed:

- Using an indexing structure.
- We can avoid the traffic of data by using index searching.
- We can use the RSA algorithm (cryptography technique) for the security purpose.

## ADVANTAGES

- It achieve data and search load balancing.
- No traffic bottleneck in the network.
- Provides security while providing information.

Typically, indexing structures preserve the locality and the directionality of multidimensional information. Intuitively, locality implies that neighboring multidimensional information is stored in neighboring nodes, while directionality implies that the index structure preserves orientation. The notions of locality and directionality are very important. If an index structure preserves these properties then searching in the index corresponds to searching in the multidimensional space which can highly improve query evaluation cost.

ALGORITHMS:

## BACKGROUND WORK

### PEER-TO-PEER (P2P)

Computing or networking is a distributed application architecture that partitions tasks or work loads between peers. Peers are equally privileged, equipotent participants in the application. They are said to form a peer-to-peer network of nodes.

### P2P CHARACTERISTICS

- **Self organizing:** no global directory of peers or resource
- **Symmetric communication:** no client/server role
- **Decentralized control:** no centralized sever

**FIG. 1: A PEER-TO-PEER SYSTEM OF NODES IN DECENTRALIZED INFRASTRUCTURE.**
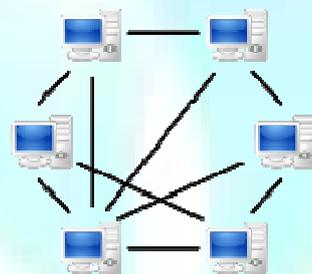


### DISTRIBUTED HASH TABLE (DHT)

Is a class of a decentralized distributed system that provides a lookup service similar to a hash table; (key, value) pairs are stored in a DHT, and any participating node can efficiently retrieve the value associated with a given key. Responsibility for maintaining the mapping from keys to values is distributed among the nodes, in such a way that a change in the set of participants causes a minimal amount of disruption. This allows a DHT to scale to extremely large numbers of nodes and to handle continual node arrivals, departures, and failures. DHT-based networks have been widely utilized for accomplishing efficient resource discovery for grid computing systems, as it aids in resource management and scheduling of applications. Resource discovery activity involves searching for the appropriate resource types that match the user's application requirements. Recent advances in the domain of decentralized resource discovery have been based on extending the existing DHTs with the capability of multi-dimensional data organization and query routing.

FIG. 2: DISTRIBUTED HASH TABLES

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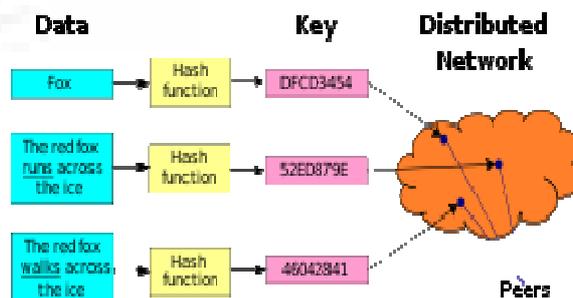
**SPATIAL DATA**

Also known as geospatial data or geographic information it is the data or information that identifies the geographic location of features and boundaries on Earth, such as natural or constructed features, oceans, and more. Spatial data is usually stored as coordinates and topology, and is data that can be mapped. Spatial data is often accessed, manipulated or analyzed through Geographic Information Systems (GIS).

**SECURITY**

- Application level security using user id and private key.
- Secured Socket Layer.
- All Messages are kept encrypted in a file.
- Failure of controller's does not affect the groups operations.

## CONCLUSION

Research in P2P systems has recently expanded in the domain of multidimensional data. This paper has surveyed some security issues that occur in peer-to-peer overlay networks, both at the network layer and at the application layer. We have shown how techniques ranging from cryptography through redundant routing to economic methods can be applied to increase the security, fairness, and trust for applications on the p2p network.

However, the reusage of existing techniques in the approaches in both categories leads to the maintenance of some fundamental features that oppose to the nature of either the distributedness or the multidimensionality. Our intention is to overcome these shortcomings by creating a technique that manages disperse multidimensional data in an inherently distributed way without altering the dimensionality.

We have presented the SPATIALP2P framework for handling spatial data in a P2P network. SPATIALP2P provides efficient storing, indexing, and searching services by preserving locality and directionality. As a result, SPATIALP2P performs exceptionally well for point and range query operations. SPATIALP2P supports dynamic insertion and deletion of spatial information of various sizes and dynamic joining and leaving of peers.

## FUTURE ENHANCEMENTS

This project addresses some technical challenges, i.e., Locality Preserving Function, query and update routing protocols, and cluster-preserving load balancing. A high level of object clustering is achieved by using the LPF on top of the existing DHTs without requiring much change to the DHTs. Efficient query and update routing protocols maximize the benefit of object clustering by significantly reducing the number of DHT lookups. The load balancing schemes well distribute loads among peer nodes while preserving the clustering property.

In the future, want to solve the challenges and intend to adjust and test the SPATIALP2P framework for data of higher dimensions.

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# CONVERGENCE TO IFRS - AN INDIAN PERSPECTIVE

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## ABSTRACT

*Accountants felt the necessity that they should talk the same language which paved for a accounting innovation "IFRS". IFRS stands for International Financial Reporting Standards which are uniform set of accounting standards propounded to be used globally with the aim to furnish useful information to different users such as shareholders, creditors, lenders, management, investors, suppliers, competitors,researchers, regulatory bodies and society at large. This article focuses on convergence on Indian Accounting Standards to International Financial Reporting Standards (IFRS), its current status and challenges.*

## KEYWORDS

Convergence of Accounting Standards, International Financial Reporting Standards, Indian Accounting Standards, Generally Accepted Accounting Practices (GAAP)

## INTRODUCTION

The process of harmonization treats the global community a single entity. As the world is becoming a global village, the awareness of investor has increased and increasing geometrically. Harmonization of accounting standards has already bagged the status of the 'language of the business' that requires reporting of the affairs in a commonly understandable way.

In the statement of Harvey Pitt, US SEC Chairman at SEC Conference (2002) is worth mentioning, "High quality global accounting standards are needed to improve the ability of investors to make informed financial decisions. Companies must keep pace with this progress in order to promote and protect their business credibility in the international market place".

As part of the harmonization in India the Accounting Standard Board of the Institute of Chartered Accountants of India (ICAI) has prepared a concept paper of Convergence with IFRS in India. In precise terms convergence can be considered "to design and maintain national accounting standards in a way that financial statements prepared in accordance with national accounting standards draw unreserved statement of compliance with IFRSs"

## REVIEW OF LITERATURE

Accounting numbers whether interpreted by the sellers and by buyers in the same way may be seen from the difference between 'bid" and "ask" prices. Thus with less differences between bid and ask prices give less possibilities for different interpretation and therefore seems to be superior. Luez and Verrecchia (2000) and Gassen and Sellhorn (2006) have shown that companies using IFRSs show smaller bid-ask spreads than those using German GAAP. Platikanova and Nobes (2006) have also shown that in Europe, on average, the bid-ask spread declines after IFRS-adoption. But in Switzerland, the effect is limited to small companies (Dumontier and Maghraoui, 2007).

Regarding the accuracy of analyst forecast, previous research show mixed results. Ashbaugh Pincus (2001) point out that analyst forecast improves after IFRS adoption. Hodgdon et al. (2008) show the compliance with IFRS s reduces analyst forecast errors. Ernstberger et al (2008) have also shown that, in Germany, forecast accuracy is higher for estimate based on IFRS or US GAAP data than for those based on German GAAP figures.

Dumontier and Maghraoui (2007) in Germany shows that compliance with IFRS does not reduce the dispersion of analyst forecast or forecast errors. Cuijpers and Buijink (2005) claim that, in Europe, dispersion of analyst forecast is higher for firms using IFRSs or US GAAP than those using local GAAPs.

According to Van Tendeloo and Vanstraelen (2005), IFRS adoptions do not present different earnings management behavior compared to companies reporting under German GAAP. Lin and Paananen (2007) points out that earnings management is higher in Germany in the post-IFRS adoption period. But Barth et al (2008) says that, in post adoption period, companies applying IFRSs show evidence of less earnings management. We noticed mixed findings in this case.

To the question of value relevance of accounting data there was mixed results. Firms applying IFRS exhibit more value relevant accounting figures than other companies (Barth et al. 2008). The value relevance of IFRS based earnings is higher than that of German GAAP based earnings (Germany: Bartov et al 2005).

IFRS adoption has no effect on the value relevance of book value and net income (Germany: Hung and Subramanyam, 2007). The value relevance of accounting figures is not affected by IFRS adoption (Sweden: Paananen, 2008)

To the question whether there is change in equity after IFRS adoption studies revealed both favorable and non favorable results. The cost of equity capital is lower for companies that adopted IFRS or US GAAP (Germany: Ernstberger and Vogler, 2008). The cost of equity capital is significantly lower for IFRS adopter (Kim and Shi, 2005).

No evidence of a lower cost of equity capital for IFRS adopters (Europe: Cuijpers and Buijink, 2005). Voluntary IFRS adopters do not exhibit lower cost of equity capital (Germany: Daske, 2006).

To the question of whether there is change in debt after IFRS adoption there is a sole study by Kim et al.2005 that IFRS adopters have lower interest rates, larger amount of loan facility, lesser restrictive loan covenants and they attract more foreign lenders. India is in the verge of convergence to IFRS, till date it is not mandated by our Government to follow IFRS, and so not many companies in India are following IFRS. With this background this article studies the possible impacts of following IFRS by the Indian Industries.

## OBJECTIVES

The objective of this article is to address upon the convergence of Indian Accounting Standards with International Financial Reporting Standards in the following areas:
1. Need for convergence
2. Impact of IFRS on accounting practices

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3.  Impact of IFRS on existing laws and regulations
4.  Impact of IFRS - few key sectors
5.  Impact of IFRS in functional areas of management

## THE NEED FOR CONVERGENCE

Convergence is needed due to the globalization of businesses and services and increase in cross-border investments and borrowings. Some of the benefits of harmonization are as under:

1.  It ensures reliable and high quality financial reporting, in certain cases, it can prove to be crucial to the economic and financial development of a country.
2.  It enables a systematic review and evaluation of the performance of a multinational company having subsidiaries and associates in various countries wherein each country has its own set of GAAP.
3.  It makes the comparison of the performance of a company against its domestic and international peers easier and more meaningful.
4.  It adds to the international credibility of a company
5.  It is a precursor for accessing international capital markets which can, in turn, reduce the capital cost and consequently, improve the performance of a company
6.  It provides a level playing field where no country is advantaged or disadvantaged by its GAAP and disclosures
7.  Stock exchanges benefit from the growth in the listings and volume of securities transactions

## IMPACT OF CONVERGENCE ON FUNDAMENTAL ACCOUNTING PRACTICES

Harmonizing existing Indian accounting standards with IFRS will have an impact on some fundamental accounting practices followed in India. A few of these are enumerated below:

### USE OF FAIR VALUE CONCEPT

Indian GAAP requires financial statements to be prepared on historical cost except for fixed assets which could be selectively revalued. Use of fair value is presently limited for testing of impairment of assets, measurement of retirement benefits and 'mark-to-market' accounting for derivatives. Under IFRS, there is a growing emphasis on fair value. In addition to the requirements under Indian GAAP, the carrying amounts of the following assets and liabilities are based on fair value under IFRS:

1.  Initial recognition of all financial assets and financial liabilities is at fair value
2.  Subsequent measurement of all derivatives, all financial assets and financial liabilities held for trading or designated at fair value through profit or loss, and all financial assets classified as needs to comply with all the accounting standards available-for-sale, are measured at fair value
3.  Non-current provisions are measured at fair value which is derived by discounting estimated future cash flows
4.  Share-based payments are measured at fair value.
5.  Option available for measurement of property, plant and equipment at fair value, subject to certain conditions
6.  Option available for measurement of intangible assets at fair value, subject to certain conditions
7.  Option available for measurement of Investment property at fair value.

### SUBSTANCE OVER FORM

Considering the overall theme of substance over form, IFRS mandates preparation of consolidated financial statements to reflect the true picture of the net worth to various stakeholders. Exceptions for preparation of consolidated financial statements are very limited. In India, currently consolidated financial statements are mandatory only for listed companies and that also only for the annual financial statements and not the interim financial statements.

Similarly, Indian accounting continues to be driven by the written contract and the form of the transaction as opposed to the substance. Consider, up front fees charged by a telecoms service provider.

Under Indian GAAP, several companies recognize such upfront fees as income because it is contractually non-refundable and is contractually received as fees for the activation process. Under IFRS, the fee is accounted for in accordance with the substance of the transaction. Under this approach, the customer pays the upfront activation fee not for any service received by the customer, but in anticipation of the future services from the telecoms company.

Thus, despite the non-refundable nature of the fees, revenue recognition would be deferred over the estimated period that telecoms services will be provided to the customer.

### PROVISION OF LAW SUPERSEDS ACCOUNTING STANDARDS

As per the preface to the Indian accounting standards, if a particular accounting standard is found to be not in conformity with a law, the provisions of the said law will prevail and the financial statements shall be prepared in conformity with such law. However, under IFRS, the entity needs to comply with all the accounting standards and other authoritative literature issued by IASB in order to comply .with IFRS. If entities adopt accounting practice as approved by another regulatory authority or in conformity with a law, which is not in accordance with IFRS, the financial statement so prepared would not be considered to be in compliance with IFRS.

### DISCLOSURES

In India, Schedule VI to the Companies Act, 1956, which prescribes a detailed format for preparation and disclosure of financial statements, lays great emphasis on quantitative information such as quantitative details of sales, amount of transactions with related parties, production capacities, CIF value of imports and income and expenditure in foreign currency, etc. Contrary to the same, IFRS is more focused on qualitative information for the stakeholders, such as terms of related party transactions, risk management policies, currency exposure for the entity with sensitivity analysis, etc. To more correctly report the liquidity position of the entity, IFRS also requires segregation of all assets/liabilities into current and non-current portions. Presently under Indian GAAP even long-term deposits and advances are disclosed under current assets, loans and advances, thereby not reflecting the true position.

### EXCEPTIONAL AND EXTRAORDINARY ITEMS

Indian GAAP requires companies to disclose significant events which are not in the ordinary course of business as extraordinary items and material items as exceptional to facilitate the reader to consider the impact of these items on the reported performance. Under IFRS there is no concept of extraordinary or exceptional since all events/transactions are in the normal course of business and if an item is material, it can be disclosed separately, but cannot be termed as 'extraordinary' or 'exceptional'.

### RESTATEMENT OF FINANCIAL STATEMENTS

Under Indian GAAP, changes in accounting policies or rectification of errors (prior period items) are recognized in the current year's profit and loss ac'count (for errors) and are generally recognized prospectively (for changes in accounting policies). Under IFRS, the prior period comparatives are restated in both cases. Indian GAAP does not have the concept of restatement of comparatives except in case of special-purpose financial statements prepared for public offering of securities.

### DETERMINATION OF FUNCTIONAL CURRENCY

Entities in India prepare their general purpose financial statements in Indian rupees. However under IFRS, an entity measures its assets, liabilities, revenues and expenses in its functional currency, which is the currency that best reflects the economic substance of the underlying events and circumstances relevant to the entity *i.e.,* the currency of the primary economic environment in which the entity operates. Functional currency of an entity may be different from the local currency. For example, consider an Indian entity operating in the shipping industry. For such an entity it is possible that a significant portion of revenues may be derived in foreign currencies, pricing is determined by global factors, assets are routinely acquired from outside India and borrowings may be in foreign

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currencies. All these factors need to be considered to determine whether the Indian rupee is indeed the functional currency or whether another foreign currency better reflects the economic environment that most impacts the entity.

**OTHER SIGNIFICANT ASPECTS**

Under Indian GAAP, provision has to be made for proposed dividend, although it may be declared by the entity and approved by the shareholders after the balance sheet date. Under IFRS, dividends that are proposed or declared after the balance sheet date are not recognized as liability at the balance sheet date. Proposed dividend is a non-adjusting event and is recorded as a liability in the period in which it is declared and approved.

## IMPACT OF EXISTING LAWS AND REGULATIONS

Accounting standard-setting in India is subject to direct or indirect oversight by several regulators,such as the National Advisory Committee on Accounting Standards (NACAS) established by the Ministry of Corporate Affairs, the Reserve Bank of India (RBI),the Insurance Regulatory and Development Authority (IRDA) and the Securities and Exchange Board of India (SEBI). Further, the Indian Companies Act, 1956 (the Act) directly provides guidance on accounting and financial reporting matters. Courts in India also have the powers to endorse accounting for certain transactions – even if the proposed accounting treatment may not be consistent with Generally Accepted Accounting Principles.

**COMPANIES ACT**

The requirements of Schedule VI of the Act, which currently prescribes the format for presentation of financial statements for Indian companies, is substantially different from the presentation and disclosure requirements under IFRS. For example, the Act determines the classification for redeemable preference shares as equity of an entity, whereas these are to be considered as a liability under IFRS. Also, Schedule XIV of the Act provides minimum rates of depreciation - such minimum depreciation rates are also inconsistent with the provisions of IFRS.

**REGULATORY GUIDELINES**

The Reserve Bank of India (RBI) and Insurance Regulatory and Development Authority (IRDA) regulate the financial reporting for banks, financial institutions and insurance companies, respectively, including the presentation format and accounting treatment for certain types of transactions. For example, the RBI provides detailed guidance on provision relating to non-performing advances, classification and valuation of investments, etc. Several of these guidelines currently are not consistent with the requirements of IFRS.

The Securities and Exchange Board of India has also prescribed guidelines for listed companies with respect to presentation formats for quarterly and annual results and accounting for certain transactions, some of which are not in accordance with IFRS *e.g.,* Clause 41 of the Listing Agreement permits companies to publish and report only standalone quarterly financial results, however IFRS considers only consolidated financial statements as the primary financial statements for reporting purpose.

**COURT PROCEDURES**

Courts in India commonly approve accounting under amalgamation/restructuring schemes, which may not be in accordance with the accounting principles/standards. Under the current accounting/ legal framework such legally approved deviations from the accounting standards/principles are acceptable.

**INCOME TAX**

Computation of taxable income is governed by detailed provisions of the Indian Income Tax Act, 1961. Convergence with IFRS will require significant changes/ clarifications from the tax authorities on treatment of various accounting transactions. For example, consider unrealized losses and gains on derivatives that are required to be marked-to market under IFRS. Different taxation frameworks are possible for the tax treatment of such unrealized losses and gains. The treatment of unrealized gains and losses need to be addressed in line with the convergence time frame. It is imperative that the tax authorities are engaged sufficiently m .advance to decide on such critical aspects of taxation.

## SECTOR SPECIFIC IMPACT OF IFRS

The impact of IFRS on various industries on accounting point of view and the implications of the accounting standards are dealt with.

**TECHNOLOGY, MEDIA AND TELECOMMUNICATION**

The impact of IFRS mainly on technology, media and telecommunication mainly in the area of revenue recognition is going to be high. These industries usually have a high incidence of what is known as bundled transactions or multiple deliverable arrangements. A common example will be in the mobile segment where packages offered to end users include provision of handsets either at a subsidized rate or free of cost, pre-paid minutes, free SMS, discounts, special offers and other incentives. In these cases it may be necessary to apply the recognition criteria to the separately identifiable components of a single transaction in order to reflect the substance of the transaction. The decision to account for a transaction in its entirety or unbundled the product into its individual components can have a significant impact on an operator's financial statements. For instance, separating handset revenues from ongoing service may result in increased revenue upfront but there may also be instances where separating a contract into components may defer revenue recognition. The accounting treatment for indefeasible rights of use (IRU) in the telecoms sector will have to be determined by the commercial substance of each individual arrangement. When determining the appropriate accounting for Indefeasible Right of Use under IFRS, it will be necessary to first consider whether the arrangement is, or contains, a lease in the light of the provisions of IFRIC 4. If it is considered a lease, then the appropriate accounting will be determined in accordance with IAS 17. If not considered a lease, it will have to be ascertained whether the arrangement constitutes the sale of goods or the rendering of services. Accordingly the relevant part of IAS 18 will have to be applied to determine the appropriate accounting of revenue.

The media sector could be impacted by the application of SIC-31, Revenue - Barter Transactions Involving Advertising Services, which deals with the circumstances where an entity enters into a barter transaction to provide advertising services in exchange for receiving advertising services from its customer.

**REAL ESTATE SECTOR**

The realty sector would also be affected due to the provisions of IAS 40 which allow investment property to be measured at cost or using the fair value model with changes in fair value being recognized in profit or loss for the period. Accounting investment properties at fair values can lead to a great deal of volatility in the income statement as well as balance sheet.

Agreements for the construction of real estate take diverse forms – some agreements are for the provision of construction services, others are in substance for the delivery of goods (e.g. housing units) that are not complete at the time of entering into the agreement.

Thus, the percentage of completion method is appropriate for some agreements for the construction of real estate, but for others revenue should be recognized only at the point that the constructed real estate is delivered to the customer.

IFRIC 15 Agreements for the Construction of Real Estate addresses whether an agreement is within the scope of IAS 11 or IAS 18, and when revenue from the construction of real estate should be recognized.

An agreement for the construction of real estate will meet the definition of a construction contract when the buyer is able to specify the major structural elements of the design of the real estate before construction begins; and/or specify major structural changes once construction is in progress.

In contrast, if buyers have only limited ability to influence the design (for example, to select from a range of entity-specified options, or to specify only minor variations to the basic design), the agreement will be for the sale of goods, and be within the scope of IAS 18. Application of IFRIC 15 is expected to have an impact on the timing of revenue recognition for most realty firms.

**INFRASTRUCTURE SECTOR**

For infrastructure firms, the application of IFRIC 12, Service Concession Arrangements, could change the way revenues are accounted for. A typical arrangement is a 'build-operate-transfer' arrangement where an operator constructs the infrastructure to be used to provide a public service and operates and maintains that infrastructure for a specified period of time. The operator is paid for its services over the period of the arrangement.

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The infrastructure within the scope of IFRIC 12 is not recognized as property, plant and equipment of the operator. This is because the operator does not have the right to control the asset, but merely has access to the infrastructure in order to provide the public service in accordance with the terms specified in the contract.

It is also not treated as a lease as the operator does not have the right to control the use of the asset. Instead, the operator's right to consideration is recorded as a financial asset, an intangible asset or a combination of the two.

### BANKING SECTOR

The banking industry will also be affected with an impact expected on the capital adequacy ratio. At the highest level, Indian banks, being subject to the RBI's rules-based accounting would require to move towards principles-based accounting of IFRS.

This distinction may prove more vexing than it initially appears, because most accounting and finance professionals in India have been used to the rules of the RBI. The overriding lesson from their years of study and work is this: If you have an issue, look up to the RBI. On the other hand, IFRS is a far shorter volume of principles-based standards, and consequently requires more judgment than Indian accountants are accustomed to.

## IMPACT OF IFRS IN FUNCTIONAL AREAS OF MANAGEMENT

From European experience in converting from one set of accounting standards to another, it has become clear that the switch to IFRS is not just an accounting issue. Adoption of IFRS is a major change management challenge for companies.

### PEOPLE AND CHANGE MANAGEMENT

Adoption of IFRS is a major change management challenge for companies. And like many other major projects, it presents a broad range of challenges impacting people, systems and processes and each aspect must be carefully managed. Changing accounting policies often requires changes to processes, systems, procedures and controls. In turn, this requires changes to the substance of employees' roles and responsibilities and, potentially, to the governance and organization of the finance function. This calls for detailed project management and planning, the application of dedicated resources and talent, and a high level of senior management commitment to making the overall project a success. And each company's circumstances are different. Different structures, relationships with subsidiaries, consolidation processes and so on will require different treatment and present different challenges. Different parts of the group may currently be reporting on multiple bases of accounting. Ensuring the adoption of a comprehensive and consistent basis of accounts and consolidation throughout a global group will almost certainly involve varying degrees of systems, process and role re-engineering.

### STRATEGY AND PROJECT MANAGEMENT

Large companies need to develop a clear strategy: for example, they should decide upon a fundamental approach as to whether to roll out fully IFRS-compatible systems and processes across the whole group all at once; or concentrate first on getting critical parts of the organization compliant, turning later to other areas. A further challenge is that IFRS standards are not static but rather they continue to change. Careful thought is essential in planning the implementation program and ensuring the new systems are sufficiently flexible and tailored to meet the requirements placed on them. As with any major change program, implementing IFRS has to be managed while at the same time keeping existing processes and systems running effectively. While the two can be kept reasonably separate during the planning stages, as implementation progresses, the challenges become greater. As real changes start to migrate into the organization, the same skills, expertise and resources are often needed, to ensure continuing reporting on the existing basis of accounting while introducing the new systems and processes. Even if external support is sought, eventually the new arrangements have to be handed off to in-house staff.

### HUMAN RESOURCE DEPARTMENT

Compensation committees will need to work closely with accounting and management functions to understand the new processes' potential impact on remuneration. A shortage of trained IFRS resources is another significant challenge companies will face. Since comparative data will be required as early as possible, companies need to act now. Does the organization have enough manpower to handle IFRS conversion Numerous areas of the company, including information technology, may need additional people on hand, especially over the next few years. Human resources committees might also want to develop succession plans for key IFRS-trained technical resources, and revisit the company's compensation strategy. This could help reduce the risk of losing key finance people.

### INFORMATION TECHNOLOGY DEPARTMENT

Although systems throughout the organization will be affected by the conversion to IFRS, by planning an upgrade to a system with a worldwide roll out starting in 2011, make sure the new system accommodates IFRS from the start. In a 2008 report titled "Effects of IFRS on Information Systems," KMPG said that IT expenses generally account for more than 50% of the cost of an IFRS conversion.

Areas what Organization should look in their Information Technology department are: Can current software support IFRS?; Can current IT systems support both GAAP and IFRS, in case they both need to be used during the transition?; Are our software vendors planning updates to handle IFRS? Is the company planning any major software upgrades in the next few years? If so, how will the new systems handle IFRS? The consequences for not being prepared could be pretty severe.

## CONCLUSION

Earlier research conducted in Europe on voluntary adoption of IFRS reveal that adopting high quality standards might be necessary condition for high quality information, but not a sufficient one (Ball et al.2003); Strong enforcement mechanisms are also necessary and the adoption of IFRS will probably not be sufficient to standardize the quality of earnings throughout Europe. India has decided to move towards IFRS but still the mandatory switch over is not finalized. But when once decided to move towards IFRS, there comes the question of the preparedness. Some ways are identified to it.

1) IFRS can be included as a subject and it should be a part of curriculum in Accounting Education; More workshops and certification courses should be added on to train existing accountants and Professionals in accounting.

2) Government and other Regulators should frame/revise regulations in consultation with NACAS to reflect the IFRSs.

3) Entities should prepare to implement IFRSs by identifying differences and addressing required financial reporting system changes. Entities should provide training to staff at all levels affected by the transition to IFRS.

4) Federation of Chambers of Commerce and Industry (FICCI), Associated Chambers of Commerce (Assocham) and Confederation of Indian Industry (CII) can also play important role in preparing their constituents for the adoption of IFRS by holding round-tables on Exposure Drafts of the IFRS, conducting seminars/workshops on IFRS for the industry participants to provide them appropriate training and provide industry specific forums to their constituents to discuss the industry specific issues in implementations of IFRSs.

5) To ensure consistency between various regulations and Accounting Standards converged with IFRSs, the regulators such as Reserve Bank of India (RBI), Insurance Regulatory and Development Agency(IRDA) and the Security Exchange Board of India(SEBI) has also to identify areas in their regulations which are not consistent with the Accounting Standards converged with IFRS and thereafter to amend the same and to create awareness among their stakeholders. At the same time to ensure that the Accounting Standards are as tax neutral as possible so that there are no adverse tax implications. Harmonization is a huge and daunting task by itself. But, it is the order of the day. However, suitable and adequate safeguards and safety nets, as listed above, also need to be built into national accounting and financial systems to achieve the objectives of harmonization.

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# COMPARING EFFICIENCY AND PRODUCTIVITY OF THE INDIAN AUTOMOBILE FIRMS – A MALMQUIST – META FRONTIER APPROACH

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## ABSTRACT
*Manufacturing industries in developing countries depends on intermediate inputs and technology. Both these factors play an important role in the productivity of industry. In the early phases of industrialization, the productivity in Indian industry was limited by the government policy such as reservation of production, high custom tariff, changes in domestic trade and excise duties. However, this situation is gradually changing during 1980s and 1990s due to the introduction of economic liberalization process. Therefore, it is essential to analyze the productivity of industry. In this study, an attempt has been made to assess the effects of economic reforms on productivity growth in Indian automobile companies using Malmquist Productivity Index, decomposes the TFP change in to technical and efficiency changes. The results of the study showed that most of the Indian automobile companies must increase their TFP and efforts must be made to provide a stable pattern to the productivity growth. However, the benefits of technological progress were not converted in to productivity gains, as there was no improvement in efficiency in the reform period. The results of the study suggest that there is need for the implementation of specific policies to improve technical progress and efficiency change, in order to precipitate a long-run balance in TFP growth.*

## KEYWORDS
Productivity, Scale Efficiency, Malmquist Productivity Index, Indian Automobile Industry, Technology adoption and Managerial Efficiency growth.

## INTRODUCTION
Manufacturing industries in developing countries rely heavily on imported intermediate inputs and sophisticated technology. Availability of both these factors also plays a crucial role in the variation in productivity of concerned industry. In the early phases of industrialization, the productivity in Indian manufacturing sector was limited by the government policies, such as, the reservation of production, high custom tariff – distorting resource allocation and prohibiting Indian Industry's ability to compete in the international market, shutting down industries in response to normal competitive market forces and various types of distortions created by the structure of domestic trade taxes and excise duties. However, the situation is gradually changing since 1970 due to the introduction of economic liberalization process, but at a slow and halting pace. The first comprehensive economic reform policy statement was formulated for India in July 1991 in the form of industrial and trade sector liberalization. Over the years several measures were undertaken by them for boosting up the industrial productivity. Tariff rates have considerably been brought down; quantitative restrictions on imported goods have been removed to a great extent. These were adopted along with changes in technology-import policy, foreign direct investment policy, to make Indian industrial sector more efficient and productive, technology sounder and an able competitor in the front of world market.

**Roderick and Subramanian (2004)** categories the reforms of 1980s and 1990s as "Pro-business" and "Pro-market", respectively. The eighties' reforms focussed on increasing the profitability of existing firms by easing capacity restrictions and reducing corporate taxes, while the reforms of the nineties allowed more competition and increased provisions for the entry of new domestic firms and Multi-National Companies (MNCs) in the Indian manufacturing sector. Under these circumstances, there emerges a need for measurement of TFP and identification of the factors that account for productivity changes. Specifically, finding out the appropriate relationship between effective exchange rate and the other trade related variables such as, import substitution, effective rate of protection, non-tariff barriers, etc., and factor productivity growth is very important in the context of recent policies of reforms. Therefore, analyzing productivity and efficiency changes during the post reform periods becomes essential for providing strategic inputs to the producers, the government and other stake holders.

## LITERATURE REVIEW
Several studies have attempted to estimate the relationship between economic reforms and productivity growth in Indian manufacturing sector. Estimation of TFPG of Indian manufacturing industries can be seen from **Goldar (1986), Ahluwalia (1991), Balakrishnan and Pushpangadan (1994), Fujita (1994), Rao (1996), Majumdar (1996), Joshi and Little (1997), Gangopadhyay and Wadhva (1998), Pradhan and Barik (1998), Krishna and Mitra (1998), Mitra (1999), Trivedi et al., (2000), Balakrishnan et al., (2000), Unni and Rani (2001), Forbes (2001), Srivastava (2001), Chand and Sen (2002), Hasan (2002), Goldar and Kumari (2003), Unel (2003), TSL (2003), Driffield and Kambhampatti (2003), Goldar (2004), Das (2004), Mukherjee (2004), Rani and Unni (2004), Pattnayak and Thangavelu (2005), Banga and Goldar (2007), Madheswaran et al., (2007), Milner et al., (2007), Soo (2008), Jabir Ali et al., (2009).** All of them examined the effect of reforms on industrial productivity. Some studies have reported that policies of liberalization improved the productivity of the manfuacturing industry **[For example, See Fujita (1994); Majumdar (1996); Krishna and Mitra (1998); Chand and Sen (2002); Unel (2003); TSL (2003); Pattnayak and Thangavelu (2005); Banga and Goldar (2007)]**, whereas some have detected negative effects, or at least no significant improvement, in productivity growth since the onset of economic reforms in 1991 **[for example, See Trivedi et al., (2000); Balakrishnan et al., (2000); Unni and Rani (2001); Goldar and Kumari (2003); Driffield and Kambhampatti (2003); Goldar (2004); Das (2004)]**. Thus, the topic of the effects of economic reforms on productivity growth remains a critical focus of research.

## PROBLEM STATEMENT
To meet the emerging challenges, there is an urgent need to bring efficiency to the production process, either through maximizing the output or minimizing the cost. While there have been numerous studies conducted on productivity growth, only a relatively few studies have concerned themselves with the sources of productivity growth in the Indian economy. The traditional Tornquist index, which is applied to calculate total factor productivity growth, is incapable of decomposing the productivity change into movements along and changes in frontier, because the Tornquist index assumes that the observed output is the consequences of the best practice frontier. Conversely, the nonparametric Data Envelopment Analysis (DEA) approach is used to compute the Malmquist Total Factor Productivity (TFP) change, which has been further decomposed into efficiency and technical change.

Total Factor Productivity can be increased by using its existing technology and factor inputs more efficiently – this is referred to as "efficiency change". The total factor productivity of an industry can also increase when the industry adopts innovations or technological improvements, and this process is referred to as "technological change". Therefore, changes in TFP from one period to the next are the products of both efficiency change and technological progress. Most previous studies conducted in India have failed to consider the sources of such changes in productivity growth. **(Sindhu and Balasubramanyam (2006).** This study has attempted to assess the effects of economic reforms on productivity growth in Indian automobile companies using the Malmquist Productivity Index, decomposes the TFP change in to technical and efficiency changes. In particular, this study intends to find the answers to the following question.
**"Has the performance of the automobile companies in India improved since the market liberalization of the 1990s in terms of productivity and efficiency changes?"**

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## METHODOLOGY

The study uses the Malmquist Productivity Index approach to analyze changes in the total factor productivity of selected firms in Indian Automobile Industry overtime. The total factor productivity change of a firm has two primary components; the shift in the production frontier over time, representing technical change, and the shift in the firm's efficiency relative to the production frontier over time, representing efficiency change. There are several other ways to measure the productivity change of a firm (**such as the Fisher Index or the Tornquist Index**), but the Malmquist index is adopt here because it permits the separation of technical change from efficiency change (**Fare, Grosskopf, Norris and Zhang, 1994**) and is consistent with the DEA efficiency estimation methodology.

The Malmquist index was introduced by **Caves et al., (1982 a, b)** who dubbed it the (output based) Malmquist index after Sten Malmquist, who earlier proposed constructing quantity indexes as ratios of distance functions (**See Malmquist, 1953**). The Malmquist index was calculated as follows ((**as outlined in Fare et al., (1997)**)).

The measurement of the Malmquist productivity index is predicated on distance functions. For simplicity, $z^t = (x^t, y^t)$ and $z^{t+1} = (x^{t+1}, y^{t+1})$, where $x^t$ is the vector of inputs used in production and $y^t$ is the vector of outputs. Now, for each time period $t = 1, \ldots\ldots T$, the output distance function is defined as follows:

$$D^t(z) = \inf\{\theta : y^t / \theta \in P^t(x)\}$$
$$= [\sup\{\theta : y^t / \theta \in P^t(x)\}]^{-1} \tag{1}$$

where superscript $t$ and $D^t$ denote that technology in period $t$ is used as the reference technology. $\theta$ is scalar, and its value is the efficiency score for each production activity. It satisfies $0 < \theta \leq 1$ for a non-negative output level, with a value of 1 indicating a point of the frontier, and thus a technically efficient production activity. This output distance function is defined as the reciprocal of the maximal proportional expansion of output vector $y^t$ with the given input vector $x^t$ in relation to the technology at $t$.

The Malmquist productivity index is defined as follows:

$$TFP = M^t = \frac{D^t(z^{t+1})}{D^t(z^t)} \tag{2}$$

This formulation is called the output-oriented Malmquist productivity index in period $t$, $M^t$ ($z^{t+1}$, z), where the technology in period $t$ is the reference technology for two differing pairs of outputs and inputs. Alternatively, we can define $M^{t+1}$ where the technology in period $t + 1$ is employed as the reference technology.

Consistent with the study of **Fare et al., (1994)**, the output-based Malmquist productivity index is defined as the geometric mean of two output-distance functions, in order to avoid selecting an arbitrary benchmark:

$$M(z^{t+1}, z^t) = [M^t . M^{t+1}]^{1/2} = \left[\left(\frac{D^t(z^{t+1})}{D^t(z^t)}\right)\left(\frac{D^{t+1}(z^{t+1})}{D^{t+1}(z^t)}\right)\right]^{1/2} \tag{3}$$

Equation (3) can be rewritten as:

$$M(z^{t+1}, z^t) = \left(\frac{D^{t+1}(z^{t+1})}{D^t(z^t)}\right) \times \left(\frac{D^t(z^{t+1})}{D^{t+1}(z^{t+1})}\right)\left(\frac{D^t(z^t)}{D^{t+1}(z^t)}\right)^{1/2} \tag{3`}$$

where the ratio outside the brackets measures the change in relative efficiency between $t$ and $t+1$, and the geometric mean inside the brackets measures the shift in frontier. That is, the Malmquist productivity index can be decomposed into change in efficiency and change in technical progress.

In a previous empirical work, **Fare et al., (1994)** utilized non-parametric linear-programming techniques. As can be seen in (3`), it must solve four different linear programming problems: $D^t(z^t), D^t(z^{t+1}), D^{t+1}(z^t), and D^{t+1}(z^{t+1}).$ Calculating the Malmquist index relative to the variable returns to scale technology, $D_j^t(z^t)$ for each industry, $j \in k = 1, \ldots, K$, one of the four different linear programming problems, can be stated as:

$$\left[D_j^t(z_j^t)^{-1} = \max_{\theta, w} \theta_j\right] \tag{4}$$

subject to
$$\theta_j y_{m,j}^t \leq \sum_{k=1}^{K} w_k^t y_{m,k}^t \quad m = 1, \ldots, M \tag{4a}$$

$$\sum_{k=1}^{K} w_k^t x_{n,j}^t \leq x_{n,j}^t \quad n = 1, \ldots, N \tag{4b}$$

$$w_k^t \geq 0 \quad k = 1, \ldots, K \tag{4c}$$

where $n = 1, \ldots, N$ are inputs, $m = 1, \ldots, M$ are outputs, and $w_k^t$ is an intensity variable indicating the production intensity of a particular activity. (Here, each industry is an activity). These intensity variables are used as weights in taking convex combinations of the observed outputs and inputs in both (4a) and (4b).

From Equation 4, the reciprocal of the output distance function can be used to find the maximum of $\theta$, which gives the maximal proportional expansion of output given constraints (4a) – (4).

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For the other distance functions, the computation of $D^{t+1}\left(z^{t+1}\right)$ is exactly the same as (4), where *t + 1* is substituted for *t*. Two other distance functions require information from two periods, $D^{t}\left(z^{t+1}\right)$ can be computed by replacing $y_{m,j}^{t}$ and $x_{n,j}^{t}$ in (4a) and (4b) with $y_{m,j}^{t+1}$ and $x_{n,j}^{t+1}$, respectively and $D^{t+1}\left(z^{t}\right)$ is the same as $D^{t}\left(z^{t+1}\right)$, where the *t* and *t + 1* superscripts are exchanged.

## RESEARCH DESIGN

Keeping in view the scope of the study, it is decided to include all the companies under automobile industry working before or from the year 1996-97 to 2008-09. There are 26 companies operating in the Indian automobile industry. But, owing to several constraints such as non-availability of financial statements or non-working of a company in a particular year etc., it is compelled to restrict the number of sample companies to 20. The companies under automobile industry are classified into three sectors namely; Commercial vehicles, Passenger Cars and Multiutility vehicles and Two and Three wheelers. For the purpose of the study all the three sectors have been selected. It accounts for 73.23 per cent of the total companies available in the Indian automobile industry. The selected 20 companies include 5 under commercial vehicles, 6 under Passenger cars and Multiutility vehicles and 9 under two and three wheeler sectors. It is inferred that sample company represents 98.74 percentage of market share in commercial vehicles, 89.76 percentage of market share in Passenger Cars and Multiutility vehicles and 99.81 percentage of market share in two and three wheelers. Thus, the findings based on the occurrence of such representative sample may be presumed to be true representative of automobile industry in the country.

Out of 20 selected companies under Indian Automobile Industry, the productivity performance of three Multinational Companies (MNC's) namely Hyundai Motors India Ltd, Honda Siel Cars India Ltd and Ford India Private Ltd computed separately because these companies established their operations in India in different accounting years. In order to have uniform period, the productivity performance of the three MNC's were computed from the year 2000-01 to 2008-09 (9 years only).

### DATA

The study is mainly based on secondary data. The major source of data analysed and interpreted in this study related to all those companies selected is collected from "PROWESS" database, which is the most reliable on the empowered corporate database of Centre for Monitoring Indian Economy (CMIE). Besides prowess database, relevant secondary data have also been collected from BSE Stock Exchange Official Directory, CIME Publications, Annual Survey of Industry, Business newspapers, Reports on Currency and Finance, Libraries of various Research Institutions, through Internet etc.

## RESULTS AND DISCUSSION

### MALMQUIST TOTAL FACTOR PRODUCTIVITY

Table 1 shows mean values of change in Malmquist total factor productivity index and its components (efficiency change and technology change) for the period 1996-97 to 2008-09. The malmquist index value greater than one implies positive TFPG and the value less than one indicates TFPG decline. Note that while the product of the efficiency change and technology change components must be definition equal the Malmquist index, those components may be moving in opposite directions. For all the companies put together, the TFP has decreased by 1.05 per cent during the study period. An important question to investigate is whether the TFPG has been achieved by improvement in technical efficiency (catch-up) and / or improvement in technology (shift in production frontier)?. The decomposition of TFPG in to efficiency change and technical change also reported in the Table 1 shows that technological efficiency change has been the main contributor to TFPG. The average technological efficiency was 2.24 per cent, while the average technical efficiency change was negative (-3.20 per cent). This suggests that, in the companies studied, technical efficiency has been the main barrier to achieving high level of TFP during the period under consideration. Further, the analysis of total factor productivity of three sectors revealed that the overall TFP growth is positive in passenger cars and multiutility sector (2.5 per cent) due to improvement in both technical efficiency of 0.6 per cent and technological efficiency of 1.9 per cent.

Another significant results from the Table 1 that the efficiency change tends to be a negative contributor to total factor productivity in the commercial vehicles and two and three wheeler sector (i.e, it is less than unity), and technological change tends to be a positive contributor (i.e., it is greater than unity) suggesting that improvement in these sectors is due to their productivity based on production frontier effect. The overall technical efficiency change in these sectors is less than one which is the main cause in dampening the total factor productivity for whole industries.

Technical efficiency change is the result of pure technical efficiency change and scale efficiency change. With regards to pure efficiency change, it is more than one in cars and multiutility vehicles sector only. In case of scale efficiency change, a value close to unity shows that all the sectors are operating at optimum scale. Therefore scale efficiency has only contributed to the improvement in technical efficiency in all the three sectors and the whole Indian automobile industry during the study period.

Another interesting finding is that only 10 out of 17 companies had registered growth in TFP during the period 1996-97 to 2008-09 (Table 1). Further, all the companies except LML Ltd under two and three wheeler sector recorded technological efficiency improvement. But only 6 out of 17 companies had recorded technical efficiency improvement. However, not all the companies registered a similar performance during the period. Some companies, for instance, Ashok Leyland Ltd and Tata Motors Ltd (under commercial vehicles sector), Hindustan Motors Ltd (under passenger cars and multiutility vehicles sector) and Bajaj Auto Ltd, Hero Honda Motors Ltd and Majestic Auto Ltd (under two and three wheeler sector) have experienced an increase in overall technical efficiency during the period, while remaining companies experienced a negative growth in technical efficiency. But for technological efficiency is concerned, all the selected companies except LML Ltd have experienced a big increase in overall technological efficiency ranges from 1.002 to 1.048 during the period. Only in case of Ashok Leyland Ltd and Tata Motors Ltd (commercial vehicle sector), Hindustan Motors Ltd (passenger cars and multiutility vehicles sector) and Bajaj Auto Ltd, Hero Honda Motors Ltd and Majestic Auto Ltd (two and three wheeler sector), improvement in these industries is due to their productivity based both catching up effect and production frontier effect.

The technical efficiency change is further decomposed into pure technical efficiency change and scale efficiency change given in the last two columns in Table 1. With regards to pure efficiency change, it is one or more than one in Ashok Leyland Ltd, Tata Motors Ltd and Swaraj Mazda Ltd (Commercial vehicle sector), Hindustan Motors Ltd, Mahindra and Mahindra Ltd and Maruti Udyog Ltd (Passenger cars and Multiutility vehicles sector) and Bajaj Auto Ltd, Hero Honda Motors Ltd and Majestic Auto Ltd (Two and three wheeler sector) during the study period. Scale efficiency indicates whether the firm can increase its productivity by becoming larger. It is evident from the table that incase of scale efficiency change, value close to unity shows that most of the companies are operating at optimum scale. The results of the study show that both the pure and scale efficiency have contributed to the growth of overall efficiency. This suggests that, in achieving high levels of technical performance over time, technical efficiency is not a long-run constraint. From the Table 1, the comparison of total factor productivity change in different companies shows that Hero Honda Motors Ltd on average has the highest growth in TFP (12.1 per cent), followed by Majestic Auto Ltd (5.7 per cent) and Bajaj Auto Ltd (4.1 per cent) total factor productivity growth. The worst performers in terms of total factor productivity growth is Maharashtra Scooters Ltd. (-28 per cent) followed by Kinetic Motors Ltd (-9 per cent). Both the best and worst performer in terms of total factor productivity growth has been found in two and three wheeler sector of Indian Automobile industry during the study period.

The mean values of changes in Malmquist total factor productivity index and its components (efficiency change and technology change) for the three Multinational companies in Indian automobile industry for the period 1996-97 to 2008-09 were computed and presented in Table 2. The analysis of total factor productivity of three MNC revealed that the overall TFP growth is positive in Ford India Private Ltd and Honda Siel Cars India Ltd, but it is negative in Hyundai Motors India Ltd during the study period. The overall TFP growth is highest in Ford India Private Ltd (27 per cent) due to improvement in technical efficiency of 24 per cent and technological efficiency of 2.3 per cent. Similarly, in Honda Siel Cars India Ltd, the productivity growth was 2.7 per cent with technical efficiency

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growth of 1.2 per cent and technological efficiency change of 1.5 per cent. Another significant result from the Table 2 that technological change tends to be a negative contributor to total factor productivity in the Hyundai Motors India Ltd (i.e., it is less than unity) which is the main cause in dampening the total factor productivity in Hyundai Motors India Ltd. The analysis of two components of technical efficiency change presented in the table revealed that pure efficiency change is more than one in Ford India Private Ltd only. In case of scale efficiency change, in all the three MNCs, scale efficiency which is one or more than one, have contributed to the improvement in technical efficiency. The table also revealed that Hyundai Motors India Ltd did not show any change in terms of pure efficiency change and scale efficiency change during 1997-2009.

**MANAGERIAL EFFICIENCY GROWTH**

Technical efficiency change can make use of existing input to produce more of same product. As one gets more experience in producing some product, it becomes more and more efficient in it. Labour finds new ways to produce by making minor modifications in the process of manufacturing which contribute to higher productivity. Therefore, to understand the contribution made by technical efficiency in the productivity growth, year-wise technical efficiency movement is presented in Table 3.

In general these results suggest that technical efficiency is an important contributor in the total factor productivity. The average efficiency change of whole automobile industry is equal or greater than one in 9 out of 12 years of the study period. During the years 1999-00 and 2000-01, the technical efficiency change for majority of the selected companies are positive and overall automobile industry efficiency increased by 10.2 per cent during 1999-00, being the second highest efficiency growth in entire period. The year 2008-09 was also most favourable for all the selected companies where technical efficiency change increased by 11.2 per cent i.e., highest for the whole automobile industry during 1997-2009. In the year 2004-05, again a tangle up trend can be seen where only two out of seventeen companies has their technical efficiency change more than 1, which was also the most unfavourable for overall automobile industry where the technical efficiency change decreased by 25.1 per cent i.e., highest for the entire period during 1997-98 to 2008-09. The results in the table also explain that Maruti Udyog Ltd did not show any change in terms of efficiency during 1997-2009. The LML Ltd, Hero Honda Motors Ltd and Majestic Auto Ltd under two and three wheelers sector has performed relatively better than all other companies in terms of efficiency change. Other good performing companies in terms of efficiency change are Hindustan Motors Ltd (passenger cars and multiutility vehicles) and Bajaj Auto Ltd and Majestic Auto Ltd (two and three wheelers). These companies have their efficiency change in positive for seven years out of twelve years.

The year wise movement of technical efficiency of three MNC's is presented in Table 4. The results presented in Table 6 revealed that technical efficiency change of three MNC's is an important contributor in the TFP. The mean efficiency change of all the three companies is greater than one during the study period. During 2002-03 and 2006-07, all the three companies showed positive growth in their technical efficiency change.

**TECHNOLOGY ADOPTION**

The second important source of total factor productivity growth is the change in the technology. Technological change is the development of new technologies or new products to improve and shift production frontier upward. Table 5 presents the comparative technical change for all companies during the period 1997-2009. It is observed from the table that the technical change can be seen in whole automobile industry greater than one during 1998-99 and 2001-02 to 2005-06, where technical change increased by 6.2 per cent, 7 per cent, 22.4 per cent, 7.8 per cent 45.8 per cent and 3.1 per cent respectively. Further, during 2001-02, 2002-03, 2004-05 and 2005-06, all the selected companies has performed better in terms of technical change, because their technical change is greater than one. The mean values of technical change of all the selected companies showed that all the companies have a relatively stable and overall technical change. However, in the terminal years 2006-07 and 2008-09 were a dreadful years for all the selected companies where technical change drop for all the companies. Maharashtra Scooters Ltd, TVS Motor Company Ltd, Majestic Auto Ltd and Hero Honda Motors Ltd under two and three wheeler sectors are the most stable companies in terms of technological change as having its change more than unity for seven out of twelve years.

Table 6 showed the comparative technical change for all the three MNC's during the study period. It is observed from the table that the mean technical change was more than one in Ford India Private Ltd and Honda Siel Cars India Ltd. Further, Honda Siel Cars India Ltd has a relatively stable in its technical change because it was more than one in six out eight years during the study period. However, technical change growth was decreased in the terminal years of the study period (2005-2009) in case of Hyundai Motors India Ltd. Table 7 presents the ranking of all the selected companies in terms of total factor productivity growth, technical change and technical efficiency change. This table also presents the ranking in terms of pure efficiency change and scale efficiency change being the components of technical efficiency change.

## CONCLUSION

The empirical estimates on the Indian automobile industry Productivity performance yielded several results that appear striking. The overall automobile industry improved technical (technological) change efficiency by 2.2 per cent while technical efficiency change put a negative effect on the productivity, as a result the overall total factor productivity during 1997-2009 decreased by 1.4 per cent. Among the three sectors, both technical efficiency change and technical change put a positive effect on the productivity only in the case of passenger cars and multiutility vehicles sector. However, in case of commercial vehicles sectors, technical progress leads to an increase of productivity by 0.4 per cent during the study period. The results from individual companies show that TFP growth is mainly contributed by technological change while technical efficiency change is only positive for ten out of twenty companies. It suggests that Indian automobile industry are lacking in terms of managerial efficiency growth. Except few companies which have relatively stable productivity includes Hero Honda Motors Ltd and Ford India Private Ltd, all other companies have a mixed trend over      1997-2009 which affects the productivity and ranking of companies. Ford India Private Ltd is at the top in ranking in terms of TFP followed by Hero Honda Motors Ltd due to highest technical change and technical efficiency. Maharashtra Scooters Ltd and Kinetic Motor Company Ltd are among the worst performer in terms of productivity over 1997-2009. The main reason for this worst performance is less improvement in managerial efficiency.

The research result suggests that Indian Automobile Companies must increase total factor productivity in most of the companies under study and efforts must be made to provide a stable pattern to the productivity growth. The reform process has increased access to superior technology in the manufacturing sector through higher foreign participation, as well as greater access to importation of higher quality of raw materials and capital equipment. However, the benefits of technological progress were not converted into productivity gains, as there was no improvement in efficiency in the reform period. **Goldar and Kumari (2003)** have presented econometric evidence indicating that slow down in TFP growth in Indian manufacturing in the post reform period is attributable, to a large extent, to deterioration in capacity utilization. It could, therefore, be concluded that there must have been a corresponding increase in efficiency to convert technological progress into productivity growth. The results of this study suggest the need for the implementation of specific policies to improve technical progress and efficiency change, in order to precipitate a long-run balance in TFP growth. Technological progress should be encouraged in industries with slow technical progress, industries, with slow efficiency change rates should be encourage to use existing technology more effectively via increased training and education.

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## TABLES

**TABLE 1: CHANGES IN TOTAL FACTOR PRODUCTIVITY AND ITS COMPONENTS OF SELECTED INDIAN AUTOMOBILE COMPANIES DURING 1996-97 TO 2008-09.**
**(MALMQUIST INDEX SUMMARY OF COMPANY MEANS)**

| Company | TFP Change | Components of TFPG | | Components of Technical Efficiency Change | |
|---|---|---|---|---|---|
| | | Technological Change | Technical Efficiency Change | Pure Technical Efficiency Change | Scale Efficiency Change |
| Ashok Leyland Ltd | 1.030 | 1.022 | 1.008 | 1.012 | 0.996 |
| Tata Motors Ltd | 1.026 | 1.020 | 1.006 | 1.000 | 1.006 |
| Bajaj Tempo Ltd | 0.975 | 1.009 | 0.966 | 0.965 | 1.001 |
| Eicher Motors Ltd | 0.981 | 1.007 | 0.974 | 0.977 | 0.997 |
| Swaraj Mazda Ltd | 1.007 | 1.026 | 0.981 | 1.000 | 0.981 |
| Hindustan Motors Ltd | 1.026 | 1.002 | 1.024 | 1.025 | 0.999 |
| Mahindra and Mahindra Ltd | 1.034 | 1.039 | 0.995 | 1.022 | 0.974 |
| Maruti Udyog Ltd | 1.015 | 1.015 | 1.000 | 1.000 | 1.000 |
| Bajaj Auto Ltd | 1.041 | 1.017 | 1.024 | 1.000 | 1.024 |
| LML Ltd | 0.937 | 0.990 | 0.946 | 0.964 | 0.981 |
| Maharashtra Scooters Ltd | 0.723 | 1.044 | 0.692 | 0.708 | 0.978 |
| TVS Motor Company Ltd | 1.019 | 1.040 | 0.980 | 0.970 | 1.010 |
| Kinetic Motor Company Ltd | 0.910 | 1.027 | 0.885 | 0.891 | 0.994 |
| Hero Honda Motors Ltd | 1.121 | 1.048 | 1.070 | 1.060 | 1.009 |
| Kinetic Engineering Ltd | 0.953 | 1.011 | 0.943 | 0.961 | 0.981 |
| Majestic Auto Ltd | 1.057 | 1.030 | 1.026 | 1.054 | 0.974 |
| Scooters India Ltd | 0.967 | 1.033 | 0.936 | 0.935 | 1.001 |
| **Commercial Vechicles** | **1.004** | **1.017** | **0.987** | **0.991** | **0.996** |
| **Passenger Cars and Multiutility Vechicles** | **1.025** | **1.019** | **1.006** | **1.016** | **0.991** |
| **Two and Three Wheelers** | **0.963** | **1.027** | **0.938** | **0.943** | **0.995** |
| **Whole Automobile Industry** | **0.986** | **1.022** | **0.964** | **0.970** | **0.994** |

**TABLE 2: CHANGES IN TOTAL FACTOR PRODUCTIVITY AND ITS COMPONENTS OF THREE MNC IN INDIAN AUTOMOBILE COMPANIES DURING 1996-97 TO 2008-09**
**(MALMQUIST INDEX SUMMARY OF COMPANY MEANS)**

| Company | TFP Change | Components of TFPG | | Components of Technical Efficiency Change | |
|---|---|---|---|---|---|
| | | Technological Change | Technical Efficiency Change | Pure Technical Efficiency Change | Scale Efficiency Change |
| Hyundai Motors India Ltd | 0.976 | 0.976 | 1.000 | 1.000 | 1.000 |
| Honda Siel cars India Ltd | 1.027 | 1.015 | 1.012 | 1.000 | 1.012 |
| Ford India Private Ltd | 1.270 | 1.023 | 1.241 | 1.224 | 1.014 |

**TABLE 3: COMPARATIVE TECHNICAL CHANGE OF ALL THE SELECTED INDIAN AUTOMOBILE COMPANIES DURING 1996-97 TO 2008-09**

| Company | 1997-98 | 1998-99 | 1999-00 | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashok Leyland Ltd | 0.995 | 0.992 | 0.978 | 0.824 | 1.055 | 1.234 | 1.051 | 1.475 | 1.029 | 0.85 | 0.999 | 0.928 | 1.034 |
| Tata Motors Ltd | 0.960 | 1.076 | 0.967 | 0.815 | 1.047 | 1.206 | 1.044 | 1.485 | 1.030 | 0.852 | 1.003 | 0.909 | 1.033 |
| Bajaj Tempo Ltd | 1.030 | 0.996 | 0.996 | 0.750 | 1.024 | 1.140 | 1.031 | 1.555 | 1.033 | 0.856 | 1.010 | 0.869 | 1.025 |
| Eicher Motors Ltd | 0.985 | 1.028 | 0.969 | 0.855 | 1.111 | 1.308 | 1.122 | 1.083 | 1.016 | 0.837 | 0.988 | 0.878 | 1.015 |
| Swaraj Mazda Ltd | 0.860 | 1.109 | 0.999 | 1.095 | 1.121 | 1.237 | 1.206 | 1.081 | 1.013 | 0.922 | 0.894 | 0.865 | 1.034 |
| Hindustan Motors Ltd | 0.976 | 1.066 | 1.068 | 0.720 | 1.020 | 1.184 | 0.974 | 1.865 | 1.056 | 0.731 | 0.958 | 0.792 | 1.034 |
| Mahindra and Mahindra Ltd | 0.863 | 1.120 | 0.952 | 0.923 | 1.127 | 1.305 | 1.064 | 1.428 | 1.026 | 0.845 | 0.994 | 0.964 | 1.051 |
| Maruti Udyog Ltd | 0.962 | 1.044 | 1.061 | 0.732 | 1.016 | 1.166 | 0.992 | 1.925 | 1.059 | 0.802 | 0.994 | 0.799 | 1.046 |
| Bajaj Auto Ltd | 1.015 | 0.987 | 0.980 | 0.789 | 1.047 | 1.219 | 1.048 | 1.458 | 1.026 | 0.842 | 0.992 | 0.945 | 1.029 |
| LML Ltd | 0.963 | 0.944 | 0.982 | 0.751 | 1.027 | 1.182 | 1.050 | 1.481 | 1.033 | 0.866 | 0.990 | 0.792 | 1.005 |
| Maharashtra Scooters Ltd | 0.925 | 1.150 | 0.936 | 0.936 | 1.124 | 1.305 | 1.067 | 1.417 | 1.027 | 0.847 | 0.996 | 0.941 | 1.056 |
| TVS Motor Company Ltd | 0.936 | 1.139 | 0.944 | 0.889 | 1.130 | 1.324 | 1.085 | 1.391 | 1.025 | 0.846 | 1.001 | 0.913 | 1.052 |
| Kinetic Motor Company Ltd | 0.986 | 1.046 | 0.974 | 0.834 | 1.062 | 1.230 | 1.044 | 1.494 | 1.030 | 0.850 | 1.000 | 0.926 | 1.040 |
| Hero Honda Motors Ltd | 0.947 | 1.151 | 0.946 | 0.997 | 1.109 | 1.226 | 1.376 | 1.185 | 1.016 | 0.877 | 0.939 | 0.920 | 1.057 |
| Kinetic Engineering Ltd | 1.037 | 1.022 | 1.018 | 0.731 | 1.026 | 1.159 | 1.010 | 1.624 | 1.036 | 0.867 | 1.027 | 0.800 | 1.030 |
| Majestic Auto Ltd | 0.887 | 1.118 | 1.122 | 0.755 | 1.021 | 1.183 | 0.974 | 2.215 | 1.058 | 0.811 | 0.958 | 0.792 | 1.074 |
| Scooters India Ltd | 0.851 | 1.092 | 0.999 | 1.131 | 1.144 | 1.228 | 1.272 | 1.096 | 1.013 | 0.921 | 0.894 | 0.865 | 1.042 |
| **Whole Automobile Industry** | **0.950** | **1.062** | **0.992** | **0.846** | **1.070** | **1.224** | **1.078** | **1.458** | **1.031** | **0.847** | **0.978** | **0.874** | **1.022** |

**TABLE 4: COMPARATIVE TECHNICAL CHANGE OF THREE MNC IN INDIAN AUTOMOBILE COMPANIES DURING 1996-97 TO 2008-09**

| Company | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Hyundai Motors India Ltd | 1.031 | 0.964 | 1.033 | 1.189 | 1.501 | 0.910 | 0.797 | 0.942 | 0.642 | **0.976** |
| Honda Siel cars India Ltd | 1.148 | 1.029 | 1.076 | 1.120 | 1.509 | 0.952 | 1.045 | 0.959 | 0.556 | **1.015** |
| Ford India Private Ltd | 0.926 | 0.903 | 1.126 | 1.047 | 1.517 | 0.845 | 0.761 | 1.092 | 1.173 | **1.023** |
| | **1.035** | **0.965** | **1.078** | **1.117** | **1.509** | **0.902** | **0.868** | **0.998** | **0.790** | **1.005** |

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TABLE 5: COMPARATIVE TECHNICAL EFFICIENCY CHANGE OF ALL THE SELECTED INDIAN AUTOMOBILE COMPANIES DURING 1996-97 TO 2008-09

| Company | 1997-98 | 1998-99 | 1999-00 | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashok Leyland Ltd | 0.817 | 1.025 | 1.331 | 1.142 | 0.956 | 0.875 | 1.190 | 0.856 | 1.112 | 1.167 | 0.926 | 0.844 | **1.020** |
| Tata Motors Ltd | 0.754 | 0.815 | 1.400 | 1.036 | 1.042 | 1.178 | 1.138 | 0.869 | 1.042 | 1.166 | 0.914 | 0.889 | **1.020** |
| Bajaj Tempo Ltd | 0.905 | 0.966 | 1.172 | 1.147 | 1.089 | 1.181 | 1.172 | 0.602 | 0.821 | 0.994 | 0.876 | 0.871 | **0.983** |
| Eicher Motors Ltd | 0.871 | 1.032 | 1.322 | 1.316 | 0.928 | 1.075 | 1.043 | 0.770 | 0.733 | 1.225 | 0.954 | 0.681 | **0.996** |
| Swaraj Mazda Ltd | 1.000 | 0.787 | 1.270 | 1.000 | 1.000 | 1.000 | 0.986 | 0.974 | 0.839 | 0.999 | 1.182 | 0.836 | **0.989** |
| Hindustan Motors Ltd | 1.029 | 1.089 | 1.089 | 1.205 | 0.939 | 1.072 | 0.846 | 0.914 | 0.745 | 1.208 | 0.962 | 1.335 | **1.036** |
| Mahindra and Mahindra Ltd | 1.240 | 0.832 | 1.127 | 0.938 | 0.853 | 0.933 | 1.161 | 0.914 | 0.985 | 1.081 | 0.979 | 0.982 | **1.002** |
| Maruti Udyog Ltd | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | **1.000** |
| Bajaj Auto Ltd | 0.923 | 1.236 | 1.021 | 1.239 | 1.334 | 1.259 | 1.130 | 0.969 | 0.959 | 0.689 | 0.724 | 1.044 | **1.044** |
| LML Ltd | 1.157 | 1.646 | 0.638 | 1.000 | 0.803 | 1.521 | 0.826 | 0.447 | 0.483 | 0.182 | 9.711 | 1.097 | **1.623** |
| Maharashtra Scooters Ltd | 0.990 | 1.024 | 1.000 | 0.571 | 0.526 | 0.560 | 0.618 | 0.669 | 0.907 | 0.306 | 0.484 | 1.279 | **0.745** |
| TVS Motor Company Ltd | 1.281 | 0.909 | 1.190 | 0.906 | 1.256 | 1.000 | 0.870 | 0.773 | 0.924 | 1.036 | 0.754 | 1.021 | **0.993** |
| Kinetic Motor Company Ltd | 1.061 | 0.964 | 1.306 | 1.223 | 0.714 | 0.789 | 0.643 | 0.625 | 0.796 | 1.239 | 0.307 | 2.073 | **0.978** |
| Hero Honda Motors Ltd | 1.381 | 1.058 | 1.347 | 1.089 | 1.046 | 0.924 | 1.082 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | **1.077** |
| Kinetic Engineering Ltd | 1.021 | 1.372 | 0.989 | 1.446 | 0.878 | 0.837 | 0.800 | 0.547 | 0.670 | 1.132 | 0.545 | 1.854 | **1.007** |
| Majestic Auto Ltd | 1.197 | 1.144 | 0.817 | 1.231 | 0.886 | 1.198 | 1.290 | 0.404 | 0.967 | 0.918 | 1.126 | 1.795 | **1.081** |
| Scooters India Ltd | 1.143 | 0.886 | 1.050 | 0.709 | 0.839 | 0.891 | 0.825 | 0.852 | 1.055 | 1.061 | 0.838 | 1.208 | **0.946** |
| **Whole Automobile Industry** | **1.032** | **1.028** | **1.102** | **1.047** | **0.927** | **0.995** | **0.958** | **0.749** | **0.868** | **0.882** | **0.935** | **1.112** | **0.964** |

TABLE 6: COMPARATIVE TECHNICAL EFFICIENCY CHANGE OF THREE MNC IN INDIAN AUTOMOBILE COMPANIES DURING 1996-97 TO 2008-09

| Company | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Hyundai Motors India Ltd | 1.000 | 1.000 | 1.000 | 0.988 | 0.663 | 1.076 | 1.070 | 0.817 | 1.625 | **1.000** |
| Honda Siel cars India Ltd | 0.897 | 1.102 | 1.130 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | **1.012** |
| Ford India Private Ltd | 4.332 | 0.923 | 1.067 | 1.136 | 0.692 | 0.907 | 2.019 | 1.137 | 1.000 | **1.241** |
| | 2.076 | 1.008 | 1.067 | 1.041 | 0.785 | 0.994 | 1.363 | 0.985 | 1.208 | 1.084 |

TABLE 7: RANKING OF COMPANIES BASED ON MALMQUIST TFP AND ITS COMPONENTS

| Company | Ranks | | | | |
|---|---|---|---|---|---|
| | TFP Change | Tech. Change | TE Change | PE Change | SE Change |
| Ashok Leyland Ltd | 6 | 10 | 7 | 6 | 13 |
| Tata Motors Ltd | 8 | 11 | 8 | 7 | 6 |
| Bajaj Tempo Ltd | 15 | 16 | 15 | 15 | 7 |
| Eicher Motors Ltd | 13 | 17 | 14 | 13 | 12 |
| Swaraj Mazda Ltd | 12 | 8 | 12 | 8 | 15 |
| Hindustan Motors Ltd | 9 | 18 | 4 | 4 | 11 |
| Mahindra and Mahindra Ltd | 5 | 4 | 11 | 5 | 19 |
| Maruti Udyog Ltd | 11 | 13 | 9 | 9 | 9 |
| Bajaj Auto Ltd | 4 | 12 | 5 | 10 | 1 |
| LML Ltd | 18 | 19 | 16 | 16 | 16 |
| Maharashtra Scooters Ltd | 20 | 2 | 20 | 20 | 18 |
| TVS Motor Company Ltd | 10 | 3 | 13 | 14 | 4 |
| Kinetic Motor Company Ltd | 19 | 7 | 19 | 19 | 14 |
| Hero Honda Motors Ltd | 2 | 1 | 2 | 2 | 5 |
| Kinetic Engineering Ltd | 17 | 15 | 17 | 17 | 17 |
| Majestic Auto Ltd | 3 | 6 | 3 | 3 | 20 |
| Scooters India Ltd | 16 | 5 | 18 | 18 | 8 |
| Hyundai Motors India Ltd | 14 | 20 | 10 | 11 | 10 |
| Honda Siel Cars India Ltd | 7 | 14 | 6 | 12 | 3 |
| Ford India Private Ltd | 1 | 9 | 1 | 1 | 2 |

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# EMERGING TRENDS IN KNOWLEDGE MANAGEMENT IN BANKING SECTOR

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## ABSTRACT

*Banking Sector all over the world is witnessing a paradigm shift. The computerization of financial operations, connectivity through World Wide Web and the support of automated softwares has completely changed the basic concept of banking. The irony of the situation is that in spite of collection of huge amount of data from the various transactions and other sources, the banks are not able to fully capitalize the benefits which can be reaped from these huge data bases. The survival mantra in the present day environment of globalization and cut throat competition is to find out the power of invisible force which runs the whole show i.e. the knowledge. The banks have realized that their biggest asset is the knowledge and not the financial resources and are using the techniques of knowledge management and data mining for customer segmentation and profitability, marketing, risk management and customer relationship management.  This paper highlights the perspective applications of data mining for knowledge management to enhance the performance of some of the core business processes in the banking sector.*

## KEYWORDS

Knowledge Creation and Retention, Information Communication Technology, Customer Relationship Management, Data Mining.

## INTRODUCTION

In the most basic sense the knowledge is defined as a derivative of information, which in turn is derived from the data. Knowledge is the information or data which has been organized in a meaningful way. Data is mostly unstructured, factual, and often times numeric, and reside in database management systems. Information is factual, but structured and crisp, Knowledge is inferential, abstract, and is needed to support decision making or hypothesis generation. Knowledge and knowledge management are being used interchangeably. Knowledge management is being used in our society since time immemorial. Its origin can be related to the time when languages were discovered. Human beings leant how to communicate with each other and this was probably the first medium through which transfer of information took place [8]. The transfer of knowledge took place from parents to children, teacher to the taught and from educated to the uneducated through the verbal or non-verbal mediums of communication [8]. This knowledge transfer was informal and was transferred to generations through customs and folklore. Till the time, the society was not widespread; these means of knowledge dissemination were successful even in the small organizations also. The major problem in this process was faced when the organizations started growing in size and magnitude, the work pressures on employees and ever changing demands of the industry posed by cut throat competitions started increasing. The solution to this problem lies in implementation of techniques of knowledge management and dissemination. The organizations are collecting huge amount of data through various transactions executed every second, but they fail to fully capitalize the benefits from these huge data bases only because they do not have some strong mechanism for knowledge collection, organization, dissemination and hence are not able to use this knowledge for the survival and growth of the organization.

Knowledge is: "... a fluid mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information"

**Karl Sveiby** defined KM as, the art of creating value from an organizations intangible assets.[14]

*Davenport and Prusak* defined KM as - KM is concerned with the exploitation and development of the knowledge assets of an organization with a view to furthering the knowledge objectives.[14]

*Despres, Charles and Chauvel,* Daniele defined KM as, the purpose of knowledge management is to enhance organizational performance by explicitly designing and implementing tools, processes, systems, structures, and cultures to improve the creation, sharing, and use of different types of knowledge that are critical for decision-making.

*According to the World Bank,* KM is the management of knowledge through systematic sharing that can enable one to build on earlier experience and obviate the need for costly reworking of learning by making the same repetitive mistakes.[14]

In the simplest sense, knowledge can be divided into two categories:[11]

- Explicit knowledge
- Tacit knowledge

Explicit knowledge is formal knowledge that can be packaged as information and can be found in the documents of an organization: reports, articles, manuals, patents, pictures, images etc. It can be expressed in form of specific language and can be shared in the form of data or scientific formula. It can be processed, transmitted and stored relatively easily.

Tacit knowledge is personal knowledge acquired by the individual experience and is shared and exchanged through direct conversations. It is highly personal and hard to formalize. It is deeply rooted in action, procedures, routines, commitment, ideas, values and emotions.

## NEED OF KNOWLEDGE MANAGEMENT IN BANKS

Since 1980's the whole concept of banking has been shifted to centralized databases, online transactions and ATM's all over the world, which has made banking system technically strong and more customer oriented. The introduction of these reforms brought with it a healthy competition around the globe and the rule of "survival of the fittest" is prevailing in the banking sector. Then arises the question, who is the fittest, the organizations which has right information available at the right time will be called the fittest. The right information will be converted in to knowledge and this acquired knowledge will help the bank to survive, grow and capture the new markets and they can provide better customer oriented services and hence can retain their existing customers also. This need of the hour forced banks to upgrade their customer service to a much higher plane in order to survive in this competitive environment [13]. They found technology as an ideal tool to achieve this objective. Public sector banks were guided by the recommendations of the Committee for up gradation of Banking Technology

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constituted by Reserve Bank of Indian, though the pace of the computerization has been moderate.[7,2,3] Till 1980s, the banks were accessible only through their branches. With the growth of technology other delivery channels and technology-aided products like ATMs, anywhere Banking, Smart Cards, Internet Banking, WAP Banking, etc.,[2,3] have provided the customers with a flexibility and ease of performing banking operations. Over the years, technology has brought a drastic change in the functioning of the banks. The earlier manual system of handling transactions, have been automated, thereby saving a lot of time and effort. In the present day environment, the huge amount of electronic data is being maintained by banks around the globe [10]. The knowledge required for various operations and decisions to be taken need not to be gathered by intrusive customer surveys or expensive market research programs, but the already collected data in the organization's store houses is to be mined for the relevant knowledge. The terabytes of data is being collected, generated, printed, stored, filed and discarded by banks; these data items serve only the short lived purpose of audit trail and paper trail. But this huge collection of data can be used for further analysis and for finding the future directions. The Total Branch Computerization (TBC) software packages being used at various branch levels are transaction oriented, as these were designed keeping day to day transactions in mind. Designing the new MIS or restructuring the existing ones would not be possible by just replacing the existing Total Branch Computerization packages. The solution seems to be in incorporating the concept of data warehousing and data mining. Data warehousing and mining will become important for banks to take business decisions [2, 3].

## THE KNOWLEDGE DISCOVERY AND MANAGEMENT PROCESS

Knowledge discovery and learning is an iterative process that extends the collection of data mining techniques into a knowledge management framework. Figure 1 shows the complete knowledge management process [15]. The steps in the KDD process contain [6]:

**1. Data Cleaning:** In this phase noise data and irrelevant data are removed from the collection.

**2. Data Integration:** In this stage, multiple data sources, often heterogeneous, are combined in a common source.

**3. Data Selection:** The data relevant to the analysis is decided and retrieved from the collected data. As data mining technique can be applied to the complete database or a representative sample of the data can be chosen. The process of feature selection is done by the use of data visualization to bring number of variables to a manageable range.

**4. Data Transformation:** It is also known as data consolidation; in this phase the selected data is transformed into forms appropriate for the mining procedure.

**5. Data Mining**: It is the crucial step in which out of the various data mining techniques available, such as neural networks, tree-based methods, logistic model, rule induction methods, or other statistical models.,the technique most suitable to the present context is chosen and is applied to extract potentially useful patterns.

**6. Pattern Evaluation**: In this step, interesting patterns representing knowledge are identified based on given measures.

**7. Knowledge Representation**: It is the final phase in which the discovered knowledge is visually presented to the user as per their requirements and hence the organization can take decisions accordingly. If the knowledge presented does not fulfill the requirements of the individual or the organization, then the process is repeated through learning and refinement of the derived solution is done [13].

## DATA MINING AS A TOOL FOR KNOWLEDGE MANAGEMENT IN BANKING SECTOR

Data mining is also called knowledge discovery from databases. Data mining is often used during the knowledge discovery process and is one of the most important subfields in knowledge management.

Data mining aims to analyze a set of given data or information in order to identify novel and potentially useful patterns [4].

Data Mining is defined as "the nontrivial extraction of implicit, previously unknown, and potentially useful information from data" [1].

It is basically "the science of extracting useful information from large databases".

**FIGURE 1: KNOWLEDGE MANAGEMENT PROCESS**
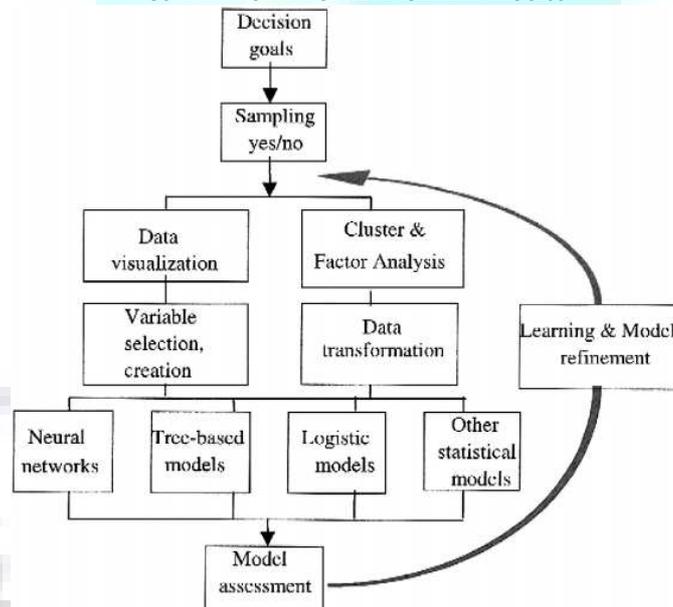


Data mining is a process that uses a variety of data analysis tools to discover knowledge, patterns and relationships in data that may be used to make valid predictions. [1].

**DATA MINING CONSISTS OF FIVE MAJOR ELEMENTS:**

- Extract, transform, and load transaction data onto the data warehouse system.
- Store and manage the data in a multidimensional database system.
- Provide data access to business analysts and information technology professionals.
- Analyze the data with the help of application softwares.
- Present the data in a useful format, such as a graph or table.

Data mining involves the use of sophisticated data analysis tools to discover previously unknown, valid patterns and relationships in large data sets. These tools can include statistical models, mathematical algorithms, and machine learning methods. Thus, data mining is not only collecting and managing data; it also includes analysis and prediction. Data mining can be performed on data represented in quantitative, textual, or multimedia forms. The Figure 2 shows the Process of Data Mining.

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**FIGURE 2: THE PROCESS OF DATA MINING**
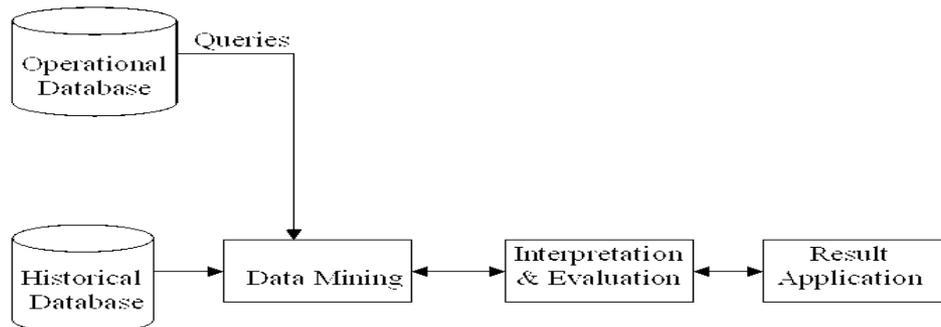


There are three major areas of application of data mining for execution of financial operations [15]:

**1. Customer Profiling** - For better Customer Relationships through Customized Services.

**2. Deviation Analysis** - For Risk management and Fraud detection.

**3. Trend Analysis** - For future forecasting.

#### 1. CUSTOMER PROFILING

Customer is considered as the king and it's the customer who is running the whole show and a huge amount of data is collected by the organizations knowingly and unknowingly, and this data can be explored to discover the hidden patterns and hence the organization can design strategies accordingly. While learning customer profiles, an organization is interested in general information like, age, sex, demographics and specific information like:

a) **Frequency of Transactions**: How many transactions are done by a customer and how frequently these are done?

b) **Size of Transactions**: How much does the customer spend on a typical transaction?

c) **Recency of Transactions**: How long it has been since this customer last performed a transaction? The recent emphasis on customer relationship management has put the focus back on the customer. The four key steps or customer relationship management are as under:

- Identifying the right customers,
- Differentiating among them,
- Interacting with and learning from existing customers, and
- Customizing the services.

This type of information collected by an organization can be mined and following benefits can be obtained:

a) **Identifying typical customer groups:** Classifying and grouping the customers with similar set of transactional behavior. The customers of a particular group can be offered services as per their requirements. Knowing the customer and targeting the right deal gets a far better response rate than a general message. Like, the customers from the service class always demand for the policy which ensures more security as they are not intended to take risks, likewise the same set of service class people in rural areas have the preferences for some particular brands which may differ from their counterparts in urban areas. This information will help the organization in cross-selling their products, Instead of mass pitching a certain "hot" product, the bank's customer service representatives can be equipped with customer profiles enriched by data mining that help them to identify which products and services are most relevant to callers[9].

b) **Prospecting the future**: Customer profiles (highlighting their age, sex, income and demographics) and their transactional behavior give clues to the organization to predict the future, Like a customer who has taken loan from the bank for the construction of a house can be contacted after 6 months, for the purchase of furniture, refrigerator or AC, as these are the obvious requirements after the purchase of a house.

c) **Success or Failure of Marketing Programs:** Customer databases provide accurate information for marketing programs. The marketer can use the patterns of purchase discovered from the database and the related marketing programs to measure the short-term and long-term effects of the programs.

#### 2. DEVIATION ANALYSIS

Knowledge of deviations from normal is extremely important for any organization. A deviation can be an anomaly or fraud or a change. In the past, such deviations were difficult to detect in time to take corrective action. Data mining tools provide powerful means such as neural networks for detecting and classifying such deviations. For example, a higher than normal credit purchase on a credit card can be a fraud anomaly. Once a deviation has been discovered as a fraud, the organization takes steps to prevent such frauds and initiates corrective action. If the deviation has been discovered as a change, further information collection is necessary. For example, a change can be that a customer got a new job and moved to a new house. In this case, organization has to update the knowledge about the customer.

#### 3. TREND ANALYSIS

Trends are patterns that persist over a period of time. Trends could be short-term trends like the immediate increase and subsequent slow down of sales following a sale campaign. Or, trends could be long-term, like the slow flattening of sales of a product over a few years. Data mining tools, such as visualization, help us detect trends, sometimes very subtle and hidden patterns can be obtained, which would have been missed using traditional analysis tools like scatter plots. The study of these trends can be helpful for the organization to identify trends in sales, costs and profits by products, regions or markets in order to understand the impact of a sales promotion campaign [6].  Data mining also provides statistical tools to precisely measure the performance of the various parameters of interest and the organization can forecast future sales. Data mining allows discovery of subtle relationships like a peak in sales of a product associated with a change in the profile of a particular group of customers.

World Bank is renowned as one of the champions in knowledge management application. It has an extensive knowledge management approach in action. Relevant information was identified that could then be captured and entered into the knowledge base so that it was accessible by all staff members. Relevant parts of the system are accessible to clients, partners, and stakeholders around the world so that they can act according to the information retrieved through these knowledge bases [11].

Bank of Montreal (BMO) is the oldest bank in Canada. It is also Canadian third largest bank with sales of $US12.23 billion in 2000. BMO is a leader in customer centric knowledge based solution [11].

## CHALLENGES IN KNOWLEDGE MANAGEMENT THROUGH DATA MINING

1. The major issue in knowledge management is the organization, distribution and refinement of knowledge. In order to maximize the effectiveness of this knowledge management process, the organization requires proper definition of the knowledge elements and measures so that the full benefit can be reaped.

2. The second most important issue in knowledge management is knowledge integration from disparate sources. Organizations need to explore data from various sources and the collected data is to be integrated to derive at a particular result. The data collected is normally heterogeneous in nature, so the process of data refinement is to be carried out, so that the appropriate data mining technique can be applied.

3 .While transferring the data, large amount of noisy data is also added which creates problem. So data is to be preprocessed by filtering the noisy data. This step is usually time consuming.

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4. Privacy Issues are the greatest obstacles. There is a war like situation between the data miner and the subjects, as while mining the data, the privacy of the subject is at the sake.

5. The results obtained from the various data mining tools are subject to validation, as these are to be tested before acceptance.

6. While studying the customer behavior usually the purchasing or transactional behavior is considered, but this analysis needs deep study of customers and their circumstances.

7. The difficulty is faced in developing customer models and moreover the validation of these models is again a Problem

## CONCLUSION

Knowledge management and retrieval of relevant knowledge as the per the requirements of the organization and hence to design the business strategies based on this knowledge is the need of the hour. If you are not able to act before your competitors that means you are dead. The data mining techniques can be of immense help to the banks and financial institutions in this arena for acquiring new customers, fraud detection in real time, providing segment based products for customized services, analysis of the customers' purchase patterns over time for better retention and relationship, detection of emerging trends to take proactive approach in a highly competitive market adding a lot more value to existing products and services and launching of new product and service bundles.

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# A STUDY ON CONSUMER ACCEPTANCE OF M-BANKING IN TIRUCHIRAPPALLI CITY

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**TRICHY**

## ABSTRACT

*This paper mainly identify the key motivators for consumer acceptance of mobile phone banking (M-Banking), mostly those that affect the consumer attitude towards the intention to use the latest technology in banking sector – the self service banking technology. A web-based survey was undertaken where respondents completed questionnaire about their perception towards M-banking perceived usefulness, problems with use of M-banking, and the reason for using M-Banking service. The customer using Mobile banking technology effectively, the database was collected from the Bank and the questionnaire was sent through mail, and the customers return back through mail. Hence the sample size for the study is 500 respondents by adopting Purposive simple random sampling technique. Both primary and secondary data were used in the study. ANOVA, Correlation and multiple regressions were used to determine whether theses factors influence consumer's attitude and intention to use M-Banking. Perceived usefulness was found to influence the consumer to use the M-Banking technology. Awareness programmes should be organized by the Banks which attracts the customers to use the new technology M-Banking effectively and makes the Banking – Happy Banking safely and securely.*

## KEYWORDS

M-banking, Technology, Banking, Mobile Communication Systems, Services.

## INTRODUCTION

Mobile banking (also known as M-Banking, mbanking, SMS Banking) is a term used for performing balance checks, account transactions, payments, credit applications and other banking transactions through a mobile device such as a mobile phone or Personal Digital Assistant (PDA). The earliest mobile banking services were offered over SMS. With the introduction of the first primitive smart phones with WAP support enabling the use of the mobile web in 1999, the first European banks started to offer mobile banking on this platform to their customers.

Mobile banking has until recently (2010) most often been performed via SMS or the Mobile Web. Apple's initial success with iPhone and the rapid growth of phones based on Google's Android (operating system) have led to increasing use of special client programs, called apps, downloaded to the mobile device.

## TRENDS IN MOBILE BANKING

The advent of the Internet has enabled new ways to conduct banking business, resulting in the creation of new institutions, such as online banks, online brokers and wealth managers. Such institutions still account for a tiny percentage of the industry. Over the last few years, the mobile and wireless market has been one of the fastest growing markets in the world and it is still growing at a rapid pace. According to the GSM Association and Ovum, the number of mobile subscribers exceeded 2 billion in September 2005, and now (2009) exceeds 2.5 billion (of which more than 2 billion are GSM).

According to a study by financial consultancy Celent, 35% of online banking households will be using mobile banking by 2010, up from less than 1% today. Upwards of 70% of bank center call volume is projected to come from mobile phones. Mobile banking will eventually allow users to make payments at the physical point of sale. "Mobile contactless payments" will make up 10% of the contactless market by 2010. Another study from 2010 by Berg Insight forecasts that the number of mobile banking users in the US will grow from 12 million in 2009 to 86 million in 2015. The same study also predicts that the European market will grow from 7 million mobile banking users in 2009 to 115 million users in 2015.

Many believe that mobile users have just started to fully utilize the data capabilities in their mobile phones. In Asian countries like India, China, Bangladesh, Indonesia and Philippines, where mobile infrastructure is comparatively better than the fixed-line infrastructure, and in European countries, where mobile phone penetration is very high (at least 80% of consumers use a mobile phone), mobile banking is likely to appeal even more.

## MOBILE BANKING BUSINESS MODELS

A wide spectrum of Mobile/branchless banking models is evolving. However, no matter what business model, if mobile banking is being used to attract low-income populations in often rural locations, the business model will depend on banking agents, i.e., retail or postal outlets that process financial transactions on behalf telcos or banks. The banking agent is an important part of the mobile banking business model since customer care, service quality, and cash management will depend on them. Many telcos will work through their local airtime resellers. However, banks in Colombia, Brazil, Peru, and other markets use pharmacies, bakeries, etc.

These models differ primarily on the question that who will establish the relationship (account opening, deposit taking, lending etc.) to the end customer, the Bank or the Non-Bank/Telecommunication Company (Telco). Another difference lies in the nature of agency agreement between bank and the Non-Bank. Models of branchless banking can be classified into three broad categories - Bank Focused, Bank-Led and Non bank-Led.

### (i) Bank-focused model

The bank-focused model emerges when a traditional bank uses non-traditional low-cost delivery channels to provide banking services to its existing customers. Examples range from use of automatic teller machines (ATMs) to internet banking or mobile phone banking to provide certain limited banking services to banks' customers. This model is additive in nature and may be seen as a modest extension of conventional branch-based banking.

### (ii) Bank-led model

The bank-led model offers a distinct alternative to conventional branch-based banking in that customer conducts financial transactions at a whole range of retail agents (or through mobile phone) instead of at bank branches or through bank employees. This model promises the potential to substantially increase the financial services outreach by using a different delivery channel (retailers/ mobile phones), a different trade partner (telco / chain store) having experience and target market distinct from traditional banks, and may be significantly cheaper than the bank-based alternatives. The bank-led model may be implemented by either using correspondent arrangements or by creating a JV between Bank and Telco/non-bank. In this model customer account relationship rests with the bank

### (iii) Non-bank-led model

The non-bank-led model is where a bank has a limited role in the day-to-day account management. Typically its role in this model is limited to safe-keeping of funds. Account management functions are conducted by a non-bank (e.g. telco) who has direct contact with individual customers.

## MOBILE BANKING SERVICES

Mobile banking can offer services such as the following:

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- Account Information
- Mini-statements and checking of account history
- Alerts on account activity or passing of set thresholds
- Monitoring of term deposits
- Access to loan statements
- Access to card statements
- Mutual funds / equity statements
- Insurance policy management
- Pension plan management
- Status on cheque, stop payment on cheque
- Ordering cheque books
- Balance checking in the account
- Recent transactions
- Due date of payment (functionality for stop, change and deleting of payments)
- PIN provision, Change of PIN and reminder over the Internet
- Blocking of (lost, stolen) cards

## PAYMENTS, DEPOSITS, WITHDRAWALS, AND TRANSFERS
- Domestic and international fund transfers
- Micro-payment handling
- Mobile recharging
- Commercial payment processing
- Bill payment processing
- Peer to Peer payments
- Withdrawal at banking agent
- Deposit at banking agent

## FUTURE FUNCTIONALITIES IN MOBILE BANKING
Based on the 'International Review of Business Research Papers' from World business Institute, Australia, following are the key functional trends possible in world of Mobile Banking. With the advent of technology and increasing use of smart phone and tablet based devices, the use of Mobile Banking functionality would enable customer connect across entire customer life cycle much comprehensively than before. With this scenario, current mobile banking objectives of say building relationships, reducing cost, achieving new revenue stream will transform to enable new objectives targeting higher level goals such as building brand of the banking organization. Emerging technology and functionalities would enable to create new ways of lead generation, prospecting as well as developing deep customer relationship and mobile banking world would achieve superior customer experience with bi-directional communications.

## LITERATURE REVIEW
The proliferation of mobile phone adoption, together with advances in mobile technology, has accelerated the development of M-services (Sullivan Mort and Drennan, 2007; Wang et al., 2006). M-services are defined as "enhanced information services accessed while mobile" (Sullivan Mort and Drennan, 2007, p. 302). An emerging component of M-services that could become a significant revenue source to both banks and telecom service providers is M-banking (Nysveen et al., 2005). M-banking involves conducting account balance and transaction history inquiries, funds transfers, bill payments, stock trades, portfolio management, as well as insurance ordering, via a mobile device (Suoranta and Mattila, 2004). It provides value for consumers, above other banking channels, through ubiquitous access, time convenience, and mobility (Anckar and D'Incau, 2002; Luarn and Lin, 2005). Despite its many advantages, the use of mobile phones in banking services is still in its infancy and Internet banking retains its position as the leading channel in electronic banking (Laukkanen, 2007a; Laukkanen and Cruz, 2009). The question therefore arises as to what are the key motivators and inhibitors of M-banking adoption.

It is argued that the complexity of service models, and the convergence of technologies and services, has resulted in limited research into the area of consumer acceptance and adoption of M-banking (Suoranta and Mattila, 2004). Most of the existing research in the area of electronic banking covers telephone banking (e.g. Al-Ashban and Burney, 2001; Howcroft et al., 2002) or internet banking (e.g. Lichtenstein and Williamson, 2006; Mavri and Ioannour, 2006). M-banking represents an innovation where both multifaceted intangible service and a technologically innovative medium of service delivery are present (Rao and Troshani, 2007). Innovation diffusion is thus even more intricate as both technology and service aspects have an effect on the characteristics of M-banking services and subsequently, its adoption by consumers.

This paper specifically informs the understanding of technology acceptance behaviour in M-banking. This is valid considering the variation in the user characteristics, acceptance, and adoption of the electronic banking channels. For instance, Curran and Meuter (2005) reported that the significance of the factors affecting the adoption of ATMs, phone banking, and internet banking differed substantially between the channels. Furthermore, internet banking users and M-banking users were found to be divergent in their demographic characteristics. Whilst Karjaluoto et al. (2002) found that the typical Finnish user of internet banking was highly educated, relatively young, and wealthy, Laforet and Li (2005) showed that education did not influence M-banking acceptance in China. Furthermore, the average age of M-banking users was found to be much higher than the average age for internet banking users within China, which is consistent with the findings of Suoranta and Mattila's (2004) Finnish study. In addition, internet banking users and M-banking users also vary in their channel attribute preferences, as well as in their value perceptions about their banking activities (Laukkanen, 2007a; Laukkanen, 2007b). As such, it is argued that research into the motivators and inhibitors of customer usage of M-banking is supported, especially given its distinctiveness relative to other banking channels. This paper explains,

1. To what extent personal profiles influence in using mobile Baking?
2. Perceived usefulness of mobile banking service.
3. Problems with the use of mobile Banking
4. Reason for using mobile banking service.

## METHODS
A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure that researcher would adopt in selecting items for the sample. Sample design may as well lay down the number of items for the sample. Sample design may as well lay down the number of items to be included in the sample. i.e. the size of the sample. The researcher determined the Sample design before data was collected. The study is descriptive in nature.

The customer using Mobile banking technology effectively, the database was collected from the Bank and the questionnaire was sent through mail, and the customers return back through mail. Hence the sample size for the study is 500 respondents by adopting Purposive simple random sampling technique.

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## TOOLS FOR DATA COLLECTION

The primary data was collected afresh for the first time and thus happen to be original character. The primary data was collected with the help of the questionnaire. A five point likert scale was used for the variables and the respondents were required to state the extent to which they agreed or disagreed with the statements in the questionnaire. Cronbach's alpha was used to measure the reliability. Cronbach's alpha is a model of internal consistency based on average inter-item correlation. Measures in this study are judged to be reliable if Cronbach's coefficient alpha is 0.7 or greater. In this research paper Cronbach's coefficient alpha is .832. The secondary data, collected from journal, Books and from internet and web site of Banks.

## ANALYTICAL TOOLS

The collected data have been consolidated, tabulated and analyzed by using relevant statistical tools like, Correlation, ANOVA and Multiple regressions.

## RESEARCH QUESTIONS

1. Does personal profiles influences using Mobile Banking?
2. Does M-Banking provoke perceived usefulness?

## STATISTICAL ANALYSIS

### ANOVA

**Hypothesis:** here will be no significant difference among age and intentions to use mobile Banking.

**TABLE - 1**

| Analyzing Variable | Dimensions | Source of Variation | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|---|
| Age | Perceived Usefulness | Between Groups | .525 | 4 | .131 | .269 | .897 |
| | | Within Groups | 21.975 | 45 | .488 | | |
| | | Total | 22.500 | 49 | | | |
| | Problems with the use of Mobile Banking | Between Groups | 1.127 | 4 | .282 | .762 | .556 |
| | | Within Groups | 16.653 | 45 | .370 | | |
| | | Total | 17.780 | 49 | | | |
| | Reasons for using Mobile banking service | Between Groups | 1.780 | 4 | .445 | .910 | .466 |
| | | Within Groups | 22.000 | 45 | .489 | | |
| | | Total | 23.780 | 49 | | | |

The above ANOVA table shows the significant difference among age and variables such as perceived usefulness, age and problems with the use of mobile banking, age and reasons for using mobile banking service. Thus, there is no significant difference among age and intentions to use mobile Banking.

### ANOVA

**Hypothesis:** There will be no significant difference among Income and intentions to use mobile Banking.

**TABLE - 2**

| Analyzing Variable | Dimensions | Source of Variation | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|---|
| Income | Perceived Usefulness | Between Groups | .813 | 2 | .407 | .881 | .421 |
| | | Within Groups | 21.687 | 47 | .461 | | |
| | | Total | 22.500 | 49 | | | |
| | Problems with the use of Mobile Banking | Between Groups | 1.132 | 2 | .566 | 1.597 | .213 |
| | | Within Groups | 16.648 | 47 | .354 | | |
| | | Total | 17.780 | 49 | | | |
| | Reasons for using Mobile banking service | Between Groups | .275 | 2 | .138 | .275 | .761 |
| | | Within Groups | 23.505 | 47 | .500 | | |
| | | Total | 23.780 | 49 | | | |

The above ANOVA table shows the significant difference among income and variables such as perceived usefulness, income and problems with the use of mobile banking, income and reasons for using mobile banking service. Thus, there is no significant difference among income and intentions to use mobile Banking.

### MULTIPLE CORRELATIONS

**TABLE - 3**

| | | Perceived Usefulness | Problems with the use of Mobile Banking | Reasons for using Mobile banking service |
|---|---|---|---|---|
| Perceived Usefulness | Pearson Correlation | 1 | .665** | .748** |
| | Sig. (2-tailed) | | .000 | .000 |
| | N | 500 | 500 | 500 |
| Problems with the use of Mobile Banking | Pearson Correlation | .665** | 1 | .622** |
| | Sig. (2-tailed) | .000 | | .000 |
| | N | 500 | 500 | 500 |
| Reasons for using Mobile banking service | Pearson Correlation | .748** | .622** | 1 |
| | Sig. (2-tailed) | .000 | .000 | |
| | N | 500 | 500 | 500 |

**. Correlation is significant at the 0.01 level (2-tailed).

The above table gives the inter correlation coefficients between the dimensions, Perceived usefulness, Problems with the use of Mobile banking, Reasons for using Mobile Banking service.

### PERCEIVED USEFULNESS

The correlation between the variables perceived usefulness and problems with the use of mobile banking was .665 which was positively correlated and highly significant, correlation between perceived usefulness and Reasons for using mobile banking services was .748 which was positively correlated and highly significant.

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**PROBLEMS WITH THE USE OF MOBILE BANKING**

The correlation between the variables problems with the use of mobile banking and perceived usefulness was .665 which was positively correlated and highly significant, correlation between problems with the use of mobile banking and Reasons for using mobile banking services was .622 which was positively correlated and highly significant.

**REASONS FOR USING MOBILE BANKING SERVICE**

The correlation between the variables Reasons for using mobile banking services and perceived usefulness was .748 which was positively correlated and highly significant, correlation between Reasons for using mobile banking services and problems with the use of mobile banking was .622 which was positively correlated and highly significant.

**MULTIPLE REGRESSIONS**

**TABLE – 4: MODEL SUMMARY**

| Model | R | R Square | Adjusted R Square | F (.Sig) | Std. Error of the Estimate |
|---|---|---|---|---|---|
| dimension 1 | .766 | .587 | .569 | 33.403 (.000) | .457 |

Predictors: (Constant), Problems with the use of Mobile Banking, Perceived Usefulness

Dependent Variable: Reasons for using Mobile banking service

From the above model summary table, the R value shows the correlation among the two variables. The R value is .587. It implies the mild correlations between the variables. The R square shows the prediction of the dependent variable Reasons for using mobile banking service. The R square shows that 56.9% predicts the dependent variable (Reasons for using Mobile banking service)

The larger the F ratio there will be more variance in the dependent variable that is associated with the independent variable. The F ratio = 33.403. The statistical significance is .000 - the "Sig". So we can reject the null hypothesis that no relationship exists between the two variables. There is relationship between independent and dependent variables.

**COEFFICIENTS**

**TABLE - 5**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .406 | .418 | | .972 | .336 |
| | Perceived Usefulness | .617 | .129 | .600 | 4.780 | .000 |
| | Problems with the use of Mobile Banking | .257 | .145 | .223 | 1.774 | .083 |

Dependent Variable: Reasons for using Mobile banking service

To determine if one or more of the independent variables are significant predictors of Reasons for using Mobile banking service, we examine the information provided in the coefficient table. From the two independent statements one statement is found to be statistically significant.

The standardized coefficient beta column reveals that Perceived Usefulness has a beta coefficient **.600**, which is significant (.000). Problems with the use of Mobile Banking has a beta coefficient .**223**, which is not significant (.083).

# FINDINGS

**PERSONAL PROFILES**

Shows the personal information of the respondents were 78% of the respondents were male. Age wise distribution of the respondents shows that 36% of the respondents belonged to the age group 36 - 40 years. Marital status of the respondents shows that 72% of them were married. Occupation information of the respondents shows that 40% of the respondents were occupied in professional jobs. Income distribution shows that 46% of the respondents belonged to the income group Rs. 20,001 to 30,000.

**PERCEIVED USEFULNESS**

The following are the findings of the respondents regarding perceived usefulness. Perception that paying bills was cheaper through mobile banking to this 42% of the respondents agreed. Faster transmission of data to this 48% of the respondents responded moderately. Authenticate with mobile phone to internet bank to this 42% of the respondents agreed. Mobile banking offered substantially more versatile services to this 36% of the respondents responded moderately. Use services via other mobile device than mobile phone to this 46% of the respondents agreed. Controlling mobile services by voice instead of typing to this 50% of the respondents agreed. According to 50% of the respondents they agreed to have personal education on mobile banking services.

**PROBLEMS WITH THE USE OF MOBILE BANKING**

The following are the findings 40% of the respondents agreed that banking through mobile had the problem of slow data transmission. 44% of the respondents responded moderately towards insufficient guidance for mobile banking, 32% of the respondents disagreed that mobile banking led to malfunctions of services, 54% of the respondents agreed that mobile banking services lacked operating instructions, 38% of the respondents agreed banks offering mobile services had poor user interface facility, 34% of the respondents responded moderately towards dexterity of mobile banking services, 40% of the respondents agreed regarding lack of time in using mobile banking, 50% of the respondents agreed mobile banking was associated with general difficulties in using the services.

**REASONS FOR USING MOBILE BANKING SERVICES**

The following are the research findings 32% of the respondents strongly agreed that mobile banking services incurred reduced amount of expense, 46% of the respondents agreed that sufficient guidance was one of the reasons for using mobile banking, 48% of the respondents agreed that usage of mobile banking was not a disappointment to them, 36% of the respondents moderately responded towards use of mobile banking for its faster data transmission facility, 30% of the respondents strongly agreed that mobile banking was user friendly and not complicated, 36% of the respondents agreed that mobile banking services were enough versatile, 30% of the respondents disagreed that Possibility of errors was minimum than in Internet banking, 42% of the respondents agreed that using key code list with mobile phone was not complicated, 50% of the respondents agreed they used mobile phone in banking, 44% of the respondents agreed Mobile phone is a practical device for banking.

**CORRELATION**

The correlation table gives the inter correlation coefficients between the dimensions, Perceived usefulness, Problems with the use of Mobile banking, Reasons for using Mobile Banking service. All the dimensions were positively correlated and highly significant with each other.

**MULTIPLE REGRESSIONS**

The R value is .587. The R square shows the prediction of the dependent variable Reasons for using mobile banking service. The R square shows that 56.9% predicts the dependent variable (Reasons for using Mobile banking service). The F ratio = 33.403. There is relationship between independent and dependent variables.

The standardized coefficient beta column reveals that Perceived Usefulness has a beta coefficient **.600**, which is significant (.000). Problems with the use of Mobile Banking have a beta coefficient .**223**, which is not significant (.083).

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## SUGGESTIONS

1. New Market developing programs should organized by the banks by focusing on creating a positive attitude toward M-banking should attract consumers to this emerging electronic banking channel.

2. Specifically, marketers should emphasize M-banking's usefulness and compatibility with consumers' lifestyle, in addition to designing M-banking systems that minimize risk and cost to the consumer.

3. Perceived usefulness and compatibility were both found to have a strong positive influence on attitude and intention to use M-banking, with perceived usefulness being the most significant motivator.

4. Marketers should take advantage of the value adding characteristics of M-banking in promoting perceived usefulness and compatibility with consumers' lifestyle.

5. Consumers need to be shown how M-banking fits in with their lifestyle and needs and how useful the channel can be within that lifestyle.

6. The problems faced by the customers should be resolved and continuous monitoring and feed back should be given to the customers.

7. New valued service should be included in mobile banking technologies.

8. A common platform and operating system should be followed by all service providers.

9. All the banks service providers must ensure their customer that there will be fast data transmission.

10. Malfunction of service should be fully eradicated.

## CONCLUSION

The research has served to enhance the understanding of the factors influencing new technology adoption within a service paradigm and from a consumer perspective. It has demonstrated that there are multiple factors at work throughout the diffusion process and that some are more influential than others under given circumstances. The knowledge gained by this research into the motivators and inhibitors of M-Banking is useful for practitioners who aim to maximize consumer adoption of this self-service banking technology.

This study furthers the understanding of the adoption of one of the innovative technologies that is driving service and technology convergence as an emerging service paradigm: Importantly, this research also provides a model for examining future mobile digital technology developments in the financial services sector as "customers move out of the bank queue and into the electronic age"

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# TECHNICAL ANALYSIS AS SHORT TERM TRADING STRATEGY IN THE   INDIAN STOCK MARKET- AN EMPIRICAL EVIDENCE IN THE PUBLIC SECTOR BANKS

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## ABSTRACT

*Stock prices fluctuate widely in the market. The stock prices are determined by the supply of and demand for securities. It is very difficult to predict stock market behavior. It is driven by media news, corporate announcements and emotions of people. It can influence the price in either direction by up and down, Positive or upward trends are considered as bull markets; negative or down ward trends are referred to as bear markets. Technical analysis is useful for predicting the short-term price movements of stocks through various technical indicators. This paper attempts to study the short term price fluctuations through the use of Relative Strength Index, Rate of Change, Breadth of the Market, charts and quantitative techniques without considering the company's financial prospects. The technical analysis has been done for Punjab National Bank and Bank of Baroda, which helps the investors to make short term investment decision .The Punjab National Bank and Bank of Baroda scripts price movements were compared with NSE index to facilitate benchmarking comparison.. The analysis has been done for the period of 4 months to study the short term period price fluctuations. The chart makes it easier for the investor to analyze correctly the technical position of stock. It also analyzes the advances and declines that have occurred in the stock market by comparing NSE as a bench marking technique. The researcher has made an attempt to emphasize the technical strength and weakness of Punjab National Bank and Bank of Baroda scripts through various technical indicators.*

## KEYWORDS

Charts, Public sector Bank, Investors, Short-term price fluctuation, Technical analysis.

## INTRODUCTION

Technical analysis is the study of market price movement, primarily through the use of charts, for the purpose of forecasting future price trends". Technical analysis is a method of evaluating securities by analyzing the statistics generated by market activity, such as past prices and volume. Technical analysts do not attempt to measure a security's intrinsic value, but instead use charts and other tools to identify patterns that can suggest future activity. Just as there are many investment styles on the fundamental side, there are also many different types of technical traders. Some rely on chart patterns; others use technical indicators and oscillators, and most use some combination of the two. In any case, technical analysts' exclusive use of historical price and volume data is what separates them from their fundamental counterparts. Technical analysis is based on historical data, but the limitation is that the past is not always an indication of future results, calling into question the validity of technical analysis. The short term investment decision based on technical analysis may not be give correct result because technical analysis is subjective and cannot be used to make consistent decision. Signals that indicate action in technical analysis may change over a period of time.

## CHART PATTERNS IS A INDICATOR OF SHORT TERM PRICE MOVEMENT

Chart patterns  is one of the important technical indicator used to study short term price movement  of share .Chart patterns are graphical representations of historical stock price movement which form repeating patterns or shapes, and are commonly employed in the stock market. Technical analysis is the study of historical price to determine future trading strategies.  Trading with technical analysis requires correctly identifying chart patterns.  Chart patterns are useful gauges of momentum, support and resistance, and other indications of strength or weakness in a stock.  Chart patterns help traders to determine market direction as well as time entries and exits. Technical analysts believe that price behavior repeat itself and therefore it is predictable by extrapolating past patterns.

## REVIEW OF LITERATURE

**Pinches (1970)**, presented a more general statement of technical analysis is as follows: 1) the market value of a security solely depends on the supply and demand of the particular security. 2) Supply and demand forces at any moment depends on many reasons, both rational and irrational. Information, opinions, moods, guesses and blind needs integrate in the price discovery process. No individual can hope to grasp and weigh them all; market automatically performs this. 3) Excepting minor variations, prices move in trends that persist for some periods. 4) Changes in trend signal an important shift in the balance between supply and demand and the same are detectable eventually in the market prices.

**Bessembinder H. and Chan K (1998),** also found that simple forms of technical analysis contain significant power for US stock index returns. However, they cautioned that transaction costs are main hindrance in profitable opportunity from technical trades. They commented it is unlikely that trade could have used technical rules evaluated by Brock and others to improve returns net of trading costs.

**Thomsett, M. C (1998**), said fundamental analysts often measure price by using a discounted cash flow model of future expected earnings. This approach relies on research into basic financial information to forecast profits, supply and demand, industry strength, management ability, and other intrinsic matters affecting a security's market value and growth potential.

**Edwards, R. D. Magee, J (2001),** observed technical analysis relies on chart pattern recognition and attempts to anticipate the direction of a price movement through comparison with similar historical chart patterns. This approach assumes that security prices are determined solely by the interaction of market demand and supply, that prices tend to move in trends, that shifts in demand and supply cause trend reversals that can be detected in charts, and that chart patterns repeat themselves.

**Nath (2001),** found presence of long-term memory while analyzing stocks traded in the Indian stock market. He found that movement of stock prices in India does not follow a random movement.

**Singh & Prabakaran (2008),** studied the returns of the Indian stock markets using various statistical tests. They found the presence of dependencies and memory feedbacks in the returns of Indian stock market. They performed Rescaled range analysis to estimate Hurst's exponent and found that the Indian capital markets are not random.

**Mitra (2010),** analyzed the profitability of moving average based trading rules in the Indian stock market using four stock index series. The study found that most technical trading rules are able to capture market movements in Indian stock market reasonably well and give significant positive returns. However, these returns are not exploitable fully because of real world transaction costs

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## OBJECTIVES OF THE STUDY

- To examine the short-term price movement of selective banking sector scripts namely Punjab National Bank and Bank of Baroda through technical indicators.
- To find out the advance and decline that has occurred in the stock market by comparing NSE as a bench marking technique.
- To formulate buying and selling strategy for Punjab National Bank and Bank of Baroda through various technical indicators.

## RESEARCH METHODOLOGY

### METHODS OF DATA COLLECTION

For this purpose some data have been collected basically from secondary sources:

### SECONDARY SOURCE

Since the study is mainly focused on short-term price movement of banking sector stock through technical analysis for 4 months and the researcher had given immense importance to collect secondary data from various investment websites. Two public sector banks were considered to analyze the short-term price movement of the company.

- Punjab National Bank
- Bank of Baroda

### TOOLS AND TECHNIQUES USED

The following tools were applied to analysis the short-term price movement of selective banking sector scripts through technical analysis:

### TECHNICAL INDICATORS

1. Relative Strength Index
2. Rate Of Change
3. Breadth of the Market.

### STATISTICAL TOOLS

1. Beta and alpha
2. Correlation
3. Simple and Exponential Moving Average.

### ANALYSIS OF FINANCIAL TOOLS

RELATIVE STRENGTH INDEX

It is an oscillator used to identify the inherent technical strength and weakness of a particular scrip or market. RSI can be calculated for a script by adopting the following formula.

$$RSI = 100 - \left[ \frac{100}{1+Rs} \right]$$

$$Rs = \frac{\text{Average Gain Per Day}}{\text{Average Loss Per Day}}$$

The RSI can be calculated for any number of days depending on the wish of the technical analyst and the time frame of trading adopted in a particular stock market.

### RATE OF CHANGE

Rate of change indicator or ROC measure the rate of change between the current price and the price 'n' number of days in the past. ROC helps to find out the overbought and oversold position of a script. It is also useful in identifying the trend reversal. Closing prices are used to calculate the ROC.

$$ROC\ I = \frac{\text{Today's Price}}{\text{Price 'n' days back}} \times 100$$

$$ROC\ II = \frac{\text{Today's Price}}{\text{Price 'n' days back}} \times 100 - 100$$

### BREADTH OF THE MARKET

The breadth of market is the term often used to study the advances and declines that have occurred in the stock market. Advances mean the number of shares whose price has increased from the previous day's trading. Decline indicates the number of shares whose prices have fallen from the previous day's trading. The net difference between the number of stocks advanced and declined during the same period is the "BREADTH OF THE MARKET". A cumulative index of net difference measures the market breadth.

### BETA

Beta is the slope of the characteristic regression line. Beta describes the relationship between the stock's return and the index return.

$$\beta = \frac{n\Sigma xy - (\Sigma x)\,\Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

### ALPHA

The intercept of the characteristic regression line is alpha i.e. the distance between the intersection and the horizontal axis. It indicates that the stock return is independent of the market return.

$$\alpha = Y - \beta X$$

### CORRELATION

Correlation is an analysis of the co variation between two or more variables. The correlation co-efficient measures the nature and the extent of relationship between the stock market index return and stock return in a particular period.

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{n\Sigma x2 - (\Sigma x)^2}\ \sqrt{n\Sigma y2 - (\Sigma y)^2}}$$

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**MOVING AVERAGE**

Moving average method is a simple device of reducing fluctuations and obtaining trend values with a fair degree of accuracy.. In this study two types of moving average are considered they are:

- Simple Moving Average
- Exponential Moving Average.

## ANALYSIS AND INTERPRETATION

**TABLE 1.1: RATE OF CHANGE FOR BANK OF BARODA AND PUNJAB NATIONAL BANK**

| Date | Price | ROC – I (%) | ROC -II (%) | Price | ROC – I (%) | ROC -II (%) |
|---|---|---|---|---|---|---|
| 8-Nov-10 | 1031.4 | | | 1360.65 | | |
| 9-Nov-10 | 1011.15 | | | 1385.4 | | |
| 10-Nov-10 | 1021.25 | | | 1367.1 | | |
| 11-Nov-10 | 1006.8 | | | 1349.4 | | |
| 12-Nov-10 | 982.25 | | | 1324.95 | | |
| 15-Nov-10 | 985.65 | | | 1333.45 | | |
| 16-Nov-10 | 972.05 | | | 1319.85 | | |
| 18-Nov-10 | 959.7 | 93.05 | -6.95 | 1303.2 | 95.78 | -4.22 |
| 19-Nov-10 | 936.45 | 92.61 | -7.39 | 1286.05 | 92.83 | -7.17 |
| 22-Nov-10 | 966.65 | 94.65 | -5.35 | 1307.45 | 95.64 | -4.36 |
| 23-Nov-10 | 963.8 | 95.73 | -4.27 | 1305.35 | 96.74 | -3.26 |
| 24-Nov-10 | 928.05 | 94.48 | -5.52 | 1265.8 | 95.54 | -4.46 |
| 25-Nov-10 | 896.2 | 90.92 | -9.08 | 1183.6 | 88.76 | -11.24 |
| 26-Nov-10 | 894.35 | 92.01 | -7.99 | 1151.45 | 87.24 | -12.76 |
| 29-Nov-10 | 910.8 | 94.90 | -5.10 | 1176.15 | 90.25 | -9.75 |
| 30-Nov-10 | 937.25 | 100.09 | 0.09 | 1218.6 | 94.76 | -5.24 |
| 1-Dec-10 | 955.55 | 98.85 | -1.15 | 1250.45 | 95.64 | -4.36 |
| 2-Dec-10 | 968.35 | 100.47 | 0.47 | 1271 | 97.37 | -2.63 |
| 3-Dec-10 | 959.2 | 103.36 | 3.36 | 1274.05 | 100.65 | 0.65 |
| 6-Dec-10 | 927.3 | 103.47 | 3.47 | 1227.1 | 103.68 | 3.68 |
| 7-Dec-10 | 902.55 | 100.92 | 0.92 | 1196.95 | 103.95 | 3.95 |
| 8-Dec-10 | 892.5 | 97.99 | -2.01 | 1180.35 | 100.36 | 0.36 |
| 9-Dec-10 | 880.35 | 93.93 | -6.07 | 1172.15 | 96.19 | -3.81 |
| 10-Dec-10 | 880.05 | 92.10 | -7.90 | 1199.15 | 95.90 | -4.10 |
| 13-Dec-10 | 885 | 91.39 | -8.61 | 1227.35 | 96.57 | -3.43 |
| 14-Dec-10 | 904.3 | 94.28 | -5.72 | 1235.7 | 96.99 | -3.01 |
| 15-Dec-10 | 883.15 | 95.24 | -4.76 | 1200.9 | 97.86 | -2.14 |
| 16-Dec-10 | 893.5 | 99.00 | -1.00 | 1211.55 | 101.22 | 1.22 |
| 20-Dec-10 | 888 | 99.50 | -0.50 | 1205.45 | 102.13 | 2.13 |
| 21-Dec-10 | 893.3 | 101.47 | 1.47 | 1215.85 | 103.73 | 3.73 |
| 22-Dec-10 | 892.6 | 101.43 | 1.43 | 1200.5 | 100.11 | 0.11 |
| 23-Dec-10 | 889.85 | 100.55 | 0.55 | 1202.9 | 98.01 | -1.99 |
| 24-Dec-10 | 891.7 | 98.61 | -1.39 | 1215.45 | 98.36 | -1.64 |
| 27-Dec-10 | 885.8 | 100.30 | 0.30 | 1207.7 | 100.57 | 0.57 |
| 28-Dec-10 | 889.45 | 99.55 | -0.45 | 1216.8 | 100.43 | 0.43 |
| 29-Dec-10 | 891.55 | 100.40 | 0.40 | 1223.9 | 101.53 | 1.53 |
| 30-Dec-10 | 899.75 | 100.72 | 0.72 | 1215.95 | 100.01 | 0.01 |
| 31-Dec-10 | 896.7 | 100.46 | 0.46 | 1222 | 101.79 | 1.79 |
| 3-Jan-11 | 892.3 | 100.28 | 0.28 | 1222.75 | 101.65 | 1.65 |
| 4-Jan-11 | 878.05 | 98.47 | -1.53 | 1220.75 | 100.44 | 0.44 |
| 5-Jan-11 | 875.35 | 98.82 | -1.18 | 1205.5 | 99.82 | -0.18 |
| 6-Jan-11 | 838.55 | 94.28 | -5.72 | 1191.15 | 97.89 | -2.11 |
| 7-Jan-11 | 848.9 | 95.22 | -4.78 | 1168.7 | 95.49 | -4.51 |
| 10-Jan-11 | 848.55 | 94.31 | -5.69 | 1151.8 | 94.72 | -5.28 |
| 11-Jan-11 | 859.9 | 95.90 | -4.10 | 1174.2 | 96.09 | -3.91 |
| 12-Jan-11 | 855.2 | 95.84 | -4.16 | 1191.9 | 97.48 | -2.52 |
| 13-Jan-11 | 829.8 | 94.50 | -5.50 | 1133.65 | 92.87 | -7.13 |
| 14-Jan-11 | 827.05 | 94.48 | -5.52 | 1119.05 | 92.83 | -7.17 |
| 17-Jan-11 | 829.45 | 98.91 | -1.09 | 1134 | 95.20 | -4.80 |
| 18-Jan-11 | 812.9 | 95.76 | -4.24 | 1147 | 98.14 | -1.86 |
| 19-Jan-11 | 825.85 | 97.32 | -2.68 | 1141.4 | 99.10 | -0.90 |
| 20-Jan-11 | 824.4 | 95.87 | -4.13 | 1141.4 | 97.21 | -2.79 |
| 21-Jan-11 | 836.8 | 97.85 | -2.15 | 1125.35 | 94.42 | -5.58 |
| 24-Jan-11 | 873.5 | 105.27 | 5.27 | 1150.1 | 101.45 | 1.45 |
| 25-Jan-11 | 868.9 | 105.06 | 5.06 | 1137.8 | 101.68 | 1.68 |
| 27-Jan-11 | 843.45 | 101.69 | 1.69 | 1108.65 | 97.76 | -2.24 |
| 28-Jan-11 | 834.3 | 102.63 | 2.63 | 1093.8 | 95.36 | -4.64 |
| 31-Jan-11 | 869.5 | 105.29 | 5.29 | 1104.45 | 96.76 | -3.24 |
| 1-Feb-11 | 855.25 | 103.74 | 3.74 | 1101 | 96.46 | -3.54 |
| 2-Feb-11 | 860.35 | 102.81 | 2.81 | 1079.95 | 95.97 | -4.03 |
| 3-Feb-11 | 857.2 | 98.13 | -1.87 | 1084.95 | 94.34 | -5.66 |
| 4-Feb-11 | 832.15 | 95.77 | -4.23 | 1059.25 | 93.10 | -6.90 |

Source: (*www.nseindia.com*)

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**TABLE - 1.2: CALCULATION OF RATE OF CHANGE**

| ROC | BANK OF BARODA | PUNJAB NATIONAL BANK |
|---|---|---|
| ROC I | 959.7/1031.4*100 = **93.05** | 1303.2/1360.65*100 = **95.88** |
| ROC I I | 959.7/1031.4*100-100 = **-6.95** | 1303.3/1360.65*100-100 = **-4.22** |

**FIG 1.1: RATE OF CHANGE FOR BANK OF BARODA**



**FIG 1.2: RATE OF CHANGE FOR PUNJAB NATIONAL BANK**



**INTERPRETATION**

If the rate of change for a script reaches the historic high values, the script is in overbought region and a fall in the value can be anticipated in the near future. Likewise, if the rate of change for a script reaches the historic low value, the script is in the oversold region and a rise in the script's price can be anticipated. Technical analysis suggests that investors can sell the scrip in the overbought region and buy it in the oversold region. Hence from the analysis of data it has been observed that the share price of Bank of Baroda and Punjab National Bank fluctuate daily and it is very difficult to predict as it is not constant.

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**TABLE 1.3: RELATIVE STRENGTH INDEX FOR BANK OF BARODA AND PUNJAB NATIONAL BANK**

| Date | Price | Gain | Loss | Price | Gain | Loss |
|---|---|---|---|---|---|---|
| 8-Nov-10 | 1031.4 | | | 1360.65 | | |
| 9-Nov-10 | 1011.15 | | 20.25 | 1385.4 | 24.75 | |
| 10-Nov-10 | 1021.25 | 10.1 | | 1367.1 | | 18.3 |
| 11-Nov-10 | 1006.8 | | 14.45 | 1349.4 | | 17.7 |
| 12-Nov-10 | 982.25 | | 24.55 | 1324.95 | | 24.45 |
| 15-Nov-10 | 985.65 | 3.4 | | 1333.45 | 8.5 | |
| 16-Nov-10 | 972.05 | | 13.6 | 1319.85 | | 13.6 |
| 18-Nov-10 | 959.7 | | 12.35 | 1303.2 | | 16.65 |
| 19-Nov-10 | 936.45 | | 23.25 | 1286.05 | | 17.15 |
| 22-Nov-10 | 966.65 | 30.2 | | 1307.45 | 21.4 | |
| 23-Nov-10 | 963.8 | | 2.85 | 1305.35 | | 2.1 |
| 24-Nov-10 | 928.05 | | 35.75 | 1265.8 | | 39.55 |
| 25-Nov-10 | 896.2 | | 31.85 | 1183.6 | | 82.2 |
| 26-Nov-10 | 894.35 | | 1.85 | 1151.45 | | 32.15 |
| 29-Nov-10 | 910.8 | 16.45 | | 1176.15 | 24.7 | |
| 30-Nov-10 | 937.25 | 26.45 | | 1218.6 | 42.45 | |
| 1-Dec-10 | 955.55 | 18.3 | | 1250.45 | 31.85 | |
| 2-Dec-10 | 968.35 | 12.8 | | 1271 | 20.55 | |
| 3-Dec-10 | 959.2 | | 9.15 | 1274.05 | 3.05 | |
| 6-Dec-10 | 927.3 | | 31.9 | 1227.1 | | 46.95 |
| 7-Dec-10 | 902.55 | | 24.75 | 1196.95 | | 30.15 |
| 8-Dec-10 | 892.5 | | 10.05 | 1180.35 | | 16.6 |
| 9-Dec-10 | 880.35 | | 12.15 | 1172.15 | | 8.2 |
| 10-Dec-10 | 880.05 | | 0.3 | 1199.15 | 27 | |
| 13-Dec-10 | 885 | 4.95 | | 1227.35 | 28.2 | |
| 14-Dec-10 | 904.3 | 19.3 | | 1235.7 | 8.35 | |
| 15-Dec-10 | 883.15 | | 21.15 | 1200.9 | | 34.8 |
| 16-Dec-10 | 893.5 | 10.35 | | 1211.55 | 10.65 | |
| 20-Dec-10 | 888 | | 5.5 | 1205.45 | | 6.1 |
| 21-Dec-10 | 893.3 | 5.3 | | 1215.85 | 10.4 | |
| 22-Dec-10 | 892.6 | | 0.7 | 1200.5 | | 15.35 |
| 23-Dec-10 | 889.85 | | 2.75 | 1202.9 | 2.4 | |
| 24-Dec-10 | 891.7 | 1.85 | | 1215.45 | 12.55 | |
| 27-Dec-10 | 885.8 | | 5.9 | 1207.7 | | 7.75 |
| 28-Dec-10 | 889.45 | 3.65 | | 1216.8 | 9.1 | |
| 29-Dec-10 | 891.55 | 2.1 | | 1223.9 | 7.1 | |
| 30-Dec-10 | 899.75 | 8.2 | | 1215.95 | | 7.95 |
| 31-Dec-10 | 896.7 | | 3.05 | 1222 | 6.05 | |
| 3-Jan-11 | 892.3 | | 4.4 | 1222.75 | 0.75 | |
| 4-Jan-11 | 878.05 | | 14.25 | 1220.75 | | 2 |
| 5-Jan-11 | 875.35 | | 2.7 | 1205.5 | | 15.25 |
| 6-Jan-11 | 838.55 | | 36.8 | 1191.15 | | 14.35 |
| 7-Jan-11 | 848.9 | 10.35 | | 1168.7 | | 22.45 |
| 10-Jan-11 | 848.55 | | 0.35 | 1151.8 | | 16.9 |
| 11-Jan-11 | 859.9 | 11.35 | | 1174.2 | 22.4 | |
| 12-Jan-11 | 855.2 | | 4.7 | 1191.9 | 17.7 | |
| 13-Jan-11 | 829.8 | | 25.4 | 1133.65 | | 58.25 |
| 14-Jan-11 | 827.05 | | 2.75 | 1119.05 | | 14.6 |
| 17-Jan-11 | 829.45 | 2.4 | | 1134 | 14.95 | |
| 18-Jan-11 | 812.9 | | 16.55 | 1147 | 13 | |
| 19-Jan-11 | 825.85 | 12.95 | | 1141.4 | | 5.6 |
| 20-Jan-11 | 824.4 | | 1.45 | 1141.4 | 0 | |
| 21-Jan-11 | 836.8 | 12.4 | | 1125.35 | | 16.05 |
| 24-Jan-11 | 873.5 | 36.7 | | 1150.1 | 24.75 | |
| 25-Jan-11 | 868.9 | | 4.6 | 1137.8 | | 12.3 |
| 27-Jan-11 | 843.45 | | 25.4 | 1108.65 | | 29.15 |
| 28-Jan-11 | 834.3 | | 9.15 | 1093.8 | | 14.85 |
| 31-Jan-11 | 869.5 | 35.2 | | 1104.45 | 10.65 | |
| 1-Feb-11 | 855.25 | | 14.25 | 1101 | | 3.45 |
| 2-Feb-11 | 860.35 | 5.1 | | 1079.95 | | 21.05 |
| 3-Feb-11 | 857.2 | | 3.15 | 1084.95 | 5 | |
| 4-Feb-11 | 832.15 | | 25.05 | 1059.25 | | 25.7 |
| TOTAL | | 299.85 | 499.05 | | 408.25 | 709.65 |

Source: (*www.nseindia.com*)

BANK OF BARODA

Gain = 299.85/22 = 13.63
Loss = 499.05/39 = 12.80
RS = 13.63/12.80 = 1.06

PUNJAB NATIONAL BANK

Gain = 408.25/27 = 15.12
Loss = 709.65/34 =20.88
Rs = 15.12/20.88 0.73

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$$RSI = 100 - \left[\frac{100}{1+Rs}\right]$$

= 100 − 48.54
**= 51.46**

$$RSI = 100 - \left[\frac{100}{1+Rs}\right]$$

= 100 − 57.80
**= 42.2**

**TABLE 1.4: RELATIVE STRENGTH INDEX FOR BANKS**

| Bank | Common Value | *Calculated Value | RSI |
|---|---|---|---|
| Bank of Baroda | 100 | 48.54 | 51.46 |
| Punjab National Bank | 100 | 57.80 | 42.2 |

*Calculated value = (100/1+RS)

In general RSI ranges between 30 and 70. Below 30 classifies oversold and above 70 distinguishes overbought. Many traders look at RSI falling below 70 as a bearish signal and breaking above 30 as a bullish indicator; however, many also look at the 50 mark as a transition of ultimate trend reversal.

The broad rule is, if the RSI is below "seventy" it indicates the bearish signal & if the RSI is above "thirty" it indicates the bullish signal. From the above analysis it can be observed that stocks of the banks are in support zone defined as a lower range for bull market.

**TABLE 1.5: CALCULATION OF BETA BETWEEN INDEX RETURN AND MARKET RETURN**

| Bank | *Calculated Value 1 | *Calculated Value 2 | Beta |
|---|---|---|---|
| Bank of Baroda | 3872.26 | 5139.32 | 0.75 |
| Punjab National Bank | 5479.36 | 5139.32 | 1.07 |

**FIG 1.3: CALCULATION OF BETA BETWEEN INDEX RETURN AND MARKET RETURN**



*Calculated Value 1 = nΣxy - (Σx)(Σy)
*Calculated Value 2 = nΣx² - (Σx) ²

**INTERPRETATION**

One per cent changes in market index return causes 0.5 per cent change in stock return. The stock is less volatile compared to the market. When stocks with more than 1 beta value is considered to be risky. From the above analysis it has been observed that the scrip's of the bank like Axis Bank, Punjab National Bank and ICICI Bank is considered to be risky and the share price of Bank of Baroda is less volatile compared to market.

**TABLE 1.6: ANALYSIS OF ALPHA BETWEEN INDEX AND MARKET RETURN**

| Bank | *    Y | * β X | α |
|---|---|---|---|
| Bank of Baroda | -0.33 | 0.18 | -0.15 |
| Punjab National Bank | -0.39 | 0.26 | -0.13 |

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**FIG 1.4: ANALYSIS OF ALPHA BETWEEN INDEX AND MARKET RETURN**



* $\overline{Y} =$      Y/n

* $\beta \overline{X} =$      Beta value * X/n

**INTERPRETATION**

It indicates that the stock return is independent of the market return. Positive alpha indicates the manager produced a return greater than expected for the risk taken and negative alpha indicates the investor has not adequately rewarded investors for the risk taken. From the above analysis, it has been observed that all the banks are not adequately rewarded investors for the risk taken and it indicates that stock return is independent of the market return for all banks.

**TABLE 1.7: CORRELATION BETWEEN INDEX RETURN AND MARKET RETURN**

| Bank | Calculated Value 1 | Calculated Value 2 | Correlation |
|---|---|---|---|
| Bank of Baroda | 3872.26 | 8042.90 | 0.48 |
| Punjab National Bank | 5479.36 | 8159.64 | 0.67 |

**FIG 1.5: CORRELATION BETWEEN INDEX RETURN AND MARKET RETURN**

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*Calculated Value 1 =  nΣxy – (Σx)(Σy)

*Calculated Value 2 = _____

√nΣx² - (Σx) ²    √ nΣy² - (Σy) ²

**INTERPRETATION**

From the analysis of data, it has been observed that in case of Bank of Baroda there is a "Lower level" of positive correlation exists between stock return and NSE index return however Punjab National Bank indicates "Higher degree" of positive correlation

**TABLE 1.8: BREADTH OF THE MARKET**

| Day | Advances | Declines | Net | Breadth | NSE |
|---|---|---|---|---|---|
| 8-Nov-10 | 638 | 799 | -161 | -161 | 6273.2 |
| 9-Nov-10 | 835 | 583 | 252 | 91 | 6301.55 |
| 10-Nov-10 | 826 | 595 | 231 | 322 | 6275.7 |
| 11-Nov-10 | 463 | 964 | -501 | -179 | 6194.25 |
| 12-Nov-10 | 211 | 1232 | -1021 | -1200 | 6071.65 |
| 15-Nov-10 | 528 | 902 | -374 | -1574 | 6121.6 |
| 16-Nov-10 | 150 | 1289 | -1139 | -2713 | 5988.7 |
| 18-Nov-10 | 426 | 1011 | -585 | -3298 | 5998.8 |
| 19-Nov-10 | 215 | 1225 | -1010 | -4308 | 5890.3 |
| 22-Nov-10 | 983 | 447 | 536 | -3772 | 6010 |
| 23-Nov-10 | 274 | 1163 | -889 | -4661 | 5934.75 |
| 24-Nov-10 | 513 | 905 | -392 | -5053 | 5865.75 |
| 25-Nov-10 | 246 | 1193 | -947 | -6000 | 5799.75 |
| 26-Nov-10 | 162 | 1290 | -1128 | -7128 | 5751.95 |
| 29-Nov-10 | 735 | 693 | 42 | -7086 | 5830 |
| 30-Nov-10 | 1076 | 358 | 718 | -6368 | 5862.7 |
| 1-Dec-10 | 1271 | 169 | 1102 | -5266 | 5960.9 |
| 2-Dec-10 | 952 | 466 | 486 | -4780 | 6011.7 |
| 3-Dec-10 | 229 | 1212 | -983 | -5763 | 5992.8 |
| 6-Dec-10 | 571 | 856 | -285 | -6048 | 5992.25 |
| 7-Dec-10 | 336 | 1090 | -754 | -6802 | 5976.55 |
| 8-Dec-10 | 158 | 1270 | -1112 | -7914 | 5903.7 |
| 9-Dec-10 | 71 | 1373 | -1302 | -9216 | 5766.5 |
| 10-Dec-10 | 1103 | 329 | 774 | -8442 | 5857.35 |
| 13-Dec-10 | 1103 | 326 | 777 | -7665 | 5907.65 |
| 14-Dec-10 | 1071 | 350 | 721 | -6944 | 5944.1 |
| 15-Dec-10 | 340 | 1075 | -735 | -7679 | 5892.3 |
| 16-Dec-10 | 780 | 625 | 155 | -7524 | 5948.75 |
| 20-Dec-10 | 734 | 688 | 46 | -7478 | 5947.05 |
| 21-Dec-10 | 939 | 485 | 454 | -7024 | 6000.65 |
| 22-Dec-10 | 761 | 655 | 106 | -6918 | 5984.4 |
| 23-Dec-10 | 596 | 811 | -215 | -7133 | 5980 |
| 24-Dec-10 | 804 | 602 | 202 | -6931 | 6011.6 |
| 27-Dec-10 | 688 | 730 | -42 | -6973 | 5998.1 |
| 28-Dec-10 | 686 | 718 | -32 | -7005 | 5996 |
| 29-Dec-10 | 938 | 467 | 471 | -6534 | 6060.35 |
| 30-Dec-10 | 811 | 608 | 203 | -6331 | 6101.85 |
| 31-Dec-10 | 1041 | 379 | 662 | -5669 | 6134.5 |
| 3-Jan-11 | 1087 | 347 | 740 | -4929 | 6157.6 |
| 4-Jan-11 | 650 | 790 | -140 | -5069 | 6146.35 |
| 5-Jan-11 | 319 | 1113 | -794 | -5863 | 6079.8 |
| 6-Jan-11 | 355 | 1069 | -714 | -6577 | 6048.25 |
| 7-Jan-11 | 128 | 1317 | -1189 | -7766 | 5904.6 |
| 10-Jan-11 | 173 | 1273 | -1100 | -8866 | 5762.85 |
| 11-Jan-11 | 458 | 964 | -506 | -9372 | 5754.1 |
| 12-Jan-11 | 1032 | 395 | 637 | -8735 | 5863.25 |
| 13-Jan-11 | 459 | 981 | -522 | -9257 | 5751.9 |
| 14-Jan-11 | 314 | 1121 | -807 | -10064 | 5654.55 |
| 17-Jan-11 | 322 | 1117 | -795 | -10859 | 5654.75 |
| 18-Jan-11 | 771 | 647 | 124 | -10735 | 5724.05 |
| 19-Jan-11 | 679 | 722 | -43 | -10778 | 5691.05 |
| 20-Jan-11 | 751 | 671 | 80 | -10698 | 5711.6 |
| 21-Jan-11 | 721 | 671 | 50 | -10648 | 5696.5 |
| 24-Jan-11 | 826 | 570 | 256 | -10392 | 5743.25 |
| 25-Jan-11 | 495 | 928 | -433 | -10825 | 5687.4 |
| 27-Jan-11 | 359 | 1062 | -703 | -11528 | 5604.3 |
| 28-Jan-11 | 147 | 1311 | -1164 | -12692 | 5512.15 |
| 31-Jan-11 | 477 | 948 | -471 | -13163 | 5505.9 |
| 1-Feb-11 | 376 | 1050 | -674 | -13837 | 5417.2 |
| 2-Feb-11 | 730 | 685 | 45 | -13792 | 5432 |
| 3-Feb-11 | 985 | 443 | 542 | -13250 | 5526.75 |
| 4-Feb-11 | 327 | 1098 | -771 | -14021 | 5395.75 |

Source: (*www.nseindia.com*)

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**FIG 1.6: BREADTH OF THE MARKET**



**CALCULATION FOR BREADTH OF THE MARKET**

Net = 638 – 799 = -**161**          Breadth = -**161**

Net = 835 – 583 = **252**          Breadth = -161+252 **= 91**

Net = 826 – 595 = **231**          Breadth = 91+231 = **322**

Net = 463 – 964 **= -510**          Breadth = 322+(-501) = -**179**

**INTERPRETATION**

Advance and decline line is compared with the market index. Generally in a bull market, a bearish signal is given when the A/D line slopes down while the NSE index is rising. In a bear market, a bullish signal is given when the A/D line begins rising as the nifty is declining. From the above analysis it has been observed that it is a bear market where bullish signal is given because the A/D line begins rising as the nifty is declining to new low. When the A/D spread crosses above its zero line, this means more stocks are advancing than declining, and vice versa.

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**TABLE 1.9: SIMPLE AND EXPONENTIAL MOVING AVERAGE FOR BANK OF BARODA AND PUNJAB NATIONAL BANK**

| Date | Price | 10days SMA | Smoothing constant 2/(N+1) | 10days EMA | Price | 10days SMA | Smoothing Constant 2/(N+1) | 10days EMA |
|---|---|---|---|---|---|---|---|---|
| 8-Nov-10 | 1031.4 | | | | 1360.65 | | | |
| 9-Nov-10 | 1011.15 | | | | 1385.4 | | | |
| 10-Nov-10 | 1021.25 | | | | 1367.1 | | | |
| 11-Nov-10 | 1006.8 | | | | 1349.4 | | | |
| 12-Nov-10 | 982.25 | | | | 1324.95 | | | |
| 15-Nov-10 | 985.65 | | | | 1333.45 | | | |
| 16-Nov-10 | 972.05 | | | | 1319.85 | | | |
| 18-Nov-10 | 959.7 | | | | 1303.2 | | | |
| 19-Nov-10 | 936.45 | | | | 1286.05 | | | |
| 22-Nov-10 | 966.65 | 987.34 | 0.1818 | 987.34 | 1307.45 | 1333.75 | | 1333.75 |
| 23-Nov-10 | 963.8 | 980.58 | 0.1818 | 986.11 | 1305.35 | 1328.22 | 0.1818 | 1332.74 |
| 24-Nov-10 | 928.05 | 972.27 | 0.1818 | 983.59 | 1265.8 | 1316.26 | 0.1818 | 1329.75 |
| 25-Nov-10 | 896.2 | 959.76 | 0.1818 | 979.26 | 1183.6 | 1297.91 | 0.1818 | 1323.96 |
| 26-Nov-10 | 894.35 | 948.52 | 0.1818 | 973.67 | 1151.45 | 1278.11 | 0.1818 | 1315.63 |
| 29-Nov-10 | 910.8 | 941.37 | 0.1818 | 967.80 | 1176.15 | 1263.23 | 0.1818 | 1306.10 |
| 30-Nov-10 | 937.25 | 936.53 | 0.1818 | 962.11 | 1218.6 | 1251.75 | 0.1818 | 1296.22 |
| 1-Dec-10 | 955.55 | 934.88 | 0.1818 | 957.16 | 1250.45 | 1244.81 | 0.1818 | 1286.87 |
| 2-Dec-10 | 968.35 | 935.75 | 0.1818 | 953.27 | 1271 | 1241.59 | 0.1818 | 1278.64 |
| 3-Dec-10 | 959.2 | 938.02 | 0.1818 | 950.50 | 1274.05 | 1240.39 | 0.1818 | 1271.69 |
| 6-Dec-10 | 927.3 | 934.09 | 0.1818 | 947.51 | 1227.1 | 1232.35 | 0.1818 | 1264.54 |
| 7-Dec-10 | 902.55 | 927.96 | 0.1818 | 943.96 | 1196.95 | 1221.51 | 0.1818 | 1256.72 |
| 8-Dec-10 | 892.5 | 924.41 | 0.1818 | 940.40 | 1180.35 | 1212.97 | 0.1818 | 1248.76 |
| 9-Dec-10 | 880.35 | 922.82 | 0.1818 | 937.21 | 1172.15 | 1211.82 | 0.1818 | 1242.05 |
| 10-Dec-10 | 880.05 | 921.39 | 0.1818 | 934.33 | 1199.15 | 1216.59 | 0.1818 | 1237.42 |
| 13-Dec-10 | 885 | 918.81 | 0.1818 | 931.51 | 1227.35 | 1221.71 | 0.1818 | 1234.56 |
| 14-Dec-10 | 904.3 | 915.52 | 0.1818 | 928.60 | 1235.7 | 1223.42 | 0.1818 | 1232.54 |
| 15-Dec-10 | 883.15 | 908.28 | 0.1818 | 924.91 | 1200.9 | 1218.47 | 0.1818 | 1229.98 |
| 16-Dec-10 | 893.5 | 900.79 | 0.1818 | 920.52 | 1211.55 | 1212.52 | 0.1818 | 1226.81 |
| 20-Dec-10 | 888 | 893.67 | 0.1818 | 915.64 | 1205.45 | 1205.66 | 0.1818 | 1222.96 |
| 21-Dec-10 | 893.3 | 890.27 | 0.1818 | 911.03 | 1215.85 | 1204.54 | 0.1818 | 1219.61 |
| 22-Dec-10 | 892.6 | 889.28 | 0.1818 | 907.07 | 1200.5 | 1204.89 | 0.1818 | 1216.94 |
| 23-Dec-10 | 889.85 | 889.01 | 0.1818 | 903.79 | 1202.9 | 1207.15 | 0.1818 | 1215.16 |
| 24-Dec-10 | 891.7 | 890.15 | 0.1818 | 901.31 | 1215.45 | 1211.48 | 0.1818 | 1214.49 |
| 27-Dec-10 | 885.8 | 890.72 | 0.1818 | 899.38 | 1207.7 | 1212.33 | 0.1818 | 1214.10 |
| 28-Dec-10 | 889.45 | 891.17 | 0.1818 | 897.89 | 1216.8 | 1211.28 | 0.1818 | 1213.59 |
| 29-Dec-10 | 891.55 | 889.89 | 0.1818 | 896.44 | 1223.9 | 1210.1 | 0.1818 | 1212.95 |
| 30-Dec-10 | 899.75 | 891.55 | 0.1818 | 895.55 | 1215.95 | 1211.60 | 0.1818 | 1212.71 |
| 31-Dec-10 | 896.7 | 891.87 | 0.1818 | 894.88 | 1222 | 1212.65 | 0.1818 | 1212.70 |
| 3-Jan-11 | 892.3 | 892.30 | 0.1818 | 894.41 | 1222.75 | 1214.38 | 0.1818 | 1213.00 |
| 4-Jan-11 | 878.05 | 890.78 | 0.1818 | 893.75 | 1220.75 | 1214.87 | 0.1818 | 1213.34 |
| 5-Jan-11 | 875.35 | 889.05 | 0.1818 | 892.89 | 1205.5 | 1215.37 | 0.1818 | 1213.71 |
| 6-Jan-11 | 838.55 | 883.92 | 0.1818 | 891.26 | 1191.15 | 1214.19 | 0.1818 | 1213.80 |
| 7-Jan-11 | 848.9 | 879.64 | 0.1818 | 889.15 | 1168.7 | 1209.52 | 0.1818 | 1213.02 |
| 10-Jan-11 | 848.55 | 875.92 | 0.1818 | 886.74 | 1151.8 | 1203.93 | 0.1818 | 1211.37 |
| 11-Jan-11 | 859.9 | 872.96 | 0.1818 | 884.24 | 1174.2 | 1199.67 | 0.1818 | 1209.24 |
| 12-Jan-11 | 855.2 | 869.33 | 0.1818 | 881.53 | 1191.9 | 1196.47 | 0.1818 | 1206.92 |
| 13-Jan-11 | 829.8 | 862.33 | 0.1818 | 878.04 | 1133.65 | 1188.24 | 0.1818 | 1203.52 |
| 14-Jan-11 | 827.05 | 855.37 | 0.1818 | 873.92 | 1119.05 | 1177.94 | 0.1818 | 1198.87 |
| 17-Jan-11 | 829.45 | 849.08 | 0.1818 | 869.40 | 1134 | 1169.07 | 0.1818 | 1193.46 |
| 18-Jan-11 | 812.9 | 842.57 | 0.1818 | 864.52 | 1147 | 1161.69 | 0.1818 | 1187.68 |
| 19-Jan-11 | 825.85 | 837.62 | 0.1818 | 859.63 | 1141.4 | 1155.28 | 0.1818 | 1181.79 |
| 20-Jan-11 | 824.4 | 836.20 | 0.1818 | 855.37 | 1141.4 | 1150.31 | 0.1818 | 1176.07 |
| 21-Jan-11 | 836.8 | 834.99 | 0.1818 | 851.67 | 1125.35 | 1145.97 | 0.1818 | 1170.60 |
| 24-Jan-11 | 873.5 | 837.49 | 0.1818 | 849.09 | 1150.1 | 1145.80 | 0.1818 | 1166.09 |
| 25-Jan-11 | 868.9 | 838.39 | 0.1818 | 847.14 | 1137.8 | 1142.16 | 0.1818 | 1161.74 |
| 27-Jan-11 | 843.45 | 837.21 | 0.1818 | 845.34 | 1108.65 | 1133.84 | 0.1818 | 1156.67 |
| 28-Jan-11 | 834.3 | 837.66 | 0.1818 | 843.94 | 1093.8 | 1129.85 | 0.1818 | 1151.79 |
| 31-Jan-11 | 869.5 | 841.91 | 0.1818 | 843.57 | 1104.45 | 1128.39 | 0.1818 | 1147.54 |
| 1-Feb-11 | 855.25 | 844.49 | 0.1818 | 843.74 | 1101 | 1125.09 | 0.1818 | 1143.46 |
| 2-Feb-11 | 860.35 | 849.23 | 0.1818 | 844.74 | 1079.95 | 1118.39 | 0.1818 | 1138.90 |
| 3-Feb-11 | 857.2 | 852.37 | 0.1818 | 846.12 | 1084.95 | 1112.74 | 0.1818 | 1134.15 |
| 4-Feb-11 | 832.15 | 853.14 | 0.1818 | 847.40 | 1059.25 | 1104.53 | 0.1818 | 1128.76 |

Source: (www.nseindia.com)

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TABLE - 1.10: CALCULATION OF SIMPLE AND EXPONENTIAL MOVING AVERAGE

| BANK | 10days SMA | Smoothing Constant | 10days EMA |
|------|-----------|-------------------|-----------|
| BANK OF BARODA | 1031.4+1011.15+1021.25+1006.8+982.25+985.65+972.05+959.7+936.45+966.65 = 9873.35/10 = **987.34** | **2/(10+1) = 0.1818** | **0.1818(980.58-987.34)+987.34 = 986.11** |
| PUNJAB NATIONAL BANK | 1360.65+1385.4+1367.1+1349.4+1324.95+1333.45+1319.85+1303.2+1286.05+1307.45 = 13337.5/10 = **1333.75** | **2/(10+1) = 0.1818** | **0.1818(1328.22-333.75)+1333.75 = 1332.74** |

FIG 1.7: SIMPLE AND EXPONENTIAL MOVING AVERAGE FOR BANK OF BARODA



FIG 1.8: SIMPLE AND EXPONENTIAL MOVING AVERAGE FOR PUNJAB NATIONAL BANK



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**INTERPRETAION**

It smoothens out the short-term fluctuation, which helps in comparing the relationship between a moving average of the security price with security price itself. A buy signal is generated when the simple moving average rises above its exponential moving average and a sell signal is generated when the simple moving average falls below its exponential moving average. From the above analysis it has been observed that a buy signal is generated for Bank of Baroda because the simple moving average rises above its exponential moving average. From the above analysis it has been observed that lower degree of sell signal is generated for Punjab National Bank because the simple moving average falls below its exponential moving average.

## FINDINGS

- The Rate of Change for Bank of Baroda and Punjab national bank stock reveals that the share price movement of the stock is not constant they are volatile because it reaches both the overbought and oversold region.
- The Relative Strength Index indicates that the share price of both the bank is in support zone, which is a sign for bull market.
- The stock price of Bank of Baroda is less volatile when compared to the market index. As the beta value is more than 1 for Punjab national bank share ,it is considered to be more volatile and risky
- The negative alpha indicates that the investors are not adequately rewarded for the risk taken by them.
- The correlation analysis shows that there is a less degree of positive correlation exists between stock return of Bank of Baroda and NSE return and there is a "Higher degree" of positive correlation exists between stock return of Punjab National Bank and NSE index return.
- From the analysis of breadth of the market, it has been observed that in a bear market, bullish signal is given because the Advance/Decline line begins rising as nifty is declining to a new low.
- As the simple moving average falls below exponential moving average a sell signal is generated for the share price of banks.
- Investors are usually not as rational as they think, and the basis for buying and selling are generally difficult to understand. Generally investors are quickly rally to take advantage of even the slightest, momentary panic

## SUGGESTIONS AND RECOMMENDATIONS

- It can be suggestive that the investors can invest in Bank of Baroda and Punjab national bank stock but the rate of Change for bank stock indicates that prices are volatile.
- Since relative Strength Index is in the lower range of bull market, the investors can invest in banks stocks and make moderate earnings.
- The Bank of Baroda stock is most suitable for investors who want to take less risk because it is less volatile when compared to stock of Punjab National Bank.

## CONCLUSION

The Rate of change for bank stock is not constant. Hence the investors can buy the script when it reaches historic high value and sell the script when it reaches historic low value. The research reveals that the banks stocks are in the support zone, thus the investors can invest in Bank of Baroda and Punjab National Bank. whereas The Bank of Baroda stock is most suitable for investors who want to take less risk because it is less volatile when compared to stock of Punjab National Bank .Simple moving average and Exponential moving average smoothens the short-term price movement for finding the buying and selling signal and also predict the market. The charts do not lie but the interpretation differs from analyst to analyst based on their approach and their skill.

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# SOFTWARE DEFECTS IDENTIFICATION, PREVENTIONS AND AMPLIFICATION IN SDLC PHASES

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ABSTRACT

*The present paper finds that to detect and cure software defects is one of the best band esteemed quality activity which saves time, cost and man power. It also delivers qualited and more user friendly software product to customers.*

**KEYWORDS**
SDLC – Software Development Life Cycle.

## INTRODUCTION

In software development area there is no any such software development company which develop 100% error free software. What is Software error? Occurrence of the technical difficulty in software is the error. But when any customer complaints about software then we can conclude about error. Software error is error -resulting from bad code in some program involved in producing the erroneous result[1]. To maintain software error of defects it is necessary to concentrate over phases of SDLC "Software defect" has many interchangeable names: software bug, error, fault, failure, crash and anomaly. The institute for electrical and electronic engineering (IEEE), the standards body regulating even the software profession, defines a software bug as a programming error that causes software to malfunction. IEEE sees defect as a product anomaly when software does not conform to customer expectation and specification. A crash is an extreme case of a software defect that stops the software from further working.

## SOME SOURCES OF DEFECTS

Software defects can arise from misinterpreting customer requirements, poor programming habits, wrong programming logic, poor testing and even untested software implementation scenarios. For example, a customer specifying a blue background to a website and the developer producing a white background is a defect. Even though the website runs fine, it does not meet customer requirements.

## DEFECTS IN SDLC

Defects can occur at any phase in the software development life cycle (SDLC). The SDLC phases are requirements analysis, systems design, program design, program implementation, program testing, system testing and maintenance. Thus since defects can occur at any phase, the defect life cycle involves quality assurance at every phase. Configuration management enables defects to be recorded and tracked to removal. Thus tools for configuration management and defect tracking will be required in the defect life cycle quality assurance.

### 1. Customers don't know what they want

Due to the Technical concern behind the concept software development the customer who developes software can't have any clear idea about the problem. If software developer identifies problem from customer then customer can take care about the clear understanding about problem. Enlist all the task that to be completed by software developer. List of all the task/functions are finalised here.

### 2. Requirements change during the course of the project

The second most common problem with software projects is that the requirements defined in the first phase change as the project progresses. This may occur because as development progresses and prototypes are developed, customers are able to more clearly see problems with the original plan and make necessary course corrections; it may also occur because changes in the external environment require reshaping of the original business problem and hence necessitates a different solution than the one originally proposed. Good project managers are aware of these possibilities and typically already have backup plans in place to deal with these changes.

To solve this problem, you should:

- Have a clearly defined process for receiving, analyzing and incorporating change requests, and make your customer aware of his/her entry point into this process.
- Set milestones for each development phase beyond which certain changes are not permissible -- for example, disallowing major changes once a module reaches 75 percent completion.
- Ensure that change requests (and approvals) are clearly communicated to all stakeholders, together with their rationale, and that the master project plan is updated accordingly.

### 3. Customers doesn't follow principles

The analysis in each phase may be extended due to some long activities. Due to the assurance by developer to the customer about quality developer tries to develop Quality software. Customer can't understand this difficulty and ask for final product again and again.

To solve this problem, you should:

- Convert the software requirements specification into a project plan, detailing tasks and resources needed at each stage and modeling best-case, middle-case and worst-case scenarios.
- Ensure that the project plan takes account of available resource constraints and keeps sufficient time for testing and quality inspection.
- Enter into a conversation about deadlines with your customer, using the figures in your draft plan as supporting evidence for your statements. Assuming that your plan is reasonable, it's quite likely that the ensuing negotiation will be both productive and result in a favorable outcome for both parties.

### 4. Communication gap between customer and Developer

Often, customers and engineers fail to communicate clearly with each other because they come from different worlds and do not understand technical terms in the same way. This can lead to confusion and severe miscommunication, and an important task of a project manager, especially during the requirements analysis phase, is to ensure that both parties have a precise understanding of the deliverable and the tasks needed to achieve it.

To solve this problem, you should:

- Take notes at every meeting and disseminate these throughout the project team.
- Be consistent in your use of words. Make yourself a glossary of the terms that you're going to use right at the start, ensure all stakeholders have a copy, and stick to them consistently.

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## BEHAVIOR OF SOFTWARE DEFECTS

Basili and Boehm assembled a list of ten rules of thumb which main purpose was to highlight pitfalls in software engineering. Seven of these rules are directly related to how defects impact the project [Boehm and Basili, 2001]. First, it is 100 times more expensive to correct a defect after delivery than during the requirements or design phase. Second, 40 to 50 percent of the effort in the project is spent on rework which could have been avoided. Third, 20 percent of the defects results in 80 percent of the rework and 80 percent of the defects come from 20 percent of the modules while half of modules are almost free of defects. Developing high dependability software are often 50 percent more expensive than low dependability software, and 90 percent of the downtime comes from 10 percent of the defects. However, investing the 50 percent extra is well worth it if the software is to be maintained. Last, 40 to 50 percent of software contains defects which are nontrivial. The results described by Boehm and Basili in [Boehm and Basili, 2001] gives an impression of how software defects influence the total costs of software projects.
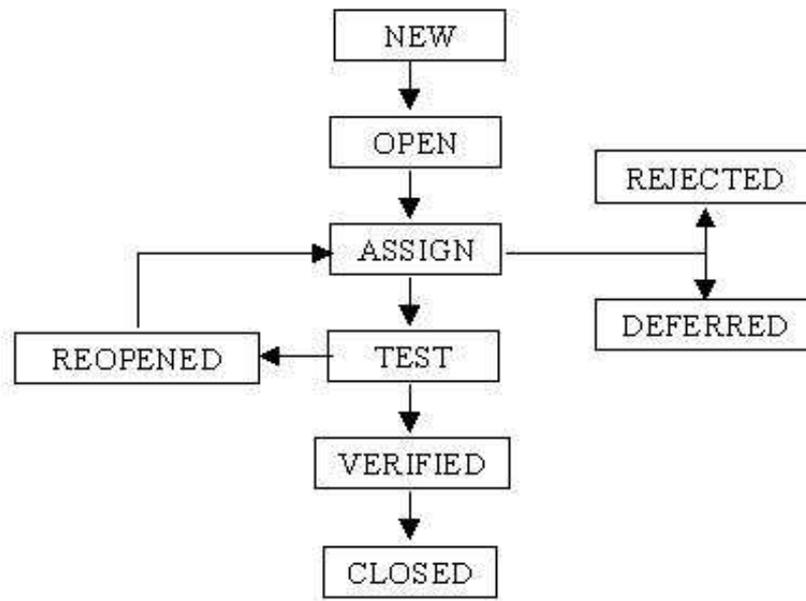


## DESCRIPTION OF VARIOUS STAGES

**1. New:** When the bug is posted for the first time, its state will be "NEW". This means that the bug is not yet approved.

**2. Open:** After a tester has posted a bug, the lead of the tester approves that the bug is genuine and he changes the state as "OPEN".

**3. Assign:** Once the lead changes the state as "OPEN", he assigns the bug to corresponding developer or developer team. The state of the bug now is changed to "ASSIGN".

**4. Test:** Once the developer fixes the bug, he has to assign the bug to the testing team for next round of testing. Before he releases the software with bug fixed, he changes the state of bug to "TEST". It specifies that the bug has been fixed and is released to testing team.

**5. Deferred:** The bug, changed to deferred state means the bug is expected to be fixed in next releases. The reasons for changing the bug to this state have many factors. Some of them are priority of the bug may be low, lack of time for the release or the bug may not have major effect on the software.

**6. Rejected:** If the developer feels that the bug is not genuine, he rejects the bug. Then the state of the bug is changed to "REJECTED".

**7. Duplicate:** If the bug is repeated twice or the two bugs mention the same concept of the bug, then one bug status is changed to "DUPLICATE".

**8. Verified:** Once the bug is fixed and the status is changed to "TEST", the tester tests the bug. If the bug is not present in the software, he approves that the bug is fixed and changes the status to "VERIFIED".

**9. Reopened:** If the bug still exists even after the bug is fixed by the developer, the tester changes the status to "REOPENED". The bug traverses the life cycle once again.

**10. Closed:** Once the bug is fixed, it is tested by the tester. If the tester feels that the bug no longer exists in the software, he changes the status of the bug to "CLOSED". This state means that the bug is fixed, tested and approved.

While defect prevention is much more effective and efficient in reducing the number of defects, most organization conducts defect discovery and removal. Discovering and removing defects is an expensive and inefficient process. It is much more efficient for an organization to conduct activities that prevent defects.

## BUG LIFE CYCLE IMPLEMENTATION GUIDELINES

- Make sure the entire team understands what each bug status exactly means. Also, make sure the bug life cycle is documented.
- Ensure that each individual clearly understands his/her responsibility as regards each bug.
- Ensure that enough detail is entered in each status change. For example, do not simply DROP a bug but provide a reason for doing so.
- If a bug tracking tool is being used, avoid entertaining any 'bug related requests' without an appropriate change in the status of the bug in the tool. Do not let anybody take shortcuts. Or else, you will never be able to get up-to-date bug metrics for analysis.

## TECHNIQUES FOR SOFTWARE DEFECT PREVENTION AND IDENTIFICATION

A quality process should produce close to zero-defect software that meets the user requirements. In this article, we will go through step-by-step, the various practices/techniques that can help you prevent defects in your software, and how to catch them if they already exist.

### TO KNOW CUSTOMER REQUIRMRNTS

When a customer provides you a requirement, it's not that you start working on it there and then (Figure 1, below). You first need to understand clearly what the customer wants. Once you have gone through the requirement, put down what you have understood. Then, get your understanding confirmed from the customer. Doubts, if any, in the requirement specification, must be clarified at this stage. Do not procrastinate or hesitate in asking your queries. If customers are many try to understand all the customers and collect common data or unambiguous data from that collection.

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**FIG. 1: REQUIREMENT WORKFLOW FOR CLARIFICATION**
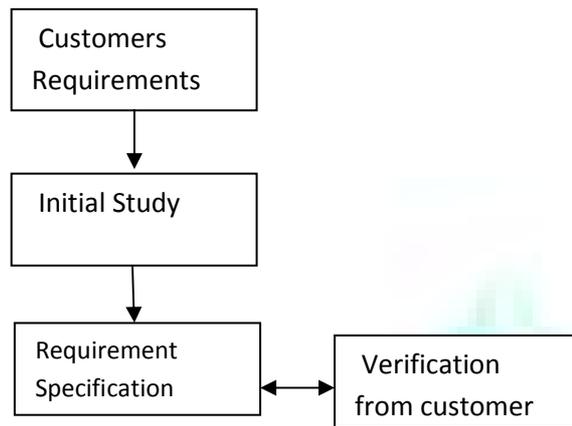


While working in development process there are many defects creeping in due to misinterpretation of the requirement specification. Fixing such defects at a later stage can prove costly. So, it is very important that you get your understanding verified from the customer.

**PEER REVIEW**

Software project development is one of the Team work activity .Functioning as a team is a skill. Delivering a high quality product is no responsibility of an individual. It's the entire team who is responsible for it. If the product fails, each team member is responsible for it.

Review is an important part of team work. Peer Review refers to participation of team members in the development and assessment of task/activity performed by an individual.

In this process, illustrated in Figure 2 below, a team member requests an artifact to be reviewed. The other team members then provide their review comments which may include corrections, suggestions and doubts on the artifact.

The artifact is then updated based on the review comments. This process is repeated till the artifact is up to satisfaction of all the team members. Of course, in case of any conflict it is the Project Leader who makes the final judgment.

**FIGURE 2: HUNTING FOR ARTIFACTS**
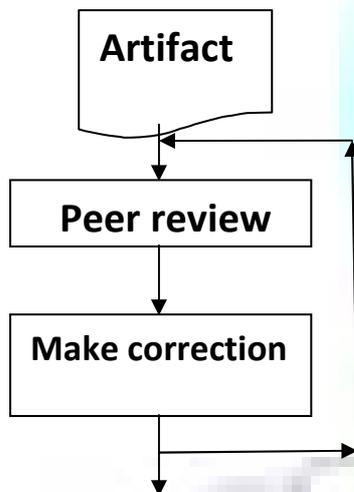


**REVIEWS IN DIFFERENT SOFTWARE DEVELOPMENT STAGES**

a. Requirement Specification Review. As we discussed in the last point, understanding the customer requirement is very important. So, while you prepare the Requirement Specification, get it reviewed by your team members. Ten people in a team may have ten interpretations of the specification. Discuss it out within your team, and then pass your understanding to the customer for verification.

b. Design Review. Once the requirement specification gets finalized, we move on to the design phase. In the design stage, you would now think about how to approach the problem.

As you will agree, review at this stage is vital. Selection of a wrong strategy can put the entire system in a miserable state. Reviews performed at this stage will help you in:

*Analyzing various strategies to solve the problem.

* Analyzing feasibility of each strategy.

* Knowing advantages/disadvantages of each strategy.

c. Code Review. Code Review involves examining the source code to find defects. While working on development of system software tools, I have been a witness to how code review can really help you find defects.

It is good to let someone in your team walk through you code, and do the review. All the members must review the code changes with respect to other modules and give their feedback in case some side-effect is suspected.

Many defects such as memory leaks, wrong passing of arguments, unreachable code, lack of readability, high complexity and maintainability issues can be identified via code review. Finding defects at the coding stage, and fixing them there and then, would prove to be less expensive than finding them in the testing stage.

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**A defect amplification model [IBM81]** can be used to illustrate the generation and detection of errors during the design and code generation actions of a software process.

## DEFECTS DETECTION

| Defects | Detection |
|---|---|

| | Percent Efficiency |
|---|---|
| Errors passed through | |
| Amplified errors 1:x | |
| Newly generated errors | |

Errors from previous step →

Errors passed to next step →
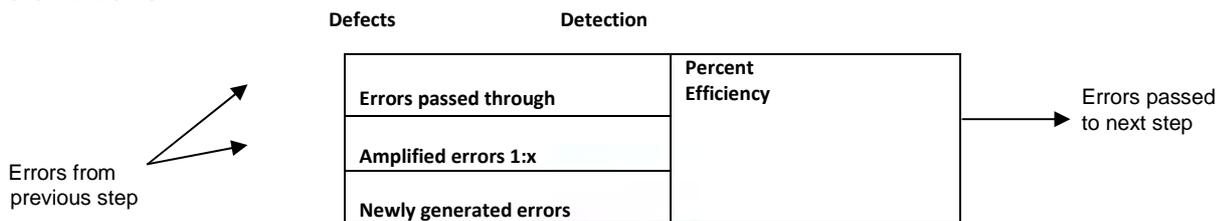
## DEVELOPMENT STEP

Figure 2.4 illustrates hypothetical example of defect amplification for a software development process in which no reviews are conducted. As shown in the figure each test step is assumed to uncover and correct fifty percent of all incoming errors without introducing new errors (an optimistic assumption). Ten preliminary design errors are amplified to 94 errors before testing commences. Twelve latent defects are released to the field. Figure 2.5 considers the same conditions except that design and code reviews are conducted as part of each development step. In this case, ten initial preliminary design errors are amplified to 24 errors before testing commences.

Only three latent defects exist. By recalling the relative cost associated with the discovery and correction of errors, overall costs (with and without review for our hypothetical example) can be established.

To conduct reviews a developer must expend time and effort and the development organization must spend money. However, the results of the preceding or previous, example leave little doubt that we have encountered a "Pay now or pay much more lately" syndrome.

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# A STUDY ON TIME MANAGEMENT IN EMERGENCY DEPARTMENT THROUGH NETWORK ANALYSIS IN A CORPORATE HOSPITAL

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## ABSTRACT

*Emergency Medicine Department is an area where an emergency patient, who need immediate medical or surgical treatment to preserve life and maintain vital functions. As the demands on the emergency medicine (EM) system continue to increase, improvements in the organization of work and the access to timely clinical and system information will be required for providers to manage their workload in a safe and efficient manner. The aim of the paper is to find the critical pathway, expected completion time and variance of path in the emergency department. The method used is primary data by direct observation through stop watch. Network analysis is drawn as per the activity process flow in the department. This paper discusses and evaluates the performance of the Emergency department in terms of its responsiveness to an emergency as the efficiency of an emergency service is measured by its quickness to provide care with the help of PERT and critical pathway. The result of this study suggest the critical pathway, activity slack time, path duration, expected completion time, variance of path and concludes with the suggestions and importance of golden hour in the life of emergency patient.*

## KEYWORDS

Emergency department, Flow diagram, Hospital, Network analysis, Program Evaluation and Review Technique (PERT).

## INTRODUCTION

The emergency department (ED),sometimes termed the emergency room (ER), emergency ward (EW), accident & emergency (A&E) department or casualty department is a hospital or primary care department that provides initial treatment to patients with a broad spectrum of illnesses and injuries, some of which may be life-threatening and requiring immediate attention. Emergency departments developed during the 20th century in response to an increased need for rapid assessment and management of critical illnesses. In some countries, emergency departments have become important entry points for those without other means of access to medical care. The abbreviation ER is generally used throughout the United States, while A&E is used in many Commonwealth nations. ED is preferred in Canada and Australia, and Casualty is common in Scotland.

## REVIEW OF LITERATURE

An emergency is an illness or injury for which the patient requires or desires the immediate attention of a physician (James D. Mills, 1978). The planning of treatment of large number of casualties in a short period was started in ancient times during wars and which have subsequently formed a nucleus of casualty services. Till the turn of the present century, small or large hospitals used to look after acutely ill and injured. As the hospitals developed in quality and numbers, various types of emergency services started developing. A concept of having a separate emergency service can be attributed to increase of accident cases and medical emergencies and the need of providing prompt and efficient treatment to the emergency cases (Major Baldeo Singh, 1985). The development of quality assurance was interrupted by World War I. Around 1830, the rescue service was mostly the responsibility of Red Cross and fire brigades but included the first actions of emergency physicians (Sefrin P, Weidringer J. W, 1991). After the First World War, significant advance took place in the quality of emergency services due to revolution in various treatment techniques. Since World War II there has been a continual increase in emergency room visits, making effective emergency department management more difficult. By 1960s, the accident room had become a walk-in medical clinic in many communities (Rowland, 1984). In U.S.A, full-time staffing of emergency departments by career emergency physicians began in the early 1960s. In an effort to keep up with the great increase in public demand for emergency department services, physicians have entered this field in great numbers. This king of physician staffing began as a local phenomenon in response to local pressures. It was a means of providing 24-hour emergency medical service, of providing a safety valve for the physician shortage, and of providing entry into the medical system (James D. Mills, 1978). In 1968, the American College of Emergency Physicians (ACEP) was organized. The college sees the need for specialized training in this dynamic field. It publishes scientific articles in the "Journal of the American College of Emergency Physicians" and also publishes books on management techniques. There has been an increase of more than 600% in the number of emergency visits in some hospitals since World War II. The national average increases 10% each year in USA (Jenkins A.L, 1978).
Emergency department is an area where an emergency patient who needs immediate medical or surgical treatment, to preserve life and maintain vital functions is treated. (Putsep, 1984). Nowadays, an emergency is considered from the patient's perspective. The change in emphasis is profound and its realization is crucial to the understanding of the development of the specialty of emergency medicine. In many of the smaller hospitals (except by chance) there is no physician in the building after the last one makes his rounds in the evening. The concept of critical care round the clock as a 24-hours-a-day, 7-day-a-week service by well trained physicians, nursing specialists and technicians who were prepared to take incisive action to sustain the patient's vital functions is not likely to be disputed. The concept of separate emergency service in the hospital evolved as a result of increasingly large number of accident cases and medical emergencies that report to the hospitals. (Rao, 1976).

## SIGNIFICANCE OF THE STUDY

The first 60 minutes of a medical emergency, known as the golden hour is the most crucial. The chances of survival of the wounded or critically ill are better if timely medical attention is paid. The concept of emergency medicine department with round the clock service by well trained staff to sustain the patient's vital functions is undisputed. While the concept of comprehensive emergency care is well established in developed countries, it is far neglected in India. This study has been conducted to evaluate the performance of the ER in terms of its responsiveness to an emergency as the efficiency of an emergency service is measured

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by its quickness to provide care. The design of the emergency room, protocols followed play an important role in providing quality care and bringing down the time taken to deliver care. The design and protocols in the ER were studied to understand the areas where improvement is possible.

## OBJECTIVES OF THE STUDY

1. To study the response time for each activity in emergency medical services.
2. To study the elements causing delay in providing emergency care.
3. To study issues pertaining to physical facilities, staffing pattern, and allied investigative and admission procedures.
4. To identify the drawbacks and suggest suitable solutions for better functioning of the department.
5. To optimize the time taken at emergency and accident department by applying PERT NETWORK DIAGRAM.

## RESEARCH METHODOLOGY

According to Green and Tull, a research design is the specification of methods and procedures for acquiring the information needed. It is the over- all operational pattern or framework of the project that stipulates what information is to be collected from which sources by what procedures.
**RESEARCH DESIGN:** Exploratory and Descriptive study.
**SAMPLE DESIGN:**
**SAMPLING UNIT:** Emergency department.
**SAMPLING METHOD:** Random sampling.
**POPULATION SIZE:** 150
**SAMPLING SIZE:** 30
**METHODS OF DATA COLLECTION:** By Primary data by Direct Observation and measured the time consumed in the Emergency Department by stop watch.
**DATA ANALYSIS TECHNIQUE:** Statistical analysis and Operation Research Technique and Analysis by using method PERT and NETWORK DIAGRAM.
**LIMITATIONS OF STUDY**

1. The sample size for response time analysis varies from process to process, as each patient may not necessarily undergo each and every step of the emergency care delivery.
2. It was not possible to compare the observations with any present set standards, as no such standards are available in our country.
3. One limitation inherent to the method of observation is due to the effects of interactions between the observer and the observed. The presence of the observer tends to make the observed feel conscious and influence his normal behavior and observation may get distorted.
4. But during our study, as we practically observed, this did not occur as in the highly charged atmosphere of an emergency case the staff were more involved in providing care to the patient than feeling conscious of our presence. In fact, our continuous presence in the ER and during the emergency transport process led to uninhibited interactions with the staff when they were not attending to cases. These deliberations gave us an insight into various issues and problems being faced in emergency care delivery, which we would not have known during our limited period of study.

## PERT (THE PROGRAM EVALUATION AND REVIEW TECHNIQUE)

Complex projects require a series of activities, some of which must be performed sequentially and others that can be performed in parallel with other activities. This collection of series and parallel tasks can be modeled as a network. In 1957 the Critical Path Method (CPM) was developed as a network model for project management. CPM is a deterministic method that uses a fixed time estimate for each activity. While CPM is easy to understand and use, it does not consider the time variations that can have a great impact on the completion time of a complex project. The Program Evaluation and Review Technique (PERT) is a network model that allows for randomness in activity completion times. PERT was developed in the late 1950's for the U.S. Navy's Polaris project having thousands of contractors. It has the potential to reduce both the time and cost required to complete a project.

## THE NETWORK DIAGRAM

In a project, an activity is a task that must be performed and an event is a milestone marking the completion of one or more activities. Before an activity can begin, all of its predecessor activities must be completed. Project network models represent activities and milestones by arcs and nodes. PERT originally was an activity on arc network, in which the activities are represented on the lines and milestones on the nodes. Over time, some people began to use PERT as an activity on node network.

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**ACTIVITY FLOW DIAGRAM IN EMERGENCY DEPARTMENT ACTIVITY FLOW DIAGRAM IN EMERGENCY DEPARTMENT**

```
            ┌──────────────────────────────┐
            │ Patient to be shifted from   │
            │ ambulance to emergency room  │
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │   R.M.O to attend the patient │
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │   Nurse attend the patient    │
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │ Nurse Informing the specialist│
            │            doctor             │
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │  Nurse informing the Technician│
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │  Technician attend the patient │
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │ Specialist doctor attend the  │
            │           patient             │
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │ Performing various Investigations│
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │ Arrival of Investigation reports│
            └──────────────────────────────┘
                          │
            ┌──────────────────────────────┐
            │  Billing, pharmacy activities │
            └──────────────────────────────┘
                          │
                     ╱ Patient ╲         No
                    ╱  normal   ╲──────────────┐
                     ╲         ╱               │
                          │ Yes                │
            ┌──────────────────────┐   ┌──────────────────┐
            │ Patient leaves with  │   │ Advice for       │
            │       report         │   │ treatment        │
            └──────────────────────┘   └──────────────────┘
                     │                          │
                  ( Exit )          ┌──────────────────────────┐
                                    │ Patient referred to      │
                                    │ concerned physician/     │
                                    │ shifted to the concerned │
                                    └──────────────────────────┘
```

**PROCESS STUDY BY PERT**
**ACTIVITY IN EMERGENCY DEPARTMENT**

| SYMBOL | ACTIVITY |
|--------|----------|
| A | Time taken by the patient to be shifted from ambulance to emergency room |
| B | Time taken by R.M.O to attend the patient |
| C | Time taken by nurse to attend the patient |
| D | Time taken to inform the specialist |
| E | Time taken to call the Technician |
| F | Time taken by the Technician to attend the patient |
| G | Time taken by specialist to attend the patient |
| H | Time taken for performing ECG, x-ray, lab. Investigation. Minor procedure etc. |
| I | Time taken for report arrival from labs/diagnostics |
| J | Time taken for registration, billing, pharmacy |
| K | Time between getting the report &emergency exit. |

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**EXPECTED ACTIVITY TIME &VARIANCE OF ACTIVITY TIME**

$$t_e = \frac{t_o + 4t_m + t_p}{6}$$

$$\sigma^2 = \left( \frac{t_p - t_o}{6} \right)^2$$

**THE PERT EVENT TIMES AND OTHER DETAILS AS BELOW FOR EACH ACTIVITY IN MIN**

| ACTIVITY | PRECEDED BY | $t_p$ (pessi. time) | $t_m$ (most like) | $t_o$ (opt. time) | $t_e$ (expe. time) | S .d | Var. |
|---|---|---|---|---|---|---|---|
| A | _ | 2.97 | 1.431 | 0.36 | 1.50 | 0.435 | 0.18 |
| B | A | 2.5 | 0.80003 | 0.173 | 0.97 | 0.387 | 0.15 |
| C | A | 1.783 | 0.664 | 0.223 | 0.77 | 0.26 | 0.0676 |
| D | B | 5.05 | 2.264 | 1.05 | 2.53 | 0.66 | 0.44 |
| E | B | 3.66 | 1.218333 | 0.41 | 1.49 | 0.542 | 0.29 |
| F | E | 14.53 | 3.284667 | 1 | 4.87 | 2.255 | 5.08 |
| G | D | 41.5 | 12.20833 | 1.38 | 15.28 | 6.686 | 44.70 |
| H | F,C | 44.656 | 18.802 | 3.70 | 20.59 | 6.82 | 46.594 |
| I | H | 77.66 | 34.83821 | 8.34 | 37.55 | 11.55 | 133.47 |
| J | G,H | 23.69 | 15.57333 | 6.73 | 15.45 | 2.826 | 7.988 |
| K | I,J | 21.56 | 12.61357 | 5.34 | 12.89 | 2.70 | 7.29 |
| TOTAL | | | | | 113.89 | 33.121 | 246.25 |

**ACTIVITY WITH EXPECTED TIME**

| ACTIVITY | PRECEDED BY | EXPECTED TIME |
|---|---|---|
| A | - | 1.50 |
| B | A | 0.97 |
| C | A | 0.77 |
| D | B | 2.53 |
| E | B | 1.49 |
| F | E | 4.87 |
| G | D | 15.28 |
| H | F,C | 20.59 |
| I | H | 37.55 |
| J | G,H | 15.45 |
| K | I,J | 12.89 |

**INTERPRETATION**

Average time per patient in the study sample is 99.335min.
Expected time per patient in the study sample is 113.89min.
Total Standard deviation in the study sample is 33.121min.
Total variance in the study is 246.25min.

**EXPECTED NETWORK DIAGRAM**

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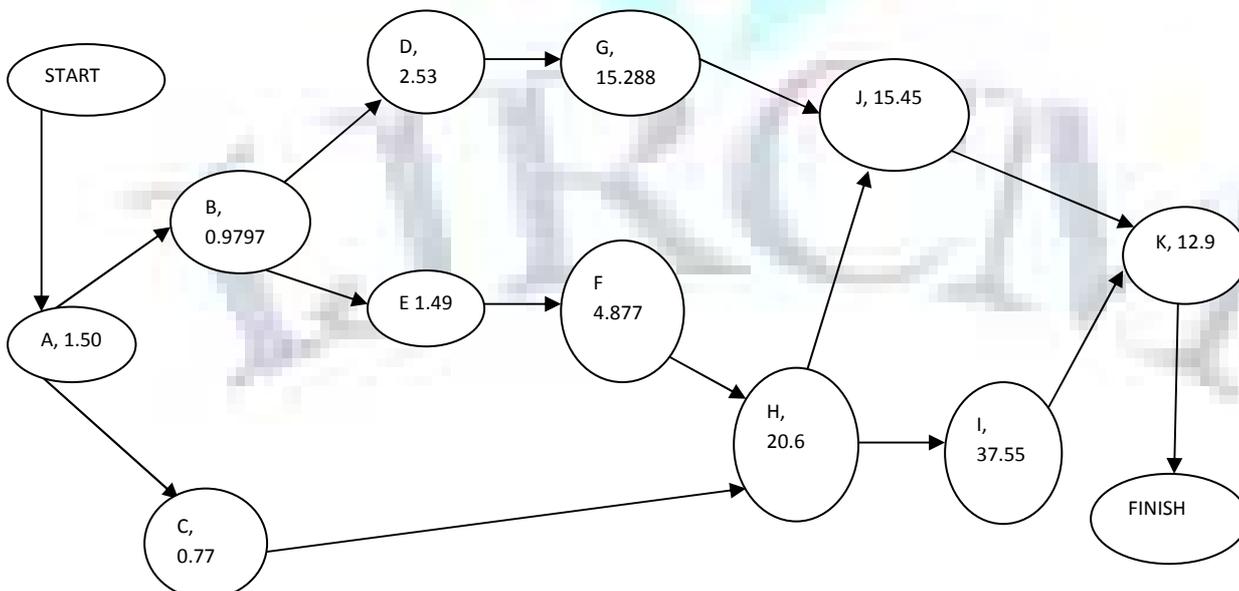
**CRITICAL PATH**

A - B – E – F – H – I - K = 1.50 + 0.97 + 1.49 + 4.87 + 20.59 + 37.55 + 12.89 = 79.89 mins (Critical path)

A – B – D – G – J – K = 1.50 + 0.97 + 2.53 + 15.28 + 15.45 + 12.89 = 48.62 mins

A – C – H – I – K = 1.50 + 0.77 + 20.59 + 37.55 + 12.89 = 73.3 mins

A – B – E – F – H – J – K = 1.50 + 0.97 + 1.49 + 15.45 + 20.60 + 12.89 = 52.9 mins

A – C – H – J – K = 1.50 + 0.77 + 20.59 + 15.45 + 12.89 = 51.2 mins

**[EARLY START TIME &FINISH TIME]: [T ES, T EF]**

**(LATEST START TIME& LATEST FINISH TIME):   (T LS, T LF).**

**SLACK**

The slack of an event is a measure of the excess time and resources available in achieving this event. Positive slack would indicate ahead of schedule; negative slack would indicate behind schedule; and zero slack would indicate on schedule.

**ACTIVITY SLACK TIME**

T ES = EARLIEST START TIME FOR ACTIVITY

T LS = LATEST START TIME FOR ACTIVITY

T EF = EARLIEST FINISH TIME FOR ACTIVITY

TLF = LATEST FINISH TIME FOR ACTIVITY

**ACTIVITY SLACK = T LS – T ES = T LF – T EF.**

**PATH SLACK**

DURATION OF CRITICAL PATH = PATH DURATION/PATH SLACK.

**ACTIVITY SLACK TIMES IN MIN**

| ACTIVITY | ES | EF | LS | LF | SLACK |
|---|---|---|---|---|---|
| **A** | 0 | 1.50 | 0 | 1.50 | 0 |
| **B** | 1.50 | 2.47 | 1.50 | 2.47 | 0 |
| **C** | 1.50 | 2.27 | 8.06 | 8.83 | 6.56 |
| **D** | 2.47 | 5 | 33.72 | 36.25 | 31.25 |
| **E** | 2.47 | 3.96 | 2.47 | 3.96 | 0 |
| **F** | 3.96 | 8.83 | 3.96 | 8.83 | 0 |
| **G** | 5 | 20.28 | 36.25 | 51.53 | 31.25 |
| **H** | 8.83 | 29.43 | 8.83 | 29.43 | 0 |
| **I** | 29.43 | 66.98 | 29.43 | 66.98 | 0 |
| **J** | 29.43 | 44.88 | 51.53 | 66.98 | 22.1 |
| **K** | 66.98 | 79.87 | 66.98 | 79.87 | 0 |

**EXPECTED COMPLETION TIME AND VARIANCE OF PATH -   A – B – E – F – H – J – K**

**EXPECTED COMPLETION**

**TIME =** A – B – E – F – H – J – K = 1.50 + 0.97 + 1.49 + 15.45 + 20.60 + 12.89 = 52.9 MINS

**PATH VARIENCE =** 0.18 + 0.15 + 0.29 + 5.08 + 46.594 + 7.988 + 7.29 = 67.57 MINS

## DISCUSSION AND CONCLUSION

Emergency Room is one of the most critical areas of a hospital when seen in terms of availability of facilities and immediate service.  The solutions we propose here are in the light of the fact that services present in the ER may not be utilized on a day to day basis but even so deserve merit because when it comes to dealing with emergencies a hospital cannot bear to lose a patient with an excuse of not having adequate services available. One of the most important factors affecting a patient's survival and the degree of disability is the treatment available immediately after the injury. Genuine emergency patients have to be treated without delay with adequate expertise. The organization and delivery of emergency services as emergency departments have been found to be unsatisfactory and have long been neglected. There has been lot of improvement in provision of emergency care in developed countries, where separate emergency departments have been created at considerable costs. The emergency medicine department provides a unique service, it is neither inpatient nor outpatient im terms of scope or manner and type of operation. While planning and organizing emergency medical services, it is crucial to recognize the complex and volatile nature of the services. The EMD service is expensive and the cost of provision of this service far exceeds cost of general patient care.

## FINDINGS

1.  Patients should receive immediate response from nursing and medical staff.
2.  Specialist doctor taking excess time to attend emergency patient.
3.  More time is consumed in shifting patient by attendant when patient arrives at emergency.
4.  When ambulance arrives with a patient at emergency, many times attendants and nursing staff are not prepared as security guards delay in informing them by blowing the whistle. So, the Emergency department staff is unaware of patient arrival.
5.  Attendants are inadequately trained.
6.  Inadequate number of attendants.
7.  Delay in the issue of investigation reports.

## SUGGESTIONS

1.  The major time delay is because of specialist doctor attending the patient. This needs to be minimized by appointing 24 x 7 emergency doctors in Emergency department.
2.  Priority given for emergency department patients for investigation report generation.
3.  Adequate number of attendants should be provided in the department.

## CONCLUSIONS

1.  The organization can improve its efficiency and quality care by effective utilization of time in emergency department.
2.  Proper allocation of activity in accordance with prompt service timing can save numerous lives and prevent threat of danger to the criticality which will improve the quality and standardization of care of the hospital.
3.  All the employees working in the emergency department must be aware of Standard Operating Procedure (SOP) of the department.
4.  Prompt and accurate medical care facility increase patient satisfaction which leads to high patient turnover and it indicates the quality of patient care.

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# MAINTAINING CENTRALIZED BANK INFORMATION FOR GETTING QUICK ACCESS OF INFORMATION OF ALL OTHER ACCOUNTS USING DENORMALIZATION OF DATABASE CONCEPT OF COMPUTER

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## ABSTRACT

*Today in India many Nationalize and co-operative banks are working and a person can open account in any bank as per rules and regulations of respective bank. But some time a person may have more than 10 or 15 accounts it is very difficult to remember the account number and all account details and there is no any organization which can give the accounts information like balance in account, withdrawal of balance from account. So to overcome this problem we can use renormalizations of database concept from computer, which can provide all account information on a single click to person itself and the government for Taxation purpose.*

## KEYWORDS

CAN (Central Account Number), Demormalization, Normalization, Central Account id.

## INTRODUCTION

Denormalization is a technique to move from higher to lower normal forms of database modeling in order to speed up database access. By using denormalization we can enhance the performance of database. Denormalization is the process which is exactly opposite to normalizations in which we divide the data into many tables. Here in renormalization we are expecting the abstract of all the data from different tables in the database.
Here is the diagram that shows the process of renormalizations:

**FIG. 1: PROCESS OF RENORMALIZATIONS**
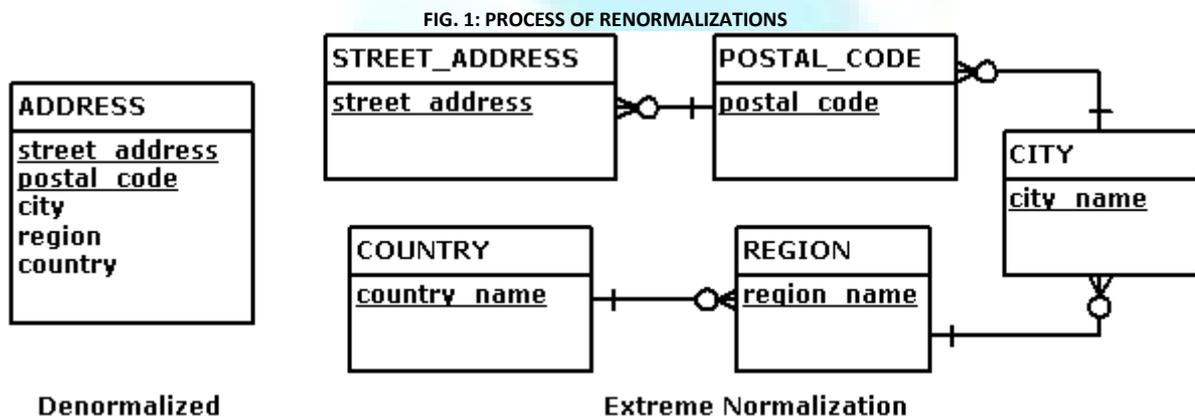


In the diagram the ADDRESS table shows both normalization and denormalization.
In normalization all the data is divided in to different tables and there is relation between each table for accessing the information.
In today's era a person is having so many accounts in many banks. So each and every time it is not possible to remember the account number and his password during the transaction so because of this he may face problems to overcome this problem we can use the data Renormalizations to bring uniformity or to reduce to remember the account number and password every time.

## ACTUAL IMPLEMENTATION

We maintain one separate Central account for each and every account in every bank in India for a person.
The structure or content of the central account is as follows:

**TABLE 1.1**

Bank account numbers
Bank name
Balance

**TABLE 1.2**

Ex.
Central Account Id : 100000000001

| Bank Account Number | Bank Name | Balance |
|---|---|---|
| 5002600225 | State Bank Of India | 250000 |
| 1235897424 | Bank Of Maharashtra | 400000 |
| 5897436489 | Canara Bank | 654000 |
| 9856478524 | Bank Of Badoda | 549823 |

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Table 1.1 and 1.2 shows the account information of Central  Account which include the bank account number which gives the information about the various accounts in different banks along with the second field Bank name of respective account. The next field shows the balance of the respective account.
When we implement the actual denormalization concept connect all bank  accounts to the central bank account which is shown as below:

**FIG.: 2**
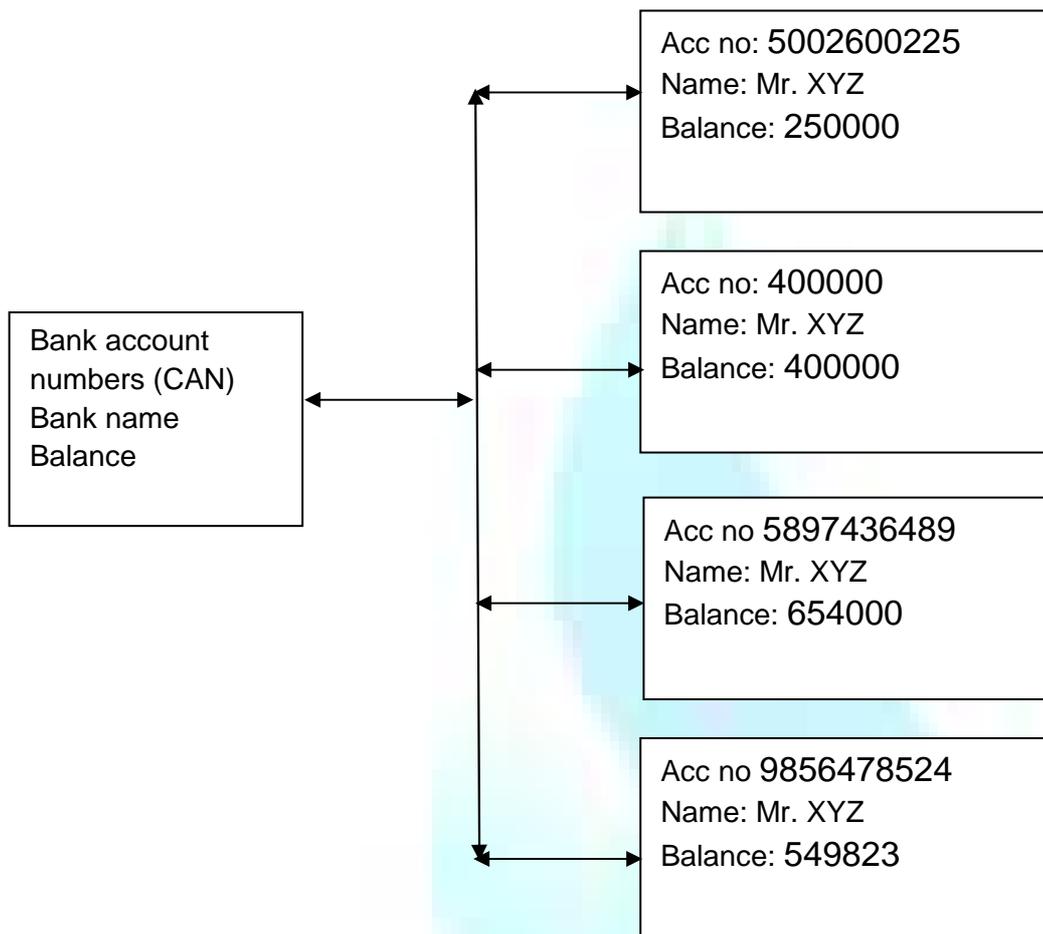


The relation shown bidirectional arrow because whenever there is update in any of the account, immediately the central account will be updated.
Due to this it is not necessary to remember all account numbers and passwords it will provide the little bit ease for the customer who do their transaction regularly.

## HOW TO IMPLEMENT
1. If customers account already exists in the many banks, first collect all bank account information and generate one central account number and connect all other bank accounts to central account. If customer opens account in new bank. Connect each and every account that customer opens in the bank to the central account.
2. If customer opens new account then with that account the new central account will also generated.

## BENEFITS
### BENEFIT OF CUSTOMER
Instead of remembering all account information of various banks and passwords he can get the information by remembering only one account number and password with one click he can get all the accounts information of all his bank accounts.
### BENEFIT FOR GOVERNMENT
1. If the get all the information or bunch of information in a single account information then it is very easy to know the total balance available his/her all account in overall India.
2. It leads to decrease the corruption because no one can hide his account information because all the banks comes under the Central Account Number (CAN)

## CONCLUSION
By using CAN (Central Account Number) it is very easy to get all account information of a person to person himself as well as government. And because of denormalization the whole process speed up.

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# DIGITAL OPPORTUNITIES IN NORTH INDIA: A STUDY ON DIGITAL OPPORTUNITY PARAMETERS AMONG NORTH INDIAN STATES

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## ABSTRACT

*This study is based on an empirical analysis of Information and Communications Technology (ICT) archival data. Some previous studies consider the impact of ICT on socio- economic development in the region. Using a set of regression analyses, this paper shows that ICT expansion in the North India has not only resulted in the reduction of the Digital Divide between this region but it has also had a positive impact on promoting democracy and freedom of expression in a region that suffers most from political, social and global conflicts. In recent years, several case studies have appeared on how mobile telephones, SMS and the Internet had an impact on political activities. It has been widely argued that information and communication technology (ICT) is influencing democracy all over the world. However, few studies provide any analysis of how ICT expansion correlates with measures of democracy.*

## KEYWORDS
Information, Communication, Population, Digital, Percentage.

## INTRODUCTION

The Information and Communication Technology is one of the important driving forces for modern civilization. ICT enables interactive communication unhindered by distance, volume, medium or time. It also reduces the cost of co-ordination, communication and information processing. The role of Information Communication Technology (ICT) in creating digital opportunities contributing to the construction of the Digital information environment in the society has a greater role of the economic development. In India ICT contributes to change at social, political and economic levels of the economy. India has emerged as one of the fastest growing economics in the world. India's Technological capabilities and raising exports in information technology has been one of the major drivers of the growth. [1][2]

## HISTORY OF DIGITALIZATION

The origin of Digitalization was on May 24, 1844 when the first electronic telegraph route was opened between Washington D.C and Baltimore, and when Samuel Morse sent the historic first message" What hath God Wrought?" As the telephone invented by the Bellin 1876, began to supersede the electronic telegraph, the telecommunications industry started upon a century long detour during which the majority of communications was transmitted via analogue rather than digital circuits. But the digitization of public telecommunication networks began in the 1980s. [3]

## OBJECTIVE
Following are the objectives of the Study
- To identify the percentage of population covered by the mobile technology in North India
- To Identify the percentage of the wire-lines covered in North India
- To know the Internet access tariff as a percentage of per-capita income in North India
- To know the mobile access tariff as a percentage of per-capita income in North India

## ANALYSIS AND DISCUSSION
### PERCENTAGE OF POPULATION COVERED BY MOBILE TECHNOLOGY [4][5]
Table1 shows the percentage of population covered by mobile Technology in North Indian States. Based on number of mobile phone subscribers base Rajasthan tops the order 44,473,945 followed by Delhi, Haryana, Punjab and J&K. But while going by the percentage of population covered by the mobile technology the results are different. Here, Delhi tops the order with 245.7% followed by Punjab, Haryana, Rajasthan and J&K.

TABLE 1: PERCENTAGE OF POPULATION COVERED BY MOBILE TECHNOLOGY

| STATE | POPULATION | MOBILE PHONE SUBSCRIBER BASE | % OF POPULATION COVERED BY MOBILE TECHNOLOGY |
|---|---|---|---|
| DELHI | 16,753,235 | 41,171,114 | 245.7 |
| HARYANA | 25,353,081 | 20,389,507 | 80.4 |
| J&K | 12,612,782 | 5,754,286 | 45.6 |
| RAJASTHAN | 68,621,012 | 44,473,945 | 64.8 |
| PUNJAB | 27,704,236 | 30,147,893 | 108.8 |

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**FIGURE 1: POPULATION AND MOBILE PHONE SUBSCRIBERS**
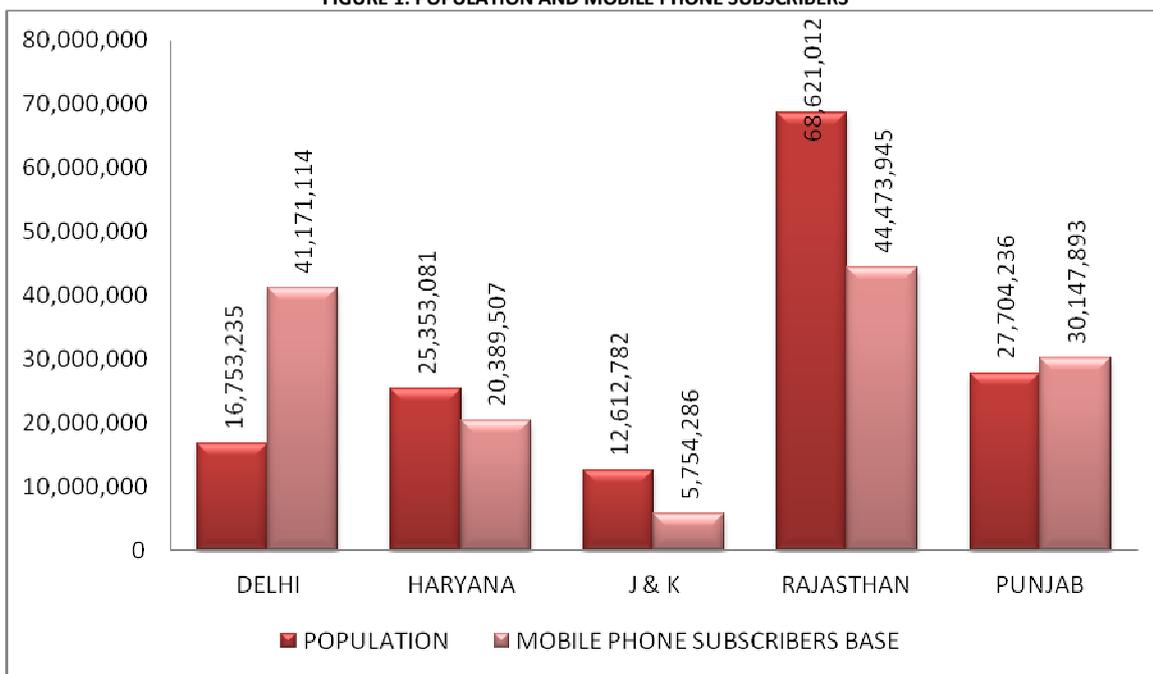


**FIGURE 2: PERCENTAGE OF POPLULATION COVERED BY MOBILE TECHNOLOGY**
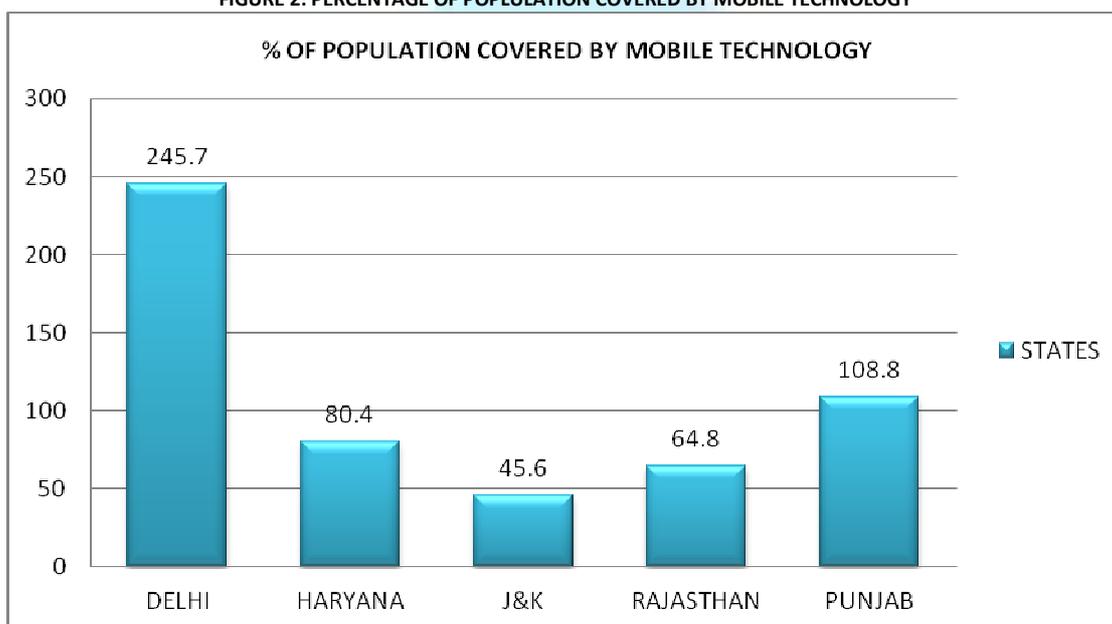


**PERCENTAGE OF WIRELINE CONNECTIONS AND TOTAL WIRELINE SUBSCRIBERS [4][5]**

In case of wire line connections Subscribers Punjab and Delhi in top list followed by Haryana, Rajasthan and J&K. in Wire line connection Delhi 8.3%, Haryana 1.9%,J&K 0.6%, Rajasthan 3.6%and Punjab 4.5%. The total wire line subscribers in Delhi 2843027, Haryana 640109, J&K 215517, Rajasthan 1239658, Punjab 1561107 as on May 2011.

**TABLE 2: LANDLINE SUBSCRIBERS BASE BY MAY, 2011**

| STATE | TOTAL WIRELINE SUBSCRIBERS | % OF WIRELINE CONNECTIONS |
|---|---|---|
| DELHI | 2,843,027 | 8.3% |
| HARYANA | 6,401,09 | 1.9% |
| J&K | 2,155,17 | 0.6% |
| RAJASTHAN | 12,396,58 | 3.6% |
| PUNJAB | 15,611,07 | 4.5% |

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**FIGURE 3: TOTAL WIRELINE SUBSCRIBERS**
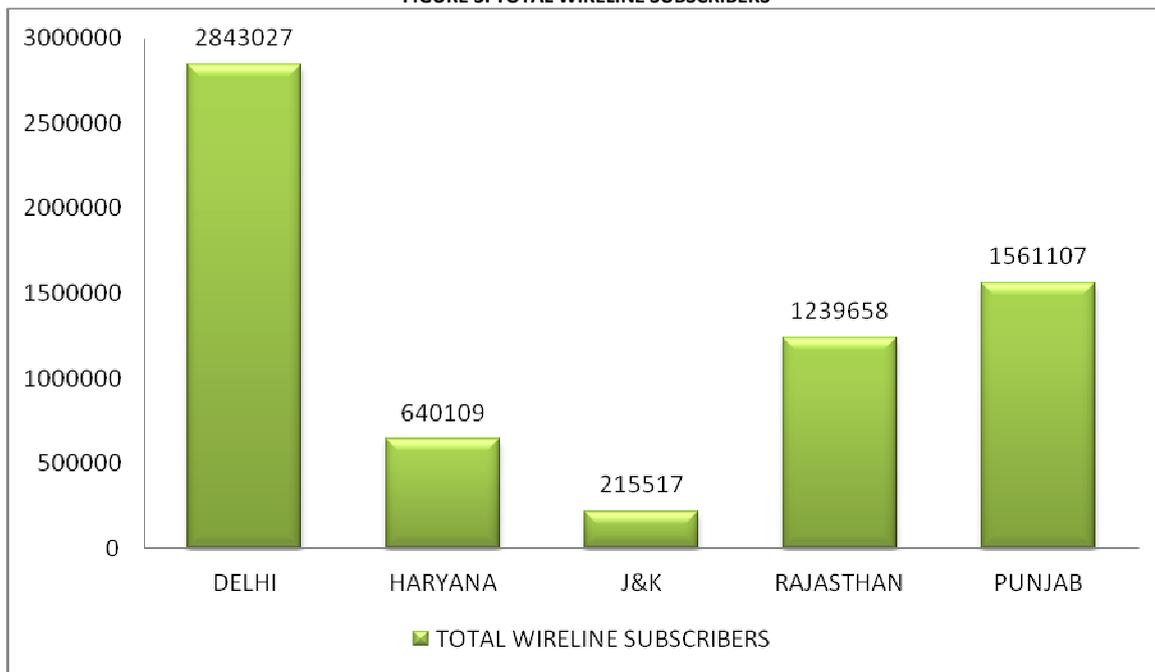


**FIGURE 4: PERCENTAGE OF WIRELINE CONNECTIONS**
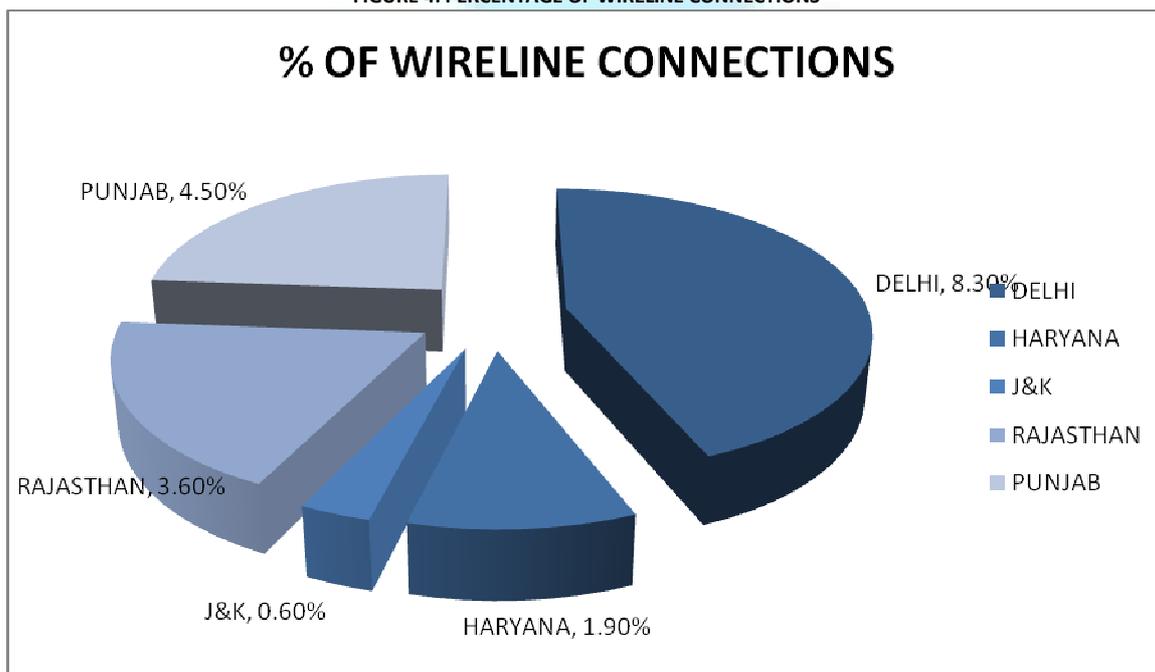


**PERCENTAGE OF INTERNET ACCESS TARIFFS PER-CAPITA INCOME [6][7]**

The minimum amount required for the broadband access per month is Rs 250. The percentage of Internet access Tariffs Per capita of Delhi is 3.12%, Haryana 3.80%, J & K 9.80%, Rajasthan 8.77% and Punjab 4.82%. According to Per-capita income Delhi ranked first followed by Haryana, Punjab, Rajasthan and J &K. Delhi has highest Per-capita income 95943 followed by Haryana 78781, Punjab 62153, and Rajasthan 34189 and J&K 30582.

**TABLE 3: PER-CAPITA INCOME AND INTERNET ACCESS TARIFFS OF STATES**

| STATE | PER-CAPITA INCOME | INTERNET ACCESS TARIFFS | % INTERNET ACCESS TARIFFS PER-CAPITA |
|---|---|---|---|
| DELHI | 95,943 | 3000 | 3.12 |
| HARYANA | 78,781 | 3000 | 3.80 |
| J&K | 30,582 | 3000 | 9.80 |
| RAJASTHAN | 34,189 | 3000 | 8.77 |
| PUNJAB | 62,153 | 3000 | 4.82 |

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**FIGURE 5: PER-CAPITA INCOME AND INTERNET ACCESS TARIFFS**
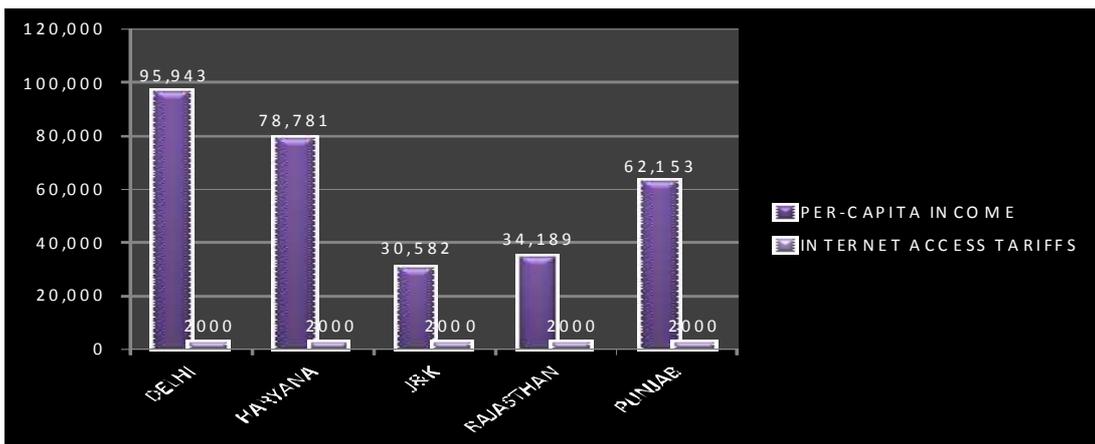


**FIGURE 6: PERCENTAGE OF INTERNET ACCESS TARIFFS PER-CAPITA**
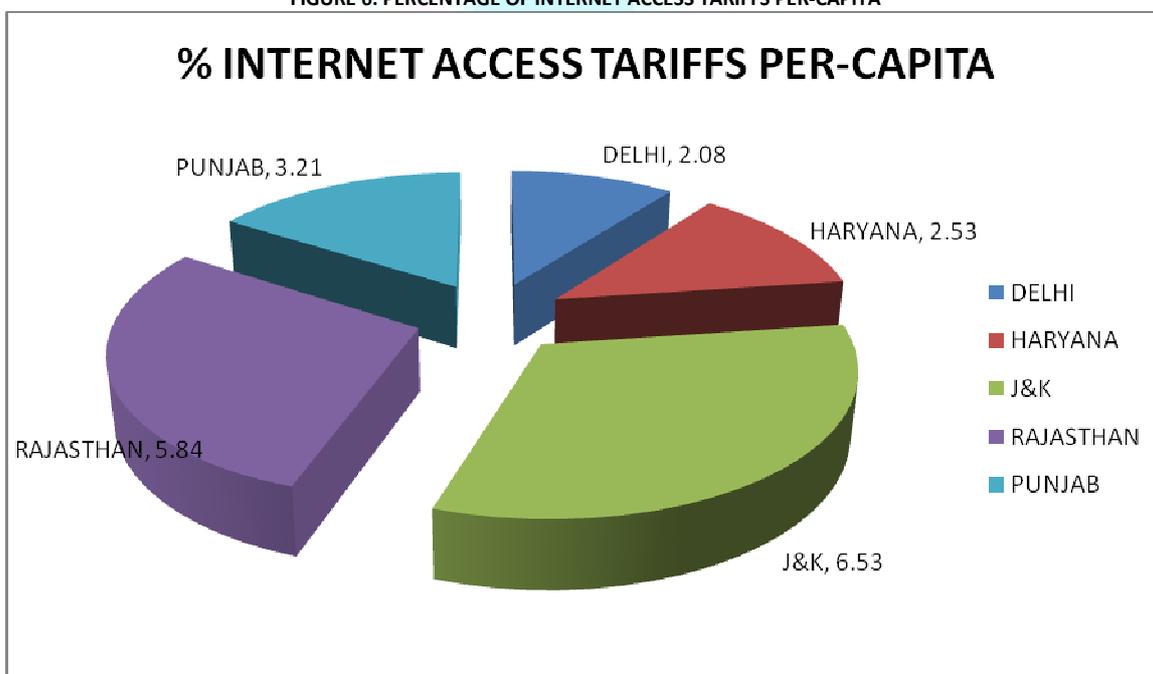


**PERCENTAGE OF MOBILE PHONE TARIFFS PER-CAPITA INCOME [4][7]**

Minimum amount required for the mobile phone activation per month is Rs 99/- which makes an annual minimum mobile tariff of Rs 1188/-. The percentage of mobile tariff per capita of Delhi is 1.23%, Haryana 1.50%, J&K 3.88%, Rajasthan 3.47% and Punjab 1.91%.

**TABLE 4: MOBILE PHONE TARIFFS AND ITS PERCENTAGE STATE WISE**

| STATE | STATE PER-CAPITA INCOME | MOBILE TARIFFS | % MOBILE TARIFFS PER-CAPITA |
|---|---|---|---|
| DELHI | 95,943 | 1188 | 1.23 |
| HARYANA | 78,781 | 1188 | 1.50 |
| J&K | 30,582 | 1188 | 3.88 |
| RAJASTHAN | 34,189 | 1188 | 3.47 |
| PUNJAB | 62,153 | 1188 | 1.91 |

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**FIGURE 7: PER-CAPITA INCOME AND MOBILE TARIFFS**
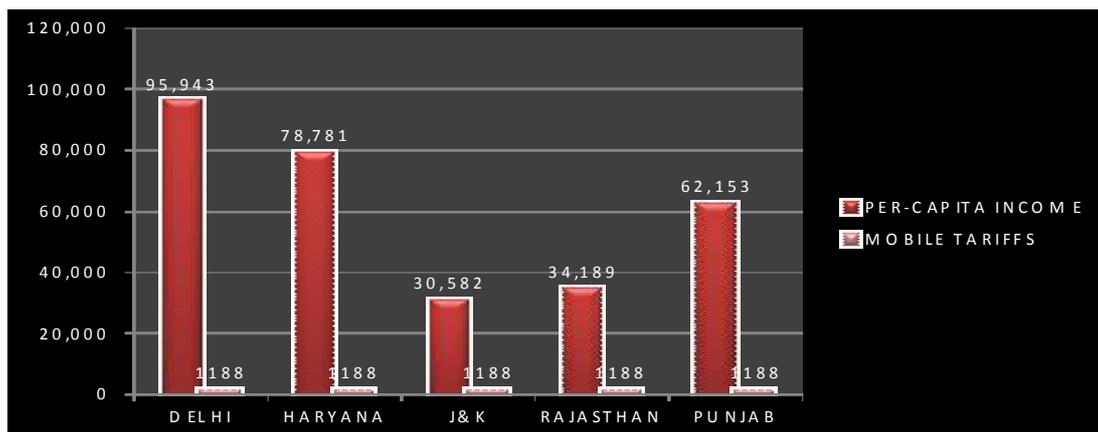


**FIGURE 8: PERCENTAGE OF MOBILE TARIFFS PER-CAPITA**
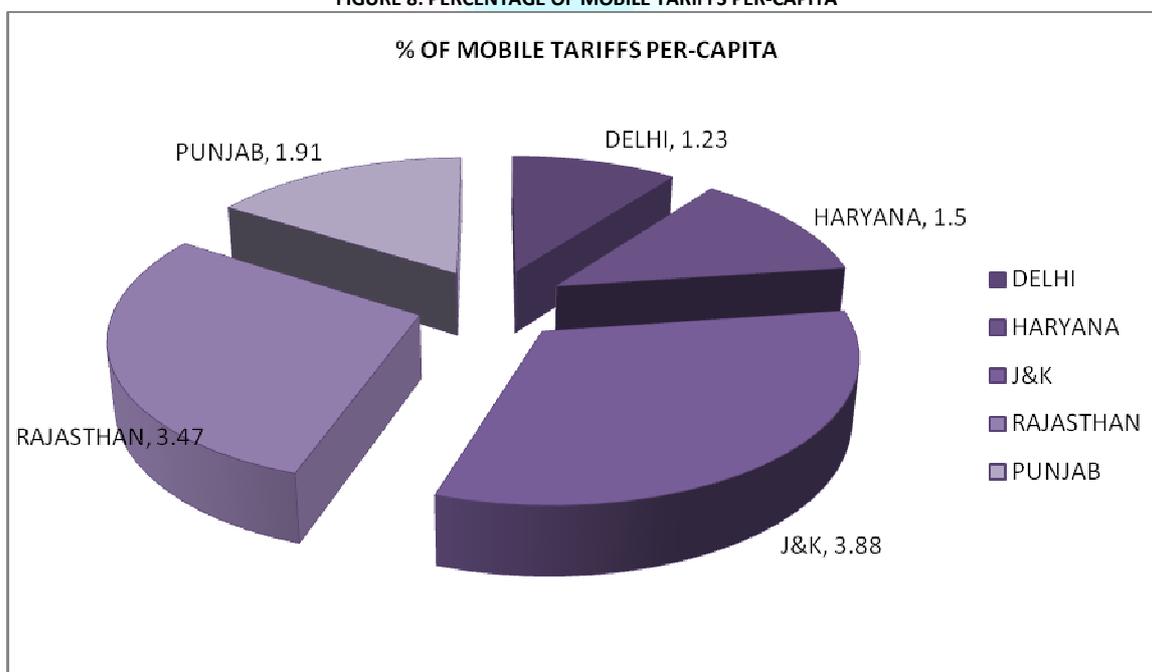


## CONCLUSION

The unequal access to information and communication technologies has led to the digital divide not only in developing countries but globally as well. Although India has made encouraging efforts to bridge the gap by initiating a number of projects and programs for rural and remote locations. So, a lot more needs to be done to bring the people into the information society. All that is required is strong determination among people, good policy–makers and political support to bridge the digital divide. Libraries and information centers have a special role in providing information to all in order to reduce the gap between those who have the facilities to access digital information and those who do not. The country needs to improve the infrastructure of public libraries and link them with community information centers.

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# BUSINESS ETHICS & GOVERNANCE

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## ABSTRACT

*Today due to different unethical practices done by the various big organizations, the stakeholders and customers are regularly showing negative responses. So it has become the need for every organization to create transparency in its business practices which can only be possible through ethics and good governance. It is only the recent years that Business Ethics & Corporate Governance have become almost a public issue and have started getting favourable responses from the corporations, government agencies, shareholders, employees, suppliers, customers, competitors, the news media, community residents etc. i.e.; the entire society. With the growing strength of consumer movements and rising levels of awareness among stakeholders, corporations are realizing that stakeholders and customers are no longer indifferent to unethical practices. So companies have now begun to integrate ethics into their corporate cultures and concentrate on appropriate corporate governance mechanisms in place. This paper covers the ethics and governance, essential governance principles, ethical codes and guidelines for an organization. It also shed light on, how ethics influence the corporate governance and how corporate governance affects firm performance.*

## KEYWORDS
Ethics, Ethical codes, Corporate governance, Governance principles.

## INTRODUCTION

One of the serious challenges facing mankind in organized social life is ethics - that is, the problem of choice between good and bad, do's and do not's etc. All the creations in this natural world follow certain fixed laws of nature. That is why we can exactly predict when the sun will rise tomorrow. But we cannot predict human behaviour in the same way. Nobody can confidently say that two individuals would behave in the same way tomorrow as they do today, because man has been endowed with the freedom to decide, which other creations do not possess. That is why philosophers and scholars have emphasized ethical development of human beings to ensure rational behaviour in society.

Since the last few years, we have witnessed a range of corporate scandals and failures from Enron, Arthur Anderson and WorldCom internationally to the recent Satyam Saga in India. More and more skeletons are tumbling out and the fact that this is happening in the bear market has further amplified the effect. Questions are being asked on audit and finance functions, board compositions and prevailing regulations. There is a war cry everywhere, "The system needs to improve".

## BUSINESS ETHICS

'Ethics' is derived from the Greek word *ethos*, which means good and bad, right and wrong and should and should not related concept or philosophical idea (Khan,1985). This branch of philosophy deals with values relating to human conduct with respect to the rightness or wrongness of certain actions (Holmquist, 1993). According to Uhr, justice is the heart of ethics (Uhr, 1988). The parallel word of justice in the Greek language is *dikeia*, which means convention, law and good judgment, right and just (Gulet, 1983). Therefore, a just person is s/he whose behaviour reflects all those ethical qualities. The Latin concept of just person means virtuous person with ethical and strong moral character (Encyclopedia Britannica, 1976). Thus ethics determines an expected mode of behaviour in society and organizations. It is a guidance system to be used in making decisions.

*ETHICS = TRUTHFULNESS + TRANSPARENCY + RIGHTEOUSNESS + MORALITY*

*"Ethics may be defined as some standardized form of conduct which may be used to determine what is good or what is bad, what is right or what is wrong, what is true what is false, what is just or what is unjust, what is proper or what is improper, what is fair or what is unfair and what should be done what should not be done" (Banik, 2008).*

The phrase **business ethics** refers to identifying the difference between right and wrong and choosing to do what is right. It can be used to describe the actions of individuals within an organisation, as well as the organisation as a whole. These are the written and unwritten codes of principles and values that govern decisions and actions within a company. In the business world, the organization's culture sets standards for determining the difference between good and bad decision making and behaviour. **Business ethics** are the rules of business conduct, by which the propriety of business activities may be judged. It is the society which dictates the ethical principles. Such principles attempt to ascertain the ethical obligations of the business.

**Business ethics is the study of business situations, activities, and decisions where issues of right and wrong are addressed.**

It is worth stressing that by 'right' and 'wrong' we mean morally right and wrong as opposed to, for example, commercially, strategically, or financially right or wrong. Moreover, by 'business' ethics, we do not mean only commercial businesses, but also government organizations, pressure groups, not-for-profit businesses, charities, and other organizations.

## CORPORATE GOVERNANCE

Governance is a dynamic connotation which according to the Oxford Advanced Learner's Dictionary means, the way in which a country is governed (Wehmeier, 2000). Simply put, governance means the activities or process of managing public affairs. It is different from government which is a physical entity encompassing various institutions (i.e., legislature, executive and judiciary) and their actors who are authorized to exercise sovereign power of the state. Governance is thus a qualitative expression and a normative concept. A 1992 World Bank book defines **governance**, as "the "manner in which power is exercised in the management of a country's economic and social resources for development" (World Bank, 1992).

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**Corporate governance** is related to how the various constituencies that define the business enterprise serve, and are served by the firm. It encompasses within its orbit, all implicit as well as explicit relationships between the corporation and its employees, customers, creditors, suppliers and all other stakeholders.

*"Fundamentally, shareholder vs. stakeholder debate diverts attention away from the role of management itself."(Maheswari, 2003).*

*"Corporate Governance refers to the system of checks and balances surrounding the exercise of corporate power." (Joshi, 2003).*

*"Corporate Governance refers to the relationship that exists between the different participants and defining the direction and performance of a corporate firm." (Prasad, 2006)*

## ESSENTIAL GOVERNANCE PRINCIPLES

A company should:-

1. **LAY SOLID FOUNDATIONS FOR MANAGEMENT AND OVERSIGHT**
   -Recognize and publish the respective roles and responsibilities of board and management.
2. **STRUCTURE THE BOARD TO ADD VALUE**
   - Have a board of an effective composition, size and commitment to adequately discharge its responsibilities and duties.
3. **PROMOTE ETHICAL AND RESPONSIBLE DECISION-MAKING**
   -Actively promote ethical and responsible decision-making.
4. **SAFEGUARD INTEGRITY IN FINANCIAL REPORTING**
   - Have a structure to independently verify and safeguard the integrity of the company's financial reporting.
5. **MAKE TIMELY AND BALANCED DISCLOSURE**
   - Promote timely and balanced disclosure of all material matters concerning the company.
6. **RESPECT THE RIGHTS OF SHAREHOLDERS**
   - Respect the rights of shareholders and facilitate the effective exercise of those rights.
7. **RECOGNIZE AND MANAGE RISK**
   - Establish a sound system of risk oversight and management and internal control.
8. **ENCOURAGE ENHANCED PERFORMANCE**
   -Fairly review and actively encourage enhanced board and management effectiveness.
9. **REMUNERATE FAIRLY AND RESPONSIBLY**
   -Ensure that the level and composition of remuneration is sufficient and reasonable and that its relationship to corporate and individual performance is defined.
10. **RECOGNIZE THE LEGITIMATE INTERESTS OF STAKEHOLDERS**
    - Recognize legal and other obligations to all legitimate stakeholders.
11. **CORPORATE GOVERNANCE RATING IS MADE MANDATORY FOR LISTED COMPANIES.**

## ETHICAL CODES AND GUIDELINES

Corporate and governance principles and codes have been developed in different countries and issued from stock exchanges, corporations, institutional investors, or associations (institutes) of directors and managers with the support of governments and international organizations. As a rule, compliance with these governance recommendations is not mandated by law, although the codes linked to stock exchange listing requirements may have a coercive effect. For example, companies quoted on the London and Toronto Stock Exchanges formally need not follow the recommendations of their respective national codes. However, they must disclose whether they follow the recommendations in those documents and, where not, they should provide explanations concerning divergent practices. Such disclosure requirements exert a significant pressure on listed companies for compliance.

In the United States, companies are primarily regulated by the state in which they are incorporated, though they are also regulated by the federal government and, if they are public, by their stock exchange. The highest numbers of companies are incorporated in Delaware, including more than half of the fortune 500.this is due to Delaware's generally business friendly corporate legal environment and the existence of a state court dedicated solely to business issues. Most states' corporate law generally follows the American Bar Association's Model Business Corporation Act. While Delaware does not follow the Act, it still considers its provisions and several prominent Delaware justices, including former Delaware Supreme Court Chief Justice E. Norman Vaesey, participate on ABA committees.

One of the most influential guidelines has been the 1999 OECD principles of corporate governance. This was revised in 2004. The World Business Council for sustainable development WBCSD has also done sustainable work on corporate governance, particularly on accountability and reporting.

## IMPORTANT MILESTONES TOWARDS EFFECTIVE CORPORATE GOVERNANCE IN INDIA

The **Confederation of Indian Industry (CII)** published India's first comprehensive code on corporate governance (Desirable Corporate Governance: A Code) in 1998. This Code was well received by Corporate India and many of its recommendations became part of subsequent regulations.

An important milestone has been the setting up of the **National Foundation for Corporate Governance (NFCG)**. This was done by the **Ministry of Corporate Affairs** in partnership with the **Confederation of Indian Industry (CII), Institute of Company Secretaries of India (ICSI) and Institute of Chartered Accountants of India (ICAI)**. The vision of NFCG is to be a catalyst in making India the best in corporate governance practices. The internal governance structure of NFCG consists of **Governing Council, Board of Trustees and Executive Directorate.** The Governing council works at the apex level for policy making. The Board of Trustees deals with the implementation of policies whereas the Executive Directorate provides the internal support and implements the decisions of the Board of Trustees.

Various committees have been appointed in the past to make suggestions for more effective corporate governance:

➢ The Kumar Mangalam Birla Committee set up by SEBI submitted its report in 2000. It's suggestions included suitable amendments to the listing agreement executed by the stock exchanges with the companies in order to enhance corporate governance standards of listed companies, drafting a code of corporate best practices, and suggested safeguards to be instituted within companies to deal with insider information and insider trading. Several of these committee's recommendations were incorporated in Clause 49 of the listing agreement of stock exchanges.

➢ The Naresh Chandra Committee gave its report in 2002. This was following the corporate scandals of the US. It made some suggestion in terms of Disclosure of contingent liabilities and risks, recommended that the CEO and CFO certify financial statements. It also suggested that independent directors will not have a pecuniary relationship with company and that there will be a statutory limit on sitting fee for independent directors. Many of these recommendations were incorporated in the Companies (Amendment) Bill 2003.

➢ The Narayana Murthy Committee gave its report in February 2003. It talked about strengthening the responsibility of the audit committee, improving quality of financial disclosures, utilization of IPO funds. It also stressed on the importance of disclosing business risks in annual reports and advocated a whistleblower policy.

## INFLUENCE OF BUSINESS ETHICS ON CORPORATE GOVERNANCE

Like never before, corporations are being asked, encouraged and pushed to improve their business practices to emphasize legal and ethical behaviour. Companies, professional firms and individuals alike are being held increasingly accountable for their actions, as demand grows for higher standards of corporate social responsibility.

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As recently as decade ago, many companies viewed business ethics only in terms administrative compliance with legal standards and adherence to internal rules and regulations. But today, attention to business ethics is on the rise across the world and many companies realize that in order to succeed, they must earn the respect and confidence of their customers. Corporate governance is the basis of accountability in companies, institutions and enterprises, balancing corporate economic and social goals on the one hand with community and individual aspirations on the other.

## CORPORATE GOVERNANCE AND FIRM PERFORMANCE

In its global investor opinion survey of over 200 institutional investors first undertaken in 2000 and updated in 2002, McKinsey found that 80% of the respondents would pay a premium for well-governed companies. They defined a well-governed company as one that had mostly outside directors, who had no management ties, undertook formal evaluation of its directors, and was responsive to investor's requests for information on governance issues. The size of the premium varied by market, 11% for Canadian companies to around 40% for companies where the regulatory backdrop was least certain (those in Morocco, Egypt and Russsia).

Other studies have linked broad perceptions of the quality of companies to superior share price performance. In a study of five year cumulative returns of Fortune Magazine's survey of 'most admired firms', Antunovich et al found that those "most admired" had an average return of 125%, while the "least admired" firms returned 80%. In a separate study, Business Week enlisted institutional investors and 'experts' to assist in differentiating between boards with good and bad governance and found that companies with the highest rankings had the highest financial returns.

On other hand, research into the relationship between specific governance controls and firm performance has been mixed and often week.

## BUSINESS ETHICS & CORPORATE GOVERNANCE IN ASIAN COUNTRIES

### INDIA

Although the discussion on ethics is almost a general phenomenon in India, unethical business practice become a recognized phenomenon in this country during Second World War. The concern with business ethics has become visible only during the nineties. Although there is a strong belief in corporate social responsibility in India, the decisions are not made in participatory way, but by the persons at the top. In terms of the rules and regulations in India, the government very often acts as a problem- creator rather than facilitator. This is due to a complex bureaucracy, corruption and undoubtedly, the absence of ethical sense in various sectors. It is high time that Indian companies start reflecting upon their corporate practices and look beyond traditional community development and a simple focus on compliance.

### PAKISTAN

Pakistan draws ethics principles primarily from Islamic law because the constitution mandates that all laws conform to Islam. Pakistan's legislature delegated the task of issuing a corporate governance code to the Securities and Exchange Commission of Pakistan (SECP), which enacted Pakistan's Code of Corporate Governance (the Code) in 2002. The SECP believes that the best way to promote the interest of all corporate stakeholders is to ensure that business is conducted in accordance with the highest prevailing ethical standards.

### SRILANKA

A revised corporate governance code has been published in Sri Lanka by the Institute of Chartered Accountants of Sri Lanka (ICASL) and Securities and Exchange Commission. Although the Code relies heavily on the UK's Combined Code on Corporate Governance, there are some noticeable differences in emphasis and wording. Both codes stress the important role performed by the chairman but Sri Lankan code expresses this most succinctly in principle A.3 as follows: *"The Chairman's role in preserving good Corporate Governance is crucial".*

### CHINA

*"China is widely perceived as having a problem in business ethics. One view holds that elements of Chinese culture tend to encourage unethical business decisions. Another perspective says that China has business ethics issues because its economy is in transition. The unclear rules of the game create opportunity for business ethics problems. The large amount of new wealth creates incentive to cut corners to get rich."* **(John Hulpke and Cubie Lau, 2008)**

China is seen as having business ethics problems. However, good business ethics help a society as a whole, and some say that good ethics can be source of competitive advantage for an organization. In the past fifty years, Chinese society has changed significantly and some traditional components of Chinese beliefs have been abandoned along the way. Following the path of development of Chinese business culture, it is not hard to understand why China's corporate governance is far from satisfactory.

## CONCLUSION

Through the above discussion on ethics in governance, it is clear that if the organization integrates ethical values in monitoring business activities it can change the image of the corporation. These ethical & moral values enhance the performance and generate believes of the investors as well as customers within the organization. A sound ethical program adds value by protecting and increasing the enterprise's **reputation**. Reputation is important for strengthening business relations and earning client's loyalty in any enterprise. Another important benefit of ethics is reduction in **corruption risk** because it provides tools to conduct business honestly. This also controls on **organizational structure** & **fosters team work** by decreasing conflict among members of enterprises. Good governance will reduce scams and scandals which have taken place in the last decade. That will help in economic growth of enterprise as well as nation. So every organization should start ethical practices in managing organization. This is the need for today.

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# EMPLOYEES' PERCEPTION ON TRAINING AND DEVELOPMENT
# (A STUDY WITH REFERENCE TO EASTERN POWER DISTRIBUTION OF AP LIMITED)

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## ABSTRACT

*Training and Development practices are designed to improve organizational performance through enhancing knowledge and skills of employees. It is essential that all activities relating to training should be in tune with the specific needs of both the organization and the employees. The HRD policy of the organization is mainly aimed at all round development of its employees. The sample for the study of 265 respondents has been selected on stratified sampling method. In this study, Eastern Power Distribution of AP Limited has been covering a majority of the respondent employees through training programmes continuously for upgrading the skills of its employees. However, care need be taken to cover the training programmes to all cadres of employees in the light of growing competition in the power station.*

## KEYWORDS
HRM, Training, Development, Employees' perception.

## INTRODUCTION

Training is one of the most vital tools of HRD as it is rightly said that "training is the act of increasing knowledge and skill of an employee for doing a particular job." Training is a process of learning a sequence of programmed behaviour. It is application of knowledge. It gives people an awareness of the rules and procedures to guide their behaviour. It attempts to improve their performance on the current job or prepare them for an intended job. Development is a related process. It covers not only those activities, which improve job performance, but also those, which bring about growth of the personality, help individuals in the progress towards maturity and actualization of their potential capacities so that they become not only good employees but also better men and women.

Training refers only to instruction in technical and mechanical operations, while 'development' refers to philosophical and theoretical education concept. Training is designed for non-managers, while development involves managerial personnel. Training may be defined as a planned programme designed to improve performance and to bring about measurable changes in knowledge, skills, attitude and social behaviour of employees for doing a particular job. Now-a-days, training has an additional purpose of facilitating changes. Management is basically equipping managers with such knowledge, skills and techniques which are relevant to managerial tasks and functions. Employee training is a systematic process by which personnel at all work levels gain and apply skills, knowledge, attitudes and insights to perform the work more productively.

## PROFILE OF THE ORGANIZATION

The AP Transco has been unbundled into a Transmission Corporation and four distribution companies effective from 1.4.2000 under the provincial second transfer scheme notified by the State Government viz., Eastern Power Distribution Company of AP Limited (APEPDCL), Central Power Distribution Company of AP Limited (CPDCL), Southern Power Distribution Company of AP Limited (SPDCL), Northern Power Distribution Company of AP Limited (NPDCL). The above distribution companies have been incorporated under the Companies Act, 1956.

The Eastern Power Distribution Company of AP Limited came into existence form April 1st 2000 as a result of dismantling of vertically integrated APSEB into functionally district entities undertaking Power Generation, Transmission and Distribution. It is initially formed as wholly owned subsidiary of APTRANSCO from power trading activity in strict compliance of the provisions of the Electricity Act 2003. This company is engaged in the business power distribution and retail power supply in its designated area covering five northeastern districts of Andhra Pradesh. APEPDCL is responsible for undertaking distribution and bulk supply of power in the operation circles of Srikakulam, Visakhapatnam, Vizianiagaram, East and West Godavari Districts and 17 divisions of coastal Andhra Pradesh. APEPDCL supplies power to over 35.54 lakh consumers belonging to different categories through a network consisting of 388 substations of 33 KV level, 1457 feeders of 11 KV level and more than 76,722 distribution transformers of different levels. The Corporate Office and Head Quarter of APEPDCL are situated at Visakhapatnam.

## NEED FOR THE STUDY

Human Resource Training is an important requirement for enabling employees to function effectively and efficiently for an organization. Updating one and orienting self to the present vision, mission and goals of the organization is an environment that is prone to innumerable factors. A few studies have been conducted by the researchers, research institutes, government and private agencies examining on training and development in different industries/organizations like Textile Industry, Visakhapatnam Steel Plant, Visakhapatnam Port Trust and State Bank of India etc., but quite surprisingly not on the area of Training and Development particularly in APEPDCL.

## OBJECTIVES OF THE STUDY

The study has been carried out with the following objectives

- to enquire into the socio-economic characteristics of employees in Eastern Power Distribution of AP Limited;
- to critically examine the various training and development programmes in the select organization;
- to evaluate the employees perception on training and development; and
- to suggest appropriate measures to improve the training and development programmes in EPDCL.

## METHODOLOGY AND SAMPLING

The study is mainly based upon primary and secondary data. A questionnaire has been prepared with different questions to examine the socio-economic status and employees' perception on training and development programme in EPDCL. A sample of 265 respondents has been selected following stratified sampling method. The sample consists of 75 respondents (20 percent) out of 375 employees in the category of Technical workmen, 85 respondents (5 percent) out of 1661 employees in the category of Non-technical workmen and 105 respondents (2 percent) out of 5257 employees in the category of Operations and Maintenance (O&M) Construction and others from Eastern Power Distribution Company of AP Limited. The secondary data has been collected from the records and annual reports of Transco, Training Centers, Periodicals, Magazines and Industry websites.

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## ANALYSIS OF THE STUDY

### SOCIO ECONOMIC CHARACTERISTICS OF EMPLOYEES

The social base of employees is an important factor influencing the pace of economic development. In order to build up a stable, harmonious and productive work force for the industry in the long run, it is essential to understand the socio-economic background of the select organization viz., Eastern Power Distribution Company of A.P. Limited.

### SEX

In olden days, women used to attend to domestic activities only. But now- a- days they also seek employment on par with men. Out of the sample size of 265 respondents, 222 employees (83.78 percent) were male and 43 employees (16.22 percent) were female respondents. Male domination is quite obvious.

### EDUCATION

The level of education is an important factor in building up strong and stable labour force needed by industry. Hence, it is useful to understand the educational background of employees working in EPDCL. The study revealed that 57 employees (21.52 percent) were graduates in technical education and 56 employees (21.13) were general degree holders. As many as 45 employees (16.98 percent) studied up to plus two level. 37 employees (13.96 percent) were post graduates in technical education i.e., M. Tech. and 28 employees (10.57 percent) were general PG degree holders. 36 employees (13.58 percent) had education only SSC. The remaining 6 employees (2.26 percent) had professional studies like Chartered Accountancy, Institute of Cost and Works Accountancy and Company Secretaryship.

### AGE COMPOSITION

Any organization big or small needs strong, energetic and dynamic work force in the productive age group. It is an important variable because it has direct relation with one's mental maturity and the consequent awareness about what is going on in the society. This analysis is useful to estimate the number of currently working employees in the different age groups. The highest number of employees (35.09 percent) belongs to 40 – 50 years age group one- third were found in the 30 – 40 years category, while, 46 employees (17.36 percent) were below 30 years. And remaining employees (14.34 percent) are in the group of above 50 years. The average age of employees in the study is 39.65 years.

### MARITAL STATUS

Marital status of employees plays a key role in entering into organization along with other personal characteristics like age, education, caste etc. It denotes the support they receive from their family members. The study found that 206 employees (77.74 percent) were married, 37 employees (13.96 percent) were unmarried, 14 employees (5.28 percent) were widowed and remaining 8 employees (3.02 percent) were divorced. Most of the employees are married in the organization.

### COMMUNITY

The Indian organizations has always been discussed and analyzed in terms of employees' caste and the pursuits associated with caste. The caste system has to some extent has its effect on occupational mobility. In the present study, an attempt has been made to analyze the caste and community of the employees. The study revealed that majority of the employees (48.67 percent) belong to Forward Castes such as Kapu, Telaga, Balija, Brahmin, Vyasya, Kamma, Reddy etc., followed by 26.42 percent belonging to Backward Castes. While 39 employees (14.72 percent) belong to Scheduled Castes and 27 employees (10.19 percent) belong to Scheduled Tribes. This composition, more or less conforms to their respective shares in the total population of the country.

### RELIGION

Religion is becoming an important aspect even in the industrial world now-a-days. Hence, an attempt has been made to analyze the religious composition of the employees. It is found in the study majority of employees (80.75 percent) belong to Hindu community. While 10.94 percent belong to Muslim community, 8.31 percent of the employees belong to Christian community. Hindu domination is quite visible which is again due to its domination in the population of the country.

### NATIVITY

Native place of an employee has been classified into two types - Local and Non-local. A person who is born with in the state (Andhra Pradesh) is considered local and born outside the state is treated as non local. It is observed in the study that 261 respondents (98.49 percent) are from Andhra Pradesh and only 4 respondents (1.51 percent) are from Tamil Nadu.The study also revealed that 144 respondents (54.34 percent) hail from urban areas and remaining 121 respondents (45.66 percent) are from village background.

### TYPE OF FAMILY

In urbanized India, nuclear families are quite common while in rural India there are still joint families and extended families. Joint family is considered to be a characteristic of the institutional structure of Indian society. In the Indian context, it is felt that industrialization disintegrated the traditional system of joint family. The study made an enquiry into this aspect and found that majority of the respondents (55. 09 percent) belong to joint family and 119 respondents (44. 91 percent) belong to nuclear family. In a society dominated by joint family system, the rise of nuclear families can be noticed.

### ANNUAL INCOME

The status and standard of living of a person is determined by the income he/she gets. Generally, the main source of income of respondents is salary. But some employees may have other sources of income from agriculture, house property etc. It is observed that 71 respondents (26.79 percent) have annual income rating between Rs. 200000 – 300000 followed by 20.78 percent between Rs. 100000 – 200000. While 47 employees (17.74 percent) have annual income Upto Rs. 100000, 38 employees (14.34 percent) have annual income that lies between Rs. 300000 – 400000. This is followed by 11.70 percent whose income lies between Rs. 400000 – 500000. The remaining respondents (9.05 percent) have an annual income above Rs. 500000.

### EMPLOYEE PERCEPTIONS

Among the total respondents, 46.04 percent expressed that their managements introduced latest technology in some of their routine operations planning for further technological changes in other departments. Among the quality of goods and services and to compete with rival competitors, more production and cost reduction are the important challenges before the management. For this, the only alternative to them is to update their technology. In this process, there emerged the problem of existing the surplus labour. Among the total respondents, 36.27 percent of the respondents reported that their management introduced computerization and 17.69 percent of the respondents also accepted the mechanization took place. These respondents also expressed that the introduction of computers in their organization created fear among the employees especially in the administration.

### MATCHING OF SKILLS

The researcher also focused on to know the opinion of respondents whether existing skills match to the new and fast changing environment due to technological developments in the organization. Out of the total respondents, 97.74 percent of the respondents opined that the present skills and knowledge had not matched with the demand of the changing work environment. The union leaders and HR managers also accepted that there was a need to extend training in latest developments and technology to the concerned employees. The unions urged their managements to intensify the training programmes to all the employees irrespective of the nature of work to provide latest skills and to make manpower multi-skilled. It is observed that the EPDCL is still practicing the traditional methods in some of its administrative departments like personnel, stores, general administration and not yet computerized. Inspite of severe financial crisis, the EPDCL management was found to be making plans to introduce IT based technology.

### TRAINING PROGRAMMES NEEDED

Among the total respondent employees, 71.32 percent felt that on the job training helps them increase their skills and ultimately leads to more and quality production in their organization. Off-the-job training programmes also help the employees to learn latest skills, talents and exposure to new techniques and styles in their work place. Institutional training is designed to enhance interpersonal skills. This type of training can be used to develop desired behaviours for future job responsibilities. Participants in the institutional training programmes seek to improve their human relations skills by better understanding themselves and others. Among the total employees, 26.42 percent wanted training in some reputed and relevant training institution.

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**FREQUENCY AND USEFULNESS OF TRAINING PROGRAMMES**

Out of the total respondents, 15.47 percent opined that their managements arranged training programmes frequently. Department wise, it may be noted that in EPDCL a few employees only acknowledged the frequent conduct of training programmes. 53.21 percent of employees expressed that the training programmes were arranged now and then, because of inadequate budgets for training programmes. Regarding its usefulness 213 respondents (80.38 percent) opined that training programmes are useful to some extent in EPDCL followed by 46 respondents (17.36 percent) who expressed that their opining on training programmes in EPDCL are very much useful to employees.

**SPECIFIC BENEFITS OF TRAINING PROGRAMMES**

Out of the total respondent employees, 53.21 percent employees expressed that the training arranged by the management helped increase their skills and 12.83 percent employees expressed that the training programmes led to increase in productivity. The employees also expressed that after attending the training programmes their job satisfaction also increased (15.85 percent) and inspired to work more. Awareness of the respective jobs is also another benefit which the trainees achieved through attending training programmes. .

**NEED FOR RE-EQUIPPING THE TRAINING AND DEVELOPMENT CENTRE**

As many as 69.81 percent of respondent employees expressed that there is a need for re-equipping training and development centre in their organization. However, 30.19 percent of employees expressed that there is no need for re-equipping training and development centre in the organization. Out of total respondents, 48.11 percent respondents opined that to maintain public relations in the organization it is necessary to re-equip the training centers and followed by 36.76 percent who offered the reason of improving working skills. The remaining respondents (15.13 percent) expressed that it is to update the regulations relating to training and development programmes.

**PROBLEMS FACED BY EMPLOYEES IN ATTENDING THE TRAINING PROGRAMMES**

Out of the total respondents, 41.89 percent respondents faced the problems of heavy workload in the office in attending the training programmes. 34.34 percent of respondents faced the problem of frequent disturbances by boss and peers through phone calls in training programmes. 13.58 percent of respondents faced problems of too many participants and the remaining 10.19 respondents faced problems of unsuitable timings in the training period.

**METHODS OF TRAINING PROGRAMME**

Lecture method is still considered to be very popular and often used in training programmes. According to weighted score of 30.99 percent of respondents, this method was used often and it's followed by group discussion method with weighted score of 18.19 percent. Another method often used is quiz method (weighted score of 17.67 percent). Case analysis and role play were also used some times (weighted score of 16.75 percent and 16.40 percent respectively). Most probably these methods were used where the nature of the programme and content necessitated their application. Though traditional in nature, lecture method was used, invariably in all methods.

**TRAINING TOOLS AND AID**

Out of 265 respondents, 63.40 percent of the respondents had taken both audio and visual media in their training period. 21.51 percent of the respondents had taken only audio media followed by 15.09 percent of the respondents that had taken only visual media in their training period.

**OPINION ON TRAINING ENVIRONMENT**

It may be noted that 40.00 percent of respondents considered the training environment as good. While 33.21 percent opined that training environment is poor, 71 respondents (26.79 percent) felt that training environment is fair. Majority of the respondents in this organization showed their opinion on training environment as good, in office rooms that are air-conditioned and computerized.

**IDEAL LENGTH OF TRAINING PROGRAMME**

Out of the total respondents, 41.89 percent of the respondents considered 2- 5 days of training programme as ideal. 33.58 percent of the respondents favoured one week of training programme. The remaining respondents (24.53 percent) preferred 15 days of training programme. Nobody in the organization considered one day training programme in the organization as ideal.

**OPINION ON TRAINING PROGRAMMES**

Out of 265 respondents, 41.89 percent of the respondent employees' opined that through the development programmes the individual skills will be improved. 32.45 percent of the respondents viewed that both the organization and individual skills will develop through training programme. 25.66 percent of the respondents opined that organization will develop through these training programmes.

**ADEQUACY OF TRAINING PROGRAMMES ATTENDED**

Out of 265 respondents, 51.32 percent of the respondents had an opinion that the training programmes they attended were 'adequate'. 32.45 percent of respondents gave a rating of 'more than adequate' and 16.23 percent had rated the programmes as 'inadequate'.

**MONETARY BENEFITS ON ACCOUNT OF ATTENDING PROGRAMMES**

Out of 265 total respondents, 67.55 percent of the respondents were not satisfied with the monetary benefits on attending training programme. However, 32.45 percent of the respondents were satisfied with their monetary benefits received on attending the training programmes.

## CONCLUSION AND SUGGESTIONS

Manpower planning aspect need to be paid adequate attention to see that right people are placed at the right time and at the right place with right skills and background and the units do not suffer from either surplus or shortage of human resource at any point of time.

The APEPDCL has been covering a majority of the respondent employees through training programmes continuously for upgrading the skills of its employees. However, care should be taken to cover the training programmes to all cadres of employees in the light of growing competition in the power station. In order to provide core competency among the people the management of utility system should upgrade the content duration and the activity of further training programmes. The APEPDCL has to take necessary action to facilitate the expected training facilities and allocate more budgets for the development of training facilities.

The training programmes must be identified on the basis of the need and must be organized on a continual basis. Evaluation of training programmes at all levels must be scrupulously observed to see that knowledge and skills are transferred to the job and result in the increased efficiency and productivity of the APEPDCL. Management Development programmes must be need - oriented and the managers must be sent to outside institutes to get more qualitative training.

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**TABLES**

**TABLE 1: CLASSIFICATION OF RESPONDENTS BY SEX**

| Sex | No. of Respondents | Percentage |
|---|---|---|
| Male | 222 | 83.78 |
| Female | 43 | 16.22 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 2: LEVEL OF EDUCATION**

| Education Level | | No. of Respondents | Percentage |
|---|---|---|---|
| SSC | | 36 | 13.58 |
| Intermediate | | 45 | 16.98 |
| Degree | General | 56 | 21.13 |
| | Technical | 57 | 21.52 |
| PG | General | 28 | 10.57 |
| | Technical | 37 | 13.96 |
| Professional | | 06 | 2.26 |
| **Total** | | **265** | **100.00** |

Source: Primary data

**TABLE 3: AGE COMPOSITION OF RESPONDENTS**

| Years | No. of Respondents | Percentage |
|---|---|---|
| Below 30 | 46 | 17.36 |
| 30-40 | 88 | 33.21 |
| 40-50 | 93 | 35.09 |
| 50 & above | 38 | 14.34 |
| **Total** | **265** | **100.00** |

**Average Age = 39.65 years**

**TABLE 4: MARITAL STATUS**

| Marital Status | No. of Respondents | Percentage |
|---|---|---|
| Married | 206 | 77.74 |
| Unmarried | 37 | 13.96 |
| Widowed | 14 | 5.28 |
| Divorced | 08 | 3.02 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 5: COMMUNITY BACKGROUND**

| Community | No. of Respondents | Percentage |
|---|---|---|
| SC | 39 | 14.72 |
| ST | 27 | 10.19 |
| BC | 70 | 26.42 |
| OC | 129 | 48.67 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 6: RELIGIOUS BACKGROUND**

| Religion | No. of Respondents | Percentage |
|---|---|---|
| Hindu | 214 | 80.75 |
| Muslim | 29 | 10.94 |
| Christian | 22 | 8.31 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 7: NATIVE PLACE**

| Native Place | No. of Respondents | Percentage |
|---|---|---|
| Village | 121 | 45.66 |
| Town | 144 | 54.34 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 8: TYPE OF FAMILY**

| Type of Family | No. of Respondents | Percentage |
|---|---|---|
| Joint | 146 | 55.09 |
| Nuclear | 119 | 44.91 |
| **Total** | **265** | **100.00** |

Source: Primary data

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**TABLE 9: ANNUAL INCOME**

| Income (Rs.) | No. of Respondents | Percentage |
|---|---|---|
| Below   100000 | 47 | 17.74 |
| 100000 – 200000 | 54 | 20.38 |
| 200000 – 300000 | 71 | 26.79 |
| 300000 – 400000 | 38 | 14.34 |
| 400000 – 500000 | 31 | 11.70 |
| Above   500000 | 24 | 9.05 |
| **Total** | **265** | **100.00** |

**Average Annual Income = Rs. 2, 59, 057/-**

**TABLE 10: EMPLOYEES' OPINION ABOUT DIFFERENT TECHNICAL CHANGES IN THEIR ORGANIZATION**

| Different Technical Changes | No. of Respondents | Percentage |
|---|---|---|
| Introduction to Latest Technology | 122 | 46.04 |
| Computerization | 96 | 36.27 |
| Mechanization | 47 | 17.69 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 11: EMPLOYEES' OPINION ABOUT MATCHING OF EXISTING SKILLS TO THE NEW ENVIRONMENT**

| Response | No. of Respondents | Percentage |
|---|---|---|
| Yes | 06 | 2.26 |
| No | 259 | 97.74 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 12: EMPLOYEES' OPINION ABOUT THE TRAINING PROGRAMMES NEEDED**

| Training Programmes | No. of Respondents | Percentage |
|---|---|---|
| On the Job Training | 189 | 71.32 |
| Institutional Training | 70 | 26.42 |
| Others (Not Applicable) | 06 | 2.26 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 13: EMPLOYEES' OPINION ABOUT TRAINING PROGRAMMES ARRANGED BY MANAGEMENT**

| Frequency | No. of Respondents | Percentage |
|---|---|---|
| Frequently | 41 | 15.47 |
| Now and then | 141 | 53.21 |
| Rarely | 83 | 31.32 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 14: EMPLOYEES' OPINION ABOUT BENEFITS OF TRAINING PROGRAMMES**

| Benefits | No. of Respondents | Percentage |
|---|---|---|
| Working skills increased | 141 | 53.21 |
| Productivity increase | 34 | 12.83 |
| More Job satisfaction | 22 | 8.30 |
| Greater awareness | 20 | 7.55 |
| Increasing promotions | 42 | 15.85 |
| Others (NA) | 06 | 2.26 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 15: IS IT NECESSARY FOR RE-EQUIPPING THE TRAINING CENTRE?**

| Response | No. of Respondents | Percentage |
|---|---|---|
| Yes | 185 | 69.81 |
| No | 80 | 30.19 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 16: PROBLEMS IN ATTENDING TRAINING PROGRAMMES**

| Problems | No. of Respondents | Percentage |
|---|---|---|
| Heavy workload in the office | 111 | 41.89 |
| Unsuitable timings | 27 | 10.19 |
| Frequent disturbances by boss and peers through phone calls | 91 | 34.34 |
| Too many participants | 36 | 13.58 |
| **Total** | **265** | **100.00** |

Source: Primary data

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**TABLE 17: METHODS OF TRAINING PROGRAMME**

| Methods | Ranks | | | | | Weighted Score | Rating | Rank |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | | |
| Lecture Method | 128 | 98 | 38 | 34 | 18 | 1232 | 30.99 | 1 |
| Role play Method | 28 | 17 | 68 | 78 | 84 | 652 | 16.40 | 5 |
| Case Analysis | 30 | 35 | 57 | 64 | 77 | 666 | 16.75 | 4 |
| Group discussion Method | 55 | 30 | 60 | 51 | 46 | 723 | 18.19 | 2 |
| Quiz Method | 24 | 85 | 42 | 38 | 40 | 702 | 17.67 | 3 |
| **Total** | **265** | **265** | **265** | **265** | **265** | **3975** | **100.00** | |

Source: Primary data

**TABLE 18: TRAINING TOOLS ADOPTED IN THE TRAINING**

| Tools | No. of Respondents | Percentage |
|---|---|---|
| Visual | 40 | 15.09 |
| Audio | 57 | 21.51 |
| Both | 168 | 63.40 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 19: OPINION ON TRAINING ENVIRONMENT**

| Opinion | No. of Respondents | Percentage |
|---|---|---|
| Good | 106 | 40.00 |
| Fair | 71 | 26.79 |
| Poor | 88 | 33.21 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 20: OPINION ON TRAINING APPROACH**

| Rating | No. of Respondents | Percentage |
|---|---|---|
| Good | 151 | 56.98 |
| Fair | 70 | 26.42 |
| Poor | 44 | 16.60 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 21: IDEAL LENGTH OF TRAINING PROGRAMME**

| Ideal Length | No. of Respondents | Percentage |
|---|---|---|
| One day | Nil | - |
| 2 -5 | 111 | 41.89 |
| One week | 89 | 33.58 |
| 15 days | 65 | 24.53 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 22: EMPLOYEES' OPINION ON TRAINING PROGRAMMES**

| Opinion | No. of Respondents | Percentage |
|---|---|---|
| Organization | 68 | 25.66 |
| Individual skills | 111 | 41.89 |
| Both | 86 | 32.45 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 23: ADEQUACY OF TRAINING PROGRAMMES ATTENDED**

| Rating | No. of Respondents | Percentage |
|---|---|---|
| More than Adequate | 86 | 32.45 |
| Adequate | 136 | 51.32 |
| Inadequate | 43 | 16.23 |
| **Total** | **265** | **100.00** |

Source: Primary data

**TABLE 24: MONETARY BENEFITS ON ACCOUNT OF ATTENDING PROGRAMMES**

| Response | No. of Respondents | Percentage |
|---|---|---|
| Yes | 86 | 32.45 |
| No | 179 | 67.55 |
| **Total** | **265** | **100.00** |

Source: Primary data

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# AN OPTIMAL BROKER-BASED ARCHITECTURE FOR TRANSACTIONAL AND QUALITY DRIVEN WEB SERVICES COMPOSITION

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## ABSTRACT

*Web service composition consists of combining web services that supports business-to-business or enterprise application integration to offer more complex services. While performing web service composition, the selection of appropriate web service for each activity in the workflow from the discovered services that satisfy a given requirement has become an important problem. However, all the existing broker based architectures consider only QoS factors for web service composition. They do not consider the transactional constraints during the composition process. This paper proposes and implements a broker-based framework for web service composition not only according to their QoS characteristics but also to their transactional properties and thereby facilitates dynamic integration of atomic web services. This is verified for various inputs and results shows that the broker provides a better web service composition.*

## KEYWORDS

Web services, quality of service, transactional web service, broker based architectures, workflow, web service composition.

## INTRODUCTION

Web services provide ready-to-use functionalities through fixed interfaces for other applications by hiding the implementation details and they are commonly used in real world applications. There exist a huge number of web services that can handle particular requests. With the increasing number of available web services, maintaining these services and searching for the ones that satisfy a given requirement has become an important problem. In order to handle a complex request, a combination of more than one service is required. This process of combining web services to achieve complex tasks is called Web Service Composition (WSC).

Consider the example of travel agency as shown in Figure. 1. A customer calls a travel agent who notes down the customer requests. He generates a trip request that consists of many hotel and flight reservations etc. The travel agent performs all bookings by sending the generated requests to specialized services which work independently of each other. If both the services have been completed successfully, the confirmation process put all the documents together and informs the customer. This is in the case of closed world scenario. In the open world scenario, there will be a number of processes trying to achieve the same goal. The Web service composition is done to integrate all the required services together to provide successful execution of the request from the customer.

**FIGURE 1.TRAVEL AGENCY**
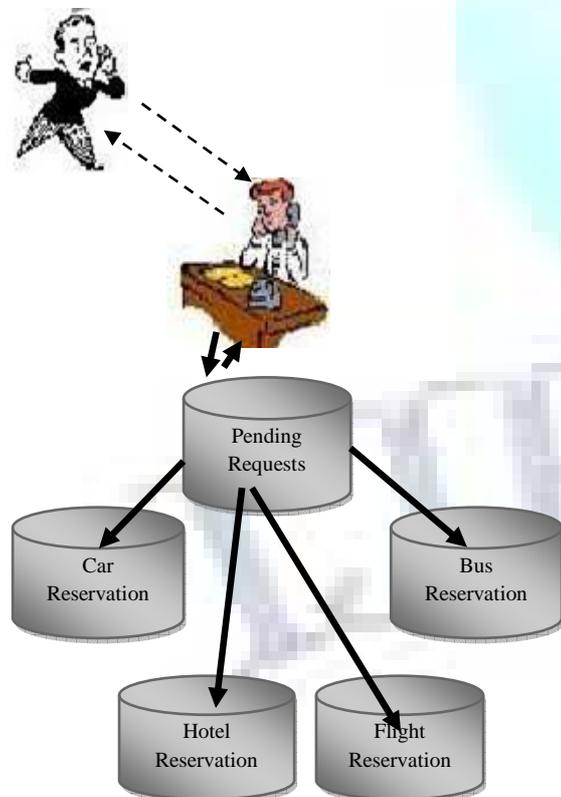


The Web service composition mainly includes three steps: 1) Web service discovery, 2) selection of the component Web services, and 3) execution of the composite Web services.

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*A.    Web Service discovery*

There are several thousand services, which can be used for composing required applications. However, for composing services for the application, these services must first be discovered. Based upon the description given by the customer, the broker based architectures discovers available web services for each activity in the work flow. The UDDI of Web services provides a more powerful approach to model and search Web services.

*B.    Web Service selection*

The service selection is the step of deciding which service has to use to finally perform the task. For instance there may be services performing similar goals and users can select the one that is closest to the customer intention. However, different services that perform the same goal, may offer different objects, at different costs, quality levels, etc. The Service providers provide web services with the QoS specification. The consumers specify the service that is to be served with their own QoS requirements. So the need to select the appropriate web services becomes more important during the second step of web services composition.

Generally, when a client application invokes operations in a composite WS, the composite WS executes these operations by serving as a broker that delegates the operations to some atomic WSs. The operation invocations between the application, the composite WS, and the atomic WSs are shown in Figure. 2. When the application invokes operations in composite WS[1], for instance let it be O1, then O1 can be executed either using O1 in atomic WS W1 or W3. The set of atomic WSs to be delegated is called the WS community.

Web service consumers require tools to search for suitable services. This poses challenges not only in discovery mechanisms and guaranteeing high quality services. The web services composition performs the service selection, that can be done based on quality factors and transactional properties. Due to the dynamic nature of Web services, several system issues must be considered when integrating Web services. This paper proposes a broker-based architecture for the dynamic integration of Web services with QoS constraints and transactional properties. The main motivation of the proposed framework is to delegate brokers to make intelligent service selection for business process requesters.

**FIGURE 2: INVOKING RELATIONSHIPS BETWEEN ATOMIC WSS, THE COMPOSITE WS, AND THE APPLICATION**
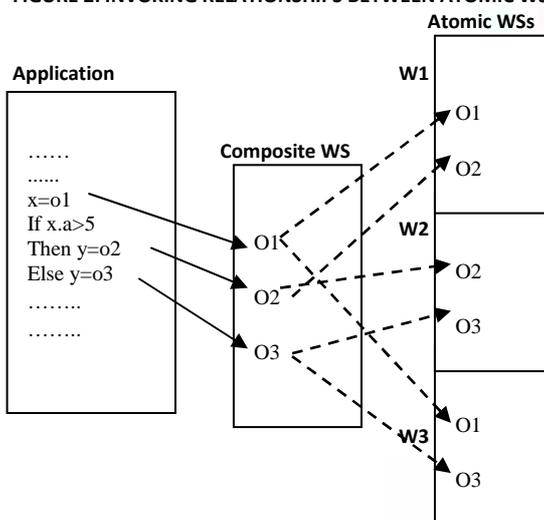


## RELATED WORKS

Many researchers have studied on the adaptive and dynamic service composition problem. Many industry standard XML-based languages have been developed recently, to specify web services interactions.  Previously, a framework for quality-driven web service composition [2] was proposed that selects the web services based upon the QoS requirements of the requestors. S.Majitha et al proposed a framework for reputation-based semantic service discovery [3]. Diego and Maria [4] proposed an extended Web service architecture to support QoS management. There are many web service discovery models that contain UDDI to accommodate the QoS information and a management system to build and maintain service reputations and a discovery agent to facilitate service discovery. Different approaches for various optimal web service selection problems have been proposed in the previous years. However, none of these approaches takes into account the transactional behavior of the composite WS.

A set of activities having a transactional behavior are co-ordinate  by workflow systems, by transactional protocols, and by Advanced Transactional Models (ATMs).The workflow systems can be managed by using exception handlers[5] and also by ensuring atomicity of each  activity within the workflow. Bhiri et al. [6] extend workflows patterns in order to consider the transactional behavior in case of failures and recovery. BTP (Business Transaction protocol), WS-TXM etc are transaction protocols. BTP uses XML messages for managing the workflow between business partners. ATMs (Advanced Transaction Models) can be nested transactions, split and join transactions, flexible transactions etc. Several approaches use ATM to implement transactional behavior for WSs. This paper considers flexible transactions for web service composition.

When considering end-to-end constraints, selection algorithms are of two types: Combinatorial approach and graph approach [7]. The combinatorial approach models the selection problem as a Multiple Choice Knapsack Problem (MCKP) and gives an efficient algorithm to solve it. However, this approach can only treat one execution path at a time. So for an execution plan with more than one execution path, we need to run the algorithm more than once, and compare the results to find the optimal solution. The graph approach models the problem as a Directed Acyclic Graph (DAG) and converts the original problem to the problem of finding the highest utility path in DAG with an end-to-end constraint. It can handle the whole execution plan at the same time. Both the approaches consider end-to-end QoS constraints.

Genetic Algorithms [8] are also used for web service selection. A hybrid genetic algorithm uses a local optimizer to improve the individuals in the population and utilizes a crossover operator and mutation. The individuals in the initial population are randomly generated at first, and at the end of each generation the local optimizer is used to improve the individuals in the population. The local optimizer maximizes the overall QoS value and also minimizes the number of constraint violations of an individual.

A new TQoS selection algorithm is proposed [9]. It consists of a Web service selection approach supporting transactional and quality-driven WS composition. The new broker based architecture focuses on the selection of WSs based on their QoS and transactional behavior using the TQoS selection algorithm.

## THE TQoS BROKER ARCHITECTURE

The new TQoS broker based architecture performs with an objective of selecting the best web service that satisfies transactional properties as well as the requester's QoS constraints and preferences. The Broker [10] contains six main components such as WF-Modeller, WS-Locator, Transactional WS-Adaptor, QoS WS-Adaptor, Output-Generator, and QoS-Manager as shown in Figure. 3.

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*A. WF-Modeller*

The First step is done by the WF-Modeller. The requestor inputs a service description to the Broker referring to the required final Web service [11]. The WF-Modeller returns a workflow as a result. It returns a set of activities where each activity is complemented by a set of semantic annotations, to describe its functionalities and capabilities.

**FIGURE 3: QoS BROKER ARCHITECTURE**
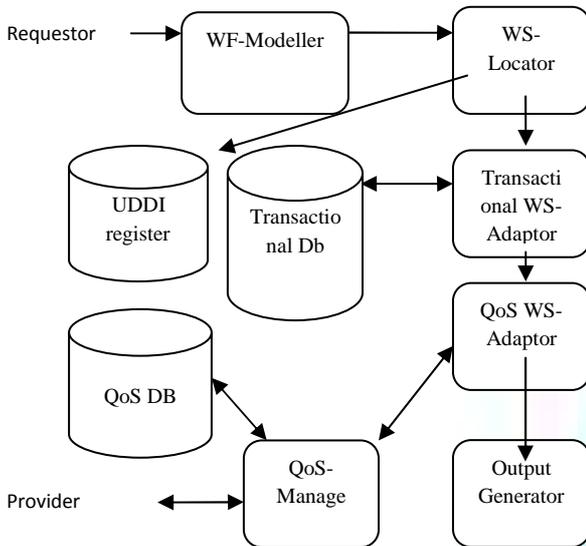


*B. WS-Locator*

Based upon the workflow that has been generated, the WS-Locator will identify one or more Web services for each workflow activity. It searches the UDDI registry to find similar web services for each workflow activity. It exploits both UDDI search functionality, and semantics annotations to perform the assignment.

*C. Transactional WS-Adapter*

Based upon the required transactional property of the activity, the appropriate web services are selected from the located ones. The required transactional property depends upon that of the immediate previous activity.

*D. QoS WS-Adaptor*

The requestor specifies QoS requirements along with the request. From the set of services for each workflow activity obtained from the Transactional WS-Adaptor it will select the best web services satisfying requestor's end-to-end QoS constraints and preference for every task to take part in the composition.

*E. QoS Manager*

The QoS property values provided by service providers are finally verified by the QoS-Broker

*F. WSBPEL generator.*

This is the last step. The results returned by the QoS Adaptor are translated into a WSBPEL document.

*Step 1*: User submits the request to the Broker.

*Step2*: The WF-Modeller converts the request to a flow model.ie; it generates a workflow based upon the user's request. The workflow is given to the WS-Locator.

*Step3*: The WS-Locator discovers the available web services for each activity in the workflow. It searches the services in the UDDI registry.

*Step4*: The Transactional Adaptor selects the appropriate services that satisfying the transactional property from the available services for each activity given by the WS-Locator.

*Step5*: The requester's demand may include not only functional aspect of web service but also non-functional aspects like Quality of service (QoS). The services those satisfy transactional property for each activity is given as input to the QoS WS-Adaptor. From that it will select the service that satisfies user's end-to-end QoS constraints.

*Step6*: If a service problem occurs during process execution, it is reported to QoS-Manager and affects on some QoS property values. The QoS property values obtained from the service providers are verified and certified by the verifier and certifier component before registering them into the QoS Database.

*Step7*: Finally Output generator generates a document based upon the composition and give back to the customer.

## TRANSACTIONAL COMPOSITION

*A. Atomic Transactional Web Service*

An atomic transactional Web Service (*AT*) is a component service of a composite web service. These component services are Web services operation (*op*), i.e. A*T*= {*op*1, *op*2, ... *opi, ... opn*}, where *opi* denotes service operation which is the component service of ATS, *opi*∈*ATS*, *i*=1, 2,..., *n*.

The transactional properties of an atomic web service may reveal the 3 features [12]:

**Definition 1(Pivot WS)**: A pivot WS is one which is neither compensatable nor retriable. On one hand, there is no guarantee that this type of web service can be executed successfully. On the other hand, a committed pivot web service cannot be rolled back.

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**TABLE 1: TRANSACTION PROPERTY OF A SEQUENTIAL AND A CONCURRENT EXECUTION OF TWO ELEMENTARY WSS**

| ws1 | ws2 | ws1seqws2 | ws1splitws2 |
|-----|-----|-----------|-------------|
| p | p | a | a |
| p | c | a | a |
| p | pr | a | a |
| p | cr | a | a |
| pr | p | a | a |
| pr | c | a | a |
| pr | cr | ar | ar |
| pr | pr | ar | ar |
| c | p | a | a |
| c | c | c | c |
| c | pr | a | a |
| c | cr | c | c |
| cr | p | a | a |
| cr | c | c | c |
| cr | pr | ar | ar |
| cr | cr | cr | cr |

**Definition 2(Compensatable WS)**: A WS is compensatable if it is able to offer compensation policies to semantically undo the original activity.

**Definition 3(Retriable WS):** A web service is retriable if it is able to offer forward recovery. In other words, activities with this property can guarantee a successfully termination after a finite number of invocations.

For example, consider a simple service for buying flight tickets. Consider that such service has three operations: Reservation, Cancel reservation and Purchase. The Reservation is for making a flight reservation, Cancel reservation for canceling a reservation, and Purchase, for buying a ticket. The reservation operation that reserves a seat in an airline reservation system is compensatable since there is an operation for canceling reservations. The cancel reservation operation is retriable since it eventually succeeds after a finite set of retries. On the other hand, suppose if it is a non refundable ticket purchases then the purchase operation is pivot because it cannot be undone.

**TABLE 2: TRANSACTION PROPERTY OF A SEQUENTIAL AND A CONCURRENT EXECUTION OF A CWS WITH AN ELEMENTARY WS**

| cws | ws | cwsseqws | cwssplitws |
|-----|----|----------|------------|
| a | p | a | a |
| a | c | a | a |
| a | pr | a | a |
| a | cr | a | a |
| ar | p | a | a |
| ar | c | a | a |
| ar | pr | ar | ar |
| ar | cr | ar | ar |
| c | p | a | a |
| c | c | c | c |
| c | pr | a | a |
| c | cr | c | c |
| cr | p | a | a |
| cr | c | c | c |
| cr | pr | ar | ar |
| cr | cr | cr | cr |

**B.     Composite Transactional Service**

A composite transactional Service (*CT*) is a composite Web service, i.e. $CT = \{tws1, tws2, ..., twsi, ..., twsn\}$, where tws*i* denotes atomic transactional Web service, $twsi \in CT$, $i=1, 2, ..., n$.

The transactional properties of a CWS highly depend on the transactional properties of its component WSs and on the structure of the workflow. We have the following definitions:

**Definition 4(Atomic CWS):** A CWS is atomic if once its entire component WSs complete successfully. Their effect remains forever and cannot be semantically undone. On the other hand, if one component WS does not complete successfully, then all successfully executed component WSs have to be compensated.

**Definition 5(Compensatable CWS):** A CWS is compensatable if its entire component WSs is compensatable.

**Definition 6(Retriable CWS):** An atomic or a compensatable CWS is retriable if all its components are retriable.

**Definition 7(**Transactional CWS): A Transactional Composite Web Service (TCWS) is a CWS whose transactional behavioral property is in $\{\overline{a}, \overline{ar}, c, cr\}$

## QOS COMPOSITION

QoS issues are considered as an important factor in web service selection. QoS can be used to differentiate web services. The new broker architecture uses a global QoS optimization selection algorithm whereas the existing TQoS algorithm considers only local optimization. The global QoS optimization selection algorithm is as follows: a set of transactional WSs is selected for each activity based upon their transactional properties. From those set of services, an end-to end QoS driven service selection is done.

For the selection of a WS for each activity, the system uses the classical Multiple Criteria Decision Making (MCDM) approach [13]. This selection is based on the weights assigned to each quality factors. The local selection is not suitable for QoS based web service composition when consider the constraint like maximum total price since such global constraints cannot be verified locally. The global selection solves the problem by considering all possible service combinations. The aggregated QoS value of each service combination is computed and the one with maximum aggregated utility value is selected.

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The Quality assessment of web service is used for obtaining high-quality results [14]. Web service QoS requirements affects the performance of web services. Often, unresolved QoS issues [15][16] cause critical transactional applications to suffer from unacceptable levels of performance degradation. The Quality of service (QoS) is a combination of several qualities or properties of a service, specified in Table 3.

**TABLE 3: OUTLINES SOME POSSIBLE QWS METRICS THAT CONSIDER WHEN DISCOVERING RELEVANT SERVICES**

|   | Parameter | Description |
|---|---|---|
| 1 | Response Time | Time taken to send a request and receive a response |
| 2 | Availability | Number of successful invocations/total invocations |
| 3 | Throughput | Total number of invocations for a given period of time |
| 4 | Likelihood of success | Number of response/number of request messages |
| 5 | Reliability | Ratio of the number of error messages to total messages |
| 6 | Compliance | The extent to which a Web service follows the Web Services Interoperability (WS-I)Basic Profile |
| 7 | Latency | Time the server takes to process a given request |

## COMPOSITION FLOW MODELS

1) *Sequential Composite Services*: The activities within a sequential composite service [17] are executed with a sequential dependency between them. As a result, the transactional property of an activity will be affected by the transactional property of the immediate preceding activities.
2) *Concurrent Composite Services*: In concurrent composite services, different paths are allowed to execute simultaneously. There are no dependent restrictions between these paths. The system can schedule these activities independently.
3) *Alternative Composite Services*: Only one path of alternative composite services will be executed.
4) *Iterative Composite Services*: The activities within an iterative composite service are executed with repetition. Figure.4 illustrates composition flow models.

**FIGURE 4: COMPOSITION FLOW MODELS**
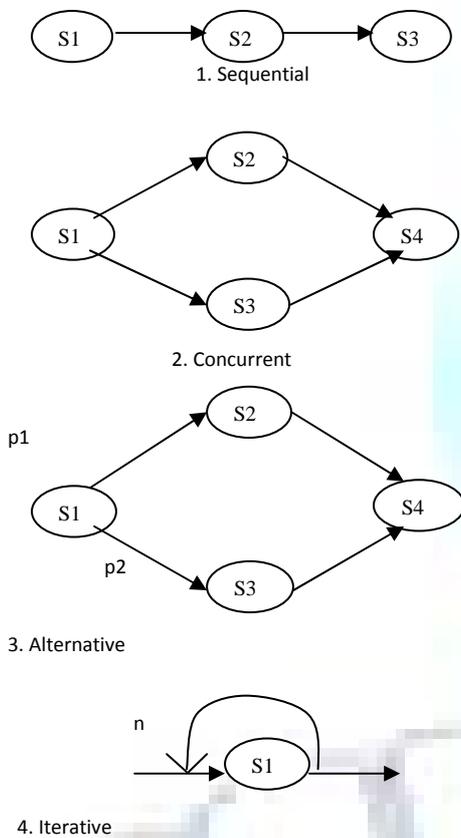


## TQOS SELECTION ALGORITHM

In the TQoS-driven selection algorithm, a workflow is given as the input and a TCWS is the output. When a WS is assigned to an activity of the workflow, its transactional property influences the selection of the WS for the next activities.

TQoS define two notions of execution risk in a transactional system:

*Risk 0*: The system guarantees that if the execution is successful, the obtained results can be compensated by the user. The user can choose another application that can be used to undo the previous effect.

*Risk 1*: The system does not guarantee that the result can be semantically undone by the user in case of successful execution.

TQoS algorithm considers both the sequential pattern and parallel pattern while assigning web services to the activities in the work flow.

*A.   Sequential Pattern Assignation*

*Proposition 1*: In a sequential pattern, if the web service assigned to the first activity of the pattern is pivot (p), pivot retriable (pr), atomic ($\tilde{a}$), or atomic retriable ($\widetilde{ar}$), then the WS assigned to the second activity should be pivot retriable (pr), atomic retriable ($\widetilde{ar}$), or compensatable Retriable (cr) in order to obtain a TCWS. If all components of a CWS are Retriable, then the Transactional Property (TP) of the resulting TCWS is atomic ($\tilde{a}$) and is moreover atomic retriable ($\widetilde{ar}$).

*Proposition 2*: In a sequential pattern, if the WS assigned to the first activity of the pattern is compensatable (c) or Compensatable retriable (cr), then WS of any transaction property can be assigned to the second activity to get the resulting CWS as always transactional (TCWS).

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If the WS assigned to the second activity is either pivot (p), pivot retriable (pr), atomic ($\vec{a}$), or atomic Retriable ($\overline{ar}$), then the TP of the resulting TCWS is atomic ($\vec{a}$). The TP of TCWS is compensatable (c) if the WS assigned to the second activity is either compensatable (c) or compensatable retriable (cr). When both component WSs are retriable, the resulting TCWS is retriable. Most of the existing broker-based architectures consider only sequential pattern.

*B.    Parallel Pattern Assignation*

*Proposition 3*: If a pivot (p) or an atomic ($\vec{a}$) WS is assigned to one activity of a parallel pattern, to obtain a TCWS, and then the WS assigned to the other activity should be compensatable retriable (cr). The transactional property of the resulting TCWS is atomic ($\vec{a}$).

*Proposition 4*: If a pivot retriable (pr) or an atomic retriable ($\overline{ar}$) WS is assigned to one activity of a parallel pattern, to obtain a TCWS, the WS assigned to the other activity should be pivot retriable (pr), atomic retriable ($\overline{ar}$), or compensatable retriable (cr). The transactional property of the resulting TCWS is atomic retriable ($\overline{ar}$).

*Proposition 5*: If a compensatable (c) WS is assigned to one activity of a parallel pattern, to obtain a TCWS, the WS assigned to the other activity should be compensatable (c) or compensatable Retriable (cr). The transactional property of the resulting TCWS is compensatable (c).

*Proposition 6*: If a WS is assigned to one activity of a parallel pattern is compensatable retriable (cr) then the resulting CWS is independent of the WS transactional property assigned to the other activity. If the WS assigned to the other activity is pivot/atomic (p/$\vec{a}$), compensatable (c), pivot/ atomic retriable (pr/$\overline{ar}$), or compensatable retriable (cr),   then the transactional property of the resulting TCWS is atomic ($\vec{a}$), compensatable (c), atomic retriable ($\overline{ar}$), or Compensatable retriable (cr) respectively.

Previously coordination of a set of activities having a transactional behavior has been tackled by workflow systems, by transactional protocols, and by Advanced Transactional Models (ATMs).Transaction protocols define a model for coordinating the transaction execution of Web services based on a predefined set of transaction messages.

## IMPLEMENTATION AND RESULTS

The web service composition with transactional and quality driven properties is implemented in Visual Studio 2008.It uses the workflow template. The programming is done in C# and platform used is Windows XP. It uses the SQL database 2000 as the backend server.

**FIGURE 6: THE WORKFLOW USED**
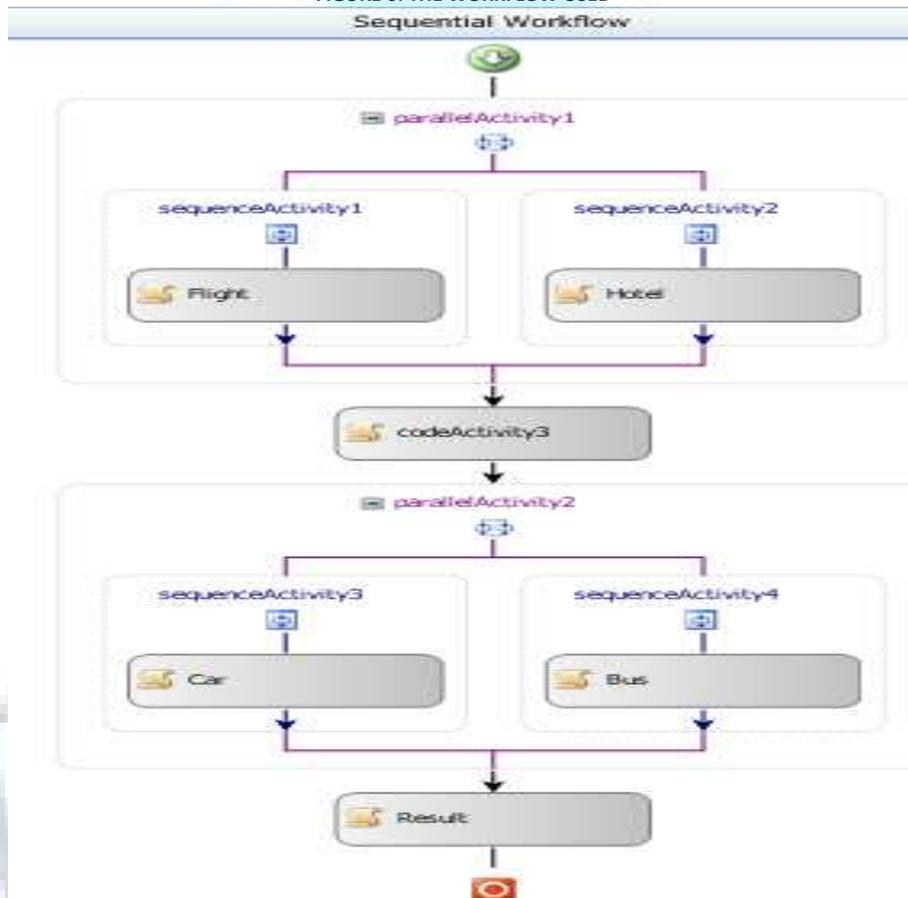


A Broker with 15 web services is implemented. The workflow generated as shown in figure 6. It considers both the sequential and parallel execution. In sequential the transactional property of an activity depends on its immediate preceding activity. Therefore it selects a web service refering to the transactional properties such that it provides efficient commit transactions. For parallel implementation both the actions are executed at the same time. The transactional property of the output of parallel activities depends on the transactional property of both the actions.

The customer gives the requirements to the input webpage is shown in fig.7. Based on the requirements our broker selects the best web services from the 15 available web services. For this it consider the transactional property of the web services based on the workflow. The execution begins and finally it give the best results as shown in fig.8 and customer can book them based on the number of travelers and the details are stored to the database. The program executes and gives the best results. The results are tested for various inputs and it has been proved that it provides better efficient results considering both the quality and transactional properties for both the sequential and parallel workflow.

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**FIGURE 7: THE INPUT WEB PAGE USED**
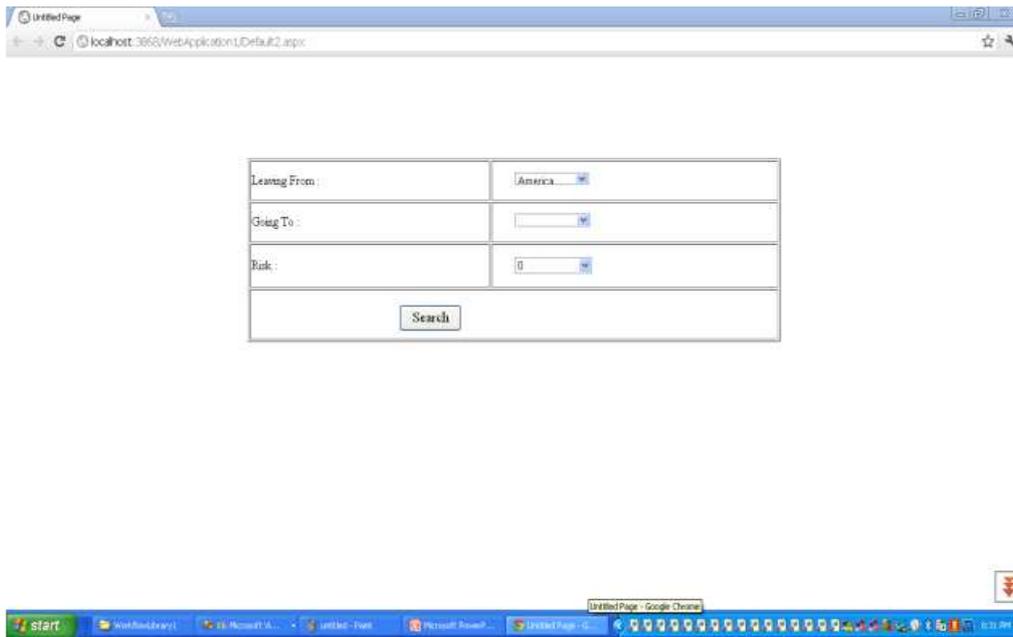


For instance, based on the input requirement the broker selects best web services for flight, hotel, car or bus services. The web services associated with the activities are shown in Table4. The flight and hotel web service selections are performed using AND split and the car or bus service selection is performed using XOR split. The AND and XOR split are executed sequentially. Thus sequential, parallel and alternative executions are performed together in a workflow. The results are verified for random inputs and it provides a better service selection as shown in Table 5.

**FIGURE 8: THE OUTPUT FORM THAT GIVES THE BEST SERVICES**
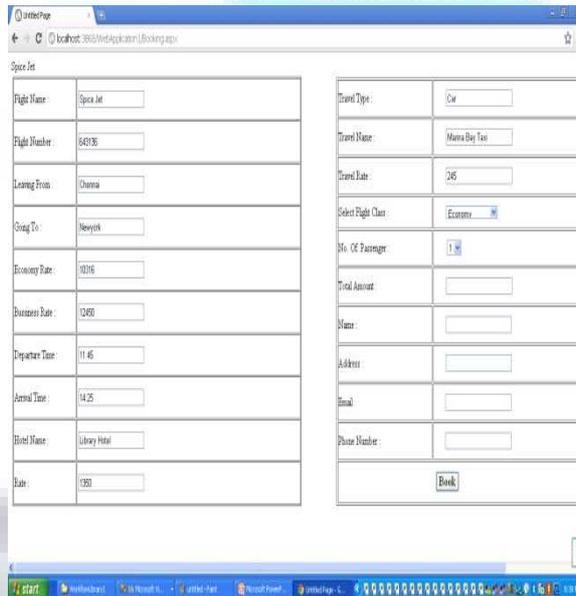


**TABLE 4: WEB SERVICE ASSOCIATED WITH THE ACTIVITIES**

| Activity | Candidate web services |
|----------|------------------------|
| Flight   | F1,F2,F3               |
| Hotel    | H1,H2,H3,H4            |
| Bus      | B1,B2,B3,B4            |
| Car      | C1,C2,C3,C4            |

**TABLE 5: RESULT OF THE BROKER**

| From | To | Flight | Hotel | Bus | Car |
|------|----|--------|-------|-----|-----|
| A    | B  | F2     | H3    | B4  | X   |
| S    | A  | F3     | H4    | X   | C3  |
| A    | B  | F3     | H1    | B1  | X   |
| D    | B  | F1     | H3    | X   | C2  |

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## CONCLUSIONS

With the emerging role of web services in business processes, the requirement of composing and executing them has begun to draw high attention, and today the need to find the optimal web services composition for the business processes is a challenging issue. This paper proposes a new broker based architecture that performs an optimal web service composition according to the transactional properties and user QoS requirements which is an added advantage than existing brokers. This will dynamically generate a workflow based on user's request and make a better web service selection for the composition. As the new broker based architecture makes use of the modified TQoS algorithm, it considers both sequential and parallel patterns and provides global optimization.

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# WEB USAGE MINING: A BOON FOR WEB DESIGNERS

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## ABSTRACT

*Web usage mining is one of the categories of web mining which extract useful usage patterns from web data particularly web servers. This paper provides a brief overview on Web Usage mining, its data sources, Processing techniques and Applications.*

## KEYWORDS

Web mining, Web Usage Mining, Pre-processing, Pattern Discovery, Pattern analysis.

## INTRODUCTION

In today's world we are overwhelmed with data and information from various sources but starved of knowledge. This has lead to the need of mining useful data especially from the huge source of data that is World Wide Web. Hence Web mining, has been the focus of several recent research projects and papers. Web mining is that area of data mining which deals with the extraction of interesting knowledge from World Wide Web [1].Depending upon which type of data is to be mined on web the Web mining is categorized into three different classes. These categories are web content mining, web structure mining, web usage mining. In web content mining, we discover useful information from the contents of web site which may include text, hyperlinks, metadata, images, videos, and audios. Search engines and web spiders are used to gather data for content mining. In web structure mining, we mine the structure of website on the basis of hyperlinks and intra-links inside and outside the web pages. In web usage mining (WUM) or web log mining, users' behavior or interests are revealed by applying data mining techniques on web log file [2].

## NEED FOR WEB USAGE MINING [2]

Web usage mining is the type of Web mining activity that involves the automatic discovery of user access patterns from one or more Web servers. Today organizations rely more on internet and World Wide Web to conduct business. Most of the data of these organizations is generated automatically by web servers and collected in server access logs. Analyzing such data can help these organizations in the following:-
a) Design cross marketing strategies
b) Determining Life time value of clients
c) Evaluate the effectiveness of the promotional campaigns
d) Optimizing functionality of web–based application
e) Website Personalization
f) Targeting advertisements to specific group of users.
g) Better Website Structure.

## WEB DATA

For knowledge discovery in databases one of the primary steps is to create a suitable data set for the data mining tasks. The different type of data collected for web mining can be client side data, server side data, proxy data or organization database. These data collected not only differ in terms of  location of the sources from which they are collected but also the kinds of data available ,segment of population from which the data was collected and method of implementation used .the different kinds of data that can be used for web mining is classified as following:

### Usage data
Data that describes the usage patterns of Web pages, such as IP addresses, page references, and the date and time of accesses and various other information depending on the log format [3].

### Content data
Data which is imparted for the user and is actually the visible data on the web page comprising of mainly text and graphic.

### Structure data
Structure data gives the organization of the content. This includes the intra-page and inter-page structure. Intra-page gives the arrangement of html and xml tags within a web page and inter-page information refer to the hyper links connecting the web pages.

### User Profile
Data which provide demographic information about the user of the web site such as customer profile information and registration data [3].

### Data sources
The data sources used in Web Usage Mining may include web data repositories like:

### Web Server Logs
Web servers are surely the richest and the most common source of data for performing web mining as it record the browsing behavior of site visitors. The data in them reflects the concurrent access of web site by multi users. These logs usually contain basic information e.g. name and IP of the remote host, date and time of the request line exactly as it came from the client, etc. This information is usually represented in standard format e.g. Common Log Format, Extended Log Format and LogML [2].But one cannot completely rely on the server logs due to the various level of caching in web environment as cached web pages are not recorded in the server logs. Packet sniffing technology can also be used to collect usage data through server logs. Other type of information like cookies and query data is also stored by the web servers in separate logs. Server side also provide content data and structure information and web page meta information [3].

### Web Proxy Logs
Web proxy acts as an intermediate level of caching between the client browser and web servers. Proxy caching reduces the loading time of web page as well as network traffic load .Collecting navigation data at the proxy level is basically the same as collecting data at the server level .The main difference is in the case that proxy servers collect data of groups of users accessing huge groups of web server. Proxy reveals the actual HTTP requests from the multiple clients to multiple Web servers [3].

### Web browser Logs
Usage data can be tracked also on the client side by using Java Script, java applet, or even modified browsers. Though performance of java applets is same as that of server logs but they incur some additional over head especially when they are loaded. Java scripts on the other hand consume little interpretation time but cannot capture all user clicks. Java Scripts and java applet collect only the single-user and single client browsing behavior whereas the modified browser are

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more versatile as they collect data about a single user over multiple websites. These techniques avoid the problems of users' session identification and the problems caused by caching. In addition, they provide detailed information about actual user behaviors'. But these approaches rely heavily on the users' cooperation and rise many issues concerning the privacy law [2].

Data obtained from the above data sources can be categorized into several data abstractions such as users, page view, client session, server session, click streams and many more.

## WEB USAGE MINING PROCESS

Web usage mining consists of three main processes as shown in Fig. 1.

A. Pre-processing(Data preparation)
B. Pattern discovery
C. Pattern analysis and visualization

**FIG. 1: WEB USAGE MINING PROCESS [5]**
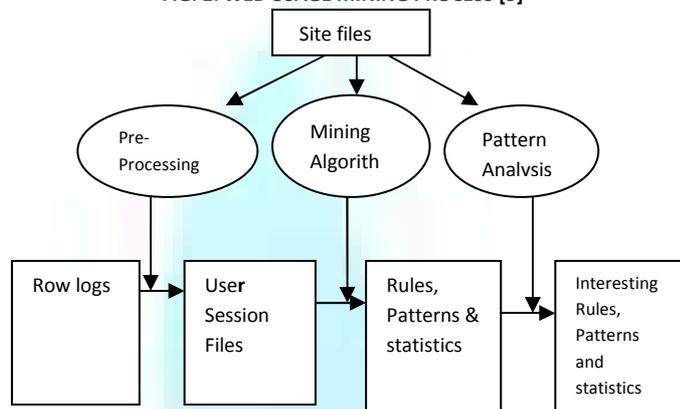


### Pre-Processing

Data pre-processing transforms the data into a format that will be more easily and effectively processed for the purpose of the user. In context to web usage mining the click stream data is cleaned and partitioned into a set of user transaction representing the activities of each user during different visits to site. Other sources of knowledge such as the site content or structure as well as the semantic domain knowledge from site ontologies may also be used in pre-processing or to enhance user transaction data [6].  The different types of pre-processing in Web Usage Mining are:

Usage Pre-Processing: Pre-Processing relating to Usage patterns of users.

Content Pre-Processing: Pre-Processing of content accessed.

Structure Pre-Processing: Pre-Processing related to structure of the website [3].

### Pattern Discovery

In this stage the statistical, database and machine learning operations are preformed to obtain hidden patterns reflecting the typical behavior of the user as well as the summary statistics on web resources, session and user [7]. Web Usage mining can be used to uncover patterns in server logs but is often carried out only on samples of data. The mining process will be ineffective if the samples are not a good representation of the larger body of data. The following are the pattern discovery methods [6].

a) Statistical Analysis – Statistical technique are the most common method to extract knowledge about visitors to a web site. By analyzing the session file, one can perform different kinds of descriptive statistical analyses (frequency, mean, median) on variables such as page view, viewing time and length of a navigational path [3].

b) Association Rules – Association rule learning is popular and well researched method for discovery relations between variables in large data bases. They show attributes value conditions that occur frequently together in a given dataset [13].

c) Clustering - In unsupervised classification, called clustering or exploratory data analysis, no labeled data are available. The goal of clustering is to separate a finite unlabeled data set into a finite and discrete set of "natural," hidden data structures [12].

d) Classification – Classification is a data mining (machine learning) technique used to predict group membership for data instances. For example, you may wish to use classification to predict whether the weather on a particular day will be "sunny", "rainy" or "cloudy". Popular classification techniques include decision trees and neural networks [11]. Classification is useful in such areas as topic aggregation and Web community identification [4].

e) Sequential Patterns - This Technique discovery inter-session pattern such that the presence of the set of items is followed by another item in time-ordered set of sessions or episodes. With the help of this technique the Web marketers can predict future visit patterns which will be helpful in placing advertisement aiming at particular group of users [3].

f) Dependency Modeling – This is another useful pattern discovery technique in Web Mining. The primary main is to develop a model, representing significant dependencies among various variables in Web domain. Such information may help develop strategies to increase sales of a product offered by a website [6].

### Pattern Analysis

*This is the final step in the Web Usage Mining process. After the pre-processing and pattern discovery, the obtained usage patterns and statistics are further processed, filtered  to remove uninteresting information and result is aggregated  into user model that can be used for market predictions and decision making [6]. The methods like SQL (Structured Query Language) processing and OLAP (Online Analytical Processing) can be used [3]*

## WEB USAGE MINING APPLICATION

### Letizia

*Letizia is an application that assists a user browsing the Internet. As the user operates a conventional Web browser such as Mozilla, the application tracks usage patterns and attempts to predict items of interest by performing concurrent and autonomous exploration of links from the user's current position. The application uses a best-first search augmented by heuristics inferring user interest from browsing behavior [6].*

### WebSift (Web Site Information Filter)

*Website is an application which performs Web Usage Mining from server logs recorded in the extended NSCA format (includes referrer and agent fields), which is quite similar to the combined log format. The pre-processing algorithms include identifying users, server sessions, and identifying cached page references through the use of the referrer field. It identifies interesting information and frequent item sets from mining usage data [3].*

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*Adaptive Websites*

*An adaptive website adjusts the structure, content, or presentation of information in response to measured user interaction with the site, with the objective of optimizing future user interactions. Adaptive websites are web sites that automatically improve their organization and presentation by learning from their user access patterns. User interaction patterns may be collected directly on the website or may be mined from the web server logs.*

*Web Personalization*

*Is personalizing the browsing experience of a user by dynamically tailoring the look, feel, and content of a Web site to the user's needs and interests. Personalizing the website broaden and deepen customer relationships, provide continuous relationship marketing to build customer loyalty, help automate the process of proactively market products to customers by lights-out marketing and cross-sell/up-sell products ,provide the ability to measure customer behavior and track how well customers are responding to marketing efforts [8].*

## CONCLUSION

*Web Usage Mining is current field of research in the area of web mining. As the world is shrinking due to globalization and more and more organizations are using internet as a platform for their business, the need for mining the web data is increasing. Web Usage Mining provides an excellent way to deal and process web data particularly the server data to extract useful web usage patterns. This paper proves to be a starter kit to the beginners on Web Usage Mining.*

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