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IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY IN VARIOUS BUSINESS MODELS IN INDIA

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Edited by: Dr. Hetal J. Mehta & Dr. Poojaba V. Rana

Mehta & Rana



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Dr. Hetal J. Mehta

Principal

*Swami Sahajanand College of Commerce & Management
Bhavnagar, Gujarat*

Dr. Poojaba V. Rana

Assistant Professor

Department of English

*Swami Sahajanand College of Commerce & Management,
Bhavnagar, Gujarat*

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PREFACE

Almost all agree on the importance of ICT adoption in Companies, while the importance of Companies as engines to economic growth is well acknowledged worldwide. Companies would need as well as effective information systems to support and to deliver information to the different users. Such information systems would include those technology that support decision making, provide effective interface between users and computer technology and provide information for the managers on the day-to-day operations of the enterprises. Information is needed for various purposes and serves as an invaluable commodity or product. Information is very important aspect of decision making in all levels of management in enterprises, especially in competitive business environment and managers utilise information as a resource to plan, organise, and staff administer and control activities in ways that achieve the enterprises objectives. The ability of Companies to realise their goals depends on how well the organisation acquires, interprets, synthesises, evaluate and understands information and how well its information channels supports organisational processes. This technology will continue to enable the growth of global work, where Companies operate across national boundaries. Today, new technologies, especially Internet technology are changing the global flows of information, trade and investment and the competitive advantage of industries, services and regions. These changes are requiring from all enterprises, no matter of their size to invest in the adoption of new technology. The ability of Companies to survive in an increasingly competitive and global environment is largely influenced upon their capacity to access information as a resource and usage of new technologies. Greater use of these technologies is often associated with improved availability of information, quality of work, effectiveness and efficiency in accomplishing tasks. As the digital economy blossoms, e-commerce and ICT have had a significant economic impact on enterprises and society as a whole. They are being applied in many areas such as manufacturing, procurement, distribution and financial services. They are a source of improvements in efficiency in these activities, in enterprise management and in workers' skills. They also enhance the delivery of public services and access to social services such as education and health.

The structural transformations in the various sectors have led to a greater organisational interdependence between firms, especially between large companies and Companies, which are often sub-contractors providing goods and/or services. This is particularly true of transformations that, applying the concepts of vertical disintegration or networks, have pushed companies to re-centre on their core activities and to modularise their production systems. The external pressure of large companies and clients has led numerous Companies to set up ICT, especially in industrial sectors. Information and Communication Technology or ICTs allow users to participate in a rapidly changing world in which work and other activities are increasingly transformed by access to varied and developing technologies. Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, non-profit agencies, governments and criminal enterprises) to interact in the digital world. Information and communication technology (ICT) has become vital for the survival and success of business companies. Developments in ICT have dramatically accelerated innovations and have changed entire industries.

Chapter 1 gives an introduction about Information and Communication technology in its uses in today's business world and corporate sector. Chapter 2 is explaining the role of information and communication Technology in the IT sector, where the Information and communication technology is used most. Chapter 3 covering the aspect of importance of information and communication technology in advancement in banking sector. Chapter 4 talks about the role of information and communication technology in the Agri Business sector. Chapter 5 mentioning the role of information and communication technology in upgradation of the education sector and the advancement of teaching style with the help of technology. Chapter 6 plays an important role in explaining the role of information and communication technology in the growing Logistic Industry.

Dr. Hetal J. Mehta
Dr. Poojaba V. Rana

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INTRODUCTION

Today organisations of all types are utilising Information and Communication Technologies (ICT) around the globe, not only for cutting costs and improving efficiency, but also for providing better customer service. Governments too, around the world, are adopting ICT to provide better services to their citizens. The adoption of ICT by organisations requires a business environment encouraging open competition, trust and security, interoperability and standardisation and the availability of finance for ICT. Most of the large and international organisations in India have effective computer systems to efficiently conduct business. A number of large organisations have spent huge amount of money on installing computer systems to support their business processes. However, the situation has not been the same with Companies similar to other parts of the world for various reasons.

Information and Communication Technology (ICT) covers technologies like the simple telephone, point-of-sale systems, stand-alone PCs, networked environments, Internet, and credit card facilities. ICT is the array of primarily digital technologies designed to collect, organise, store, process and communicate information within and external to an organisation and, in our case, Companies. ICT is a broad concept that covers Information Systems (IS), Information Technology (IT) and digitalisation. Many authors on this topic concur that ICT brings changes in the global information flow, behaviour, patterns and options of customers, and Companies stand to benefit from

ICT in reduced transaction costs, inventory controls, quality controls, access to a wider market space and leveraging economies of scale. According to Moodley (2002), ICT is an enabler for global networking economy. ICT offer enterprises a wide range of possibilities for improving their competitiveness: they provide mechanisms for getting access to new market opportunities and specialised information services such as distance consulting, continuous training, new advisory modes, etc. ll

Companies have gradually recognised the positive impact ICTs, such as computer terminals, e-mail and the Internet and their applications can have on their business. In advanced OECD (Organisation for Economic Cooperation and Development) countries, most small firms, including micro-enterprises with fewer than ten employees, now have at least the computer terminal, usually with Internet access. Many types of business software can improve information and knowledge management within the firm, leading to more efficient business processes and better firm performance. Communication via e-mail and the Internet can help to improve external communication, in either Business-to-Commerce (B2C) or Business-to-Business (B2B) context, and may reduce transaction costs, increase transaction speed and reliability, and extract maximum value from each transaction in the value chain.

Companies play an important role in economic development of a country. Several theories elaborate on connection between information technology, economic development and social change. Almost all agree on the importance of ICT adoption in Companies, while the importance of Companies as engines to economic growth is well acknowledged worldwide. Companies would need as well as effective information systems to support and to deliver information to the different users. Such information systems would include those technology that support decision making, provide effective interface between users and computer technology and provide information for the managers on the day-to-day operations of the enterprises. Information is needed for various purposes and serves as an invaluable commodity or product. Information is very important aspect of decision making in all levels of management in enterprises, especially in competitive business environment and managers utilise information as a resource to plan, organise, and staff administer and control activities in ways that achieve the enterprises objectives. The ability of Companies to realise their goals depends on how well the organisation acquires, interprets, synthesises, evaluate and understands information and how well its information channels supports organisational processes. This technology will continue to enable the growth of global work, where Companies operate across national boundaries. Today, new technologies, especially Internet technology are changing the global flows of information, trade and investment and the competitive advantage of industries, services and regions. These changes are requiring from all enterprises, no matter of

their size to invest in the adoption of new technology. The ability of Companies to survive in an increasingly competitive and global environment is largely influenced upon their capacity to access information as a resource and usage of new technologies. Greater use of these technologies is often associated with improved availability of information, quality of work, effectiveness and efficiency in accomplishing tasks. As the digital economy blossoms, e-commerce and ICT have had a significant economic impact on enterprises and society as a whole. They are being applied in many areas such as manufacturing, procurement, distribution and financial services. They are a source of improvements in efficiency in these activities, in enterprise management and in workers' skills. They also enhance the delivery of public services and access to social services such as education and health.

A path-breaking innovation of all time, Information and Communication Technology (ICT) has brought about a paradigm shift in individuals' personal and professional lives. This research investigates the impact of ICT on organizational performance in select Companies. While doing so, it takes into consideration variables like organizational characteristics and organizational resources. The study also takes into account the strategic choice of being a first-mover or a subsequent adopter. Companies have spearheaded the ICT revolution that has impacted businesses all over. But, what has been the impact of ICT on the Companies themselves? It is an intriguing and unique question addressed by this research study. The choice of the IT industry as a contextual setting for this study is not by accident. Instead, it attempts to find the impact of ICT on those very IT organizations that impact others.

The utilization of ICT technologies and applications began in the 1990s. In the recent past, ICT applications, such as electronic commerce (on-line business) and Enterprise Resource Planning (ERP), have become essential for a business to endure and flourish. Competition between firms has driven them to discover the wellsprings of growth and fortify their market position. The relationship between business value creation and web-based business is new, and more investigation is required to be done. Web-based business decreases the cost of running the business and boosts incomes. Thus, web-based business is relevant and viable in the creation of goods and services. An ERP is an integrated system that unites all the applications that an organization needs in a single system. This empowers organizations to accelerate the dynamic cycle and react quickly to the changes in the market. The era of digitalization – both its evolution and the speculations for the future have been captured in five phases by Micheal Seemann (2019). The review is global and touches upon various facets of the digitalization movement. Since the creation of the transistor, technology has evolved rapidly with modern-day innovations and solutions like Big Data (BD), Big Data Analytics (BDA), Machine Learning, Artificial Intelligence (AI), Internet of Things (IoT), and many more.

One explanation for the pervasiveness of ICT is that these technologies theoretically permit gains in productivity, particularly in terms of transactions and coordination. The strategies implemented by companies to encourage ICT and electronic commerce are theoretically supposed to improve company performance through cost reductions and differentiation strategies. However, ICT provide only a partial explanation for performance improvement in most studies. As Solow's Paradox¹ indicates, measuring this performance gain has proven quite difficult and subject to debate. Historically, large companies were the first to set up ICT, both for organisational reasons (e.g., to maintain links with subsidiaries, to coordinate distant sites) and economic reasons (e.g., to better integrate processes, to automate data exchanges with key suppliers). In order to accomplish these goals, these pioneering companies had to restructure their operational processes, modify their organisational structures and redefine their core activities and their positions in the value chains. Thus, digitalizing a company's internal and external processes necessitates changes in organisation and management. These changes often generate costs and risks that are proportionately greater for Companies, which may also lack expertise and knowledge, leading to longer ICT implementation and appropriation phases.

The structural transformations in the various sectors have led to a greater organisational interdependence between firms, especially between large companies and Companies, which are often sub-contractors providing goods and/or services. This is particularly true of transformations that, applying the concepts of vertical disintegration or networks, have pushed companies to re-centre on their core activities and to modularise their production systems. The external pressure of large companies and clients has led numerous Companies to set up ICT, especially in industrial sectors.

ICT is the integration of information processing, computing and communication technologies. Information and communication technology can be defined as technology that enables the acquisition, processing, transformation and distribution of information. Information and communications technology (ICT) refers to all the technology used to handle telecommunications, broadcast media, intelligent building management systems, audio visual processing and transmission systems, and network-based control and monitoring functions. Although ICT is often considered an extended synonym for information technology (IT), but its scope is much broader. ICT has recently been used to describe the convergence of several technologies and the use of common transmission lines carrying very diverse data and communication types and formats. ICT tools can be used to find, explore, analyze, exchange and present information responsibly and without discrimination. ICT can be employed to give users quick access to ideas and experiences from a wide range of people, communities and culture.

Information and Communication Technology or ICTs allow users to participate in a rapidly changing world in which work and other activities are increasingly transformed by access to varied and developing technologies. Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, non-profit agencies, governments and criminal enterprises) to interact in the digital world. Information and communication technology (ICT) has become vital for the survival and success of business companies. Developments in ICT have dramatically accelerated innovations and have changed entire industries. The most popular example is the Internet, which has revolutionized business practices and the entire modern world. Hence, companies are constantly pressured to keep up with the latest developments in the field of ICT.

Information technology (IT) means using computers to store, retrieve, transmit, and process data or information in a business context. IT system includes information and communications system or, more precisely, a computer system – both hardware and software – operated by a group of users. To summarize, IT is a subset of ICT. ICT encompasses both the internet as well as mobile, which is powered by wireless networks. It also includes landline telephones, radio, and television – all of which are still widely used today, along with cutting-edge ICT pieces such as AI and robotics. The list of ICT components is large, and it continues to grow. Some components, such as computers and telephones, have existed for decades but smart phones, digital TVs and robots, are more recent entries. The arrival of ICT may play a role in restoring competitiveness, since these technologies are also a factor in relaxing the constraints specific to Companies. ICT makes a number of services possible in a large range of processes and transactions within and between companies. Internally, ICT applications can improve knowledge and information management practices; they can also allow more rapid and more reliable transactions between businesses to business (B2B) and between businesses and consumers (B2C). They are equally quite effective in improving external business communications and service quality for both new and existing clients. They also appear to be a source of competitive advantage for Companies under certain conditions.

The technology innovations that have cut across all the business domains through major technology applications. Scheck (2016) has given eight such impacts:

- **Cloud Computing:** The rapid adoption of Cloud Computing can be attributed to its efficiencies to run any business operation. Cloud Computing uses the latest Information Technology to accrue benefits from its ability to reduce the time taken to go to market and efficiently manage resources to grow businesses. Progressively, businesses are moving to the cloud to use its numerous advantages. It has been anticipated that more than \$1 trillion will be

invested in IT spending to move businesses to cloud computing by 2020. Ed Anderson, research VP Gartner, mentions that many organizations adopt a Cloudfirst strategy to stay ahead in this fast-growing new economy. Further, this growth in the cloud increases the IT spent, but it has helped a new generation of start-ups get established quickly and efficiently.

- **Automation of Business Processes:** Across the years, there has been a conscious drive towards automating the business processes to improve productivity and make processes more efficient. Information technology enables to automate these business processes, thereby saving time and costs of operations. The time and costs saved can be re-purposed to build other efficiency tools and focus on other activities required to speed up business processes more than ever. Various software automation tools are available to automate processes like accounting, tracking productivity, customer relationship management, production process monitoring and management.
- **Working Remotely:** A well-implemented IT system enables remote access to the company's distributed network. This allows its employees to log in and work remotely, bypassing the need to be physically present at a work location. The ability to work remotely has various advantages. This remote working model has gained popularity in recent times, and many people will opt for this in the future. Ian Adams, Head of Marketing at Mitie, observes that departments like HR, IT, Finance, Operations and Sales function work collaboratively to make this remote working model operate seamlessly.
- **Mobile Technology:** Mobile Technology has gathered momentum due to its inherent benefits ranging from ease of communication, saving time and improving business transaction speed. The acceptance and ever-growing use of IT has also helped in the proliferation of mobile technologies across the masses. A new way of working is BYOD (Bring Your Own Device). BYOD helps employees bring their choice of devices to work rather than using the standard devices provided by an organization. This new way of working has become popular due to the freedom of choice it gives. It has been observed that 74% of the organizations prefer this trend; hence BYOD is bound to grow further. Mobile technology has seen unprecedented growth as it helps increase productivity and its ability to integrate with other workplace tools and processes seamlessly.
- **Securing Information:** The amount of data that is being processed and stored is ever increasing. Organizations have the challenge of storing these enormous amounts of data and ensuring that this data is safe and secure. If data from these databases are lost or corrupted, there can also be legal

issues. To prevent this loss, Information Technology provides the solutions to protect and store the databases securely. Rather than physical databases servers, these days' virtual storage systems have been developed to store these databases. This virtual storage ensures secure access to only a few designated users, thereby ensuring that these databases are safe from hacking and are more robust to sustain physical damage. This way, Information Technology helps ensure business integrity.

- **Customer Satisfaction:** For any business, one of the critical areas of impact is customer experience and satisfaction. Customer satisfaction defines if the customer is happy or not with the product or service. A strong customer support team and its 24x7 availability is the key to catering to dynamic needs. Information Technology provides the software utilities and applications to communicate and resolve customer issues in real-time. Tools like Email, cloud-based/ automated issue handling systems and Customer Relationship Management (CRM) applications are examples of tools that help resolve customer issues.
- **Management of Resources:** To run any business, it needs abundant resources ranging from HR, finances, raw materials for production, and others. These resources are scattered across various geographic locations for large firms. IT helps to manage these resources efficiently by providing software and infrastructure solutions. For example, Enterprise Resource Planning (ERP) software can be integrated with other organization-wide systems to improve the efficiencies of different business processes.
- **Open Source Software:** Information Technology has enabled businesses to use open-source software, which allows free software without licensing them. This free software offers the possibility to modify the software to customize as and when required. Many software products that businesses use has an open-source variant that is broadly available on the Internet. The free version of the software can be a scaled-down version of the same software, which offers the flexibility to use that variant they can afford against the value they want to get in a business.

All this gives any business the advantage and flexibility to do what matters most, ensuring the maximum value they can get.

Evolutions of ICT

The beginning of ICT can be traced back when humans started to use objects to communicate with one another. It is ascertained that ICT began along with the rise of humans. In the past few decades there is a tremendous change in the field of communication technology and information dissemination. The public agencies have

changed the way of service delivery with the implementation of ICT in these years. Rise of e-commerce and m-commerce have given a new direction to the retailers to offer their product and service effectively. The evolution of ICT in this electronic era is broadly classified into five parts which are discussed below:

- **Pre-1990 and 1990s:** The evolution of ICT started in pre 1990, in this era ICT were solely used for classification and indexing purposes for office automation. The size of storage and computing devices were so huge at this time causing inconvenience to handle. However in 1990, the wide adoption of ICT services like information display system, LAN, personal computing, intranet and email, World Wide Web and information process technology started in the western countries. Public sector adopted this to enhance the information sharing and file transfer across various government department and zones. Further the implementation of this service also enhanced the online public information access. As a result the public operations and management became more effective and efficient.
- **Late 1990-2005:** In the trend of technology development this era have created a revolution. In this phase many technologies have erupted like search engines, internet, web 2.0, web conferencing and online surveys. With the invention of technology like web 2.0 websites for organisations were developed which emphasize user-generated content, ease of use, participatory culture and interoperability for end users. With the technologies like internet and interactive web platform the information portals and service delivery to public has become more user friendly and effective.
- **2005-2008:** Digitization and networking in the previous years have set a path for the enterprises to offer their service with the help of web 2.0 platforms. With the eruption of mobile and wireless technology this online retailing process was further simplified and a new market formulated as m-commerce. The technologies like Radio frequency identification (RFID) and Geographic Information System (GIS) have benefitted the enterprises and their consumers to track the inventory and products in the supply chain to both of them. In this technology era the dynamic structure for delivering the product and service were built and many infrastructure improvements were carried out for future.
- **2009:** Now In this era, the development in the field of ICT were done specially to provide safer electronic environment to the beneficiaries and to provide a virtual storage platform for big data. Cloud computing in this era has bring a revolution in the field of big data analytics, with this the on-demand availability of computer system resources can be managed in terms of data storage and without direct active management by the user. E-Governance service was

started in this era as these technologies have the capability to handle big data with greater efficiency and security. Emergence of these technologies has provided a backbone to the enterprises and government in delivering services and value to customers.

COMPONENTS OF INFORMATION AND COMMUNICATION TECHNOLOGY SYSTEM

Contrary to popular belief, although ICT means everything technical, an essential part of the ICT system includes people. ICT is a system created by the people and for the people. A brief description of the five components that constitute ICT is given below. These five components are slightly different from those shown in Figure 3.1, and likewise, such minor differences can be seen in most of the literature on components of the ICT system.

- **Data:** Data is any set of characters that is gathered for some purpose, usually analysis. It can be any character, including text and numbers, pictures, sound, or video.
- **Computer Hardware:** Computer Hardware is the physical equipment that works with data. Equipment can be as little as a cell phone that fits in a pocket or as extensive as a supercomputer that fills a large space. Peripherals are pieces of equipment that work with computers, for example, consoles, external circle drives, and switches. With the growth of the Internet of Things, any device from home machines to wearables to industry machines will have the option to receive and send information. Physical components in a computer or peripherals. This is the physical technology that works with information. Hardware can be as small as a smart phone that fits in a pocket or as large as a supercomputer that fills a building. Hardware also includes the peripheral devices that work with computers, such as keyboards, external disk drives, and routers. With the rise of the Internet of things, in which anything from home appliances to cars to clothes will be able to receive and transmit data, sensors that interact with computers are permeating the human environment.
- **Computer software:** The equipment has to comprehend what to do, and that is the part of the software. The software can be distinguished into two categories: system software and application software. The essential bit of system software is the working system, for example, Windows or iOS, enabling the equipment to function. Application software is intended for explicit errands, for example, handling a spreadsheet, making a report, or planning a Web page. The hardware needs to know what to do, and that is the role of software. Software can be divided into two types: system software and application software. The primary piece of system software is the operating system, such as Windows or iOS, which manages the hardware's operation.

Application software is designed for specific tasks, such as handling a spreadsheet, creating a document, or designing a Web page.

- **Telecommunications:** This telecommunications component connects the equipment within a network. Connections can be using wires, such as Ethernet links or fibre optics, or remote links, such as Wi-Fi. A network can integrate computers in a particular area, for example, an office or a school, through a Local Area Network (LAN). If computers are more scattered, the network is known as a Wide Area Network (WAN). The Internet can be thought of as a network of networks.
- **Databases and data distribution centres:** This component of the ICT is the place where the "material" (data) that different components (software and others.) work with is stored and retrieved. A database is where data is stored and recovered by a query. A data storage system contains the complete data in whatever structure that an organization needs. Databases and data storage systems have received more significance within information systems with the rise of 'big data', a term for the enormous measures of data that can be collected and investigated.
- **Human resources and techniques:** The last and potentially significant component of information systems is the human component. People who run the system use technology to gain knowledge from information available in large databases. This analysis based on past data can help manage future activities.
- **Information:** Information is a set of data which is processed in a meaningful way according to the given requirement. Information is processed, structured, or presented in a given context to make it meaningful and useful. Information assigns meaning and improves the reliability of the data. It helps to ensure undesirability and reduces uncertainty. So, when the data is transformed into information, it never has any useless data.
- **Procedures:** Actions conducted in a series of a certain order to ensure the system will run smoothly. Procedures are a series of actions and step undertaken to ensure that the computer system executes task as is expected of it.
- **People:** Data entry were made by people in computer systems by various means, e.g. keyboard or voice recognition etc. People are needed to run the system so that the knowledge in the huge databases and data warehouses can be turned into learning that can interpret what has happened in the past and guide future action.

EFFECTIVENESS OF INFORMATION AND COMMUNICATION TECHNOLOGY

Effectiveness refers to the achievement of the objectives; if a pre-set goal is achieved, effectiveness results. On the other hand, if a pre-set objective is not achieved, ineffectiveness results. Combining the managerial and technical aspects, we draw the following list of essentials for the effectiveness of the ICT system:

- Overall ICT strategy
- Use of ICT for predictive and prescriptive analysis
- Adoption of latest ICT methods/technologies like AI, BDA, IoT, DS and others.
- Seamless integration of ICT in the entire organizational set-up
- Planned spend on ICT initiatives
- ICT initiatives are pro-active vii) Training of staff in ICT
- Observing ethics in ICT
- Existence of a robust overall control system and also quality controls
- Regular forecasting of likely ICT developments

IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY

The impact of ICT can be viewed as its influence on various business domains - manufacturing, marketing, finance and HR. This impact is explained below:

- **Manufacturing:** Industry 4.0 (The Fourth Industrial Revolution) uses modern, innovative technology to automate business and manufacturing processes. It enables robots to run the operations and gives workers ICT tools to make the business processes efficient. Computer-enabled and controlled operations can decrease setup time, improve manufacturing speed, monitor the resources, and reduce lead times, thereby aiding the manufacturing business.
- **Marketing:** The impact of technology has been felt on both - the buyer and the seller. Due to the Internet' presence, the customer is well informed about the product and services much before purchasing. The information available on the internet enables the seller to communicate and the buyer to ask questions. New avenues, like digital marketing, have opened up to reach out to more customers with lesser acquisition costs. Businesses that adopt this marketing mode also have to face competition as the other sellers would have the same technology (Ecommerce) to aid the selling process. Technology has enabled data-driven selling and allows for more customized and better penetration to reach those same buyers. The cost of acquiring a customer has reduced, and the outreach has increased across geographies spawning into manyecosystems (Digital Marketplace).

- **Finance:** Technology has created a huge impact due to the digitization of financial instruments and transactions. It has been observed that Information Technology has been adopted in every facet of the financial world. From exchanging budgetary instruments to tracking individual spending plans to reveal a business's profit, each money travel is being facilitated by IT. Information technology permits the fast computation of budgetary insights. Electronic exchanges of cash trading, reporting, budgeting, bookkeeping, and other aspects like planning have significantly benefited because of ICT.
- **HR:** Technology advancement has impacted all business areas, from a changing global perspective to a workforce on the lookout for remote working options. This implies that an organization's human resource area cannot remain behind and must adapt and upgrade its systems to cater to the new demands from the workforce and the business. Data analytics focused on people have come to the fore, and IT is enabling this move. HR planning has to be based on past data and future needs. IT has systems to search for the skilled workforce on the internet, followed by automated systems to evaluate and onboard the workforce online with minimal physical intervention. The changing ecosystem is mobile dependent, and the new demands to up-skill and employee engagement systems of HR have to be mobile application enabled. This is just the beginning of the various innovations which are being catered like predictive analytics based on Big Data and others.

ORGANIZATIONAL PERFORMANCE

Organizational performance means the actual output or results of an organization as measured against its intended outputs (or goals and objectives). Organizational Performance is a broad concept that has both financial and non-financial attributes. The qualitative factors include product quality, marketing effectiveness, customer satisfaction, and others. The financial factors include margins, growth, balance sheet metrics, and stock performance. It can be conceptualized as the total of operational, financial, and market-based performance. Organizational performance is the comparison of the actual results against the planned goals and objectives in any organization. The organizational performance includes some specific areas of results:

- Financial performance (profits, return on assets, return on investment, etc.);
- Product market performance (sales, market share, etc.); and
- Shareholder return (total shareholder return, economic value, etc.).

Specialists in numerous fields, strategic planners, operations managers, finance directors, legal counsels and entrepreneurs keenly monitor organizational performance. Many firms manage organizational performance using the balanced

scorecard methodology where performance is tracked and measured using multiple dimensions, for example,

- Financial performance.
- Customer satisfaction.
- Social responsibility.
- Employee satisfaction.
- Shareholder satisfaction.

The organization itself does not perform any work, but their workforce performs their assigned tasks, and a blend of these accomplished tasks results in organization performance.

There are other non-production and support tasks performed by the organization, like management, providing infrastructure, compliance and are directly and indirectly related to human and social factors, technology, shared resources, economic factors, regulatory measures, markets, management theory, organizational culture (Goals, Value, Beliefs, and Norms), organizational climate, motivational behaviour and teamwork, structure, technological and physical resources, financial resources and leadership style. When they work in tandem, a blend of these resources results in effectiveness, efficiency, development, and employee satisfaction. After utilizing all the resources, the organization produces a product or service contributing to organizational performance.

ORGANIZATIONAL RESOURCES (OTHER THAN ICT)

Organizational Resources are all assets that are available to a firm for use during the production process. The four basic types of organizational resources are human, monetary, raw materials, and capital. Organizational resources play an essential role in delivering organizational performance. The very objective of organizing resources is to enable the organization to perform well. If this objective is achieved, the organizational resources are said to be managed effectively. Effectiveness generally implies the inclusion of efficiency also. Organizational resources have an essential task to contribute towards the success of organizational performance. Two things are important in this context – accessibility of the resources and their utilization. Proficient asset management is vital in accomplishing corporate objectives. Some of the essential organizational resources are given below:

- **Workforce:** Almost every business requires human labour to deliver the work. The workforce includes the total of individuals who work in an organization.
- **Management:** Without a coordinating hand, various organizations would wind up accomplishing practically nothing. This is the reason managerial capacities and actual execution is a fundamental asset for organizations.
- **Aptitude:** It is imperative to have the right aptitude to dominate and master the space in which an organization operates.

- **Equipment and Tools:** Most organizations require particular mechanical assemblies to achieve their work, whether it is a piece of special equipment, one kind of software, or a machine intended to do a specific task.
- **Finances:** An organization's finances empower it to utilize enormous quantities of its other resources. This can incorporate the instalment of wages, the acquisition of hardware, or the leasing of a workspace.
- **Vitality:** Today, it is challenging to keep up a business without exploiting vitality, whether it comes as gas to control an armada of trucks or power to keep an office stacked with PCs completely operational.
- **Land:** Land is exceptional as an asset that is used to suit a particular business need.
- **Time:** Since no business can accomplish its objectives instantaneously, every business needs to regard time as an asset. Since the expense of time is estimated in terms of another asset, time often should be considered alongside resources, for instance, work, vitality, and land.

Each business has to plan how to utilize their available resources in the most optimum way to maximize the returns and ensure no wastage of these valuable resources.

The following indicators demonstrate the effectiveness of organizational resources other than ICT:

Overall Indicators

- Overall Enterprise Level Resource planning
- Coordination of organizational resources
- Optimum utilization of organizational resources
- Resource updating
- Resource maintenance

Key organizational resources other than ICT

- Managerial and leadership resources
- Physical infrastructure
- Technical resources
- Financial resources
- Human resources

Most of the Companies work on projects. Resources allocation and management is a significant aspect of project management. Planning and tracking of organizational resources are one of the key responsibilities of the management and

employees. It is essential to track if the resources have single assignments or if they work simultaneously on multiple assignments. It gives an understanding of resource's ability and allows management to best match the task and resources. For resource management, both over and under-utilization of the resource can result in adverse outcomes. For instance, on days when appropriate loading of work assigned to a resource and sufficient challenging work is available, the resource feels better and is satisfactorily occupied with work. This implies the resource should be adequately occupied to feel satisfied. On the other side, it has been observed that overusing a resource and an extraordinary workload can prompt burnout. Notwithstanding, research shows that when planned and controlled effectively (for example, resource management), it reduces the danger of burnout. This can likewise be applied to organizing other (non-human) resources. The machines or equipment can effectively be utilized to ensure no damage or wear and tear due to overuse. Maintenance breaks can be planned at regular intervals to ensure that there is no breakdown, and fixes can be applied in time. Better utilization implies more satisfactory and effective output, reducing overburdening and ensuring clear, focused delivery of objectives. Resources are utilized to their maximum potential, keeping projects delivery within time and costs.

FIRST AND SUBSEQUENT MOVER ADVANTAGE OF USING INFORMATION TECHNOLOGY

First Movers Advantage

In the context of technology, first-mover advantage is a significant concept. It can be defined as a service or product that increases a firm's competitive advantage by virtue of being the first to market. Being the first mover enables an organization to establish strong brand recognition and customer devotion before competitors enter the arena. Other benefits include additional time available to perfect its service or product and to set a market price often at a premium for the new product or service.

First movers in an industry are often followed by competitors trying to capitalize on the primary mover's success and additional market share. Usually, the principal mover has established a sufficient market share and a strong customer base to stay ahead in the market.

As an example of businesses with a first-mover advantage, innovators like Amazon and eBay can be considered. Amazon created the principal online bookstore, which was immensely successful. When other retailers established the presence of an online bookstore, Amazon had already achieved huge brand recognition and reaped its first-mover advantage into marketing a range of unrelated and additional products. As indicated by Forbes' "The World's Most Innovative Companies" 2019 positioning, Amazon positions second. It has yearly revenues of \$280 billion and,

by the end of the year 2019, had a 20% yearly sales growth rate. eBay constructed the meaningful primary website for online auction in 1995 and continues to be a well-known shopping site worldwide. It has ranked 43rd on the Forbes list of the most innovative companies. The organization generates \$287 billion in yearly revenues, with a 2.8% yearly sales growth rate.

Subsequent Adopter Strategy

Despite the numerous advantages available of being a first mover, there are disadvantages too. For example, other businesses can duplicate and improvise on the first mover's products, thereby penetrating the primary mover's share of the market. It costs around 60% to 75% less in replicating a product than creating a new product. Additionally, often in the bid to be the first to market, an organization may forsake key product features to expedite production. On a remote chance that the market responds negatively, later entrants could capitalize on the primary mover's failure to produce a product that lines up with consumers' interests; and the cost to create versus the cost to imitate becomes completely disproportionate.

ORGANIZATIONAL PERFORMANCE

Organizational performance means the actual output or results of an organization as measured against its intended outputs (or goals and objectives). Organizational Performance is a broad concept that has both financial and non-financial attributes. The qualitative factors include product quality, marketing effectiveness, customer satisfaction, and others. The financial factors include margins, growth, balance sheet metrics, and stock performance. It can be conceptualized as the total of operational, financial, and market-based performance.

ICT is called a revolution, and rightly so, it has brought some fundamental changes in almost all spheres of human life. It has affected business, economy, industry, and commerce, but it has significantly influenced cultural and social norms in the world. The research aims at understanding the impact of ICT on the performance of Companies. In line with the title, allied concepts like organizational characteristics, organizational resources, and organizational performance form part of the discussion in this chapter. Organizational Characteristics refer to the features of a High Performing Organization. Organizational Resources refer to the availability and management of resources other than ICT. Organizational performance relates to the outcomes of the organizational effort. Information and Communications Technology (ICT) is an extended-term for Information Technology (IT) that encompasses unified communications and the integration of telecommunications and computers and necessary software, storage and audiovisual, enabling access, storage, transmission, and interpretation of information.

ORGANIZATIONAL CHARACTERISTICS

Organizational characteristics are features emanating from the structure or strategy and the company culture. Below are some features which are prominent organizational characteristics:

- Division of work
- Coordination
- Common objectives
- Cooperative relationships

Authority and responsibility relationships In the study context, by organizational characteristics, we mean distinguishing features that high-performance organizations exhibit.

INFORMATION COMMUNICATION AND TECHNOLOGY & BUSINESS PERFORMANCE

Companies use ICTs both as input in the production process, and in the transaction process selling their products or acquiring inputs. ICTs can enhance enterprise performance through indirect cost saving such as labour costs and increased labour productivity, and direct cost reduction of firm's input such as information costs. On top of these short-run impacts of ICT adoption in the production process, the use of ICTs in the transaction process can foster input and output market expansion. However, in the long run, ICT may have an even bigger impact as it can completely restructure the production process and transaction methods, increase flexibility and improve outputs. Though ICTs can influence the performance of an enterprise in multifaceted ways, we limit ourselves only to ICT effects on enterprise return, labour productivity and market expansion. Despite the potential benefits of ICT and e-commerce, there is debate about whether and how their adoption improves firm performance. Use of and investment in ICT requires complementary investments in skills, organisation and innovation and investment and change entails risks and costs as well as bringing potential benefits. While many studies point to the possibility of market expansion as a major benefit for Companies, larger businesses can also expand into areas in which Companies dominated. Moreover, it is not easy for Companies to implement and operate an on-line business, as this involves complementary costs for training and organisational changes as well as direct costs of investing in hardware and software solutions. The emergence of ICT is not only reshaping the business models but also intensely interlining enterprises across its internal as well as external value chain. In other words business enterprises are in the process of major transformation in order to meet the challenges of network economy. The role of ICT is redefined as a fundamental enabler in creating and maintaining a flexible business network of inter-organisational arrangements – joint ventures,

alliances and partnerships, long term contracts, technology licensing, and marketing agreement. Traditionally in house developed customised MIS have been used to enhance business networking and now ERP systems, SCM systems, CRM systems and e-Business portals are being used to establish business networking systems. Most of the SME in India are in early stage of business networking as they have recently started adopting integrated information systems such as ERP and supply chain systems.

Recent Organisation for Economic Co-operation and Development (OECD) analysis shows the impacts of ICTs and e-business strategies on firm performance are positive overall, but that ICTs are not a panacea in themselves. The OECD's Electronic Commerce Business Impacts Project (EBIP) studied a set of 220 early successful adopters of e-business strategies in a range of established sectors in eleven different countries. This study showed the positive impacts of e-commerce on their turnover and profitability and to a lesser extent on employment, most notably when e-commerce is part of larger business strategies of firms (OECD, 2002). Further work by researchers in 13 OECD countries based on large scale statistical surveys provides evidence that the use of ICT can contribute to improved firm performance, in terms of increased market share, expanded product range, customised products and better response to client demand. Moreover, it indicates that ICT may help reduce inefficiency in the use of capital and labour, e.g. by reducing inventories, and that the more customers or firms are connected to the network, the greater the benefits (spill over effects). However, the analysis shows that complementary investments in skills, organisational change and innovation are keys to making ICT work, and that the use of ICT affects firm performance primarily when accompanied by other changes and investments and that without these, the economic impact of ICT may be limited.

An important characteristic of ICTs is that they are mostly scale neutral and available to small firms and poor countries as well, although access is restricted by poor infrastructure and high cost. The increased use of ICTs in enterprises leads to a substitution of ICT equipment for other forms of capital and labour and may generate substantial returns for the enterprises that invest in ICTs and restructure their organisation. However, though ICTs have high return potentials, they may erode a firm's profitability by integrating markets and exposing Companies to competition. Particularly, Companies in rural areas serve the local market niche and are protected against competition from bigger enterprises because of high information and communication costs, they are expected to face more competition and hence a reduction in monopoly rents.

ICTs can cause the costs of input and output market interactions for an enterprise to drop. As a result, the costs for inputs can decrease as ICTs reduce information and search costs, and the price of output can raise as ICTs increase the

effective price of output by reducing the search and information costs of trade. Both the input and output markets in developing countries are characterised by imperfect and asymmetric information. As seller looking for a buyer is unlikely to be fully informed about all the potential buyers. Negotiation costs are also large. ICTs have the potential to improve seller-buyer communications. As a result, ICTs-particularly Internet-can change the way that seller-buyer matches are made, and Companies can integrate themselves with the global market. In other words, the demand for a particular product produced by a SME may become less dependent on local market conditions.

Like any firm, an SME decides which type of ICT products to adopt based on the concrete benefits they can bring to its core business, the ICT capacity of its employees, and the financial resources available. Most people are familiar with basic ICT such as fixed phone lines, mobile phones, fax, computers, and basic document processing software- like Microsoft Office. Advanced communication technology, however, is more complex. Advanced communication technology relies primarily on the Internet and the intranet, which allow people within the firm to share files with each other over the same network. Having Internet connectivity enables firms to do faster research, set up websites, conduct e-commerce, and set up video conferences. One of the most revolutionizing developments in advanced communication technology is Voice-over-Internet Protocol (VoIP). VoIP includes all types of voice communication transmitted through the Internet, whether it is between computer and computer or in hybrid form between computer and regular phone. It competes directly with traditional fixed line and mobile phone operators. Users only pay for their dial-up, broadband, or wireless Internet connection. iSuppli, a market-research firm, estimates the number of VoIP residential users worldwide will reach 197 million by 2010 (The Economist, 2005). Most complex of all is advanced IT. It is often very expensive, sophisticated and takes more time to implement by a firm. Companies can sign up for one or all available services. In order to reduce costs, some firms opt to outsource this component or use an Application Service Provider (ASP) that provides functional software capabilities over the Internet.

WHY SHOULD COMPANIES ADOPT INFORMATION COMMUNICATION AND TECHNOLOGY?

Companies are often the main driver for a country's economic growth. However, as the number of Companies increases, competition increases, which then results in a decrease in prices, customer base, or both. This in turn will erode existing profits, creating less incentive for people to start Companies. This dynamic is captured by balancing feedback loops where the greater the number of Companies, the greater the competition, resulting in a slower rate of growth for Companies. To counter the increasing competition, firms can lower prices, increase promotion of their

product, improve their product, add new distribution channels, and/or improve their internal processes. The challenge is to counter competition when the firm still has the financial resources to do so. Otherwise, once the pressure of competition sufficiently erodes the SME's profits, it will no longer have resources to counter the competition and will have to exit the market. Foreign firms in both the import and export markets further add to competitive pressures, especially if they react faster to improve their product, process, promotion, or distribution channels. This is the problem of the Digital Divide. When firms in developed countries adopt ICT, firms in developing countries will lose out on the competition. This in turn can slow the growth rate of Companies and hurt the economy as a whole. ICT can thus play a very important role because it can help Companies both create business opportunities and combat pressures from competition. Appropriate ICT can help Companies cut costs by improving their internal processes, improving their product through faster communication with their customers, and better promoting and distributing their products through online presence. In fact, ICT has the potential to improve the core business of Companies in every step of the business process.

INFORMATION COMMUNICATION AND TECHNOLOGY AND EMPLOYMENT CREATION

In the context of socio-economic development process, globalisation and the shift towards a more integrated and interdependent world economy, poverty and unemployment have become of global concern. The urge to remedy and contain poverty as well as to adapt to flexible labour markets with varying technical skill requirements are priority issues for increasing human welfare and for avoiding the transformation of the human development divide into national, regional, and global conflicts. The progress of human development is becoming more and more uneven throughout the world. The North-South divide was accentuated during the fifth World Trade Organisation (WTO) conference in Cancun. The collapse of the communist regime in Russia has triggered an East-West divide in Continental Europe that is currently infringing the enlargement of the European Union. Growing concentration of poverty and joblessness within developing countries are triggering a national divide with a chronic damaging effect on socio-economic growth. In Asia, poverty remains a problem that requires immediate actions in order to secure future socio-economic stability and development in the region. Even though, the percentage of India States population in 1999 living below \$1 a day is estimated less than 10% and is forecasted to remain below 10% till 2015, the percentage of population that is malnourished during the same period is around 10% and is estimated to increase in 2015. In addition, two macro factors have stimulated more poverty and hunger since 1999, the first is the worldwide economic recession that followed the collapse of the Internet bubble and the second is the increasing political instability in the region.

Unemployment rates for India for 2010 are estimated 10.70%. The risks associated with unemployment, especially among youth, are damaging to the social cohesion of countries as jobless people are easily discouraged and lured into crime, drug abuse, religious fanaticism, and migration. Unemployment and underemployment pose a need for fundamental changes in order to develop new appropriate skills that meet the needs of the 21st century labour market demands.

SOCIETAL AND ECONOMIC IMPACT OF INFORMATION COMMUNICATION AND TECHNOLOGY

ICT is leveraged for economic, societal and interpersonal transactions and interactions. ICT has drastically changed how people work, communicate, learn and live. Moreover, ICT continues to revolutionize all parts of the human experience as first computers and now robots do many of the tasks once handled by humans. For example, computers once answered phones and directed calls to the appropriate individuals to respond; now robots not only can answer the calls, but they can often more quickly and efficiently handle callers' requests for services. ICT's importance to economic development and business growth has been so monumental, in fact, that it's credited with ushering in what many have labelled the Fourth industrial revolution. ICT also underpins broad shifts in society, as individuals en masse are moving from personal, face-to-face interactions to ones in the digital space. This new era is frequently termed as Digital Age. For all its revolutionary aspects, though, ICT capabilities aren't evenly distributed. Simply put, richer countries and richer individuals enjoy more access and thus have a greater ability to seize on the advantages and opportunities powered by ICT.

In 2018, a report stated that 5.135 billion have access to a cell phone (Global Digital Report, 2018). However, internet access through either mobile or fixed broadband remains prohibitively expensive in many countries due to a lack of ICT infrastructure. Furthermore, the World Bank report in 2018 estimated that out of the global population, more than 4 billion people have access to the internet. Additionally, it estimated that only 1.1 billion people have access to high-speed internet. This discrepancy in access to ICT has created a term called as digital divide. The World Bank, numerous governmental authorities and non-government organizations (NGOs) advocate policies and programs that aim to bridge the digital divide by providing greater access to ICT among those individuals and populations struggling to afford it. In context to India in the past few years many cellular enterprises have tried to bridge this gap so that the Digital India initiative can have some ground effectiveness. The United Nations considers one of its Sustainable Development Goals (SDG) to "significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020. Economic advantages are found both within the ICT market as

well as in the larger areas of business and society as a whole. Within the ICT market, the advancement of ICT capabilities has made the development and delivery of various technologies cheaper for vendors and their customers while also providing new market opportunities. For instance, telephone companies that once had to build and maintain miles of telephone lines have shifted to more advanced networking materials and can provide telephone, television and internet services; consumers now enjoy more choices in delivery and price points as a result.

SIGNIFICANCE OF INFORMATION COMMUNICATION AND TECHNOLOGY IN MODERN DAY BUSINESSES

In enterprises, advances within ICT have brought a slew of cost savings, opportunities and conveniences. This ranges from highly automated businesses processes that have cut costs, to the big data revolution where organizations are turning the vast trove of data generated by ICT into insights that drive new products and services, to ICT enabled transactions such as internet shopping, telemedicine and social media that give customers more choices in how they shop, communicate and interact. Through ICT, managers and employees can take decisions quickly and accurately with the information available from corporate data. This will also help the decision makers of enterprises to manage operations effectively and respond rapidly to business opportunities or threats. But ICT has also created problems and challenges to organizations as well as for individuals in terms of risks, security and safety. The digitization of data, the expanding use of high-speed internet and the growing global network together have led to new levels of crime, where so-called bad actors can hatch electronically enabled schemes or illegally gain access to systems to steal money, intellectual property or private information or to disrupt systems that control critical infrastructure. ICT has also brought automation and robots that displace workers who are unable to transfer their skills to new positions.

- **ICT in Agriculture:** Information and communication technology in agriculture, also known as e-agriculture, focuses on the enhancement of agricultural and rural development through proper information dissemination and communication processes. ICT has performed many key in agricultural development starting from decision support system to the trading of crops. The timely availability of right information and its proper utilisation is indispensable for people engaged agriculture (Ahmad et al., 2015). ICT plays a key role as decision support system to farmers. Through ICT, farmers can be updated regularly with the recent information about agriculture, weather, new varieties of crops, fertilizers, pesticides and new ways to increase productivity and quality control through telecommunication services. The dissemination of adequate, efficient and tailored technologies related to agro-climatic zone, size of farm and soil type improves the quality and productivity

of the output. ICT has the great potential to widen marketing horizon of farmers. With the ICT services they can connect directly to the customers and buyers for their produce by skipping the middle man from the traditional market channel. It also allows farmers to directly enquire about the price prevailing in the market and with this they can get the justified prices for their produce without any broker intervention. Through this the farmers' income can be improved and they will also feel empowered and confident in taking decisions.

- **ICT in Supply Chain Management:** The tremendous growth of ICT in Supply Chain Management (SCM) is playing a critical role in optimising decisions of the supply chain network flow for achieving enterprise competitiveness, enhancing the service, cutting the supply chain costs and reducing risks. With technologies like Electronic Data Exchange (EDI), Radio Frequency Identification (RFID), GIS, ERP, E-commerce, Decision Support System (DSS) and Internet of Things (IoT) the efficiency of supply chain network can be enhanced significantly. These technologies fill the loopholes in the supply chain network upto a great extent and technology like RFID help the enterprise in inventory management and tracking with its service. Manufacturers, suppliers, retailers, shippers, distributors and customers are the major stakeholders in the supply chain of enterprises, technological advancements in the SCM will satisfy each of these players and value addition can be done through proper ICT implementation. The proper dissemination of ICT in SCM is a win-win condition for all the participants here as it results in lowering cost of product, reduced working capital needs, and increased customer satisfaction.
- **ICT in Food Retail Market:** The food retail industry has reached a consensus to use new ICT technologies, such as cloud computing, Big Data, the Internet of Things, and Artificial Intelligence (AI), to create innovative operational models. New technical methods are accelerating digital transformation of the retail industry, helping it make breakthroughs in many areas, such as shopping efficiency and consumption experience. In other words, the retail industry is undergoing an intelligent revolution. Whether it is online or physical, smart retailing has given a new direction to the enterprises in offering their product and services. The goal of smart retail is to centre on multiple dimensions (for example, consumers, requirements, products, and services), maximize efficiency in specific actions (such as sensing life world scenarios, pushing solutions, and implementing fast deliveries), across the entire process from commodity production to consumer experience. ICT enabled food store in India is emerging with exponential rate and most of the shopping malls have designated separate area especially for food and gourmet section. Food

stores which have implemented technologies like EPOS-Electronic point of sale, EFTPOS-Electronic funds transfer at point of sale, smart cart, digital information display units, smart storage facilities to keep the products fresh and fast delivery service with product tracking option to make the buying effective were classified as ICT enabled food store. The food retail in India is dominated by unorganized sector and the size of organized retail is merely 5% (Unnisa, 2018). Unorganized sector in food retail is primarily dominated by general stores, rural counter stores (kirana), kiosks, street vendors and street markets while organized sector includes gourmet stores, department stores, discount stores, supermarkets and hypermarkets, e-tailers and cash-and-carry formats.



2

IMPACT OF INFORMATION AND COMMUNICATION IN IT BUSINESS

BACKGROUND AND INTRODUCTION

A path-breaking innovation of all time, Information and Communication Technology (ICT) has brought about a paradigm shift in individuals' personal and professional lives. This research investigates the impact of ICT on organizational performance in select Information Technology (IT) companies. While doing so, it takes into consideration variables like organizational characteristics and organizational resources. The study also takes into account the strategic choice of being a first-mover or a subsequent adopter.

IT companies have spearheaded the ICT revolution that has impacted businesses all over. But, what has been the impact of ICT on the IT companies themselves? It is an intriguing and unique question addressed by this research study. The choice of the IT industry as a contextual setting for this study is not by accident. Instead, it attempts to find the impact of ICT on those very IT organizations that impact others.

BACKGROUND

The utilization of ICT technologies and applications began in the 1990s. In the recent past, ICT applications, such as electronic commerce (on-line business) and Enterprise Resource Planning (ERP), have become essential for a business to

endure and flourish. Competition between firms has driven them to discover the wellsprings of growth and fortify their market position. The relationship between business value creation and web-based business is new, and more investigation is required to be done. Web-based business decreases the cost of running the business and boosts incomes. Thus, web-based business is relevant and viable in the creation of goods and services. An ERP is an integrated system that unites all the applications that an organization needs in a single system. This empowers organizations to accelerate the dynamic cycle and react quickly to the changes in the market.

The era of digitalization – both its evolution and the speculations for the future have been captured in five phases by Micheal Seemann (2019). The review is global and touches upon various facets of the digitalization movement. Rise of the Machines - Science and Technology Facilities Council (2018) has created a visual evolutionary snapshot shown in figure 1.1. Since the creation of the transistor, technology has evolved rapidly with modern-day innovations and solutions like Big Data (BD), Big Data Analytics (BDA), Machine Learning, Artificial Intelligence (AI), Internet of Things (IoT), and many more.

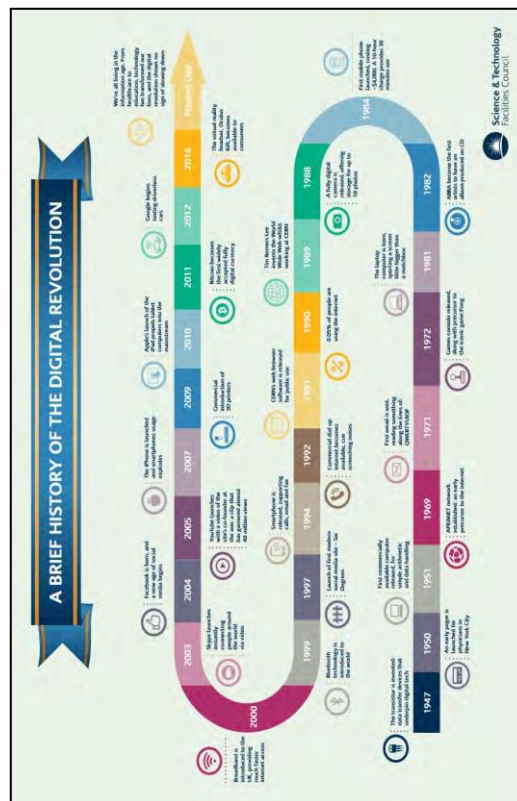


Figure 1.1: The Digital Evolution

(Source: "Rise of the Machines - Science and Technology Facilities Council", 2018)

Introduction to Key Concepts

The core subject explored in this research is the impact of ICT and other organizational variables on organizational performance. In this section, a brief introduction to these concepts is covered. A detailed discussion has been done in Chapter 3 of the thesis.

Impact of ICT

There has been a phenomenal impact of ICT on business. The impact of technology is felt across various business functions. The following matrix depicts the span of impact:

	Operations	Marketing	Finance	Quality	HR
BYOD	√	√	√	√	√
BI	√	√	√	√	√
BD	√	√	√	√	√
BDA	√	√	√	√	√
AI	√	√	√	√	√
IoT	√	√	√	√	√
ML	√	√	√	√	√
Cloud	√	√	√	√	√
DS	√	√	√	√	√

Figure 1.2: The ICT impact vertical and horizontal matrix

It indicates the technology innovations that have cut across all the business domains through major technology applications. Scheck (2016) has given eight such impacts:

Cloud Computing

The rapid adoption of Cloud Computing can be attributed to its efficiencies to run any business operation. Cloud Computing uses the latest Information Technology to accrue benefits from its ability to reduce the time taken to go to market and efficiently manage resources to grow businesses.

Progressively, businesses are moving to the cloud to use its numerous advantages. It has been anticipated that more than \$1 trillion will be invested in IT spending to move businesses to cloud computing by 2020. Ed Anderson, research VP Gartner, mentions that many organizations adopt a Cloud- first strategy to stay ahead in this fast-growing new economy. Further, this growth in the cloud increases the IT spent, but it has helped a new generation of start-ups get established quickly and efficiently.

Automation of Business Processes

Across the years, there has been a conscious drive towards automating the business processes to improve productivity and make processes more efficient.

Information technology enables to automate these business processes, thereby saving time and costs of operations. The time and costs saved can be re-purposed to build other efficiency tools and focus on other activities required to speed up business processes more than ever.

Various software automation tools are available to automate processes like accounting, tracking productivity, customer relationship management, production process monitoring and management.

Working Remotely

A well-implemented IT system enables remote access to the company's distributed network. This allows its employees to log in and work remotely, bypassing the need to be physically present at a work location.

The ability to work remotely has various advantages. This remote working model has gained popularity in recent times, and many people will opt for this in the future.

Ian Adams, Head of Marketing at Mitie, observes that departments like HR, IT, Finance, Operations and Sales function work collaboratively to make this remote working model operate seamlessly.

Mobile Technology

Mobile Technology has gathered momentum due to its inherent benefits ranging from ease of communication, saving time and improving business transaction speed. The acceptance and ever-growing use of IT has also helped in the proliferation of mobile technologies across the masses.

A new way of working is BYOD (Bring Your Own Device). BYOD helps employees bring their choice of devices to work rather than using the standard devices provided by an organization. This new way of working has become popular due to the freedom of choice it gives. It has been observed that 74% of the organizations prefer this trend; hence BYOD is bound to grow further.

Mobile technology has seen unprecedented growth as it helps increase productivity and its ability to integrate with other workplace tools and processes seamlessly.

Securing Information

The amount of data that is being processed and stored is ever increasing. Organizations have the challenge of storing these enormous amounts of data and ensuring that this data is safe and secure. If data from these databases are lost or corrupted, there can also be legal issues. To prevent this loss, Information Technology provides the solutions to protect and store the databases securely.

Rather than physical databases servers, these days' virtual storage systems have been developed to store these databases. This virtual storage ensures secure access to only a few designated users, thereby ensuring that these databases are safe from hacking and are more robust to sustain physical damage. This way, Information Technology helps ensure business integrity.

Customer Satisfaction

For any business, one of the critical areas of impact is customer experience and satisfaction. Customer satisfaction defines if the customer is happy or not with the product or service. A strong customer support team and its 24x7 availability is the key to catering to dynamic needs. Information Technology provides the software utilities and applications to communicate and resolve customer issues in real-time. Tools like Email, cloud-based/automated issue handling systems and Customer Relationship Management (CRM) applications are examples of tools that help resolve customer issues.

Management of Resources

To run any business, it needs abundant resources ranging from HR, finances, raw materials for production, and others. These resources are scattered across various geographic locations for large firms. IT helps to manage these resources efficiently by providing software and infrastructure solutions. For example, Enterprise Resource Planning (ERP) software can be integrated with other organization-wide systems to improve the efficiencies of different business processes.

Open Source Software

Information Technology has enabled businesses to use open-source software, which allows free software without licensing them. This free software offers the possibility to modify the software to customize as and when required.

Many software products that businesses use has an open-source variant that is broadly available on the Internet. The free version of the software can be a scaled-down version of the same software, which offers the flexibility to use that variant they can afford against the value they want to get in a business.

All this gives any business the advantage and flexibility to do what matters most, ensuring the maximum value they can get. The impact of ICT can be viewed as its influence on various business domains - manufacturing, marketing, finance and HR. This impact is explained below:

Manufacturing

Industry 4.0 (The Fourth Industrial Revolution) uses modern, innovative technology to automate business and manufacturing processes. It enables robots to run the operations and gives workers ICT tools to make the business processes efficient.

Computer-enabled and controlled operations can decrease setup time, improve manufacturing speed, monitor the resources, and reduce lead times, thereby aiding the manufacturing business.

Marketing

The impact of technology has been felt on both - the buyer and the seller. Due to the Internet' presence, the customer is well informed about the product and services much before purchasing. The information available on the internet enables the seller to communicate and the buyer to ask questions. New avenues, like digital marketing, have opened up to reach out to more customers with lesser acquisition costs. Businesses that adopt this marketing mode also have to face competition as the other sellers would have the same technology (Ecommerce) to aid the selling process. Technology has enabled data-driven selling and allows for more customized and better penetration to reach those same buyers. The cost of acquiring a customer has reduced, and the outreach has increased across geographies spawning into many ecosystems (Digital Marketplace).

Finance

Technology has created a huge impact due to the digitization of financial instruments and transactions. It has been observed that Information Technology has been adopted in every facet of the financial world. From exchanging budgetary instruments to tracking individual spending plans to reveal a business's profit, each money travel is being facilitated by IT. Information technology permits the fast computation of budgetary insights. Electronic exchanges of cash trading, reporting, budgeting, bookkeeping, and other aspects like planning have significantly benefited because of ICT.

HR

Technology advancement has impacted all business areas, from a changing global perspective to a workforce on the lookout for remote working options. This implies that an organization's human resource area cannot remain behind and must adapt and upgrade its systems to cater to the new demands from the workforce and the business.

Data analytics focused on people have come to the fore, and IT is enabling this move. HR planning has to be based on past data and future needs. IT has systems to search for the skilled workforce on the internet, followed by automated systems to evaluate and onboard the workforce online with minimal physical intervention. The changing ecosystem is mobile dependent, and the new demands to up-skill and employee engagement systems of HR have to be mobile application enabled. This is just the beginning of the various innovations which are being catered like predictive analytics based on Big Data and others.

Organizational Performance

Organizational performance is the comparison of the actual results against the planned goals and objectives in any organization. The organizational performance includes some specific areas of results:

- Financial performance (profits, return on assets, return on investment, etc.);
- Product market performance (sales, market share, etc.); and
- Shareholder return (total shareholder return, economic value, etc.).

Specialists in numerous fields, strategic planners, operations managers, finance directors, legal counsels and entrepreneurs keenly monitor organizational performance. Many firms manage organizational performance using the balanced scorecard methodology where performance is tracked and measured using multiple dimensions, for example,

- Financial performance.
- Customer satisfaction.
- Social responsibility.
- Employee satisfaction.
- Shareholder satisfaction.

The organization itself does not perform any work, but their workforce performs their assigned tasks, and a blend of these accomplished tasks results in organization performance.

There are other non-production and support tasks performed by the organization, like management, providing infrastructure, compliance and are directly and indirectly related to human and social factors, technology, shared resources, economic factors, regulatory measures, markets, management theory, organizational culture (Goals, Value, Beliefs, and Norms), organizational climate, motivational behaviour and teamwork, structure, technological and physical resources, financial resources and leadership style. When they work in tandem, a blend of these resources results in effectiveness, efficiency, development, and employee satisfaction. After utilizing all the resources, the organization produces a product or service contributing to organizational performance.

Various models have been developed for measuring organizational performance. Popular amongst those are:

- Balanced Scorecard (Kaplan and Norton, 1996),
- Malcolm Baldrige model (Garvin, 1991),
- Performance prism (Neely et al., 2002; Neely, 2004) and
- European Foundation for Quality Management (EFQM) (Armstrong, 2000).

SOME LITERATURE REVIEW CONDUCTED ON IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY IN IT SECTOR

Martin-Rojas et al. (2019) posit that organizations contend earnestly to achieve competitive advantage under rapidly changing conditions. Through technology, they differentiate themselves from other organizations to get an unrivalled market position. Decisions concerning technology variables are essential to an organization's competitive strategy, positioning, and emplacement. The exploration investigates how top administration upholds technology and technical skills empower technology acquisition, integration, and infrastructure in firms, impacting organizational performance through corporate entrepreneurship. The examination is performed utilizing Structural Equation Model on a sample of 201 Spanish technology firms. The outcomes show that the consciousness of technical issues empowers entrepreneurship in the firm.

The significance of digital innovation is growing in the context of the need to create digital solutions; that, in turn, empowers the digital transformation across organizations and ventures. The challenge is the lack of empirical study of digital innovation factors that contribute to the information gap. The paper examines the impact of digital orientation and digital capability on digital innovation and the impact of digital innovation on the link between organizational performance and digital orientation as well as digital capability. This study tests another conceptual system using review information of 105 small to medium-sized IT firms in Malaysia and utilizing structural equation model (SEM) assessment from the partial least square (PLS) approach. The results show that digital orientation and digital capability positively impact digital innovation, which further influences financial and nonfinancial performance (**Khin et al., 2019**).

This research is based on the recent practices in manufacturing and their influence on organizational performance. More research is to be done on the impact of improvement activities, for example, ERP, on organizational performance. The study presents data on internet-enabled supply chains. The literature research is based on the incorporation of supply chain and enterprise resource planning. The theoretical foundation identified with a resource-based hypothesis, technology, condition, and organization has been summed up in the research. The assessment will be helpful for strategy creators to understanding the issues identified with the supply chain, its coordination, adaptability, and performance (**Jutamat et al., 2019**).

This study is focused on the alignment–performance relationship to understand the impact of alignment dimensions and organizational performance measures. Although strategic alignment is known to improve organizational performance, the motivation behind this paper was to find answers to understand how various alignment measurements impact organizational performance. The information

obtained from 161 senior IT and business heads in China was studied using a structural equation modelling technique. The study identified that quality-oriented strategic alignment measurement has a significant relationship with all performance measures. Contrarian to the view, both product and marketing-oriented strategic alignment parameters do not positively affect the financial return. Similarly, the marketing-oriented strategic alignment parameter has an inconsequential relationship with operational excellence. This study suggests that a combined business strategy and IT strategy will work better. **(Ilmudeen et al., 2019)**

Zahra et al., (2019) conducted a study in the context of SMEs. The authors state that the significant reason for this study was to analyze the contribution of knowledge management on information technology capability and organizational performance in small and medium-sized enterprises (SMEs). SMEs have been extensively acknowledged as the springboard for financial gains. Nonetheless, the organizational performance of SMEs is low, which requires an extraordinary level of information technology capability. The study was based on 1500 operational SMEs engaged with textile manufacturing to meet the local and international commitments. This study was quantitative across the research design. Large portions of the respondent were managers, senior officers, and executives. A total of 300 questionnaires were circulated by utilizing simple random sampling. Information was broke down by using PLS-SEM. The study's observations have indicated the concurrence with the proposed hypotheses of the study and found that information technology capability has a positive impact on organizational performance. Moreover, knowledge management has assumed a mediating role. Consequently, this study will be helpful for owners and managers of SMEs in the textile area to learn the significance of information technology and knowledge management to improve performance.

Lal et al., (2020) planned to comprehend the drivers of cloud-based services (CBS) adoption and its effect on the performance of Indian organizations. The conceptual model was created utilizing the technology-organization-environment framework, the combination of innovation theory, technology acceptance model, transaction cost economics, and balanced scorecard model. This quantitative study gathered data from IT specialists of 334 Indian organizations utilizing a questionnaire survey strategy. Data examination utilizing structural equation demonstrates that amongst six distinguished drivers, the credibility of cloud service provider has the most grounded sway on the decision to embrace CBS, trailed by economic flexibility, top management attitude, perceived usefulness, and relative advantage. Perceived ease of application of the CBS was found statistically insignificant. On the other hand, the effect of CBS adoption was discovered to be most grounded on the financial performance of the organizations. Further, CBS's adoption drivers and their effect on performance shift significantly based on the age and size of the organizations.

Singh et al., (2019) posit that big data has high operational and strategic potential in business value creation and is essentially the big thing in innovation. It gives actionable ideas for a firm's performance and to gain a competitive advantage. Big data requires substantially more than using new analytics, as firms figure out how to exploit big data to unbridle new hierarchical capacities and value. It is likewise relevant to note that corporate commitment to the utilization of big data analytics is significant as past writing recommends that corporate commitment influences big data assimilation through acceptance and action, thus improving and sustaining the firms' performance. A few partners likewise propose that firms have to leverage analytics over the gut impulses, requiring a data-driven decision-making culture for firms to drive an unrivalled performance from their workers. To use business analytics for value creation, it is unnecessary to depend on authoritative decision-making measures, including resource allocation cycles and resource orchestration measures.

Bhatt et al., (2019) state that today, using analytics and Information Technology, investigating each type of information is conceivable. Be it manufacturing, Supply Chain, Retail, Service, Product, Sales Marketing, or pharmaceuticals and Healthcare. Lately, hospitals are confronting the issue of overcrowding, and medical staff cannot convey healthcare appropriately. With the assistance of the Information Technology System utilized in hospitals for routine work, high quality and high amount of information can be produced. With the ability to break down the information precisely for the internal operations, planning, and forecasting for the benefits of the patients in choosing the idea of the treatment, medicines utilized, or the probable adverse drug reaction pharmacologically, the healthcare organization largely benefits. The study focuses on scaling up to improve operational efficiencies by using information technology and analytics.

Sukati et al., (2020) researched how SCM practices dimension (supply chain partnerships, customer relationships, information exchange in supply chains, information technology, employee training, and internal operations) impact the performance of business organizations in the tourism service industry. A questionnaire was given to a sample of 85 managers in hospitality organizations (hotel, restaurant and transportation companies) to collect data. The following finding was obtained: (1) There was a positive correlation between strategic supply chain partnership and organizational performance. (2) Customer relationship has a significant impact on organizational performance. (3) There is a relationship between Information and organizational performance. (4) Information technology was found to have a significant impact on organizational performance. (5) The research indicates a significant correlation between internal operations and organizational performance.

Malar et al., (2019) claim that Information Technology (IT) can increase firms' ability to provide and sustain competitive advantages. IT contributes to changing the

nature, scale, and scope of service delivery. This research focuses on identifying and examining the processes through which IT impacts business value in service processes. The study has centred on the customer as a co-creator of firm value. It has analyzed risks and socio-technical challenges associated with introducing an online banking service system in India. The research summarizes the implications of IT strategy and how organizations can avoid value destruction when customer participation is increased in the delivery of online services.

Otoo (2019) study aims to understand the role employee competencies play in the association between human resource management (HRM) practices and organizational effectiveness of the pharmaceutical industry in Ghana. An integrated research model was made by combining key factors from past literature. This model was validated by applying structural equation modelling (SEM) to the data collected from 550 employees of the selected pharmaceutical industries. The reliability and validity were established through confirmatory factor analysis (CFA). The research findings help stakeholders, policymakers, and management of the pharmaceutical industry formulate HRM practices to influence and shape employees' skills, knowledge, and behaviour, thereby improving organizational effectiveness.

Iqbal et al., 2019 carried a study to empirically investigate the impacts of knowledge management (KM) facilitators on KM processes in research universities to check the immediate connection between KM processes and organization performance. This examination additionally proposes to look at the mediating role played by intellectual capital (IC) and innovation in the relation between KM processes and the performance of universities. The study used a sample of 217 academic and administrative workforce in research universities to test the hypothesized relationships through the partial least squares - structural equation modelling method. The results uncover that KM enablers significantly affect KM processes. The results additionally demonstrated that KM processes impact organizational performance directly and indirectly through innovation and IC. This study confirms the impact of KM and proposes how research universities and higher instructive organizations can promote innovation and IC and thereby improve organizational performance.

George et al., (2019) claim that strategic planning is a generally accepted management approach in contemporary organizations. The underlying assumption is that it is a fruitful practice in public and private organizations that positively affects organizational performance. Nonetheless, strategic planning has been criticized for curbing strategic thinking. This article attempts a meta-analysis of 87 correlations from 31 observational examinations and asks if strategic planning elevated organizational performance? A random-effects meta-analysis uncovers that strategic planning has a positive, moderate, and huge effect on organizational performance.

Meta-regression examination proposes that the positive effect of strategic planning on organizational performance is most grounded when performance is calculated as effectiveness and when strategic planning is done as formal strategic planning. This effect holds across all sectors (private and public) and countries.

The study (**Pang et al., 2018**) assessed the impact of motivation on work satisfaction and organizational performance in the container delivery industry of Taiwan. Four motivation parameters were identified using the exploratory factor analysis with other variables like remuneration, job satisfaction, job stability and work environment. And five job satisfaction parameters were used, namely: work policy, work autonomy, workload, performance and status. The organizational performance dimensions included financial and non-financial performance. The internal consistency of questionnaire responses was tested using Cronbach's alpha and corrected item-total correlation coefficients. ANOVA tests were used to check for differences in respondents' perceptions of these factors according to different demographics. A multiple regression model analysis was done to observe the relationships between motivation, job satisfaction and organizational performance. Results showed that salary and job performance positively affected financial performance attributes like turnover growth rate, return on assets, and profitability. In contrast, job environment and autonomy positively affected non-financial performance attributes, like customer service, employee productivity, and service quality.

The reason for this study (**Nikpour, 2017**) was to research the mediating function of the worker's organizational commitment on the association between organizational culture and organizational performance. The study was a descriptive and Correlational examination that was conducted through the research. The study was based on the employees of the education department of Kerman province, and 190 people were chosen as a sample by Cochran's equation. The data was studied utilizing SPSS and AMOS software. The research showed that the proposed model had a proper fit, and the mediation of worker's organizational commitment had a very high degree of impact on the association between organizational culture and organizational performance.

Singh et al., (2019) state that open innovation as a driver of organizational performance of small and medium-sized enterprises (SMEs) has got minimal academic consideration in terms of research. Prior work and results of open innovation in SMEs were studied with reference to the resource-based and knowledge-based views of the SMEs. Data from 404 SMEs were gathered, and structural equation modelling was used to test the hypotheses. The examination recommends that top management knowledge value and knowledge-making practices impact open innovation, further impacting organizational performance.

Rehman et al., (2019) carried research to decide the influence of management control system (MCS) on organizational capabilities and organization performance. Data was collected from chief financial officers and general managers from the textile industry to test the hypotheses empirically. A sample size of 160 respondents was used to analyse the data using the partial least square equation. The findings clarified a significant influence of rewards and compensation, cybernetic, and administrative controls on the organisation's performance. Similar findings were observed with cybernetic, cultural, planning, and administrative controls, rewards and compensation, with organizational capabilities. Regardless of this, planning controls and cultural controls do not influence organizational performance. Organizational capabilities mediate the linkage between each of the five components of MCS as a package and organizational performance. The findings give sufficient evidence to the top management of the textile industry to improve organizational performance based on the study's findings. Furthermore, enhancing organizational capabilities will likewise improve organizational performance.

Fawcett et al., (2019) study is based on the question – "Can Cross-functional collaboration improve organizational performance?" The reports range from having mixed views on the relationship with many positive and few negative responses. This study evaluates the possible moderating role of strategic purity and strategic choice on the collaboration-performance linkage. Based on Constituency-Based and Organizational Conflict speculations, different parts of strategy (orientation and purity) are hypothesized as immediate influences on an organization's collaborative capability, just as moderating influence on the collaboration-performance linkage. The research has been conducted on European supply chain managers. The study finds that while the differentiation strategy is directed at the collaboration performance relation, counterintuitive results related to strategic purity are clarified by strategic intensity. This recommends that collaboration does not passively adjust divergent goals among various groups of the firm. But, the proactive arrangement is necessary as a super ordinate enabler.

This investigation (**Rasool et al., 2019**) analyzed how human resource management (HRM) can indirectly and directly impact sustainable organizational performance (SOP), along with organizational innovation (OI) as a mediator. For this quantitative examination, a 31-item questionnaire was utilized to gather information on HRM and SOP from twenty Shanghai branches of 5 Chinese banks. HRM was characterized as multidimensional, comprising employee staffing, performance management, staff development, and compensation and benefits. Partial least squares structural equation modelling (PLS-SEM 3.2) was utilized to estimate the impacts. The HRM practices related to performance management and compensation and benefits demonstrated an immediate and positive influence on SOP. Considering

indirect relationships, each of the four dimensions of HRM was positively identified with OI (product, process, and knowledge innovation), which was further positively associated with SOP.

Organizational innovation was in this manner appeared to assume an interceding function among HRM and SOP. Performance is a genuine worry for manufacturing SMEs, particularly for pharmaceutical SMEs in Thailand. In particular, pharmaceutical SMEs face challenges concerned with how to increase performance by applying total quality management and entrepreneurial orientation. This study evaluates the entrepreneurial orientation and total quality management of organizational performance of pharmaceutical organizations in Thailand. This study also evaluates the moderating role of organizational learning. To study the associated variables, the information was assembled from the owners and managers of Thai pharmaceutical SMEs. This study inferred that entrepreneurial orientation and total quality management are the elements that together improve the performance of pharmaceutical organizations in Thailand. Discoveries of the study exhibit that organizational learning moderates the relationship of TQM with the performance of pharmaceutical organizations; however, it does not moderate the connection of entrepreneurial orientation. The theoretical contribution of the current study lies in its utilization of organizational learning as a facilitator of the connections of entrepreneurial orientation, total quality management, and pharmaceutical SMEs' performance. From the practical perspective, the key contribution of this study is that pharmaceutical SMEs in Thailand may welcome the advantages of dedicating more thought and contribution regarding the execution of entrepreneurial orientation, total quality management, and organizational learning to accomplish a sustained competitive advantage (**Chienwattanasook et al., 2019**).

Chae (2019) claims that as new information technologies emerge every day, it is important for organizations to ascertain whether to be first adopters or subsequent adopters of innovation in IT applications. The massive effect of the Internet and digitization leads to the question of whether the fundamental rules of first-mover advantages are yet relevant to information technology investment in an era of rapid development and globalization. Early investment in complex information systems generated a sustainable competitive advantage in the previous generation of information system development. However, as the costs of creating and developing information systems decrease quickly in the digital era, the business value from an early investment in innovative IT applications is not likely to be associated with sustained profitability. This study looks at the timing of investment in mobile banking to check whether the early investment in innovative IT systems can lead to first mover advantages in the digital age.

Dushnitsky et al. (2019) observe that some of the best-performing companies these days are exchange platforms (e.g., Alibaba, Airbnb, Uber). The platform literature offers a good view of pricing and non-pricing strategies yet do not say much about the following two points. To start with, there is sufficient data available about individual strategy, but not enough about strategy mix; for example, which combination of strategic choices do platforms undertake concurrently? Secondly, there are detailed studies on the effect of specific strategies and their corresponding results, yet there is no information on the performance implications of platforms' overall strategy mix. The paper addresses these gaps utilizing a dataset of 756 crowd funding platforms – a prominent example of exchange platforms – across EU-15 countries. This research has contributed to an increase in knowledge at the intersection of the platform and strategic management literature.

Chen et al., (2019) identified a learning curve where costs decline with subsequent experience, suggests that early entry provides learning opportunities to create a competitive advantage by reducing future costs relative to the later entrants. This suggestion can be argued as subject to an under-appreciated limitation— the scope and extent of progress down the learning curve may be considered uncertain. On the other hand, if there is uncertainty in the learning curve, then the assumption regarding the benefits of learning curves might under or over-emphasise the early entry's economic value. Here two types of uncertainties can be considered— prospective (the future production cost) and contemporaneous (the current production cost) uncertainty. Based on the findings through computations, while prospective uncertainty in the learning curve improves early mover advantage, contemporaneous uncertainty decreases early mover advantage. Further, it is observed how these findings are dependent on learning spillovers between a leader and follower firms. In conclusion, when a learning curve cannot be ascertained relative to the expected learning rate, it is actual observation, rather than expectations about this rate, that determines the extent of early mover advantage.

Ranasinha (2018) writes that markets are not dominated by those who arrived first. Eventually, market control is determined by whoever is first to meet the needs of the customer best. In an evolving market space, accepting those needs might be unclear today; however, it will rapidly evolve and harden over time. Google generates more money from digital advertising sales than others globally, yet Yahoo! invented the Pay-Per-Click (PPC) model. Furthermore, Apple did not create the smart phone, MP3 player, or tablet computer. Microsoft Windows was not the principal PC operating system, nor Oracle, the primary database company. However, today, each of these businesses dominates their

specific market segments. Rather than constantly looking to new market opportunities, perhaps a more lucrative and sustainable way ahead lies in better understanding customers' problem areas in the markets that already exist. It is recommended to offer a better product or service in the space the organization already serves.

ORGANIZATIONAL CHARACTERISTICS

In the research context, an organizational characteristic refers to those distinguishing features that high-performance organizations exhibit. One popular framework that presents such organizational characteristics is the HPO Framework developed by De Waal (2010). A brief note of the same is given below:

The HPO Framework is a conceptual framework that enables an inventory and categorization of the distinguishing factors of an HPO. The most common factors were tested in a worldwide survey across 3,000 organizations in different industries to recognize the HPOs' most significant characteristics. These characteristics structure the HPO Framework; it consists of five aspects: briefly described below (De Waal, 2010).

Aspect 1: High Management Quality

As per De Waal (2010), the most important factor is quality of management where the managers have integrity, are decisive, focused on action and achievements, effective and self-confident. They likewise have a strong leadership style. They emphasize building trust relationships with their staff, mentoring and facilitating these employers, and having an influential exemplary role.

Aspect 2: Quality of Staff

In an HPO organization, its members are inspired to achieve extraordinary results. They are trained to be resilient, flexible and be responsible for their work. The organization has a diverse and complementary mix of resources. Furthermore, they grow through partnerships with suppliers and customers.

Aspect 3: Focus on the Long Term

The third HPO factor is the organization's ability to maintain a long-term relationship with each stakeholder. It creates growth through collaboration with other organizations of suppliers and customers. The organization regularly seeks opportunities for alliances and collaborative relations (based on a shared vision).

Aspect 4: An Open and Action-Focused Culture

To develop new ideas and improve their performance to elevate the organization to a higher level, everyone invests a meaningful amount of time and attention to communication, knowledge exchange, and learning. The managers encourage change and allow for mistakes as a learning experience.

Aspect 5: Continual Improvement and Renewal

Continual improvement and innovation are vital to set the organization apart. In an HPO, all the staff members feel ethically obliged to consistently strive for the best result out of themselves, their colleagues, and the organization. The organization excels in its core competencies and continually innovates by determining what is best for the organization.

Organizational Resources (other than ICT)

Organizational resources have an essential task to contribute towards the success of organizational performance. Two things are important in this context – accessibility of the resources and their utilization. Proficient asset management is vital in accomplishing corporate objectives. Some of the essential organizational resources are given below:

- **Workforce:** Almost every business requires human labour to deliver the work. The workforce includes the total of individuals who work in an organization.
- **Management:** Without a coordinating hand, various organizations would wind up accomplishing practically nothing. This is the reason managerial capacities and actual execution is a fundamental asset for organizations.
- **Aptitude:** It is imperative to have the right aptitude to dominate and master the space in which an organization operates.
- **Equipment and Tools:** Most organizations require particular mechanical assemblies to achieve their work, whether it is a piece of special equipment, one kind of software, or a machine intended to do a specific task.
- **Finances:** An organization's finances empower it to utilize enormous quantities of its other resources. This can incorporate the instalment of wages, the acquisition of hardware, or the leasing of a workspace.
- **Vitality:** Today, it is challenging to keep up a business without exploiting vitality, whether it comes as gas to control an armada of trucks or power to keep an office stacked with PCs completely operational.
- **Land:** Land is exceptional as an asset that is used to suit a particular business need.
- **Time:** Since no business can accomplish its objectives instantaneously, every business needs to regard time as an asset. Since the expense of time is estimated in terms of another asset, time often should be considered alongside resources, for instance, work, vitality, and land.

Each business has to plan how to utilize their available resources in the most optimum way to maximize the returns and ensure no wastage of these valuable resources.

First Movers Advantage

In the context of technology, first-mover advantage is a significant concept. It can be defined as a service or product that increases a firm's competitive advantage by virtue of being the first to market. Being the first mover enables an organization to establish strong brand recognition and customer devotion before competitors enter the arena. Other benefits include additional time available to perfect its service or product and to set a market price often at a premium for the new product or service.

First movers in an industry are often followed by competitors trying to capitalize on the primary mover's success and additional market share. Usually, the principal mover has established a sufficient market share and a strong customer base to stay ahead in the market.

As an example of businesses with a first-mover advantage, innovators like Amazon and eBay can be considered. Amazon created the principal online bookstore, which was immensely successful. When other retailers established the presence of an online bookstore, Amazon had already achieved huge brand recognition and reaped its first-mover advantage into marketing a range of unrelated and additional products. As indicated by Forbes' "The World's Most Innovative Companies" 2019 positioning, Amazon positions second. It has yearly revenues of \$280 billion and, by the end of the year 2019, had a 20% yearly sales growth rate. eBay constructed the meaningful primary website for online auction in 1995 and continues to be a well-known shopping site worldwide. It has ranked 43rd on the Forbes list of the most innovative companies. The organization generates \$287 billion in yearly revenues, with a 2.8% yearly sales growth rate.

Subsequent Adopter Strategy

Despite the numerous advantages available of being a first mover, there are disadvantages too. For example, other businesses can duplicate and improvise on the first mover's products, thereby penetrating the primary mover's share of the market.

It costs around 60% to 75% less in replicating a product than creating a new product.

Additionally, often in the bid to be the first to market, an organization may forsake key product features to expedite production. On a remote chance that the market responds negatively, later entrants could capitalize on the primary mover's failure to produce a product that lines up with consumers' interests; and the cost to create versus the cost to imitate becomes completely disproportionate.

Putting all of them together

Based on all the above discussion, the following conceptual model has been developed for the study.

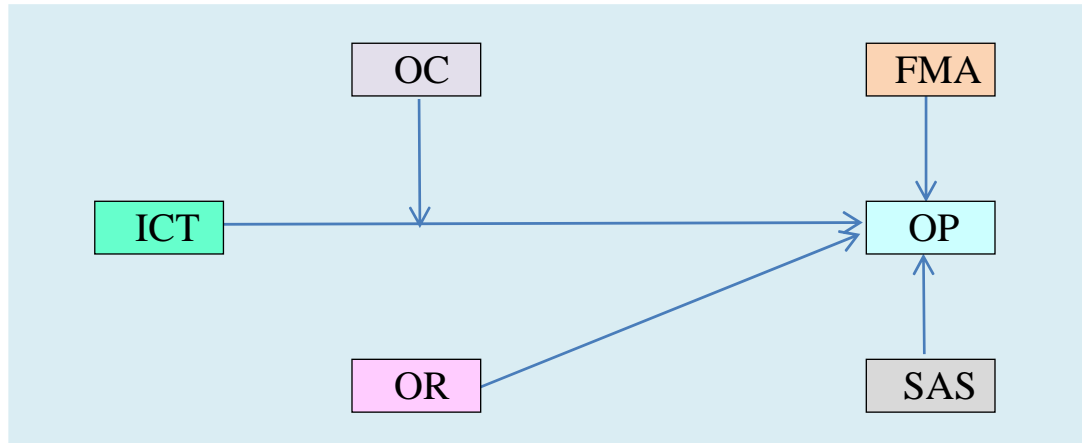


Figure 1.3: The Conceptual Model for the Study

ICT = Information and Computer Technology initiatives in organizations

OC = Organizational Characteristics

OR = Organizational Resources (other than ICT) OP = Organizational Performance

FMA = First Movers Advantage SAS = Subsequent Adopter Strategy

The study endeavours to assess the impact of ICT on IT companies' organizational performance, taking into account the effects of variables like organizational characteristics, organizational resources, first movers advantage, and subsequently adopted strategy.

THE IT INDUSTRY

A brief contextual overview of the IT industry is given below:

The global information technology industry is on pace to reach \$5.2 trillion by 2020, as indicated by the research consultancy IDC. Economies, jobs, homes and individual lives are becoming digital, connected, and more automated. Innovations powering the technology growth appear to be on the cusp of a significant tipping point.

The U.S. is the largest technology market globally, representing 32% of the aggregate, or approximately \$1.7 trillion in 2020. In the U.S., just as in numerous other countries, the tech sector represents a critical portion of economic activity. CompTIA's Cyberstates report reveals that the economic effect of the U.S. tech sector, measured as a percentage of GDP, exceeds that of most other industries, including notable sectors, for example, retail, construction, and transportation.

Despite the size of the U.S. economy, most technology spending (68%) happens beyond its borders. Spending is often correlated with factors like population, GDP, and market maturity.

Western Europe remains a critical contributor among global regions, representing approximately one of every five technology dollars spent worldwide. As the other countries go, China has established itself as a significant player in the global tech market. China has adopted an approach similar to that observed in developing regions. China has applied a twofold approach - closing the gap in categories such as IT infrastructure, software and services, together with establishing leadership positions in emerging technologies like 5G and robotics.



3

IMPACT OF INFORMATION AND COMMUNICATION IN BANKING SECTOR

INTRODUCTION

Indian Economic Growth in the late 1990s and the first decade of this century was primarily driven by IT, telecom, and manufacturing. The IT revolution has contributed for the development of banking sector with the introduction of ITC based services. In the service sector segment, banking and financial sector services are the largest contributors to the national income. Indian software exports rose by 13 times from about US\$ 6.3 billion in 2000-2001 to US\$ 83.5 billion in 2018-19. The Reserve Bank of India has played a significant figure in creating a kind of model (Unified Payments Interface (UPI)) which is being observed internationally in the digital payments area. The Bank of International Settlements (BIS) has said that "the UPI framework of India can become an international model to facilitate quick and seamless payments not only within countries but across countries". Even the National Payments Corporation of India (NPCI) has decided to establish a subsidiary to focus on taking the UPI model to other countries as a business proposition. The role of banks is very challenging and complex in the globalized economy. The additional challenges arise from the internal macro policies and regulations. The challenges are summed up as challenges derived from the spheres of monetary policy, regulation and supervision of financial markets as well as detection of frauds, risk management functions and internal control systems of banks and non-banks, amongst others (RBI,

2020). To have a healthy, resilient, and robust financial system, the system must take care of the emerging challenges and respond to them appropriately. As banks' engagement with technology is increasing at a rapid pace, the challenge for the regulator would be to balance efficiency with prudential measures to mitigate risks to be able to harness the opportunities offered by Fintech (RBI, 2019).

The banking system plays an important role in promoting the economy. The development of an economy is depended on a strong banking system and similarly, banks are more prosperous when the economy does well. It is essential for banks to raise their customer base, maintain their customers and give their products and services which are most advantageous to their customers. In the era of information technology, it is vital for banks to adopt the latest technology because technology has become a part of life and across all business sectors and even more so in banking. Banks compete with each other and other institutions for newer technology in offering products and services in the market place. While the focus of this study is the impact of ICT in the banking sector, it has traced the conceptual framework of Information and Communication Technology (ICT), the banking sector in India and the growth of ICT based services in the banking sector in India.

THE BANKING SECTOR IN INDIA

India is the largest country in South Asia with a huge financial system characterized by many and varied financial institutions and instruments (Sathye, 2005). India is one of the top 10 economies in the world, where the banking sector has tremendous potential to grow. It has the potential to become the fifth largest banking industry in the world by 2020 and the third-largest by 2025, according to an industry report (Manikyam, 2014). The Indian financial sector was well-developed even prior to the political independence of the country in 1947 (Sathye, 2005). The face of Indian banking has changed over the years. Banks are now reaching out to the masses with technology to facilitate greater ease of communication, and transactions are carried out through the Internet and mobile devices (Manikyam, 2014). Indian banking is the lifeline of the nation and its people. Banking has helped in developing the vital sectors of the economy and usher in a new dawn of progress on the Indian horizon. Today, Indian banks can confidently compete with modern banks in the world.

Finance is the key factor for the growth and development of any economy. Progress of the economy depends on a well developed and well organized financial sector. There is no doubt that the health of the economy reflects on the sound financial performance of Banks. The Banking Sector plays a significant role in improving the pulse rate of economic activities. They attract savings, assist financially backward sections and circulate money for different developmental activities. Indian Banking Sector, after the introduction of LPG (Liberalisation, Privatisation and

Globalisation) Policy in the economy, found a big push in investing on ICT strategy. A great transformation took place from brick and mortar services to automated banking environment. Especially IT Act, which was enacted on October 17, 2000 gave a new dimension and brought E – Banking services to banking platform.

The Structure of Indian Banking Industry

A bank is a financial institution that provides banking and other financial services to their customers. A bank is generally understood as an institution which provides fundamental banking services such as accepting deposits and providing loans. There are also non-banking institutions that provide certain banking services without meeting the legal definition of a bank. Banks are a subset of the financial services industry (Manikyam, 2014).

The Indian banking industry has its foundations in the 18th century, and has had a varied evolutionary experience since then. The initial banks in India were primarily traders' banks engaged only in financing activities. Banking industry in the pre-independence era developed with the Presidency Banks, which were transformed into the Imperial Bank of India and subsequently into the State Bank of India. The initial days of the industry saw a majority of private ownership and a highly volatile work environment. Major strides towards public ownership and accountability were made with nationalization in 1969 and 1980 which transformed the face of banking in India. The industry in recent times has recognized the importance of private and foreign players in a competitive scenario and has moved towards greater liberalization. The banking industry in India functions under the control of Reserve Bank of India. Reserve Bank of India is the Central Bank of India. It was established on 1st April 1935 under the RBI Act of 1934. It holds the apex position in the banking structure. RBI performs various developmental and promotional functions. Indian Banks mainly are classified into Scheduled Banks and Unscheduled Bank.

The Scheduled Banks in India comprised of Scheduled Commercial Banks (SCBs) and Scheduled Cooperative Banks. Scheduled commercial banks are further classified into public, private, foreign banks and Regional Rural Banks (RRBs); and constitute those banks that have been included in the Second Schedule of Reserve Bank of India (RBI) Act, 1934. Co-operative banks include Urban and Rural Cooperative Banks. Non-scheduled banks are those which are not included in the second schedule of the RBI Act, 1934. At present these are only three such banks in the country.

India has established the first Indian bank in 1786. Over these two centuries, the journey of the Indian banking system, tremendous developments have been made in terms of the regulations governing it, the ownership structure, products and

services provided and the technology deployed. Indian banking evolution can be mainly categorized into four distinct phases.

- **Phase I-** Pre-independence phase (before 1947)
- **Phase II-** Era of nationalization and consolidation (1947-1991)
- **Phase III-** Introduction of Indian financial and banking sector reforms and partial liberalization (1991-2004)
- **Phase IV-** The period of increasing liberalization (2004 onwards)
- **Phase IV** can be considered as a modern phase.

ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN SPECIAL REFERENCE TO BANKING SECTOR

Today, Technology is transforming every aspect of the banking sector. Digital capabilities in this sector are showing new vistas. After 1990's new economic policy, Banks started to use technology driven methods in their business activities to provide attractive and qualitative services at a greater extent to their customers. ICT related services have made Banking business more convenient and easy for their customers. At present all successful Banks are engineering and redesigning their service pattern and offering a variety of products/services to different types of customers in the economy. Technology has become a magical wand in the hands of Banks. Technology has created wonderful opportunities to reframe customer – centric, competitive and faster services in their sector. Commercial Banks are successful in implementing advanced technology in their daily business. No doubt that ICT strategy has increased productivity and profitability of this Banking segment, but on the other hand, Urban Cooperative Banks are also slowly sinking into the Information and Communication Technology world. They are waking up to explore the advanced technological weapons to face a series of challenges and cut throat competitions. They are going for these solutions to reach exciting destinations. Automation in this sector is showing a ray of hope. It is believed that ICT networking system and leading innovations revolutionalise these technology laggards Cooperative Banks. ICT strategy in the banking sector is the best way to face extremely intense competition in this business world. With this new approach, Banks are sincerely trying to win the minds of customers and gradually making their employees more competitive and updated with the recent technology. Today click on the mouse and touch on the keypad have made financial transactions more efficient, rapid and productive.

Information and Communication Technology is a hybrid of communication technology and information technology. Information and Communication Technology is the acronym of ICT that includes whole technical means which are utilized for handling information and facilitating communication. It consists of computers, network

hardware, communication lines, and all the required software. In fact, ICT has consisted of information technology, telephone, electronic media, and all kinds of process and transfer of audio and video signals, and all control and managing functions based on network technologies. ICT concept includes the transfer and use of all types of information. ICT is the base of each economy and a driving force of social changes in this century. In India, the growth of these two information technology and communication sectors is very significant in the past two decades (Celebic and Dario, 2011). According to Internet Live Stats Data, it is estimated that by 2021, internet users in India will be increased to 635.8 million (Rani, 2017). Therefore, taking the advancement of Information and Communication Technologies (ICT) and its implementation is an increasing challenge for any nation big or small, developed or developing. So, for a country like India which has potential emerging markets, more particularly in the area of Information technology, remaining away or uniformity of the globalization trends world is untenable (Festus, 2013; Sharma and Abhinav, 2004).

ICT in India has seen excellent opportunities at low cost operation, skilled labour pool, Optimistic economic environment; FDI Policies etc. These benefits have made India the leader in the ICT sector. According to International Data Corporation 2012, Indian ICT market was expected to grow to US \$ 44.8 billion up to march 2014 from US \$ 35.1 billion. Over the decades, India has been the test bed for ICT developments. ICT has become a trump card. ICT is omnipresent in this country. ICT is used in health, education, Banking, insurance, business and other socio-economic services. ICT is reaching the unreached and connecting the unconnected regions of this nation and a platform has been created to attract more players in the economy to promise and provide better services. There is no universally accepted definition of ICT because applications of ICT are constantly evolving. Every day new software packages are designed and proposed for organisations, business and other sectors.

The Word ICT has three segments viz, (a) Information (b) Communication and (c) Technology. Information is a processed data and it consists of facts, figures and knowledge. Communication is of two types such as a traditional way of Communication and technical communication. Newspapers, magazines, radio and television are traditional tools of communication. Information and communication go together to share knowledge and awareness to awaken the mass. Along with these traditional tools, today technical communication tools are gaining familiarity such as Internet, wireless, wire lines and satellite networks.

In the Banking Sector, Hardware and software technological tools are used. Computer and related machineries like printer and scanner are used. Also coins & currency counting machines, passbook printers, currency discriminators, coin sorters, ATM machine, Kiosks are very much needed to perform business activities and

software segment includes system software and application software. Anything that can be stored electronically is software. System software includes all the utilities that make computers to function and application software includes word processors, spreadsheets and data base management systems. India with its skilled English speaking youth is holding a success key. The ICT industry is eager to enter into the next phase of growth to empower Indian rural landscape, to reach the gross root level to promote development activities, to ensure transparency and most importantly to achieve the goal of growth with equality. So ICT is the need of the hour. Nowadays, the usage of ICT is essential to the survival and the growth of Banking institutions. It is hard to assume that the Indian Banking Sector in the absence of computers, ATMs, Mobile phones, Internets and so on stands unable to face the sky rocketing competitions. Until recently Banking services in India were following the footsteps of tortoise. To perform simple Banking transactions both Banking staff and customers had to spend half a day, but with new technical tools these Banks have found wide spread reach.

Banks in India by entering into the environment of technology led services are digging opportunities and customers are also willing to adhere to technology based services. But the Banks have to keep three important aspects in their business mind i.e.

- Changing demand and choice of customers
- Market trends
- Exploring innovative products/services.

Along with plenty of opportunities Banks are not ready to face unprecedented risk factors involved in ICT implementation in their business operations such as ATM frauds, Credit Card Frauds, Internet Banking and Mobile Banking frauds, data interception and others. Fraudulent transactions have become obstacles to go for E-Banking Services. Banks with proper security and safety measures can design secured financial products / services to have every successful transaction because ICT is bringing leap change in the Banking environment.

RBI has directed UCBs to adopt the core banking system and has given the deadline for Large UCBs by December 31st, 2013, branch Banks by June 30th, 2014 and unit Banks by December 31st 2014. In this background there is a call for the integration of Banking Sector and advanced technology up gradation. It is not an exaggeration that ICT based services in the Banking sector saves energy, time and provides virtualised services to its customer. Speeder and effective progress are ensured only with this latest technology. Good customer service is becoming a main motto of Banks in recent years. Customer's satisfaction is a prime goal in each Bank case. Customers are the end users of this Banking technology. When customers consider these innovative services as interesting one, the Bank's attempt becomes

successful. E-Banking services apart from some security and safety measures have positive effects on customers. Banking sector in India with advanced technology found a paradigm shape and introduced E- Banking products / services gradually. As ICT is becoming essential as-well-as a sufficient condition for Banks in recent years good customer service in this sector has become a prime objective. It is a highly challenging task to read customers' minds. Customers' preferences and satisfaction levels change with the evolution and development of technology. Therefore, Banks are also implementing customer - focused strategies to increase their customer base. Customers' are also turning their faces towards E – Banking services to reap maximum satisfaction. Modern customers have some special features and they want to utilize the best ICT based services. Most of the customers are computer literates, frequent mobile users and Internet dependents.

ICT has provided access to education, health & government services so it can help in reducing poverty of societies. IT is becoming a necessary part of each service industry for development, supporting growth, promoting innovation and increasing competitiveness. In today's era, information and communication technology (ICT) has become a core of the banking industry while the banking sector is the core part of every vigorous economy. The effect of globalization, competition, and innovation in the banking sector is completely significant. The banking sector has brought a complete paradigm shift on the bank's performance and on the customer service delivery by information and communication technology (ICT). Banks have to invest and focus on ICT services to compete with global competition, match the world development, and decreasing the operation cost. The growth and development of ICT have advantages like convenience and comfortable service, remote reach, time-saving, cost-saving, flexibility, user-friendly; deliver a diversity of value-added products and services. By ICT, banks are able to achieve their long term objective as customer acquisition, maintenance, and increase share (Ali, 2018). The banking sector of India has found out the necessity of digital technologies and is moving to embrace digital banking quickly since a few years ago. Banks are investing in digital technologies like mobile banking, e-wallets and virtual cards, etc. Digital banking has offered few new innovations like Digital-only/Virtual Banking, Biometric Technology, Artificial Intelligence, Blockchain Technology, Bitcoin and Robotics (Dun and Bradstreet, 2017).

There are two theoretical theories:

- **Diffusion of Innovations Theory:** The diffusion theory is proposed by Everett M. Rogers in 1962. The theory explains about the spread of a technology through a society or industry. According to this theory, the diffusion of a technology generally follows an S-shaped curve as early versions of technology are rather unsuccessful, followed by a period of successful

innovation with high levels of adoption, and finally a dropping off in adoption as a technology reaches its maximum potential in a market. Information technology is an innovation of 20th century which made inroads into 21st century with the usage of computers reaching to a level of office workstations, server machines and hosting websites. Roger observes that this process relies heavily on human capital. According to him the innovation must be widely adopted in order to self-sustain. Within the rate of adoption, there is a point at which an innovation reaches critical mass.

- **Sen Capability Approach:** Capability approach is an economic theory proposed in early 80s as an alternative approach to welfare economics. The capability approach defines development as an enlargement of capabilities. The focus of the capability approach is development of individual capabilities. Sen considered the collective or social arrangement as merely instrumental in fostering the development of individual capabilities. ICT is an enabling technology which improves the capabilities of human beings. Sein and Harindranath (2004) took an 'enabler' view of ICT and proposed that it essentially relates to the enhancement of an individual's capabilities through empowerment and knowledge.

The new face of Banking is alluring customers to utilize hi-tech services in Banks. Banks also with new types of E – Channels are delivering a variety of financial services. They are designed to cater the needs and expectations of customers.

- Banks with various E- payments and E – Banking services are able to provide 24 x 7 / 365 services to provide quality and transparent services.
- Customers anywhere at any time can draw, deposit any amount of money, can check Bank statement and open or close account. E- Banking services have become more convenient to them and they can transact their business even in their physical absence.
- Banks by selling their higher end financial products are attracting new customers and with these services/ products are providing E – Transactions are made easy without the geographical or demographical limitations.
- Customers feel prestigious and proud to use credit/debit/smart cards E – Payments and internet/mobile Banking transactions.
- Banks with advanced technology have aimed at providing flexible, qualitative, friendly and easily accessible services to their customers.

Today brick and mortar Banks have become click mouse and touch keypad Banks. Banks are trying hard to catch up the buzzword consumer satisfaction. Customers are also convinced that E – Banking services of Banks have a basket of

wonderful services. Though a customer of any Bank is a potential buyer of a product/service, efficiency of the Bank can be judged only from the point of employees. Technology up gradation in the Banking sector, not only requires customers' demand for advanced technology based services, but also needs adoptable and dynamic employees to utilize the advantages of these updated services. To understand the status and developments of ICT tools in the banking sector, it is important to know the perception of employees. It is essential to understand their work experience. Therefore an attempt has been made to get information regarding the pros and cons of ICT usage from employees and customers point of view. Environment in the Banking sector has made its employees capable of dealing with their routine work successfully. It has brought employees out from the monotonous and isolated work to ever changing working environment. Employees with these updated services are ready to handle any situations or responsibilities:

- E – Banking services have reduced the working hours and work pressure of employees.
- ICT based services have a positive impact on the performance and productivity of employees.
- Modern Banking is increasing the competitive spirit of employees and on the other hand, they are also feeling comfortable and getting updated.
- Customers for any queries or doubts approach websites and get quick responses from employees with upgraded technology. Therefore, it has improved the relationship between employees and customers.

Certainly technology is bringing a new luster to the banking sector. Both the customers and employees of this sector are aware of the importance of technology driven services. This new trend has increased competitive spirit and commitment of employees and has made customer service easy, faster and dynamic.

LITERATURE REVIEW RELATED TO INFORMATION AND COMMUNICATION TECHNOLOGY IN BANKING SECTOR

Kadam and Bharati (2013) investigated the ICT and electronic banking in Indian banking and focused on its features, services, and structure. The study also described how Indian banking with the guidance of RBI, adopting new technologies for better performance of ICT. The study highlighted the history of computerization and various developments of ICT that have taken place in the Indian banking Industry. The study explained that Indian banking attracting and maintaining their customers by concentrating more on front-office automation and Customer Relationship Management (CRM). The study pointed out the several economic and social factors that are the important barriers to prevent the development of electronic banking to its advantages.

Halemani (2018) discussed in his work the importance of cashless transactions under digitalization in the Indian banking system. The study showed Sweden is the first country that adopted the cashless transactions. Up to 40 percent of Brazil's and China's population is using cashless transactions while rather than 30 percent of the Indian population using cashless transactions recently. The study explained customers can transact their banking business easy, fast and profitable by using the digital system. The cashless transaction facilities are available in all banks and can be transacted through ATMs, Online Banking, Mobile Banking, Banking Automated Clearing System, plastic cards, new apps like BHIM, PhonePe, Google Pay, etc. The study noted some advantages of cashless transactions that provided for people in society such as easy to pay, riskless business, cost-saving of printing the notes, reduce the crimes, and decrease the demand and collection of note, however, disadvantages are like difficult to adopt due to illiterate of the people, heavy work and stress for employees, and security problems.

Selvi (2012) evaluated the growth of IT in the Indian banking sector via trends on the computerization of public sector banks, number /bank-wise/area wise distribution of ATMs, and usage of debit and credit cards. This study examined 98 percent of branches of public sector banks completely were computerized, while almost 90 percent were on the core banking during the year 2010. The usage of ATMs was low in the rural areas although it was more in metropolitan centres. State Bank Groups in the number of ATMs were increasing yearly in compare to all types of banks. The trend over the years indicated a declining in the case of credit cards and the trend line of debit cards was positive during the period of study. It can be concluded that there was a massive growth of technological usages in the banking sector except for the usages of credit cards.

Saeed and Roberta (2013) focused on the ICT, which can affect the performance and efficiency of commercial banks and the impact of banking reforms on the banking sector in Libya since 2005. The study is presented from a practitioner's prospect, using raw data gathered from interviews with seventeen of Libyan employees working at a variety of top levels within the five largest commercial banks operating in Libya. The study revealed that the commercial banks of Libyan were using a low level of ICT and poor state infrastructure, especially within the fields of telecommunications and electricity, which created unpleasant efficiency within Libyan commercial banking operation and government intervention was the main reason behind the lack implementation of ICT. The study suggested it is necessary that the banking sector shifts towards modern banking services via the internet and modern communication, but in their opinion, this renovation is essential for the modernization and development of the economy.

The impact of information and communication technology on the Nigerian banking industry was studied by Muhammad A., et al., (2013). The major objective of the study is to examine the role of information and communication technology (ICT) in increasing the efficiency of banking operations of selected commercial banks during 2001 and 2011 in Nigeria. To analyze the data the study applied fixed and random effects models. To find out the results the Net profit, ATM usability, and ebanking services were regressed on return on equity. The study revealed that the use of ICT in the banking industry does not improve the performance of the selected banks. The commercial bank's performance is enhanced by increasing in bank's profitability in Nigeria. Also, the coefficient of e-banking services had a positive effect on bank performance.

Alawode, et al., (2011) analyzed the impacts made by the information and communication technology in the banking industry of Nigeria. The study introduced the ICT and ICT infrastructure used by banks. The survey data collected from some selected banks of Nigeria that were using ICT infrastructures like internet access, internal network, SMS alert, substitution of postal mail, ICT security measures, authentication, and automated payment system within the year 2000 to the year 2008. The study pointed out the banking industry is growing with respect to recent innovations of technology that are appearing in the world. The study also concluded acceptance of ICT had affected the content and quality of banking operations. The Nigerian Banks should invest in ICT cause to ensure the effective performance of banking operations. Investment in ICT products is a requirement for bank management to simplify accurate, convenience, and speed or otherwise lose out to their competitors.

Singh, et al., (2012) analyzed the relation of innovation inputs and performance in Indian banking for the period of 1998 to 2010. The study pointed out all service sectors have gone in for a huge investment in ICT as an innovation input and outputs are productivity, profitability, efficiency, and growth. The relation of innovation and performance index has been analyzed by using the correlation, regression, and other techniques. The study showed the contribution of technology to banks' performance has a differential behaviour. And banks' performance is not only related to its technological stance but also other areas of competencies.

Toseef M., et al., (2016) evaluate the behaviour of employees of Pakistan banks towards the adoption of information and communication technologies to serve customers. The results of the research indicate a positive relationship between ICT adoption and strategic advantages, cost, risk, and training. The study pointed out that strategic advantages & cost were the most influential factors in the banking sector of Dera Ismail Khan KPK Pakistan to adopt and use ICT. The relationship between the variables of the study described that competitive advantages, management of cost,

risk, and training are necessary for the effective performance of recently adopted technologies in the banking sector. Furthermore, the study presented that as low as the cost and risk lead to adopting the maximum of ICT.

The influence of adaption internet banking analyzed in Mauritius by Padachi et al., (2007). The study examined that order cheque book is a service that internet banking users mostly accepted. The result showed internet banking users often operate their banking services by payment to another personal account, inter-account transfer, transfer to the credit card account, recharge mobile phones, fixed / current deposit account and debit/ credit card. The younger the generation, the higher the education level and the higher income customers are more likely to use Internet banking. To compare the socioeconomic variables of non-internet banking users to internet banking users, the study revealed that there is no significant difference between the two respondent customers for age and education level but there is not the case for the mean monthly income of two group users. The study indicated that the most important factor in the adoption of internet banking is the ease of use. The study by cross-tabulation observed the respondents that have an internet facility, working in the Internet banking/finance field, education level in the 'postgraduate' stage and high income are most sensible in using internet banking.

The factors influencing of E-banking in rural India was studied by Ramachandran (2018). The primary data of the study was collected through questionnaires from the Erode district of Tamil Nadu. 250 respondents responded to the questions that were related to socio-economic factors, level of awareness on Ebanking among the customers of private and public banks and factors that have an impact on selecting E-banking. The results of this present paper displayed 68.8 percent of respondents were awareness of E-banking facilities. Among reasons for the lack of awareness of E-banking facilities, the account of respondents was not selfmaintained got a higher percentage (34.8). The majority of the customers were comfortable with internet browsing. The customers mentioned the lack of high-speed internet was the reason for not utilizing the E-Banking facilities. The study recommended the banks, by considering to English & regional language of their websites and reducing the errors and frauds in internet banking to encourage the consumers of internet banking facilities.

Information/ICT literacy levels and skills of librarians were analyzed by Umeji, et.al., (2013). The major objective of this study was to understand the effectiveness and efficiency of information/ICT literacy among academic librarians in the electronic era. The study indicated that the librarians of Madonna University didn't have information/ICT literacy/skills. Furthermore, most of the problems of librarians are that ICT facilities are available but they are not interested in the use and adapt them for the services delivery. The study concluded the lack of ICT literacy/skills in the digital

age is the reason for the librarian. The study also observed that lack of use of the English language and library course between students is the lukewarm attitude of librarians.

Ashokan, Sandhya (2016) conducted a study on the operational efficiency of commercial banks in India with the purpose of comparison to the public and private sector banks. The study examined the productivity efficiency of total advance per employee, total deposit per employee, and total business per employee of these different sectors of banks from 2009 to 2013. The study found that the number of nationalized bank branches had increased. Also, employee efficiency and internal management of nationalized banks that which is better than other sectors of commercial banks. Maximum employees and branches were working with SBI and its Associate banks during the study period. The study observed that nationalized banks had maximum deposits per employee, advance per employee, and business per employee. The study suggested SBI should adopt new technology and business recovery like new generation private sector banks to achieve optimize effective management in public sector banks.

Growth rate of public and private sector banks was analyzed by Agrawal and Yadav (2015). The study compared the growth rate of Punjab National Bank and HDFC Bank from 2004 to 2014. The important parameters that study examined for growth of selected banks are net assets growth, net profit/loss growth, ROA, and NPA. Net assets of HDFC are much higher than PNB. Also comparing the net profit of selected banks showed the annual compound growth rate of HDFC banks is a higher and huge difference. HDFC bank utilizes its assets are more efficiently and present a better performance in comparison to Punjab National Bank. The study completed the growth of private sector banks is better than public sector banks during the period of study.

EXPANSION OF ICT BASED SERVICES IN BANKING SECTOR IN INDIA

The banking sector in India realized the need for computerization to improve its customer services and MIS reporting from during the early 80s when India was experiencing IT revolution along with the rest of the world. But it picked up momentum with the liberalization policies that the country adopted during the reform period. Reserve Bank of India established a committee to look into the computerization process in banks in 1988. The New Economic Policy introduced as part of the economic reforms during the early 90s witnessed a change in the structure of the banking sector in India with the participation of private sector banks in the banking sector. Liberalization and Globalization process gave an opportunity for the entry of several private sector and international banks. This increased greater competition among the banks and public sector banks were expected to play the role of level playing field. The banking sector in India has adopted technology in Bank Mechanization and Automation. The introduction of standard cheques, encoders, and

MICR based cheque processing in the 1980s and the introduction of Electronic Funds Transfer (EFT), Core Banking Solutions and implementation of ATM (Automated Teller Machine) in the 1990s improved the overall efficiency of banking operations. The Reserve Bank of India has taken strong initiatives in strengthening the Payment and Settlement Systems in banks.

After 1991 due to new economic reform, new private sector banks were established their business with the latest technology of the time. Even they attracted customers from old banks into their fold. This forced the existing banks to concentrate on adapting technology in their business as well. Nowadays all banks' aim is giving quick, accurate and quality services to their customers and Digitization is the highest agenda for all Indian banks. To point out the digital revolution in the Indian banking sector, IMPS, RTGS, NEFT, NECS, Online Banking, TeleBanking, Mobile banking are significant landmarks. Internet banking has changed the form of banking by conducting financial transactions on a secured website operated by banks. In the long run, Robotics, enabled by Artificial Intelligence (AI), is expected to bring major changes in the banks worldwide. The business advantage which AI offers is more than the risks people perceive. Nowadays, technology is considered to be the key to Indian banking. ICT had affected extremely the banking sector. By using technology, Banks are able to provide a better quality of services to customers besides ensuring accurate information at a faster rate on banking transactions. Therefore ICT in the banking sector has become an inescapable part. Indian banks are using different technologies to give banking services to their customers. This section indicates the important technologies used in Indian banking operations. Several instruments are developed to improve the transparency and efficiency in the banking services. The following are the details about the banking services based on ICT.

- **Automated Teller Machine (ATM):** An ATM device is an electronic machine that allows the customer to directly use a secure method of communication to access their bank accounts. ATMs were made for resolving problems like reducing the pressure of labour unions, available 24x7, and reducing queue of the customer in bank branches. Nowadays ATMs are considered a new technology in banking for reducing the cost of the transaction and increasing the convenience of customers. ATM is operated by plastic cards with some features to withdraw or deposit funds, check account balances, check statements information, transfer funds, order a cheque book, advertising regarding banking product, mobile recharge, ticketing, and bill payment, etc. To use any services at ATM, customers should enter the personal identification number (PIN) for authentication in the bank. Now ATM of one bank can be used on any other bank ATMs in the bank due to an ATM switch network.

- **Tele-Banking:** It is known as Phone Banking or Telephone Banking as well. Phone banking is a service that the bank is provided to its customers to perform transactions over the landlines and mobiles. Most of Telephone banking services is using an automated phone answering system with voice recognition capability or phone keypad response. The authentication of customers is provided by a numeric or verbal password or through security questions asked by a live representative. Telephone banking has offered all features of an automated teller machine except cash withdrawals and deposits.
- **Mobile Banking:** Another service is provided by the bank to the customer for performing banking transactions through mobile phones or tablets. Through mobile banking, customers can perform balance checks, account transactions, mobile recharge and payment of utility bills, etc. Mobile banking services can also be used via short message service (SMS) or an application installed on the cell phone. Mobile banking reduces the biggest limitation of internet banking among the requirement of personal computer or laptop with an internet connection. These are three methods of mobile banking over wireless application protocol (WAP), SMS texting, and unstructured supplementary service data (USSD). The growth of mobile banking score over internet banking due to mobile banking enables anywhere, anytime banking services.
- **Internet Banking:** Internet banking is also called as Online banking, Virtual banking, and Web banking. The internet provided a free exchange of information via a global interconnected network. Online banking had given banks to provide their products and services through the internet due to easy accessibility to an internet facility and the availability of a computer. Banks offer internet banking services in two ways. The first one by adding the internet as additional channels with branch banking and the second is virtual banks by starting the internet.
- **Plastic Cards:** The plastic card is a unique electronic payment type. It is also known as a stored-value card or electronic purse system. The plastic card technology is used for purchase products and services through the internet or market, withdrawal of funds, deposit funds, etc. The cashless has been increased due to different types of cards like Debit Cards, Credit Cards, Visa, American Express, and Prepaid Cards.
- **Credit Cards:** This is a post paid card. The credit card allows the cardholder to pay money for goods and services based on the holder's promise to pay for them. The first bank in India that introduced the credit card was the Central Bank of India, known as "Central Card" in 1981. The banks' pre-decided limit

of credit according to the individual credit rating and interest is charged after decided time. Credit Cards are used in India like Visa, Master Card, American Express, etc. The different kinds of credit cards are issued in India like Gold Card, Silver Card, Platinum Card, Business Card, and Prepaid Credit Card.

- **Debit Cards:** A debit card is a plastic card and known as check cards also. The debit card built on credit card infrastructure and ATM network basis for obtaining cash, making payments, accessing detail accounts information, charging PIN, etc. Banks provide a debit card to customer freely at the time of opening account. For the security purpose of using debit cards, RBI declared that for each transaction through the debit card on ATM user has to enter the PIN from January 2011. The major benefit of using debit cards is replacing interest bearing debt created through credit and due to payment through actual amount in customers' accounts. Visa, Master Card, and American Express are three major issuers of debit cards which were accepted largely in almost countries.
- **Electronic Fund Transfer (EFT):** It is also called an online transaction. Electronic Fund Transfer (EFT) is a transaction that takes place from one bank account at the same bank or to different bank accounts without any paper money due to initiation through the electronic terminal like ATM, Credit card, Fed wire and point of sale (POS) transactions. EFT payments are extremely secured because of the need for complete details like account number of the beneficiary and bank IFSC code.
- **National Electronic Fund Transfer (NEFT):** National Electronic Fund Transfer is an Indian facilitates electronic transfer of money from one bank account to another bank account. These services were introduced in 2005 by Reserve Bank of India. The NEFT operates on Deferred Net Settlement (DNS) that settles transaction in hourly batches. NEFT is based on net settlement. With NEFT transfer, the biggest advantage is that, there is no limit on the minimum or maximum amount that can be transferred.
- **Real Time Gross Settlement (RTGS):** The Real Time Gross Settlement is funds transfer on a real time from one bank to any other bank. The transaction can be done at "real time" so fund transfer will happen at the moment of operation. The RTGS is basically transferring large value and the minimum amount to be transferred is Rs. 2 Lakh. RTGS is one of the fastest interbank money transfer facility due to RTGS happens in real time.
- **Electronic Clearing Service (ECS):** Electronic Clearing Service is an electronic mode of funds transfer from one bank account to another bank account with the branches of the same or other banks. ECS facility can be

used, especially bulky payments, by institutions for making payments such as distribution of dividend interest, salary, pension among others. Electronic Clearing Service can be used for credit and debit purpose. This service is offered by RBI since 1996-97 under Electronic Clearing Corporation.

- **Immediate Payment Service (IMPS):** Immediate Payment Service is provided an interbank electronic instant mobile money transfer service through mobile phone and introduced by the National Payment Corporation of India. Using IMPS, it must be register under IMPS and 7 digit MMID (Mobile Money Identifier) number to transfer funds through IMPS. The IMPS facility is available via iMobile and Internet banking. IMPS is a most convenient and instant mode of transferring money between account holders and banks. Specific features of IMPS are availability 24x7, security and confirmation on transfer immediately.
- **Magnetic Ink Character Recognition:** MICR facilitates the faster process of cheque clearing. Traditional way of cheque clearing method was delaying the cheque clearing transactions. With MICR method cheque collection and clearing can be done at a faster rate. MICR cheque leaves have (8x3 2/3) standardised size. Bank branch code and account type are printed on this. Magnetic Ink character recognition is used on cheques and deposit slips. It detects those characters and converts them into digital data.
- **Point of Sale Terminal:** Point of sale terminal deals with computerised information files of customers. POS is a swipe machine which is provided to a merchant establishment customer without paying cash by swiping their magnetic plastic card which buys goods and services.

Core Banking Solution helps customers to transfer funds, to operate accounts and avail all Banking transactions from any branch of a Bank. It creates a network among all branches of a Bank. CBS is used in many ways.

- To get a statement of accounts
- To transfer funds,
- To make payments in any branch,
- To get demand drafts in any branch,

The core banking solution aims at providing efficient and transparent quality services.

- **ATM Service:** ATM is also noted as Automated Teller Machine or Automatic Teller Machine and it is also simply said in commoners' language as any time money. It is an electronic communication device installed in the premises of a particular or established outside the area of the Bank to help customers to do

their transactions without the need of Bank staff. Customers have to insert card with magnetic strip which contains their Bank's information and enter the PIN code to perform financial transactions.

- **Email, Voicemail and SMS Alerts:** The customers are provided with E-mail option. Banks send mails regarding passbook statements and E-Banking services. Customers can also contact managers when they face security and transaction related aspects. Customers with a touch tone phone can directly call concerned department. The automatic Voice recorder is used for queries if the call is not answered. Customers can leave a message to them. This is called Voice mail service. Foreign Banks in India have become successful in providing this service to their customers when customers withdraw or deposit money or repay loans, Banks send automated SMS alerts for confirmation of registered mobile numbers. It is regarded as SMS alert services. It is also a type of mobile Banking.
- **Mobile Banking:** RBI issued guidelines for Banks to start mobile Banking transaction in 2008. Mobile Banking technology is a system that allows customers who have smart phones to perform their Banking transaction. It includes
 - Checking Bank statements
 - Monitoring term deposits
 - Accessing to mutual fund and Equity statements
 - Accessing to loan statements
 - Transferring funds
 - Paying bills, etc.

Therefore, it is said that Mobile Banking is an E - Banking service provided by Bank to do transactions in the physical absence of the customer.

- **Internet Banking:** Internet Banking is a convenient E-Banking service provided by the Banks to their customers. With this service, customers can do Banking transaction anywhere or at home or office. Internet Banking service provides the following services
 - To check account information
 - To open fixed deposits
 - To recharge prepaid mobile or DTH
 - To pay utility bills
 - To transfer funds
 - To open or close accounts

With net Banking transaction customers can avail various services online even after office hours.

- **Card Based Transactions in Banks:** Banks issue credit, debit and smart cards to their customers. Debit cards are provided by Banks to help customers to withdraw money anytime and anywhere. They are considered as plastic money. With these cards they can also purchase goods and services without paying cash. ATM machines are established in different areas for home Bank to help customers. These cards are provided with personal identified number (PIN) to check Bank statements, to withdraw money or to make cash payments in shopping centers. Banks also provide smart cards to customers. They are built in microprocessor used for financial transaction. They have unique identity solution. The smart card contains the name of the account holder, card number, photo of the card holder and others. They are used as electronic wallets and considered to be secure. Banks also provide credit card facilities to their customers. It helped the account holder to purchase goods and services in shopping centers without paying money at that time, but they have to repay that amount with interest to the concerned Bank within a specified period

Communication networks in Banks facilitate to share and exchange messages with other member Banks. They avoid language barriers and interpretation problems and provide 24x7 communication facility. BANKNET was introduced by RBI in 1991 to transfer Inter-Bank and Intra-Bank messages within a country by public sector Banks that have membership in this network. COMET has given facility to send messages from minimum 8 lines consisting of 48 characters. Indian Financial Network (INFINET) is satellite based using network, i.e. VSAT (Very Small Aperture Terminal) was introduced by RBI in 1999. It is considered as a backbone for the Indian Banking sector. It consists of 950 VSATs in 127 cities of this country. Society for worldwide Interbank Financial Telecommunication (SWIFT) is a code recognized as a Banks identifier code. Each Bank has its own unique codes. This code comprises 8 – 11 characters. It facilitates Bank to exchange messages with other Banks. The message delivery is very fast. Each Bank aspires to adopt the best possible strategy to improve performance and to achieve predetermined goals. To this background ICT has become an important tool in redefining and redesigning the Banking sector. This development has assured timeless and placeless Banking business by dismantling significance of the physical structure of Banks. ICT based services help Banks to come out of loopholes of manual system of traditional Banking environment. Today Banks have realised the benefits of this latest technology Technological development in the Indian Banking sector started in the year 1962 when the RBI introduced unit record machine to process statistical data. In the year 1967 RBI and the State Bank of India brought computers to their banking operation to maintain branch transaction. The RBI appointed a working group to highlight the importance of computerization of

the banking business in 1970. In 1983 The Indian Bank Association (IBA) made an agreement with the National Confederation of Bank Employees (NCBE) and All India Bank Employees Association (AIBEA) to start the computerisation process at branches and head office level of Banks.

Computers in the Banking sector were used at that time for the following reasons:

- For investment management
 - To maintain ledger accounts
 - To maintain branch information
 - For remittance purpose
 - For foreign exchange dealings
- Computerization in the banking business included
- Microprocessor
 - Electronic legal posting machines (ELPM)
 - Main frame computers
 - Accounting machines

Those machines allowed installing in 2500 branches, including the head offices of Banks. RBI also insisted Banks to take the assistance from software vendors Viz, CMC Limited, Combol, Unify database and Unix OS. RBI also formed Rangarajan Committee, which was the first committee, which highlighted the importance of computerization in Indian Banks. In 1982 RBI appointed working group on MICR for cheque processing under the chairmen ship of Dr. Y B Dhamle to introduce MICR technology in important cities like Delhi, Chennai, Mumbai and Calcutta. T. N. Iyer committee in 1987 also recommended BANKNET, establishment of electronic data processing cells and SWIFT implementation during this period. The Second Rangarajan Committee in 1988 suggested to go for 900 mini computers at all levels of Banks all over India and insisted to automate 2500 branches of Banks in India before entering the year 1994.

In 1983 Indian Banks Association made an agreement with all India Bank Employees' Association (AIBEA). As per agreement Banks has to follow the following instructions

- Banks who have less than 500 branches should computerise at least 3 branches every year.
- Banks who have more than 500 branches should computerise at least 5 branches every year.

- Banks should install ATMs gradually in all cities
- Setting up pass book printers, note-counting machines, signature verification equipment etc.

WS Saraf Committee in 1994 and Shere committee in 1995 recommended to start E – Payment system. RBI considered technology as a key driver in the Banking business management. RBI in 1998 under the chairmanship of Sri Narasmiham appointed a committee to look into various issues concerned with Banking business. The committee recommended to use E – Files and digital signature in Banks. In the same year the RBI also recommended the technical assistance products of department for international development. RBI in 1996 established IDRBT (Institute for development and research in Banking industry) and research and development were encouraged. Vasudeva committee in 1999 suggested to blend INFINET with satellites and microwave lines and to start up V – SAT network for inters Bank and intra-Bank operations. In 2001 Mithal committee concentrated on security issues in implementing ICT tools in banking transactions. The early 2000's witnessed a tremendous growth of IT tools in Banks computer and communication technologies like Internet, Mobile, ATM and others have lots of potential to redesign the Indian Banking platform. According to the reports of RBI, at the end of March 2011 nearly 97.8percent of public Banks were fully automated, but private and foreign Banks were 100percent computerized in India. Economic reforms in India opened new avenues to the Banking sector to the global economy. Relaxed rules and regulations of Indian government provided an opportunity to adopt electronic Banking. Especially Private Banks and Foreign Banks became efficient in using ICT tools in their business operations. This trend brought pressure on nationalized Banks to adopt technology enabled services. To maintain healthy competition on the platform of Banking Sector, it has become inevitable for Banks to go for advanced technology in their operations.

GROWTH IN USAGE OF ICT BASED SERVICES IN PUBLIC AND PRIVATE SECTOR BANKS IN INDIA

As explained earlier, several ICT based services are introduced in both public and private sector banks. With the growth in the private sector banks, there is a pressure on the public sector banks to compete with the private sector banks in the provision of efficient services to the customers by using the information technology. Trends in the growth and utilization of ICT based services in major selected public and private sector banks are discussed below.

- **Growth in Automated Teller Machines (ATM):** Automated Teller Machines are the most **widely** used ICT based services by all sections of the population. Usage of Electronic payments and the usage of ATM grow hand in hand. Efforts to digitalize of transactions to reduce delays and ensure transparency

have increased payments through electronic transfers. In order to provide access to the usage of ICT based services, the first requirement is availability of ATM within the reach of users. Therefore the first step in the successful usage of electronic services depends on the availability of ATM at a reasonable distance. Trends in the growth of ATMs of the public and private sector banks are presented in table 4.1.

Table 4.1: Trends in Growth of ATMs of Sample Banks

Year	Number of ATMs		% Change over the previous year	
	Public Sector Banks	Private Sector Banks	Public Sector Banks	Private Sector Banks
2006	10338	8095		
2007	13442	8422	30.03	4.04
2008	15021	10115	11.75	20.1
2009	22476	13377	49.63	32.25
2010	29904	16179	33.05	20.95
2011	38188	21100	27.7	30.42
2012	44086	32228	15.44	52.74
2013	50485	38240	14.51	18.65
2014	77774	42558	54.05	11.29
2015	90256	45396	16.05	6.67
2016	94555	48565	4.76	6.98
2017	113641	51031	20.19	5.08
2018	112222	51788	-1.25	1.48
Average	54799.08	29776.46		
CV	69.62	58.30		
CAG	20.13	15.35		

Source: RBI, Annual Reports of Banks

The data shows that most of the growth of ATMs occurred between 2009 and 2012 in the case of both public sector banks and private sector banks. Later on the growth declined and in the case of public sector banks, it was negative between 2017 and 2018. In terms of annual average growth rate, the ATMs of public sector banks have recorded a higher growth rate (20.13%) compared to the private sector banks (15.35%). While there is greater variability in the growth of ATMs of public sector banks (69.62%) it is less in the case of private sector banks (15.35%).

- Bank-wise Expansion of ATMs of Selected Banks:** The neoliberal policies backed by technological changes in the usage of Information Communication Technology (ICT) resulted in the usage of technology in banking sector also. Usage of ATM has increased considerably in India and the number of ATMs is an indicator for the usage of ICT technology in banking sector. Data relating to the expansion of ATMs of both public and private sector banks is presented in table 4.2.

Table 4.2: Number of ATMs of Public and Private Sector Banks in 2006-07 and 2016-17

Number of ATMs							
Public Sector Banks				Private Sector Banks			
SI No	Name	No. of ATMs		SI No	Name	No. of ATMs	
		2006	2017			2006	2017
1	Bank of India	314	7717	1	AXIS Bank	1891	14163
2	Canara Bank	815	10519	2	Dhanlaxmi Bank	61	371
3	Corporation Bank	901	3169	3	HDFC Bank	1323	12260
4	Dena Bank	240	1538	4	ICICI Bank	2200	13882
5	IDBI Bank	377	3537	5	IndusInd Bank	214	1988
6	Indian Overseas Bank	280	3679	6	Karnataka Bank	75	1380
7	Punjab National Bank	700	10681	7	Karur Vysya Bank	291	1747
8	State Bank of India	5569	59263	8	Kotak Mahindra Bank	1891	2163
9	State Bank of Mysore	215	1426	9	South Indian Bank	145	1320
10	Syndicate Bank	326	3974	10	Yes Bank	4	1785
11	Union Bank of India	473	7518				
12	Vijaya Bank	128	2001				

Source: RBI, Annual Reports of Banks

The data shows that among the public sector banks, state bank of India has the largest number of ATMs and the number increased considerably in 2017 due to branch expansion as well as merging of other state banks into SBI during 2017. Canara bank and Punjab National Bank are the other two banks with more number of ATMs. Similarly in the case of private sector banks ICICI Bank, AXIS Bank and HDFC Banks have more than 10,000 ATMs during 2017. The ATMs of AXIS Bank increased from 1891 in 2006 to 14163 in 2017. While majority of the public sector banks have more than 2000 ATMs, only few of the private sector banks have more than 2000 ATMs.

- Growth in Mobile Banking Services:** It will be interesting to know the current status of ICT in Indian banking, hence this study was calculated transaction done through different ICT devices like Mobile, NEFT, RTGS for 12 public sector banks and 10 private sector banks from April to March 2018-19. Data relating to the number and value of transactions done through mobile banking of the public sector and private sector banks are presented in tables 4.3 and 4.4.

**Table 4.3: Usage of Mobile Banking in Public Sector Banks
(April to March 2018-19)**

SI No	Bank Name	Average Transactions		Average Transactions	
		Volume (Number)	CV (%)	Value (Rs'000)	CV (%)
1	Bank of India	25685877	70.16	54402404	77.94
2	Canara Bank	10838044	51.38	38943708	39.92
3	Corporation Bank	6203585	57.13	19853676	41.41
4	Dena Bank	1874150	55.41	5754804	56.46
5	IDBI Bank	5244660	42.02	20580441	31.08
6	Indian Overseas Bank	6403531	54.26	15973188	49.79
7	Punjab National Bank	984821	36.48	10150285	34.34
8	State Bank of India	93803229	39.52	428714993	66.41
9	Syndicate Bank	4604619	47.42	14892693	36.29
10	Union Bank of India	8131636	146.24	33100119	73.24
11	Vijaya Bank	922817	5.27	7865476	10.48

Source: Publications of RBI

The data shows the among the public sector bank, the State Bank of India has the largest volume and value of transactions but with variability 39.52 percent during the period of study. On the other hand, Vijaya Bank is showing the least volume transactions (922817) with a variability of 5.27 percent. The Union Bank of India achieved the highest variation in a number of transactions and Bank of India with a variability of 77.94 percent in value of transactions. Although Vijaya Bank obtains the least variation in number and value of transactions.

**Table 4.4: Usage of Mobile Banking in Private Sector Banks
(April to March 2018-19)**

SI No	Bank Name	Average Transactions		Average Transactions	
		Volume (Actual)	CV (%)	Value (In Rs'000)	CV (%)
1	AXIS Bank	60926992	39.79	313894714	20.66
2	Dhanlaxmi Bank	23073	16.00	241028	34.41
3	HDFC Bank	33477558	44.69	351515326	32.78
4	ICICI Bank	38664589	31.43	321388089	20.23
5	IndusInd Bank	4709165	28.20	59139738	18.67
6	Karnataka Bank	1305007	27.06	13114832	9.16
7	Karur Vysya Bank	1215056	20.07	15976317	20.65
8	Kotak Mahindra Bank	19449349	33.30	163352878	24.77
9	South Indian Bank	1608292	41.20	10463601	26.54
10	Yes Bank	3325934	49.85	36949401	23.97

Source: RBI

The Average volume transaction of 10 private sector banks during 2018-19 ranges between 60926992 in Axis bank to 23073 for Dhanlaxmi bank. The other two banks with higher volume transactions are ICICI Bank and HDFC Bank. In the case of private sector banks, the highest value transactions were made by HDFC Bank while the least was made by Dhanlaxmi Bank. The greater variation number of transactions is related to Yes Bank (49.85%) and HDFC Bank with a variability of 44.69 percent is the second. Dhanlaxmi Bank has the lowest volume and value of mobile transactions with the lowest variation in the number of transactions (16.00%) and the highest variation in value transaction (34.41%) between the private sector banks during the period of study. Inter-bank variation in number and value of transaction of mobile banking is more in public sector banks compared to the private sector banks.

- **Usage of Real Time Gross Settlement (RTGS):** below tables presents the number of transactions done through Real Time Gross Settlement (RTGS) in public sector banks and private sector banks for the period from April 2018 To March 2019. The average RTGS transactions between April to March 2018-19 for each public bank and variability have been calculated and presented in table 4.5.

**Table 4.5: Usage of RTGS in Public Sector Banks
(April to March 2018-19)**

SI No	Bank Name	Inward 2018-19				Outward 2018-19			
		Average Volume		Average Value		Average Volume		Average Value	
		Total	CV (%)	Total (in Rupees Billions)	CV (%)	Total	CV (%)	Total (in Rupees Billions)	CV (%)
1	Bank of India	269422	7.75	1678	28.20	381630	7.10	1827	24.99
2	Canara Bank	259651	8.24	914	20.07	267046	9.94	1077	31.06
3	Corporation Bank	132343	7.06	612	29.00	168852	6.24	662	17.80
4	Dena Bank	65548	6.82	167	19.26	76603	5.79	183	18.81
5	IDBI Bank	309016	7.54	3119	16.57	265131	6.87	3020	15.00
6	Indian Overseas Bank	122447	7.61	438	27.00	126619	6.33	464	18.30
7	Punjab National Bank	419460	7.90	1582	12.14	461456	6.81	1793	11.43
8	State Bank of India	1714319	5.97	11248	12.45	1419084	7.73	11998	11.69
9	Syndicate Bank	105859	7.51	367	26.45	77270	8.70	398	36.32
10	Union Bank of India	291683	7.92	887	10.82	371166	7.27	959	12.12
11	Vijaya Bank	85003	3.93	401	30.88	123416	5.37	429	30.18

Source: RBI

The data shows that the State Bank of India has made the highest number and value of RTGS transactions inward and outward. While Dena Bank received the

least during the reference period. The number of inward transactions of SBI stood at Rs. 1714319 and outward transaction of its stood at 1419084. In order to the value of inward transactions of SBI is 11248 Rs. Billion and value outward transactions stood at 11998 Rs. Billion. While the number of inward and outward transactions of Dena Bank stood at 65548 and 76603. As the result indicate Vijaya Bank gets the least variation number of inward and outward RTGS transactions in order to 8.24 percent and 9.94 percent. Although the least variation number of the inward and outward transactions was generated by Canara Bank (3.93% and 5.37%) in the case of the public sector banks.

Table 4.6 shows RTGS transactions done in private sector banks from April 2018 To March 2019.

Table 4.6: Usage of RTGS in Private Banks (April to March 2018-19)

SI No	Bank Name	Inward 2018-19				Outward 2018-19			
		Average Volume		Average Value		Average Volume		Average Value	
		Total	CV (%)	Total (in Rupees Billions)	CV (%)	Total	CV (%)	Total (in Rupees Billions)	CV (%)
1	AXIS Bank	812796	7.96	9015	13.38	644760	8.13	9153	13.70
2	Dhanlaxmi Bank	11848	10.05	23	32.72	16137	6.48	27	27.37
3	HDFC Bank	1871376	7.31	24373	11.29	1669751	6.87	25109	12.59
4	ICICI Bank	841146	8.54	9212	13.43	829118	8.91	9292	13.24
5	IndusInd Bank	174830	9.73	1168	16.43	175747	9.84	1158	14.02
6	Karnataka Bank	61260	8.26	115	21.22	78586	6.60	136	19.69
7	Karur Vysya Bank	109134	6.54	166	12.65	123736	5.25	177	10.03
8	Kotak Mahindra Bank	496463	8.76	2601	14.16	513221	10.45	2706	14.09
9	South Indian Bank	59601	7.61	224	27.41	72988	8.21	226	25.37
10	Yes Bank	313462	10.01	2461	16.73	331591	8.64	2336	16.37

Source: RBI

The data present that HDFC Bank has received the highest RTGS transactions and Dhanlaxmi Bank has the least. The number of inward transactions ranges between 11848 in Dhanlaxmi Bank and 1871376 in HDFC Bank. The other two banks with higher volume and value RTGS transactions are ICICI bank and AXIS Bank. Also, the variation inward and outward value in Dhanlaxmi Bank were most variability between other banks (32.72% and 27.37%). The Variability of Karur Vysya Bank is the least in the case of number inward/outward transactions and outward value transactions in order to (6.54%, 5.25%, and 10.03%). While the variability of HDFC Bank is the least in value inward transactions (11.29%). Variation in inward

and outward volume transactions is more in private sector banks compared to the public sector banks. But the variation in inward and outward value transactions is more in public sector banks.

- **Usage of National Electronic Funds Transfer (NEFT):** Average National Electronic Fund Transfer (NEFT) transactions between April To March 2018-19 for selected public and private sector banks and its variability has been calculated and presented in below table. Table 4.7 shows the number of transactions done through NEFT in public sector banks for the period from April 2018 To March 2019.

Table 4.7: Usage of NEFT in Public Sector Banks (April to March 2018-19)

S. No	Bank Name	Outward Debits 2018-19				Inward Credits 2018-19			
		Average Transactions		Average Value		Average Transactions		Average Value	
		Number	CV (%)	Amount (Rs. Million)	CV (%)	Number	CV (%)	Amount (Rs. Million)	CV (%)
1	Bank of India	2397959	7.07	150717	9.45	7705133	11.63	405629	9.63
2	Canara Bank	2986082	5.55	315641	7.02	5986417	10.08	461321	18.6
3	Corporation Bank	1891396	6.36	169003	75.00	2821906	9.44	191753	14.29
4	Dena Bank	507381	7.72	49756	14.26	1577830	15.52	77155	12.17
5	IDBI Bank	5294082	10.55	385657	14.77	3852924	11.09	473370	10.84
6	Indian Overseas Bank	1584021	7.01	124526	9.21	3469226	11.56	177995	10.71
7	Punjab National Bank	4165203	6.66	387229	10.46	10137612	10.6	688157	12.62
8	State Bank of India	22525396	8.34	2796929	12.12	44423073	11.6	3061462	10.86
9	Syndicate Bank	1432523	5.39	212792	20.09	3135974	9.54	218844	21.68
10	Union Bank of India	2450037	6.69	298130	9.75	5500223	11.17	415510	12.48
11	Vijaya Bank	713225	7.16	73129	12.51	1711598	10.25	122081	15.16

Source: RBI

Note: CV is Coefficient of Variation in the Usage during the Financial Year 2018-19

The data shows the number of outward NEFT transactions of the public sector banks during 2018-19. The data reveals in terms of outward debits State Bank of India is in number one position. It recorded the highest inward transactions both in volume and value during 2018-19 and Dena Bank registered lowest transactions. Similarly in the case of inward credits also SBI ranks high with 44423073 inward credits valuing Rs. 3061462. The number of outward debits range between 22525396 in State Bank of India to in Dena Bank registered the least number of outward transactions of 507381 during the same period. But in terms of variability, the

variability in the transactions of SBI is marginally higher compared to the other banks. After SBI, IDBI Bank registered high outward transaction both in volume (5294082) and value (Rs. 385657 Million) In terms of variation, Corporation Bank has registered the highest variation in the value of outward debits (75%). The lowest variability in the number of outward transactions is observed in Syndicate Bank (5.39%). Also, the highest variation in the number of inward transactions is observed in Dena Bank (15.52%) and the highest variation in the value of inward transactions is observed in Syndicate Bank (21.68%).

Table 4.8: Usage of NEFT in Private Sector Banks (April to March 2018-19)

S. No.	Bank Name	Outward Debits 2018-19				Inward Credits 2018-19			
		Average Transactions		Average Value		Average Transactions		Average Value	
		Number	CV (%)	Amount (Rs. Million)	CV (%)	Number	CV (%)	Amount (Rs. Million)	CV (%)
1	AXIS Bank	16851883	9.91	1277960	9.81	8897188	8.36	1139761	13.69
2	Dhanlaxmi Bank	146355	4.77	6853	14.84	168142	6.80	9631	9.98
3	HDFC Bank	26180882	30.12	2592999	29.69	13926870	31.23	2443239	31.38
4	ICICI Bank	18029128	15.18	1301369	12.72	11918948	6.90	1563592	13.96
5	IndusInd Bank	3156118	12.58	324574	17.17	1409601	10.68	276619	14.42
6	Karnataka Bank	443240	6.79	36560	17.96	1144578	9.32	59231	17.77
7	Karur Vysya Bank	1060640	10.63	84830	12.46	1374006	8.17	92221	8.05
8	Kotak Mahindra Bank	6893805	12.09	601434	11.98	4143525	10.50	611595	10.54
9	South Indian Bank	668470	8.91	57118	13.61	856838	9.18	55893	9.74
10	Yes Bank	9303301	13.06	635064	16.26	2542800	17.16	541136	14.83

Source: RBI

The data reveals that in private sector banks HDFC Bank has made the highest NEFT transactions outward and inward in number and value while Dhanlaxmi Bank has the least. The number of outward NEFT transactions ranges between 26180882 is HDFC Bank to 146355 for Dhanlaxmi Bank. In order to the value of outward transaction ranges between 2592999 Rs. Million is HDFC Bank to 6853 Rs. Million for Dhanlaxmi Bank. The other two banks with higher NEFT transactions outward and inward in number and value are ICICI Bank and AXIS Bank. The Highest variability of outward and inward NEFT transactions is shown for HDFC Bank. AXIS Bank has made the lowest variability of value outward transactions (9.81%) and Karur Vysya Bank has received the lowest variability of value inward transactions (8.05%).

SUMMARY

The banking system plays an important role in promoting the economy. The development of an economy is depended on a strong banking system and similarly, banks are more prosperous when the economy does well. It is essential for banks to raise their customer base, maintain their customers and give their products and services which are most advantageous to their customers. In the era of information technology, it is vital for banks to adopt the latest technology because technology has become a part of life and across all business sectors and even more so in banking. Banks compete with each other and other institutions for newer technology in offering products and services in the market place. While the focus of this study is the impact of ICT in the banking sector, it has traced the conceptual framework of Information and Communication Technology (ICT), the banking sector in India and the growth of ICT based services in the banking sector in India.

Several national and international research studies have revealed the impact of ICT on the efficiency of banking for many years. ICT is an innovation that had a profound influence on banking operations. It changed the entire banking operations in recent years and this has some both positive and negative impacts on the banking operations. There is mixed evidence regarding the impact of ICT on the efficiency of banking.

SUGGESTIONS

The study clearly brought out the extent and use of ICT in major public and private sector banks. The study observed that there are no gender differences in the usage of ICT based banking services and majority of the employees opine that ICT in banking services is desirable. The same opinion is expressed by majority of the customers. Though majority of the important stakeholders feel that ICT improves efficiency and transparency, several customers expressed fears in using the ICT based services due to the risk of online frauds. Similarly some of the employees also expressed that they are not very confident of using ICT in the banking as they did not have training. Therefore, the problems with the efficient use of ICT are in the implementation. Based the opinions of the employees and customers, the following suggestions are made to improve the use of ICT in banking.

- Majority of the customers feel that the ICT based transactions are not safe as they don't have proper understanding of the use of ICT. Therefore it is important for the banks to have more interaction with the customers and organize awareness camps to improve the usage of ICT as it is more transparent and efficient.
- Though some training programmes are organized for training the employees in the use of ICT, majority of the employees in public sector banks did not have proper training. Therefore is it important to send the employees for proper training so that they become more efficient in the use of ICT.

- Banks can create more help desks to help the customers with the use of ICT in banking.
- More research is to be promoted to make the ICT based operations more user friendly so that many will be motivated to use it.
- Several bank employees expressed problems with connectivity, electricity and server. These are basic infrastructure for the use of ICT in banking. Therefore Government has to pay more attention to improve these conditions.
- More customers from the private sector banks are more comfortable with the use of ICT based services as there are several services the banks are offering. The public sector banks have to invest money in providing more value added services.



4

IMPACT OF INFORMATION AND COMMUNICATION IN AGRICULTURE BUSINESS

INTRODUCTION

ICTs are information handling tools, a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information (UNDP, 2001). The old ICTs include radio, television, newspaper and telephone whereas new ICTs comprise of computers, satellite, wireless technology and internet. With appropriate content and applications these tools are now able to work together and combine to form a networked world with a massive infrastructure of interconnected telephone services, standardized computer hardware, internet, radio and television covering every corner of the globe. ICTs present a groundbreaking approach to address developmental questions due to their unequalled capacity in providing access to information instantaneously from any location in the world at a reasonable low cost to bring down the global geographic boundaries faster than ever thought possible. Television and radio were the main electronic broadcasting technologies in rural communities whereas internet and mobiles have toppled it in the past two decades. ICTs are a range of technologies that integrate information technology devices such as personal computers with communication technologies, telephones and telecommunication networks. Expansion of both the range of the technologies and their convergence with conventional media has taken place all the time.

Due to this rapid and ongoing convergence a number of ICT devices come into existence such as digital cameras, digital video cameras and players, personal digital assistants, slide projectors, mobile phones and their compatibility with more traditional media such as radio (digital, satellite) and television (cable, digital, satellite). ICTs can be key enabler in the agribusiness sector by rendering dynamic and real time global level exchange of data, information and knowledge throughout the agricultural value chain. ICTs therefore are gathering of technologies that can be used to collect, store and share information among people using multiple devices and media.

Despite the recent development in ICT, the telephone network still have not touched the vast rural sections of the country and therefore last mile connection is yet to be achieved (Rao, 2007). Much of the supply side organizational strategy has focused on solving the problem of last mile connectivity in deploying ICTs in rural areas. Amongst the three approaches, the most common mean is internet access through fixed telephone lines using dial up technology in rural areas. The other two means are wireless technologies and VSAT terminals where the telephone infrastructure is poor. The telephone dial up access provides the throughput of about 10kbps on an average and wireless and VSAT offer scope for broadband access. VSAT and telephone dial up access are fairly standardized technologies whereas wireless connectivity was the subject of considerable experimentation in the recent past. Availability of computer peripherals are important component in supply perspective for providing connectivity and access to IT based services in rural areas. With the declining cost in IGTs peripherals and technological innovations such as computers, touch screens, voice based delivery devices, mobiles etc. have revolutionized the information development processes.

AGRIBUSINESS

In the wake of increasingly complex agribusiness environment traditional methods of information dissemination largely depend on conventional media and extension workers have been failed to fulfill the growing demand of information and services to the farming sector. Every activity in this vein involves creation, processing and communication of information. The need of timely, reliable and cost effective input information at all the stages of decision making process has arisen, that are not only restricted to technical aspects of growing crops or rearing livestock but to include a number of issues ranging from credit, insurance information, market intelligence etc.

The decisions made by farmers lie in the diversified ranges from choice of inputs (crop varieties and seeds, water, power, fertilizers and pesticides), market transactions, farm operations (tillage, sowing, - water management, fertilizer management, pest management, harvest), post-harvest operations and transactions (storage, transport, marketing, processing, etc.) and many others. Several other

nonfarm decisions which impacted farm operations include savings, investments, education, health, etc. accessed and supported by various organizations (i.e. input suppliers, rural credit agencies, extension services and NGOs).

KEY INFORMATION USED - BY FARMERS WITHIN THE AGRICULTURAL KNOWLEDGE SYSTEM

Agricultural Technologies

- New crop varieties and their requirements
- Results of demonstrations
- Best practices

Technical assistance during growing season (for land preparation, sowing, input management, irrigation, soil and water conservation, pest management, harvest, post harvest management, contingency planning) provided by experts and organizations directly or through different media

- Experience of other farmers
- Access to physical and financial resources

Markets

- Mandis (grain markets), Prices, quality requirements
- Inputs (costs, quality) V
- Handling costs
- Transaction costs
- Credit availability (sources, options)
- Labour supply and demand
- Distribution and other logistics
- Selling options

Natural Resources

- Climate
- Weather (principally rainfall and temperature)
- Extreme weather events (cyclones, drought, water stress periods)
- Soils information
- Water sources, quality and availability

Policy

- Land ownership
- Agricultural credit

- Agricultural marketing
- Entrepreneurship incentives
- Off farm income options
- Dispute settlement
- Agricultural Insurance

NEED OF ICT MODELS

Information required in this vast agribusiness prospective generally comes from research organizations, government sector, private sector, **NGOs** and institutional establishments etc. This information can be improved by using broad spectrum of communication systems and activities through the integration of multimedia mechanism into daily processes. ICTs can act as a potential mechanism to improve the efficiency of information system by delivering information from a centralized source and to collect then in a better quality array. Usually farmers face information and knowledge gaps to prioritize their livelihood activities and investment decisions more effectively. These are categorized as long term decisions such as education, training and technical support for livelihood development of individuals or groups and short term decisions such as news relating to markets, weather etc.

Improving the quality and quantity of available information is necessary but not sufficient for better decision making. Overall improvement requires vigorous stakeholder participation to better defend their interests and articulate their needs. There is a need to realize how to convert this information into knowledge by acquiring, transmitting, shifting and integrating it into conceptual systems among individuals and groups. Apart from the incidence of the technological transformation in the world the power of knowledge (technical knowledge and information gaps arisen from the unequal distribution of technical knowledge and information) can be greatly enhanced by ICTs if they are tackled to improve and break down both these barriers of knowledge and information exchange. To tap the potential of new technologies its adaptation depends on innovations (technological, institutional and entrepreneurial) to create low cost, easy handling of devices and to set up access through public or market centers with reasonable products. But the information flows are generally top down in nature with less local relevance to farmers who are not capable to avail the question and answer services or supply feedback to the extension services and research centers. These restraints of knowledge creation and knowledge sharing have led extension services to focus on the value of two way flow of information with a shift towards a more participatory approach. Participatory approach can be achieved by improving and enhancing two way flow of information, instead of the outdated mode of one way information delivery mechanism although it is also necessary.

Information is at the core of the information exchange processes in agricultural information systems. To make sure that information can be understood by local people the sharing of knowledge should be available in local context or content specific and relational in nature. There is a vast amount of literature recommending approaches to design information content locally in context of language, culture, information delivery channel and information layout. For instance "A common request for context specific information denotes that it must be locally relevant and appropriate. Many people prefer information to be exchanged orally in their mother tongue and value face to face demonstrations and follow up". Therefore information system of the target groups should be organized in the layout of farmer's particular information needs, local language issues etc. through best suited technologies. As the extension system has recognized the role of ICT in facilitating the farmer's choice of information exchange in the rural community. Need for diversified sector specific information- system, easier to handle for all the groups of rural people regardless of their status impediment the information delivery system to reach the bottom of the pyramid in rural areas. On the other side integration of ICT into a local ownership format encouraged the active participation for example local radio station promotes community involvement through a close relationship with its listeners. Emphasis should also be given on the indigenous agricultural knowledge to farmers over scientific knowledge because farmers themselves are best able to learn in the environment of how they are controlling the information and exchange among them. However to support and build the capacity of indigenous knowledge the information sharing must be assessed in the local context and choice that leads to increase the flow of information. For example, internet technologies through participation of stakeholders at every level and existing organizations operating at the community level disseminate information more specific to the local requirements.

In the present agricultural scenario which is changing from subsistence to high valued agriculture ICTs can play a major role in enhancing the farmer's activities and increasing their productivity, access to market information and reducing transaction cost. Information kiosks, mobile phones, internet etc. facilitate farmers to access commodities price for better decision making. In fact agriculture is around four times more effective at raising incomes among the poor than other sectors. The arrivals of ICTs are well timed to unleash the post green revolution development that greatly improved agriculture productivity. However there is a provable need for a new revolution that will bring lower prices for consumers (through reduced waste and more efficient supply chain management), add to smart agriculture and incentivize farmers (for example through higher income) to increase their production. With the booming mobile, wireless and internet industries ICTs have found traction even in poor small farm holders. Five main trends have driven

ICT in agriculture. Decrease in costs, increases in competition and expansion of last mile infrastructure are the number of factors that has increased the pervasiveness of connectivity.

The supply side improvements have met strong demand from customers around the globe. Unlike all networked technologies mobile phones exhibit more valuable effects than other devices. In contrast to landlines mobile phones have a strong appeal to users. Being connected means being reachable (World Bank, 2011); mobile phones are in the vanguard of ICTs in agriculture. By the end of March 2011, mobile phones reached 70 million subscribers and its penetration exceeds two subscriptions for every three people. Mobile based applications are also becoming more appropriate for rural people. Some of available technologies such as SMS service providers can offer mobile banking, transactional services (selling inputs) and information services (market price alerts etc.). Other publicly and privately provided services such as extension and advisory can be delivered over mobiles.

A number of studies have found that mobile phone accessibility has increased agriculture income. Ilahiane (2007) found in his study that farmers average income increased by nearly 21 percent who possessed mobile phone. Farmers have little information about market prices thus mobile phones equipped with other ICTs could overcome this by facilitating market prices of agricultural products to both producers and consumers. Several studies showed that introduction of mobiles to farming communities who lacked any form of connectivity previously, made them to better realize market prices. For example in Kerala fishers who were previously unaware of daily prices in different markets were now able to contact various ports to find the best offer price for their catch. Mobile phones have greatly lowered the cost of information and reduced the transaction cost of farmer's activities. De Silva and Ratnadiwakara (2008) in their study conducted in Sri Lanka, compared the transaction cost at the different stages of information needs for example while attempting to ascertain fertilizer costs 53 percent of the informational transaction costs were incurred during the growing season. Mobile phones may help users to minimize travel cost, time, distance etc. because in farming time saving is important as many crops are highly time sensitive.

The reach and affordability of broadband internet is also improving dramatically but at a slower rate in developing countries. In 2010 the number of internet users crossed 2 billion and over half of these users are now in developing countries. Internet connectivity around the world has grown exponentially since 2000 by over 480 percent. In the rural Indian context farmers selling their crops and buying inputs, parents seeking matrimonial alliances for their children and job seekers are all potential users of internet based matching services. Depending on the nature of the market, mobility of participants, length and value of transactional relationship, overcoming of geographical

barriers can be noteworthy. Best results can come from a mix of different media such as radio, television, telephones, computer based information kiosks, computers, video, digital cameras, internet, web and e-mail based services. Thus integrated uses of ICTs promote knowledge development not only by providing bundled of information but to offer it in more selective and in an understandable format. The attractiveness of new ICTs in replacing old technologies (e. g. Radio) cannot be achieved automatically, but need a collective action of communities and regions. In designing effective ICT interventions several measures should be taken such as understanding local information, communication practices, priority of information, and communication needs of end users, literacy and social norms.

DEVELOPMENT OF ICT MODELS

The world is facing a broader development in the dissemination of information and knowledge by ICT models. Information dissemination to farmers consists of several players and organizations. A number of projects and programs have been developed in which ICT led systems are introduced to enable development in agriculture system. The main component in the development of ICT led system consists of supply side and demand side perspective. Supply side perspective includes technical (connectivity, computers and peripherals, software and applications and capacity building of farmers) and organizational (corporate agribusiness model and public or NGO service model) aspects. Some of them have been initiated by Non Governmental Organisations (NGOs), specialist institutions, state sector, private commercial sector and combinations of these. It can be broadly categorized as public, private and NGOs. Although public sector used ICTs to provide better public services in agriculture (land registration, forest management and extension services), but was often thrashed out to survive due to insufficient funding.

The entrepreneurial nature of ICTs attracts new partnerships and forms of investment such as mobile phone applications, software design, local language customization, remote transaction services. Private companies working with public sector are often interested to provide their products and services to smallholders. For example: mobile network operators invest in providing large text packages at a lower price, collecting premiums and distributing payments in rural areas. Commercial enterprises such as processors, input suppliers and exporters are also interested to invest in ICTs in order to increase their efficiency and revenue among small farm holders. The new initiatives in the use of ICT include community radio, SMS, voice-based cellular telephony, information through telecenters, internet kiosks, village knowledge centers, multipurpose community centers etc. However mobile and internet based information delivery models have transformed the traditional agricultural extension services into the corresponding conventional extension services by the use of new ICT initiatives.

Public, Private and NGO based Models

In the past 200 ICT based projects have been initiated in India among which most of them suffered from pilot project syndrome. To make them in the long run funding agencies are one of the main criteria to look into the sustainability of the projects. Many projects are funded by international agencies followed by central governments and state governments. Table 6.3 demonstrates that the majority (22) of projects were funded or implemented by or in partnership with international organizations. Local or national NGOs/NPOs (17) private companies, state government agencies and central government agencies were major implementing agencies playing an important role in many projects. Several public and private sector ICT enabled initiatives have been undertaken in India in the last decade especially to cater the needs of agricultural and rural sector development.

APAARI (Asia Pacific Association of Agricultural Research Institutions, 2004) study on Asia Pacific showed that since 1990s agricultural extension systems have significantly weakened and their effectiveness has reduced primarily due to reduce funding in agricultural development. A number of private agriculture projects with low investment have been developed and implemented in India. To develop a differentiated development approach among small scale farmers ICTs should not be seen as a means of improved data collection only but it can offer a great potential in increasing the flow of public good type of information. The information is public good when it is easily accessible to all. In the context of agricultural extension public good type of information should be available without restriction or restrictive institutional controls which include weather forecasts, basic information on soils, cropping techniques, market prices, food safety etc. The public sector faces several financial problems in the agricultural extension services that could be greatly overcome by, the use of ICTs because it provides efficient information transfer, minimizes cost and enhances speed of information exchange. To make information as a public good in the context of the public sector reforms and market driven reforms paradigms emphasis should be given on the private sector service delivery.

As much of the ICT infrastructure and services belong to the private sector; there also exists a role of public sector information system to harness the available technology in the new paradigm. With the involvement of private sector, the underutilized public information can be accessed at both the national and local level by sharing and making extensive availability of it. The integration of ICTs into localized knowledge system can exploit the rent seeking opportunity. As the development needs to focus on wide spread and cross sectoral adoption, ICT could be used across a wide range of innovative institutional partnership. A number of experiments have been made by international organizations such as FAO, UNESCO, IDR, national governments (India, Brazil, etc.) and NGOs to improve information

system. Several authors advocated about the community knowledge partnership (CKP), it could be extended by integrating the use of ICTs such as local radio with internet, audio visual linkages etc. in the innovative and decentralized institutional environment rather than historic information flow, in order to improve their access and choice of information relevant to their livelihoods. Both the public and private sector partnerships can be developed at this end with government, academic, mass media, and market based information sources. Wide range of available sources of information should be used strategically to support these partnerships in improving information access and its use among the marginalized groups. In the context of rural India, public information could be made freely available by implementing ICT based interventions in this institutional environment and with efficient networking of different agencies such as public, private and other organizations.

Alternatively they must attain sufficient scale and scope across the entire agriculture value chain to drive changes in the institutional environment at their own. Rao (2007) categorized existing models broadly into two groups, one is the closed vertical food supply chain network and the second is an open chain network model. The closed vertical supply chain model is the best for private agribusiness model to implement it in an organized manner. This model defined that participating groups and institutions cover only those transactions which add value to the business and the participants e.g. 1TC e-choupal model. It also exhibits a better understanding of agricultural supply chain by building customer (farmer) relations based on mutual trust and by developing an effective institutional framework in context of goods distribution and marketing channels under the requirements of public policy adjustments. While open chain network model involves partnership of different organizations such as government, NGOs, multilateral institutions, ICT products and service companies etc. Some of the examples are I Villages of MSSRF (NGO based), village information centers of gyandoot (government based), iCommunity of HP (ICT company based) and ikiosks of n-Logue (ISP based). This diversified partnership made open chain network model more complex. ICT component and connectivity faced issues like VSAT e. g. i-community of HP (somehow expensive), telephone dial up connectivity (relatively cheap and most common but with limited bandwidths and low reliability). The hub and spokes model of MSSRF with online VSAT internet facilitates connectivity of village centers through an intranet by email and off line data services, is one of the intermediary approaches to reduce ICT costs. N-Logue's CorDECT wireless solutions are designed primarily to reduce price and to provide telephone and broadband internet connectivity in the village centers.

The open chain model provides a platform for generating revenue in a diverse range of services and aggregates a large number of users to develop a business model. The up sealing of open chain network model requires location

specific optimal technology. ICT based business model emphasized on resource mobilization from diversified sources for their long term sustainability that could ensure local ownership of operations and capacity building of local communities. In India, a lot of private players (seed and input companies, distributors/dealers, service providers, food processors and retailers) have been involved in providing diversified activities related to agricultural requirements. Input and technology providers facilitate inputs like chemicals, fertilizers, seeds etc. and training to small farmers in a cost effective manner. Hariyali kisan bazaar, Mahindra krishi vihar (a one stop farm solution center), Tata Kisan Sansar by Tata chemicals limited etc. are a number of models working as input suppliers. Some of the players those are involved in the business as aggregators and processors generally, operate, via contract. farming. They are creating front end activities (wholesaling,, processing, logistics and retailing) as well as back end activities (primary production etc.) .which should be linked together in order to manage business opportunities for all the concerned stakeholders. The development of these models not only includes access to information but also require partnership of all aspects of people and communities. Access to markets, adequate health care, education, social support, ability to participate in political agenda setting and access to information regarding policies and procedures of the government are essential elements for overall development of these models. Development goals can be achieved by addressing the needs - of population in such a manner that complements these basic capabilities and builds all of them.

The development of ICT models in India in respect of international/local funding agencies, NGOs, domestic/international private sectors and state/central participation are the decade old interventions. The major problems in the experimental line are high user's interest, unavailability of relevant content and deprived information network. As a result most projects are financially not viable and have not met users/providers expectations and their misusages exacerbate the hope that ICT will overcome the differences of income, rural prosperity etc. A single approach could not be able to solve the problems regarding irrelevant content, insufficient understanding of technology, government's inability in providing relevant content and local unawareness. So a sustainable direction is required for the efficient working of ICT based models. To achieve it in the current development scenario ICT based models can be categorized as informational, transactional and e-governance services. Informational services disseminate generic (non-customized) information such as agricultural practices, weather forecasts, and contact information. Transactional services involve an exchange of specific (or customized) informational services or funds between two or more parties using the ICY infrastructure e.g. e-commerce and email. E-Governance services refer to transactions that involve local,

state and national government services. Providing land records, submitting user complaints to local officials and confirming a user's presence on electoral rolls are some of the examples.

A governance emerged as the most widely demanded services followed by informational and transactional services. Most of the projects offer diversified services and only some are emphasizing core services. For example Bellandur, AP online and Gyandoot operate in the typically e-governance mode. Only two projects i.e. HP iCommuoity and n-Logue cover all the three types of services whereas ITC e-choupal and Warana model belong to transactional mode of services and MSSRF and Boodikote provide informational services. Most of the projects vary from low to high e governance facility but transaction model facilitates business transaction in diversifying manner such as agriculture/veterinary and supply chain management. ICT based initiatives for agricultural development for farmer's prosperity should be multidimensional in nature addressing problems of rural communities in holistic manner touching all aspects of rural life including agriculture, human/ animal health, education, banking, governance, entertainment etc. This can be achieved by setting up rural knowledge centers using broadband connectivity with multimedia interactive modules by developing a synergy among various stakeholders. The government has many good programs to aid and support farmers but deriving benefits, from these programs largely depend on the farmers' initiatives and efforts. The proper transfer and understanding of knowledge by one person can help in its dissemination to others in .the same community. National, policy for farmers (2007) indicated that the potential of ICT would be harnessed by establishing Gyan Chaupals (Knowledge centers) in villages. Further the Common Service Centers (CSCs) of the Department of Information Technology, Ministry of Communications and Information Technology, Government of India widely evolved under the National e- Governance Plan (NEGP) and many more have been set up by the state governments to reach the last mile and last person connectivity.

The number of services that can potentially be delivered through a CSC depends on the needs of the diverse stakeholders e.g. citizen, government, business and technical feasibility of delivering these services in rural areas. The potential of CSCs could be harnessed by providing information regarding new agricultural technology. Farmers would seek this information in a feasible manner if the CSCs are able to provide information at the cost of technology. Several important services in rural areas such as health, education, agriculture, drinking water, women/child welfare, etc. are mostly provided by the government sector. Therefore clustering, integrating and ensuring completeness of services in telecenters should be provided by the government. E-Governance Embedded Rural Telecenters (EGERT) can facilitate improved flow of information between government and citizens by mediating

as an information networks. Telecenters enabled with government services are providing integrated and complete services to gain the trust of the citizens in it and to increase the footfalls of cross selling. These telecenters can provide government services more effectively by utilizing efficiency of the private sector and thereby strengthen last mile governance. Thus a sustainable design of telecenters required to embed with government services in order to increase the scope of rural service delivery i.e. expanding B2C and G2C services as well as to improve effectiveness of their delivery for fostering inclusive growth.

Another government initiated program is the Mission Mode Project (MMP) which provide information to the farmers on seeds, fertilizers, pesticides, Govt. schemes, soil recommendations, crop management, weather and marketing of agriculture produce under the National e-Governance Plan in agriculture. Several projects such as ASHA in Assam, KISSAN and e-Krishi in Kerala and Krishi Maratha Vahini in Karnataka have been initiated by the Department of Agriculture and Co-operation (DoA&C), Government of India. To lead the implementation of MMP in Agriculture DoA&C has adopted a twin strategy through AGRISNET, AGMARKNET and DACNET. AGRISNET (Agricultural Resources Information System and Networking) a project was funded by the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. Under this scheme most of the state governments have established information rich agricultural websites for example Andhra Pradesh agri-portal <http://www.apagrisnet.gov.in> Uttar Pradesh (UP) Agrisnet Knowledge Portal.

AGMARKNET project is empowering the farming community by facilitating knowledge of latest commodity prices and arrivals of information through innovative use of ICT. Its objectives were to network 2800 major agricultural wholesale markets imparting computer awareness, usage application and training to 5000 market personnel, dissemination of daily commodity prices and arrivals in major Indian languages in order to bring farmers in a better bargaining stage and to promote good agricultural marketing practices in the country. Presently more than 1000 markets from different parts of the country are reporting data regularly to the portal. Being different in functional days of markets more than 300 markets share information on a daily basis for the use of public.

DISCUSSION OF MODELS

- **E-Choupal Model:** One of the most successful initiatives launched so far is the e-Choupal. It is the largest information technology-based intervention in rural areas managed by a corporate entity Indian Tobacco Company (ITC). The ITC is one of India's leading private company having a diversified presence in tobacco, hotels, paperboards, specialty papers, packaging, agri-

business, branded apparel, packaged foods and other fast moving consumer goods. In June 2000, ITC introduced the e-Choupal system in Uttar Pradesh and other Indian states including Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, and Rajasthan with the aim of ameliorating the communication with farmers and reducing the inefficiencies arising out of agents intermediation in the mandi system. The e-Choupal initiative consists of placing computers with internet access in rural farming villages and served as a social gathering place for exchange of information (choupal means "gathering place" in Hindi) and an e-commerce hub. What began as an effort to re-engineer the procurement process for soy, tobacco, wheat, shrimp and other cropping systems have become an e-commerce platform that is also a low-cost fulfillment system focused on the needs of rural areas. For the first time the stereotype image of the farmer on his bullock cart has been replaced by that of the e-farmer browsing the e-Choupal website. Farmers now log on to the site through internet kiosks in their villages to order high quality agri-inputs, to get information on best farming practices, prevailing market prices for their crops at home and abroad and the weather forecast in the local language. E-Choupal creates a direct marketing channel by eliminating wasteful intermediation and multiple handling thus reducing transaction costs and making logistics more efficient.

Given the literacy and infrastructure constraint at village level, e-Choupal is designed to provide physical service support through a Sanchalak, a lead farmer who provides mediated access to the farmers. He is normally a mid size farmer from the same village who is trained by the company to manage and use the infrastructure and disseminate information to other farmers. He is an educated farmer from the dominant local caste: he earns a commission for any ICT procurement as well as for sales by third parties. The full content of the e-Choupal site are therefore, made available to the registered Sanchalaks only who have undergone training at the nearest ITC plant. The e-Choupal model has required significant investments to create and maintain its own IT network in rural areas and to identify and train a local farmer to manage each e-Choupal.

Functioning of e-Choupal

The e-Choupal aims at achieving a win-win situation both for the farmers and the company. At one hand a more efficient procurement chain is created for the company; on the other hand farmers receive better prices for their produce. Therefore e Choupal supply chain looks very different from the existing system and is constituted by many stages. The price of crops is communicated to the Sanchalak through e-Choupal portal, once the price is known the Sanchalak inspects the products brought by farmers and performs the quality tests. The farmers take the note

from the Sanchalak and proceed with their crop to the nearest ITC's point for collection of produce and distribution of inputs sold into rural areas. There is a processing center within a 30-40 kilometer radius of each farmer: here a chemist visually inspects the soybean and verifies the assessment of the Sanchalak. After the complete inspection and weighing, the farmers collect their payments in full at the payment counter. They are also reimbursed for transporting their crop to the procurement hub. Every stage of the process is accompanied by appropriate documentation. Samyojaks, who are adept at handling large amounts of cash are entrusted with the responsibility of payment except at procurement centers near large ITC operations where ITC handles cash disbursement. Samyojaks are incharge of the procurement hub logistics, including labour management at the hub, bagging, storage management, transportation from the hub to processing factories and handling mandi paperwork for the crops procured at the hub. For his services in the procurement process Samyojak is paid a 0.5% commission.

Technology of e-Choupal Operating Environment

The farmer's gateway to the website is www.soyachoupal.com. The protected web site requires a user ID and password to login. The recruitment of Sanchalaks as the only registered users, an account is created with a user ID and password to access the system. The Sanchalaks and others who use the system have learned a wide variety of information at their fingertips so as to access and benefit from information - on education, governmental schemes, sports and many others. Information on each Sanchalak is gathered in a semi automated way during user's registration and keeps a record of farmer visits, inquiries, purchases, etc. The web site does not currently process live transactions but ITC has plans to -do so in the near future. E-Choupal system works with a battery based UPS (uninterrupted power supply) backup. With the reliability of a battery backup the Sanchalak can use the system at least twice a day in the morning to check the prevailing mandi prices and again in the evening to check the rate of the next day. While the insufficient power supply issues exist, solar battery chargers are very often used. In order to support transactional capabilities and multimedia applications the company needs reliable connectivity with better throughput. They therefore have decided to adopt a satellite based technology (VSAT) which enables a throughput rate of up to 256 Kbps. This is however an expensive solution costing about USD 2,650 (Rs. 120,000) per installation.

- **Lifelines Model:** Lifelines, a mobile and phone based ICT project in agriculture was launched by One World South Asia (OWSA) a UK based nongovernmental organization (NGO) in partnership with British Telecom and CISCO in 2006 to provide information delivery service at the grassroots level in 700 villages in north and central India. It facilitates the exchange of

important and timely information to marginalized communities. Today Lifelines serves more than 150,000 farmers in over 2,000 villages covering the states of eastern Uttar Pradesh, Madhya Pradesh; and Haryana. British Telecom and CISCO Systems have supported the initiative as a part of their corporate social responsibility program which assumes that access to ICTs can improve people's lives and open doors to education, jobs, entertainment and interactions. The technology development solution has been supported by Tech Mahindra and WIPRO.

Functioning and Technology of Operating Environment

Lifelines provide answers to farmer queries on demand. Access to the Lifelines Q&A platform is via an Interactive Voice Response System (IVRS) that routes queries and sends back answers via an intelligent call manager and unified messaging service. The Q&A service is integrated with a web enabled application with a database of audio files and texts through IVRS exchange server (One World, 2010). The field volunteers, knowledge workers, the knowledge database of frequently asked questions (FAQs) and the panel of experts are the main elements of lifeline platform. The knowledge workers (KWs) log in to the application through a web interface to view all the calls that are waiting for and search the FAQs database for the answers. Knowledge workers process the query within 12-15 minutes and the answer is delivered to the farmer within 24 hours. If the KW finds the answer it is retrieved and stored in IVRS. If the answer is not found KW forwards the question to the subject matter experts.

Once a response is received from any of the subject matter experts, the application alerts the KW who examines the response and if appropriate, stores the answer in database and makes it available for future queries. Voice Clip of the answer is played back to the benefactor when they call back. The information can also be retrieved in text format from the information center near the village. The farmers can send pictures along with their questions and also voice clips-to clarify the issue Field volunteers are recruited by private NGOs and facilitate Lifelines services to root level farmers in the field. One field volunteer covers 10-12 villages (about 200 people per village) and also acts as field promoter of Lifelines platform at the same time. The field volunteers are paid a salary by the partner NGO. Farmers can use their own mobile once they have learned to use the IVRS technology but about 90 percent of calls are made via field volunteer's phone. The farmers can also visit the nearest information center to access the offline database in local language, to listen audio clips and to send pictures of affected crops. Farmers receive an identification number for each recorded question to hear the answer.

The queries are handled by seven or eight knowledge workers where they listen and register farmer's queries. The knowledge worker searches answers from

the knowledge database of about 400,000 stored FAQs in query handling. When the query cannot be answered by the knowledge worker the query is sent with a summary script of the attached voice recording by email to the most appropriate expert who is subject matter specialist in various agriculture fields. The expert panel comprise of about 100 active members from a number of institutions including India's Department of Agriculture, state agricultural universities and NGOs. Once an answer has been returned the response is stored by knowledge worker in the Lifelines knowledge database and played back as a voice message to the farmer. On an average Lifeline service receives about 350 to 500 calls per day.

- **Common Service Center (CSC):** A concept to reach the bottom of the pyramid has been developed through markets and private sector. This development approached through an entrepreneurship model involving private sector to target the vast, growing and untapped rural markets with low cost services and appropriate business models which has resulted a marked increase in ICT projects in developing countries. The telecenters or common services centers (CSC) have been emerged as a prominent method of reaching rural masses by providing shared public access via technological interface i.e. computers and internet. Recently the Government of India (GoI) has proposed the National e-Governance Plan (NeGP) to set up 250,000 telecenters or CSCs in rural areas (Chauhan, 2009). Recently to make fully e-district under the National e govtunent plan, a total of 41 districts across 16 states in India have been identified to roll out as a pilot project phase. Government of India has set up a target to implement it by all states/UTs across 640 districts. Its implementation is overseen by 24 secretaries of GOIICS level officers at national level, state PMU at the state level and districts e-governance society at districts level. There have been identified six mandatory services across all states. Apart from the national level implementation experiences from Uttar Pradesh provide useful insights in this regards as the GoUP aims to make its services affordable, transparent and accessible to the rural population through CSC. The following six districts have been identified namely Rae Bareli, Sitapur, Gorakhpur, Sultanpur, Gautam Budh Nagar and Ohaziabad to make them e-districts under the technology partnership of PWC, 3infotech and Wipro.

E-district has been envisaged by Government of Uttar Pradesh (GoUP) as an automation of workflow and internal processes of district administration with the possibility of seamless integration of various departments such as revenue, food, basic education, social welfare, minorities, forests, panchayati raj, rural development, agriculture, election, home, minor irrigation, passport, irrigation, excise, finance, treasuries, family welfare, horticulture, cooperatives, transport, health, land records,

registration etc. This project is of principal importance to the state and it would help in creating an automated workflow system for the district administration and in providing individual departmental services through Common Service Centers (CSCs). The following are the key objectives of establishing CSCs are:

- Enable citizens of rural 1 semi-urban Uttar Pradesh to access information and services of the Government in an 'efficient, convenient, transparent and cost effective way.
- Facilitate Citizen to Government interface for exchange of information, services and other benefits.
- Improve quality of life in rural areas through use and propagation of ICT for all sections of people, addressing the entire spectrum of their needs.
- Bridge the. 'Digital Divide' enabling the flow of information, resources and service into the rural areas and markets and vice-versa.
- Enable the building of infrastructure, technology and services for a state-wide networked economy on a single platform for the Government, Business and Citizenry.
- Achieve the ambitious goal of making the state a fully e-literate state with at least one member of each family acquiring proficiency in computers.

The CSC Scheme allows public and private collaboration to provide a platform for delivery of services, information and knowledge at the bottom level. It can integrate profits as well as social objectives into a sustainable business model in rural India.

Operating and Functioning of CSCs

CSCs are retail outlet that offers services in a structured framework of ICT infrastructure (PCs, Printers, Scanners, Digital Camera, Projection Systems, Tele-medicine Equipments, etc.), rural entrepreneurship and market mechanisms. The CSC has been established to reach the bottom level of rural areas. It is customer centric in nature and formatted in a single window system for all IT related services and retail functions.

The CSC is envisaged to offer different kinds of functions:

- Providing e-governance services within easy reach and thereby save consumer's costs on distant and repeated travel
- Providing critical information on available government developmental programs, beneficiary criteria and present beneficiary list to bring in transparency and efficiency in the programs and an opportunity for development of the marginalized sections of the community.

- Providing information and opportunities for income enhancement/generation.
 - Providing the platform for e-communication.
 - Providing avenues for e-marketing and e-shopping.
 - Providing other services required by the community and linked to the usage of the ICT infrastructure
- **Tata Kisan Sansar Model:** Tata Chemical's objective in setting up the TKS network is to empower the Indian farmer and to support the farming community in creating more value for their produce. The concept and vision of TKS have been evolved over the years and is based on identifying critical needs of the farmer. The three most critical needs are access to markets/retail spaces, credit facilities and information/advice. TKS has been pivotal in providing value added service to farmers which has helped to improve their quality of living. The network offers multiple benefits in addressing wide range of needs that farmers experience in their constant struggle towards prosperity and progress. A very important aspect of TKS is building relationships with farmers. Tata Kisan Sansar Parivar membership is a paid value-added service where key farmers and opinion leaders are enrolled through invitation. TKS provides customized training and accident insurance to its member.

Objective, Functioning and Services Provided by TKS

The objective of the Tata Kisan Sansar (TKS) network is to enable and empower the farmer in creating and generating more value for their farm produce. It provides information on new and improved agronomic practices and facilitates efficient use of agricultural inputs. TKS functions as a hub and spoke model. Each TKS center works as a franchise retail outlet covering about 30-40 villages in the surrounding area. -TKS centers are serviced by resource centers known as Tata Krishi Vikas Kendras (TKVK). Each resource center manages 17-18 TKS. There are more than 60 agronomists available at the hubs to provide advice on crops and farming issues. There are more than 150 organizers at the TKS level. TKS operates in northern and eastern India (Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal). The hub acts as a resource center to a number of TKS outlets and each TKS covers number of surrounding villages. At present, there are 25 resource centers and 497 TKSs, the initiative reaches more than 35 lakh farmers in 16,000 **villages**.

TKS centers provide inputs such as store brands of fertilizers (Urea, DAP, MOP, NPK, etc.), specialty fertilizers (zinc sulphate, boron, micronutrients, calcium nitrate, organics, water soluble fertilizers), seeds (field crops and vegetable crops), entire range of pesticides and farm implements. TKS also provides training in nutrient and pest management. They are engaged in diversified ranges of services such as

soil and water testing, contract farming, seed production, advisory services by field level agents (typically called doctors by farmers). Also TKVK helps small farmers to harness sophisticated technologies such as satellite mapping and geographical interface service (GIS) to maximize their agricultural yields. In other, than farming related services, TKS also arranges farmers meet and crop seminars (TKS website).

THE PHENOMENAL PARADOX OF ICT IN AGRI BUSINESS

Since agriculture has transformed its nature from subsistence to high value agriculture involving all the stakeholders in value chain or supply chain. Nowadays agriculture is no more a traditional type of farming rather it has evolved a new pattern, as a great deal of information and knowledge is generated and applied. Particularly the developments like green revolution and technological advancements in the areas of seeds, fertilizers, pest and markets etc. have added a new flavor in the agriculture sector. This vast level of information and knowledge is needed to be delivered in an efficient way to make farmers more informed and progressive in all the farming decisions. Typically this information on improved agricultural technologies and practices is primarily delivered by publicly funded agriculture extension services. In most developing countries including India it has been felt that the lack of reach to cover large number of farmers in the geographically dispersed areas, low motivation and lack of accountability of field level staff etc. are the factors identified as flaws in making effective and efficient information delivery to farmers thereby causing information asymmetries. Several mass media provisions initiated by public sector are employed to address these critical issues but the major breakthrough has occurred during 1990s with the development of information and communication technologies (ICTs) like mobiles/ phones, computer/ internet, television etc. Strengthening information dissemination to farmers with the help of ICTs can turn agriculture into more diversified, knowledge intensive sector of the economy and thus become more effective in meeting farmer's aspirations. With the recent developments in the field of information dissemination a number of public, private and mixed partnerships ICT enabled models came into existence to help the farmers making decisions in advanced and real time manner. Farmers showed multiple responses in using various sources of information for effective decision making. Small land holders generally adopt good quality of information from progressive farmers. Several mass media such as mobile, radio, TV etc. having high presence among the rural people showed a high level of familiarity and adoptability but were unable to disseminate updated information. Internet because of cost and infrastructural factors was accessed by only 29% farmers. Farmer's adoption of computer/internet and other mass media may provide a space for information intermediaries in selection of different media under an effective institutional provision.

The extension workers, government agencies, NGOs and cooperatives were reported by lesser number of farmers because of less deterministic and unaccountable approach of field workers. Input dealers were identified as the most reliable source of information for input price and availability, use of fertilizers and pesticides, seed sources, insecticides and weed management. Besides this, farmers also collected information by traditional means of low quality. It implied that farmers were not aware or less inclined to update themselves for the above input activities and these void spaces could be filled up by facilitating updated and relevant information to the farmers by modern ICT tools. The study gives an assessment of the role of the private and public organizations in imparting good quality of information though they are accessed by lesser number of farmers. Farmers adopted traditional sources of information for technical, irrigational and credit facilities due to lack of infrastructural, technological and cost barriers. Though the farmers lack financial instruments, it leads to giving policy recommendation for governments to make the availability of effective financial services.

Quantity of seeds and frequency of fertilizers were identified as the most preferred activities based on good quality of information by the farmers and this information was collected from diverse sources. For cultivation decision, input dealers provided better quality of information than paternal source. The farmers who were connected with any private or public sector organizations got more trusted information regarding quantity of seed and frequency of fertilizers/ pesticides. Irrigation practices mostly followed traditional pattern. This can be improved by making appropriate infrastructure, training facilities and education to farmers to reduce the wastage of water and financial burdens incurred *by farmers*.

Post harvest practices were reported as poor in quality except for 'time of harvesting the produce'. This indicates the lack of farmer's persuasiveness to these activities and the lack of innovation in business modeling approach. It leads to a strong recommendation that entrepreneurial nature of farming may be achieved by facilitating post harvest information and services especially on sorting, grading, inventory etc. to the farmers at grass root level and making them active stakeholders in agricultural supply chain. Marketing price information to sell the produce was accessed by most of the farmers followed by the activities like marketing channels, nature of transaction and types of transportation. 45% farmers received poor quality of information for marketing prices and changes in government policies. The major source of information to access market prices was through personal medium followed by output buyer and mass media channels. However the farmers were getting low quality of information by the personal means but mass media showed mixed results of good and satisfactory level of quality of information. The integrated use of ICTs would change the outlook of majority of the farmers by improving marketing value. Marketing

arrangements to sell the produce may create hope if they sell their produce to buying agencies or sell in bulk quantity to IFFCO procurement, cooperatives, e-choupal buyer etc. Transportation and financial transaction services were accessed and facilitated by the sources such as 'own' and 'progressive farmers' respectively and output buyers identified as a reliable source of information.

Finally the above results concluded that most of the sources lacked in quality of information dissemination, as reliability, relevancy and timeliness were the major constraints. It was observed that though the farmers had access to a wide range of medial sources they mostly relied on middlemen, traditional knowledge and local/ input dealers in accessing agriculture information. Modern ICTs such as information delivery models, mobile phones and internet are increasing rapidly in Indian context and their potential can be exploited in all stages of agricultural supply chain rather than limiting them to price negotiations, market prices etc. In the absence of formal and effective modes of information delivery the middlemen were also the suppliers of seeds, fertilizers, pesticides and credit to the farmers and this skewed relationship limited the benefits that could be derived from the use of ICTs.

The importance of ICTs was established in the previous results, the study was extended to the various information delivery models working in different modes of information provision to facilitate advanced and real time information in more efficient ways. These results were based on the quality of decision making by doing a comparative analysis of four models that were categorized as informational, transactional and e-governance models (ICT models = Lifeline, E-choupal, CSC and non ICT model = TKS). Our study found that overall users and non users of models showed distinct behavior in quality of agricultural decision making. The user group farmers got improved quality of information on all the aspects of supply chain decisions related to planning, input, cultivation, post harvest, marketing and distribution decisions except the agricultural activities such as how to grow, seed sources, credit support, irrigation sources, government subsidies, land preparation, number and type of irrigation, time of harvesting, transportation/ logistics, inventory decisions and nature of transactions activities.

The results indicated that farmers using any model were more planned to their farming practices in comparison to non user group. User group farmers organized their farming practices from the initial level, they were less cautious about cultivation decisions, more inclined to save their post harvest losses, well informed about market prices, more concerned about marketing and channelizing their produce in local or distant markets. Information and services delivered by models for decision making at different levels of agricultural supply chains were far better than those used by farmers who applied traditional sources of information. This strongly recommends the need of information to be delivered in appropriate manner and to be prioritized

according to agricultural supply chain stages which ultimately will lead to increase production and income of the farmers. A clear distinction has been found between user and non user groups, and then we advanced the study by comparing these models in making quality decisions by user group. The study found that the farmers using ICT models made better quality of decisions in comparison to those using non-ICT models. E-choupal users made better quality of decisions than lifeline. Lifeline (an informational model) provided better information (on 18 activities) than TKS (on 5 activities). Lifeline users made better quality of decisions across the whole supply chain except for planning decisions. Users of CSC model (kiosk based-internet) were making better decisions for planning, input, post harvest, marketing and distribution as compared to TKS model except for some of the activities like sources of seeds, soil testing and crop selection as these are the front end activities provided by TKS model via franchise ownership. While on comparing users of e-choupal with TKS we found the huge difference in quality of information as TKS model lagged at all the stages of agricultural supply chain. The above results conclude that ICT models are far better in delivering services and information than a non- ICT model. As the clear difference between ICT and non-ICT models has been established, we compared among three ICT based models. E-choupal users adopted more planned decisions than lifeline users as 14 out of 41 decisions were found to be significant. Both the set of users were on same status for cultivation decisions whereas rest of the results with significant difference favoured e-choupal users. The above results interpret that the transactional model has an edge on informational model by not only delivering information but also by providing the relevant solutions regarding seeds, weeds, markets etc. i.e. providing information as well as facilitating transactions related to these activities.

Users of e-choupal performed better than the users of CSC model on 28 activities though both are of transactional type and using internet technology but the first one covers the whole agricultural supply chain and the second one only facilitates e-governance transactions like electoral identity cards, driving licenses, passport, certificates etc. These findings suggest that by embedding agricultural information services with the CSC model, farmers could be facilitated with more enhanced and useful information knowledge on most of their agricultural decisions. CSC being a government initiated model of wide coverage area and population it would fill the void space with latest agricultural technologies and services. Comparison between informational model (Lifeline) and e-governance model (CSC) illustrated mix results. 'CSC model' was efficient in input and marketing level information and deprived in cultivation decisions whereas Lifeline model' provided better quality of information regarding planning and post harvest decisions. All the above findings concluded that there was a need to review and revisit the model's approaches toward service

provision and to make necessary changes so as to provide services in holistic manner by controlling weak aspects regarding the whole agricultural supply chain activities. In the light of above findings we can say that farmers would get enhanced production, increased income and bargain price for their surplus produce that will align them with mainstream development of the nation and will recognize them to be an important player in the agriculture value chain. The above findings brought to light important results by comparing all the models on the basis of their functioning. Transactional model (E-choupal) has emerged as the most successful model on comparing with other three types of models. This clearly indicated that e-choupal user group farmers were making better decisions right from planning to marketing and distribution stage than those of all the three models.

Informational model (Lifeline) of service provision appeared to be the second most effective model for cultivation, post harvest and marketing stages but partially abortive for planning and input decisions (very few of the activities were significant) in comparison to non ICT model (TKS). Crop selection, cropping pattern, balanced fertilizer application, weed management, technical support and training were better availed by users of informational model (Lifeline) that would reduce farmer's extra expenses incurred on inputs and facilitate better training to proper utilization of inputs that will enhance farmers financial status and establish them more firmly in the competitive market. The data gives interesting results on comparing informational and e-governance models. Users of e-governance model made better decisions for planning, input and marketing while users of informational model performed better in cultivation and post harvest decisions. E-governance model - (CSC) has been recognized as the third most effective model- in delivery of information to farmers. Generally CSC users were getting better information than TICS users for planning, input, post harvest, marketing and distribution but for cultivation both the users were similar in decision making. Thus the provision of - information and knowledge through ICT models is likely to improve the decision making process among the farming community. Further the study performed the user and non-user groups' analysis of these four models. These results will be helpful in designing of models and to add the relevant content according to the needs of the user groups. Lifeline model did not significantly improve the performance of users as a very less number of activities were better informed for decision making. Due to lack of education and unfamiliarity to the technologies, farmers prefer interpersonal information sources as more reliable, inefficiency of field workers and farmers' unwillingness to pay for the particular information may be the reason for poor performance of lifeline model.

The findings showed that the farmers with low level of education were not able to make proper use of information and knowledge being provided to them. On the other hand the farmers with higher education were able to acquire information with or

without ICT enabled facilities available to them, and thereby, made relatively better decisions on nine activities. Farmers having moderate education level made significant impact on the quality of decision making on most of the activities across the agriculture supply chain. Users of e-choupal farmers made planned decisions at all stages of agricultural supply chain. The results indicated that the user group farmers of higher education level (graduate and above) showed much better quality of decision for planning level activities (seven out of nine activities were significantly better). User farmers educated up to secondary and senior secondary level showed significantly different results for input decisions (six out of eleven activities were significant). While the user group having education up to moderate level significantly impacted on the quality of decision at cultivation processes. The results also indicated the importance of post harvest decisions, when the education level was moderate and higher. It implied that users were seriously concerned about the activities like cleaning, sorting, grading and weighing in particular. The same justification is for moderately educated user group at marketing level. According to land holding size, medium landholding farmers were more concerned about planning activities than large farmers (seven out of nine activities were significant).

However as we move up the hierarchy of social category from OBC to General the impact on quality of decision making between user and non user group improved significantly. Common Service Center (CSC) model providing e-governance services to the rural masses impacted better decisions on only nine activities out of forty one. Categorical analysis related to socio demographic variables indicated that highly educated users' preferences shifted towards input, post harvest, marketing and distribution activities. It strongly pronounced the reason that less educated farmers were not familiar with the technologies like internet and computer, as they lack in trust of information being delivered to them. Land holding pattern also showed similar results as in the case of echoupal model. OBC users made better quality of decisions and were frequent users of CSC kiosks to transact e-governance related activities like caste certificate, ration card, BPL cards etc. TKS (a non-ICT model) provides informational as well as transactional services to farmers via franchises and on-the-field demonstration medium. Farmers up to junior level of education showed significant decisions giving the perception that information content is more relevant to this group (7 out of 41 decisions were significant). According to land holding size, medium farmers made more significant decision at different levels of agricultural supply chain (8 out of 41 significant decisions were made). Socially higher class farmers often made more informational and transactional exchanges in comparison to other social groups, the justification is same as in the case of e-choupal model. The findings conclude that the socio demographic factors such as education, landholding size and social groups are important factors affecting the usage of ICT in making

decisions for the whole agricultural supply chain. The above analysis postulates some recommendations for designing the information delivery models. The services and information content should be in fragmented form according to the social characteristics, education status and land holding size. Integrating ICT components would impact better in service provision to farmers as the farmer groups consist of different levels of understanding of the information content through the medium by which they accessed. Information and knowledge delivery should be tuned with different modes of ICTs by presenting in easy, understandable and reliable format.

Locally interpreted and easily understandable information must be offered which is a prime task of ICT enabled models. The socially higher class generally made transactional and informational processing but the resource poor -farmers often lack in "reaping these benefits. Resource constraint may be the major barrier to these groups. ICT interventions need to take holistic and integrated approach for the socially lower class to use the available information with a particular attention of financial services provision. The public-private partnership could enhance the usage level of the models by covering different levels of agricultural supply chain. To make it a success, educating the farmers (especially the small and the marginal ones) **is** the need of the hour. Proper training is to be imparted to make them understand how to use the techniques of ICTs. This is the onus of the government to make optimal use of ICT by formulating a policy on the same. The study strongly recommends that ICT models embedded with transactional, informational and e-governance services greatly cater to the needs of all sects of agrarian community. Though the socio demographic factors greatly influence the ICT adoption behaviour among farming community, farm related functions and its attributes are also debatable issues. Regression analyses of these variables in the adoption of ICTs pictured important results in designing ICT based information delivery models. The major part of farmer's income coming from the farming sector is more likely to influence the adoption of ICTs related decisions. The disadvantaged farmers and poorer communities (socially deprived people) gained 57% more from the ICT-assisted interventions than those who belonged to socially higher class.

The study demonstrated that a single information delivery system could not optimally benefit the farmers. The study strongly advocated that the mixed delivery approach of services comprising both ICT and demonstration facility (informal interaction and formal training) would enhance farmer's capacity to use agriculture information more efficiently. This type of support would be much more expensive to afford than the generic information programs but could be administered through cost-sharing or other incentives which would encourage farmers to utilize ICT technologies in information processing. As evident from the recent IT development mobile accessibility has increased enormously; the potential of it could be exploited using

different features of mobile delivery mechanism like SMS, Voice call etc. This' h4s sketched a blueprint for the ongoing ICT projects run through public, private and NGOs initiatives in delivery of information content. These findings have implications not only for India but for all developing countries having similar structure of agrarian community. Because of cost, resource and time constraints the scope of the study was kept limited to only one state of India by covering only four districts. It should be expanded to more geographical locations and environmental conditions to get more results which could be generalized for the whole country. Further the study could be extended to cover up more models according to the way of dissemination of services like SMS based, video based and telecenter based to view an integrated ICT model. Additional explanatory variables such as psychological traits could be added to further research in order to enhance the predictability of models and to offer an improved understanding of farmer's adoption behavior in using ICT based interventions.



5

IMPACT OF INFORMATION AND COMMUNICATION IN EDUCATION INDUSTRY

INTRODUCTION

Education is one of the important social institutions and bases of all the societies of the world. It is a specialized social activity. The family, the kin group and the society as a whole provide education to their members through the way of participation in their everyday lives. Basic literacy in Information and Communication Technology (ICT) and education are the significant way of increasing human capacity in a society. Without the knowledge and skills required to increase human capacity, the use of new communication technologies will be impossible. Therefore, the information literacy, that is, basic skills in acquiring, managing and communicating information is essential to familiarize with new technologies and their use. ICTs are playing a very important role in transforming the mode of imparting education now-a-days. While the interactive black boards are increasingly becoming common in the classrooms, popularity of online courses is helping in improving the access and quality of education. The application of ICTs in the mode of imparting education is thus improving the quality of life of the minorities in India. Minority can be defined on the basis of language, gender, ethnicity and religion. In terms of religion, Muslims, Sikhs, Buddhists, Christians and Jains are the minorities in India. The ICT revolution offers new intrinsic opportunities for learning in education. It has facilitated live lectures or power point presentations with student interaction, web based learning,

virtual laboratory, video conferencing, database access for reference material, library, recorded lectures, etc. The first phase of ICT revolution started during World War–II with the first large, automatic, general electro-mechanical calculator, Harvard Mark. In 1947, the first transistor was discovered and on its basis, faster and more powerful computers were constructed. The second phase of ICT revolution has its roots in the 1970s when the first processors on a chip and magnetic discs were constructed. In the third phase microprocessors have become embedded in the range of products like steering systems of airplanes, domestic air conditioning systems and so on. The fourth phase of ICT revolution stretches back to the late 1960s, when the United States Department of Defence drew up guidelines for a communication network among computers (ARPANET). And finally, the fifth phase of revolution was linking without lines the new possibilities opened by mobile phones. However, the use of ICTs in education is effective in three aspects; namely, ICT-mediated instructions, ICT-enabled education and cost- effectiveness of ICT (Chandra 2003:195-216). In the ICT-mediated instruction, instruction is delivered via a technological channel, such as computer or television. The second way is to assess the merit of ICTs' use in education. The third issue assesses that information is of crucial importance to developing countries like India with fewer resources to invest. The role of ICTs in educational development depends on factors like infrastructure, teacher training and education and technical support assigned to technical staff. Besides, education is facing a significant change in preparing students for the future knowledge-based society because most teachers are not prepared to use ICTs and the majority of the educational institutions are not equipped to integrate the new ICTs. There has been enormous rise in the uses of both the old and new communication technologies in Silchar town for the years. Much of the uses of ICTs are perceived among the students of the town. Specially it may be used as a tool in teaching and learning activities to achieve equality of minority groups such as the Muslim in India as well as in Silchar town, a big group yet educationally backward, with the majority or forward groups. The use patterns of ICTs in education of minorities such as the section of Muslim students are variable in the context of place, culture and economy. At the same time, it is different in a peripheral region like North-East India. Therefore, the present study addressed the question: What ICT use patterns of education are perceived among the Muslim students studying in the higher educational institutions in Silchar town of Assam?

REVIEW OF THE LITERATURE

Studies on the use patterns of ICTs have covered access to, uses of, attitude towards and impact of ICTs starting from general aspect to educational aspect.

Internet came into existence in 1989. The powerful access provided by the Internet has sped up the pace of various uses in different fields. Studies found that

the majority of the students had access to Internet; male and some female students are of the opinion that cyber cafes are the place of Internet access who spent 3-5 hours per week for using the Internet for e-mail and net surfing for their study. Female students say that they had access to a computer off campus to a larger degree than males. Different projects aimed to expand the universal access to include content development in the regional language for the promotion of teaching science and technology to create regional language websites on secondary school-level Mathematics, Physics, Chemistry, Biology, Engineering, the Environment and Computer Science. These projects are boasts of approximately a large number of schools in its network with their own web pages. Besides, there are also the positive and negative factors affecting the adoption and development of electronic theses and dissertation (ETD) programs. The reviewed literature shows the several interrelated factors have been found to encourage the adoption and development of ETD programs in university libraries such as the appreciation of the benefits of ETD programs, awareness of these programs, and effective promotional and advocacy work that lead to cultural changes related to views on ETD programs. On the other hand, some factors have been found to discourage the adoption of ETD programs which include technological factors, legal issues and other administrative issues. ICTs are at the heart of process of education. They have impact on education which can be understood from the following studies. Pandey (2003) in his five-volume work on ICT and education deals with different aspects. He makes an analysis of networks which are the foundations for information society, ICT in childhood education, ICT and governance, framework for ICTs and teacher education and management and competition in the information age. He emphasizes in the first volume that cable network, mobile telephones, internet information highways can be defined as a high speed global network, capable of routing to subscribers at high speed a series of new interactive services such as distance learning. The second volume explains how ICT can contribute to children's learning, how it can be integrated into a play- based curriculum and how it relates to key areas of learning such as collaboration, communication, exploration and socio-dramatic play. The fourth volume explores the radical implications of ICT for conventional teaching and learning processes. A study presents the historical development of telecommunications starting from Lanlata I Satellite Earth Station which was Nigeria's first international satellite telecommunications gateway to the outside world . It emphasises that for the survival and relevance of higher education institutions in Nigeria, ICT should be declared an institutional priority with adequate funding and support. These studies were conducted in Thailand in 1995, Nigeria and Arab Gulf States.

Studies on Uses of ICTs

These studies have mainly focused on uses and the purpose of using the Internet. The picture regarding the Internet infrastructure and its usage is not quite satisfactory due to the lack of proper ICT infrastructure, poor perceptions of ICT's potential among the academic staff and lack of motivation on part of teachers which need to be given priority to realize the true potential demand for educational services of ICTs. Besides, the level of digital literacy is found more among the youth. Further, there exist many differences pertaining to males of their counterparts in matters of Internet searching and usage. Female college students get Internet access less often; spend less time online; and do not surf for different purposes as often as men. The Internet has been used in the open and distance education (ODL) which was originated from the need to extend learning opportunities at various levels to people who could not access traditional institutions for reasons borne out of economic, familial, spatial, temporal or geographical restrictions. It is creating a cost-effective virtual education system without diminishing quality experimented with various technologies like satellite broadcasting, videoconferencing, video-on-demand and intranets. The use of Open Distance and e-Learning (ODEL) methodologies in educational institutions and the use of modern ICT increase the access to educational resources. A study focused on the developments taking place in the Library & Informatics Departments of a major research and development (R&D) institutes in India; namely, the Regional Research Laboratory of Trivandrum (RRLT). RRLT is a national laboratory under the Council of Scientific and Industrial Research (CSIR) of India located in Kerala. ICT-enabled systems and resource creation are used for products and services. The project "IT @ School" and Free Software in education were initiated to remodel the conventional teaching methodologies in class-rooms through the use of Information Technology (IT). The project aims at imparting computer education to high school students. The highlight of the project is that ICT is primarily used as a tool rather than content in teaching and IT is being taught in high schools as part of the project. These studies were conducted in Africa, Thailand, Ghana, G.B. Pant University of Agriculture and Technology and Pantnagar in the years in 1998, 2002 and 2006.

Mobile telephony along with other telecommunications has enormous potential for increasing the educational development through the m-Learning, i.e., learning facilitated through the convergence of mobile technology and wireless technologies. The studies on the uses of mobile phone in education show the pattern of ownership and the use of mobile phones among undergraduate students. It was found that majority of students owned a mobile and kept it for their genuine need to be in constant contact with their parents/family members. Sending SMS (Short Messaging

Service)/MMS (Multimedia Service) are very common among them. The youth is hooked-up on the mobile which is the driving force of the emerging mobile telephone industry.

The educational television was started in 1960. The Satellite Instructional Television Experiment (SITE) was epoch-making and was implemented during 1975-76. Studies on uses of educational television show that knowledge was given more emphasis in all of the programmes whereas due importance was not given to understanding and application. The contents, presentation and effectiveness of the Countrywide Classroom (CWCR) educational television programmes are good, except knowledge due weightage has not been given to understanding application, skill, attitude and interest. There are challenges in the opportunity of the emerging e-learning in developing countries. In spite of the importance of e-learning to the African countries as an important tool for human development in the continent, e-learning is facing increased challenges in almost all the countries of the continent (except for Egypt and South Africa). Those challenges include ICT infrastructure, obtaining sufficient international bandwidth due to high international tariffs and lack of circuit capacity. It concludes that the large number of low-cost, two-way Ku-band VSAT satellite-based data sources that have been launched will address the high costs of connectivity in remote areas. The Indian Space Research Organization's (ISRO) Tele Education Satellite, EDUSAT, providing networks capable of facilitating live lectures, web-based learning, interactive training, virtual laboratory and so on are be able to revolutionise education delivery process in India. The projects undertaken learnt lessons in use of satellite communication to meet the need for education training and general awareness among the rural poor. These efforts include Satellite Instruction Television Experiment (SITE), Educational Satellite (EDUSAT) and others. These studies were conducted in 1995, 1992-93 and 1992-94 in Dr. Parsuram Mishra Institute of Advanced Study in Education, Sambalpur & Orissa and Africa.

Studies on the Attitude towards ICTs

Attitude of users towards ICT establishes a suitable environment for instruction. In establishing and developing virtual learning, understanding of social needs is essential. Using multimedia tools for instruction leads to development of cognitive skills of learners. These skills include understanding important complex elements, ability of using concepts for reasoning and ability for using conceptual knowledge for new situation. Interacting learners with their professors and other learners increase their knowledge. The students are used to instructions in the structured format using traditional norms of education by using ICTs which motivates them to integrate the learning and teaching procedures. Many higher educational institutions are organizing and optimizing electronic learning due to its effectivity. The positive attitude to ICTs leads to motivation. The Internet has helped

the majority of the students who appreciate the study material for simple language, exhaustive explanations and illustrative examples. Studies found that majority of the students were happy with the opportunity without disturbing their routine education in the conventional system. Furthermore, male students prefer more than female students to study the course that require the use of Internet showing interest in programming and playing games. The studies were conducted in Nasik and other parts of India in 2003-04.

It is found that many students who perceived the professional programme through distance mode find it as the most useful mean for knowledge enrichment but the problems identified by the students are classified under categories; viz., problems related to recognition of degree in their own organization, by any other organization/institute/university, interpretation of grades, etc. They give useful suggestions of increasing knowledge and skills, making the programme more acceptable by employers, organizations and placement services which may be provided by the university.

Studies on the Impact of ICTs

The reviewed literature show that in terms of gender, academicians and course administrators should pay more attention to the use of Internet resources as a major component in classroom teaching. Pertaining to the impact of ICTs on their performance, on average, students who use Internet-based learning scored higher than these without Internet. The students also learn more in less time in their classes when Internet-based learning was imparted. There is also a positive impact of usage of ICT on educational system which perceives ICT as a useful and friendly tool which has a positive impact on students and education system. Education, economic change, ICTs particularly advanced telecommunication services and the growth of 'knowledge' businesses are inextricably linked. This interlinking is causing a transformation of education into a new type of industry servicing new international markets, having dramatic impacts on the established educational sector. These studies were conducted in Bangalore and southern Rajasthan.

Many studies indicate that the Internet knowledge of research scholars is relatively high; the male research scholars have relatively high Internet knowledge than female research scholars; the Internet knowledge of research scholars belonging to the Arts Subjects is relatively low in comparison to science subjects. The diffusion of ICTs like the Internet changed the practice of science in less developed areas. Its impact on the research careers of scientists indicates that gender remains a durable source of inequality in Internet adoption and productivity. There is also a relationship between ICT and social change. It has reduced the influence of patriarchy on the careers of female scientists. Although the patriarchal social structure remained firmly intact, Indian women scientists have taken advantage of professional opportunities available through the

Internet to circumvent its limitations. The impact of the Internet on the careers of women scientists also changes their careers in terms of travel experiences, access to ICTs; i.e., Internet and e-mail, foreign and domestic contacts and productivity in foreign and domestic journals. These studies were done in Kerala in 2005.

Studies on satellite television show that the impact of education programmes on both students and teachers is very enthusiastic. All the programmes have positive effect on both the male and female students' learning. IGNOU provides distance learning to the professional students. There exists a significant difference in knowledge, understanding and application between teachers of TV and non-TV schools which show that satellite television play a vital role in enhancing teachers' competency. There is a positive attitude towards the ETV medium although they face the problems pertaining to adequate and proper utilization of ETV programmes. These studies were done in Delhi, Bombay, Srinagar, Jaipur, Raipur, Muzaffarnagar, Sambalpur and Hyderabad in 1986, 1987 and 1991.

Briefly, the review of the literature on the use patterns of ICTs in education shows that ICTs have become a tool for both the teaching and learning process. Now-a-days, the students are found to have taken the advantage of ICTs in their learning process. The access to and uses of these technologies have a positive attitude towards them. Internet is used by a majority of the student community. Therefore, the review shows the usage of new communication technologies in education which has a major impact on the society in relation to gender, rural-urban setting, infrastructure, etc. The review of the literature indicates that (i) there is a large number of studies on the use of ICTs in different sectors of the society; (ii) they not only visualize the technological change but also the realities of practical insights in the society; (iii) most of the studies are related to emerging interdisciplinary approach to ICT & Development in which education is an important aspect and (iv) the studies on education indicate the increasing use of the new communication technologies for e-education. Thus, the use patterns of ICTs in education call for the re-examination of the existing literature to understand the development process. Researchers need to realize that the new communication technologies should be used to enhance the learning capability among the people, especially the minority communities. Hence, the newly invented technologies are concentrated both in the rural and urban areas. In the present study, the issue of the use patterns of ICTs in education has been examined in the urban context – a better environment it provides for development of any minority group or otherwise. In spite of it, there is lack of studies on the use patterns of ICTs in education of the minorities, especially the Muslims, in the Indian context. Moreover, no such empirical study is available in the context of North East India. Therefore, the present study was undertaken to examine the use patterns of ICTs in education of Muslim students in Silchar town.

THEORETICAL PERSPECTIVE

Studies on ICTs have used various perspectives to understand their applications and impacts in various aspects of life of people. These perspectives have been discussed here in order to relate the present work to a relevant theoretical perspective. These are as follows:

There are two major perspectives that relate ICT to development. Hamelink (1998) identifies two major perspectives in this area: Utopian (Optimistic) and Dystopian (Pessimistic) perspectives. According to him, those who support the utopian perspective highlight the positive development that is brought about by information technology. Those who support the dystopian perspective argue that ICT deployment will simply reinforce historical trends toward economic disparities, inequality in political power and gaps between knowledge-disfranchised. The role of technology in society has long been an important intellectual issue for social scientists. Historically, there are three meta-analytical viewpoints regarding technology (Gendron 1977). The following discussion highlights major perspectives on the relationship of ICTs with society and development in it:

- **Utopian Perspective**

The utopian perspective holds that technology is an unalloyed blessing for mankind. Utopians see technology as a factor in providing shortcuts to the solution of many social problems. Weinberg (1981) refers to these shortcuts as technological fixes. In addition, technology provides solutions to problems caused by technology itself. The utopian viewpoint espouses rapid technological development and is skewed toward technological determinism. Failure by a technology to impact society is seen as the fault of the business and political communities who are unfortunately in control of contemporary society. The utopian viewpoint has been championed by such scholars as Buckminster Fuller (1981), Daniel Bell (1981) and Alvin M. Weinberg (1981).

The utopian perspective refers the present time as ICE age, media saturated age, new civilization, information revolution, knowledge society and age of infotainment. It derives its image from a techno-centric perspective that is characterized by an emphasis on the historical discontinuity. In this techno-centric perspective the imperatives of technological development determine social arrangements: technological potential drives history. It holds that the digital revolution definitely marks the passage of world history into a post-industrial age. Those who support this perspective argue that the emerging global information society is characterized by positive features: there will be more effective health care, better education, more information and diversity of culture. New digital technologies create more choice for people in education, shopping, entertainment, news media and travel. It is based upon the notion of a technological discontinuity – Third Wave Civilisation.

Hamelink observes that in a zero sum society, new social values will evolve, new social relations will develop and widespread access to crucial resources will be possible. All the traditional borderlines and barriers will disappear in the new virtual communities. Those who support this perspective hold the view that technology has come to stay and can be used to the benefit of human society. Many oppose such views and share a common ground which is identified as dystopian.

- **Dystopian Perspective**

Dystopians are convinced that technology is an unmitigated curse. Like the utopians, they view technology as very influential in society. However, they see technology as problem-generator rather than as problem-solver. They argue for restraint in technological development and reject the notion of technological fixes. Failure of social programs is attributed by the dystopians to technocrats who are gaining control of society. They believe that technocrats should be excluded from all policy-formulation. Jacques Ellul (1981) and John McDermott (1981) are the fervent proponents of the dystopian approach.

In this perspective it is argued that ICT deployment will simply reinforce historical trends toward social-economic disparities, inequality in political power and gaps between the information-rich (knowledge elites) and the information-poor (knowledge disfranchised). This perspective also predicts continuation and changes in the present economic, political and cultural systems. A perpetuation of the capitalist mode of production, with a further refinement of managerial control over the production processes will result in massive job displacement and de-skilling. A pseudo-democracy will emerge allowing people to participate in marginal decisions only. ICTs will enable the exercise of surveillance over their citizens more effectively than before. The proliferation of ICTs in the home will individualize information consumption to a degree that makes the formation of a democratic public opinion no more than an illusion. There are tendencies of forceful cultural globalization, e.g., 'Macdonaldization' and aggressive 'cultural tribalization', fragmentation of cultural communities into fundamentalist cells with little or no understanding of different tribes. Technology creates dependency of developing nations on the developed nations. By denying access and dividing people into 'haves' and 'have-nots', such technology is widening the existing gap between the rich and the poor. Some dystopians are Herbert I. Schiller, Ian PReinecke, Kevin Robins, Neil postman and Mark Dery.

Both perspectives have failed to recognize the fundamental impossibility of foreseeing the future social and economic implications of technological innovation. According to Hamelink (1998: 6), it is not possible to predict future social impact of any technology and social choices about the future can be made under conditions of certainty. Hamelink supports an approach focusing on social shaping of technology.

This approach emphasizes the dynamic interaction between social forces that shape technological development and technological innovations that affect social relations which was originally suggested by MacKenzie and Wajcman (1985). Among the factors shaping ICTs are socio-economic, political, cultural and gender variables, geography and market forces. According to him, it is essential for those who wish to influence the course of change in ICT, in directions that might support social development to understand what forces shape the evolution of ICTs and how these forces interact. Both utopian and dystopian perspectives emphasize the role of ICT (means) or of the developing organization in bringing about development (communicator). ICT is placed between a communicator and the audience and, thus, becomes an instrument for bringing about development of the people. In these two views, the main emphasis is on how effectively the means (ICT) can be used to bring about the development among the people or how best the communicator, e.g., a Non-Governmental Organization (NGO) uses the means (ICT) in order to develop the communities. These perspectives have an implicit assumption that people do not have any idea to develop themselves nor possess any innovative concepts to bring about social change. Thus, development has to be brought by an external instrument or organization. ICTs can play a major role in bringing people together by establishing networks among the communities.

- **Neutral School**

The Neutral School argues that technology does not have an important effect on society; technology, per se, is neither a problem-solver nor a problem-generator. In other words, technology is neither good nor bad it depends on how we use it. The neutral school of thought seeks to assess, forecast and control technology. Unlike the utopian or dystopian points of view, the neutral school is skewed toward social determinism, espousing that the impacts of a technology are shaped entirely by social, economic and political institutions. Policy, according to the neutral school, should not be oriented toward technology. The concept of a failure is irrelevant to the neutral viewpoint, since society (not technology) determines the impacts of technology on society. Mesthene (1981) claims that the three viewpoints are by themselves unhelpful to policy-makers. Based on studies conducted by Mesthene and his colleagues during the mid- 1960s in Harvard University's Program on Science and Technology, Mesthene proposed the dual-effects hypothesis. Technology has both positive and negative effects, and it usually has the two at the same time and in virtue of each other (Mesthene 1981: 103). The role of the social analyst, therefore, is to analyze the contingencies that determine the positive and negative effects of a technology; society can then attempt social, technological and political reform in order to optimize the positive effects while minimizing the negative effects. The proponent of this approach is David Sarnoff.

- **Contingency Approach**

The fourth viewpoint, the contingency approach, therefore, views the technology as problem-solver and problem-generator. It sees technology as malleable. It selectively adopts and designs technological innovations and assesses the social and technological constraints on their use. Policy is the collective responsibility of social, political and technological institutions. Examples of studies that have used the contingency approach include Ithiel de Sola Pool's (1977) dual-effects analysis on the social impact of telephone and Robert Kling's (1980) social analysis of computing.

- **Social Shaping of Technology Perspective**

The Social Shaping of Technology (SST) perspective which first appeared in 1985, exemplified a rising trend in historical and social studies of technology. It appeared when sociologists of science and historians of technology were still discovering new areas, labour process theory and technological determinism as well as the study of domestic and military technologies were new and the social construction of technology had to make its mark. In 1985, MacKenzie and Wajcman's theory leavened with older "classic essays" (by Karl Marx and Marc Bloch) argued forcefully against the notion of technological determinism and imaginatively for the proposition that technologies are socially shaped.

SST plays a positive role in integrating natural and social science concerns, offering a greater understanding of the relationship between scientific excellence, technological innovation and economic and social well-being and broadening the policy agenda in the promotion and management of technological change. SST is often taken to be synonymous with the approach, the social construction of technology or more generally with the sociological study of technology. SST stands in contrast to post-Enlightenment traditions which did not problematize technological change, but limited the scope of enquiry to monitoring the social adjustments it saw as being required by technological progress. SST studies show that technology does not develop according to an inner technical logic but is a social product patterned by the conditions of its creation and use. Every stage in the generation and implementation of new technologies involves a set of choices between different technical options. Alongside narrowly technical considerations, a range of social factors affect – thus influencing the content of technologies and their social implications.

The social shaping of technology perspective emerged from a long-standing critique of crude forms of technological determinism (Edge 1988) which held (i) that the nature of technologies and the direction of change were unproblematic or predetermined (perhaps subject to an inner 'technical logic or economic imperative'),

(ii) that technology had necessary and determinate 'impacts' upon work, upon economic life and upon society as a whole: technological change thus produces social and organisational change. It was linked to opposition to ideologies of 'technological imperative' that were particularly prevalent in British government and industry in the late 1970s and early 1980s which suggested that particular paths of technological change were inevitable.

- **ICTs and Development Perspective**

Any development perspective begins from the people, their understanding of development, communication process and their context. In this sense, people are already engaged in a communication process (by using different means that are available to them) in a socio-cultural and political process (in order to develop themselves) and thus in search for meanings of life and faith that would enable them to bring about social change and development among them. It is essential for the communicators to find ways to participate in such an ongoing process of the people and thus become participants or catalysts in the people's process of development using the available modern technology. From this understanding communication is defined as a process in which the communicator participates, shares and interacts with the audience (people). James Carey's ritual view of communication defines it as an ongoing process in which people participate and interact in sharing, negotiating and constructing meanings (social, cultural and religious). Unless audiences share such means of communication (ICT), the communicator cannot communicate with the audience. Unless computers become their medium, people cannot use it for their development. It is necessary to enable people to use ICT as a platform where they can express their expectations and meanings. There is a need to first recognize such meanings and use their means of communication to disseminate information among them. Using ICT such meanings can be disseminated not only among themselves but also to other communities that are struggling with similar issues and problems. When people are seen as participants in the developmental process, people can participate along with them in their search for development through the new technology.

It is not that technology alone enables interaction with the communities but a changed perception could help to bring about a sustainable and participatory model of development. In this regard, the technology of convergence helps communicators to change their perceptions and practices. Therefore, there is the need to identify ways how such technology can be used to establish networks for furthering organizational participation and enriching people's process of development.

- **Convergence Perspective**

The technology advancement has extended people's ability to communicate and interact with each other. ICT can bring together different types of analogical

communication forms into a single digital system. Through single system multiple operations become possible. Such digital systems are more accurate than analogue systems when services of media such as broadcasting, voice telephony, data and text exchange and online computer services operated on different networks and platforms converge into a digital form. Convergence means to bring technologically all those operations that were done using different instruments, mechanisms and means into a single digital computerized system. Hamelink (1997) observes that as a result digital technologies are instrumental in the convergence of electronics, telecommunication and data processing technologies. They bring the formerly separated and different worlds of broadcasters, cable manufacturers, publishers and Internet users together. The personal computer, the television set and the telephone begin to be integrated into the real multimedia stations. Convergence is a technological phenomenon through which telephone, radio, television, VCRs, cameras and so on are becoming an integral function of the multimedia personal computers. Recent examples of convergence include webcasting of radio and TV programming, using the Internet for the voice telephony, e-mail and chat mails through digital TV decoders and Internet services provided to TV sets via Web TV and cable networks.

The present study applies the social shaping technology perspective because it takes into account the impacts of both technology and society and context of the present study is also a human group which is influenced by technology as well as shaping it as their needs and situation. It mainly focuses on the new ICTs; namely, Internet, mobile phone and satellite/dish television which mould and shape the society by overcoming social barriers and bridge gaps even without accommodation on the part of norms and values of a community. If these technologies are made available to students, irrespective of their gender and rural-urban residence at affordable cost, the technologies will be able to reduce the existing inequalities of gender, rural-urban residence and class.

ICTs IN EDUCATION IN INDIA AND ABROAD

The present chapter provides an account of the status of ICTs in education abroad, in India and in North-East India and their outcomes. They deal with both the old and the new ICTs such as television, Internet, mobile phone, satellite/dish television and others. The aspects like access to, use of, attitude towards and impact of these ICTs are widely covered in this chapter. Information and Communication Technologies (ICTs), a recent development in technological advances, have accelerated a socio-economic and cultural revolution in society. They have become significant building blocks of the post-modern society within a very short time and are applied in diverse social areas such as agriculture, business, health, geographical information system (GIS) and the like. One of the important social domains of ICT applications is education where the ICTs have altered the way the knowledge is

produced, processed, acquired and disseminated. ICTs generally referred to a set of diverse technological tools and resources, used to communicate and to create, disseminate, store and manage information (Blurton 2002), are specifically the computing and communication facilities and features which diversely support the teaching, learning and a range of educational activities in the existing world divided by rural-urban, class and gender differences. The early dichotomous concepts used to denote such social differences are such as race, socio-economic status, gender, educational attainments, geographical divide – rural, urban and central city, age and generational divide. The inequality of the access to information is termed by various names such as 'digital divide', 'knowledge gap', 'participation gap in the information society' and, more recently, 'computer literacy gap'. The diffusion of innovations theory conceptualizes and classifies the digital divide into four categories; viz., (i) Who is divided? (unit of analysis): Individuals, organizations/communities, societies/countries/world regions; (ii) Which attribute divides? (attributes of nodes and ties): income, education, geography, age, gender, ownership, size, profitability, sector etc.; (iii) How divided? (level of digital sophistication): access, uses, attitude and impact and (iv) What type of ICT divides? (type of technology): mobile phone, Internet, digital TV etc. (Martin 2010). This classification has far-reaching consequences with practical relevance to understand 'knowledge gap', i.e., the differentiated access of various social groupings such as gender, income, race and location to information and knowledge. However, ICTs applications have enormous potential for social equalization, as well, in case of their availability to the people with equal opportunity in different social realms where education occupies a crucial position for emergence of an information society, not only in developed world but also in the developing areas like India. But the moot question is: How ICTs are factored into the education existing in a social environment of multiple inequalities? Do ICTs merely add digital divide to the existing social inequalities in education? Or, are they leveling the existing social inequalities of education in India? The chapter is based on the literature available on the access to, uses of, attitude towards and impact of the three ICTs; namely, Internet, mobile phone and satellite television in education in India.

ICTs IN EDUCATION ABROAD

Of the world's population 80% has never made a phone call. The Internet connects 100 million computers but that is only less than 2% of the world's population. London has more Internet accounts than all of Africa and New York has more phone connections than all of rural Asia (Kumar 2006: 5). This section deals with the access to, uses of, attitude towards and impact of television, Internet, mobile phone, satellite television and so on in the contemporary world.

- **Use Patterns of Internet in Education**

It is the biggest network of the world. It uses a protocol called Transmission Control Protocols/Internet Protocol (TCP/IP) suite to allow computers to communicate. Users can connect to the Internet via direct connections, online information services and Internet service providers. Computers on the Internet use client/server architecture. Its features include e-mail, mailing lists, Telnet, World Wide Web, file transfer, vast information resources, interest group membership, interactive collaboration and so on. Internet is an international network connecting approximately 1,40,000 smaller networks in more than 200 countries. The debate about the digital divide argues for the Internet's ability to bridge the knowledge divide between the developed and the less developed countries by enabling wider access to otherwise scarce educational and informational resources (UN 2000). "As the global economy is gradually transforming to a knowledge economy and with the reality of globalization, the role of ICTs continues to gain more significance".

Education, information, science, and technology become the critical source of value creation in the Internet-based economy". Currently, the focus of the debate over digital divide is shifting towards the aspects of both accessibility and content as the digital revolution accelerates the rate of globalisation and multiplies its impact exponentially across the world. An estimate of its rapid growth can be had from the fact that while radio took long thirty eight years before 50 million people tuned in, television by comparison took thirteen years to reach the same level and personal computers (PCs) reached this level of use in sixteen years. But the Internet did it in just four years.

Studies on the access to Internet in education are widely found. The National Electronics and Computer Technology Center (NECTEC) incepted the SchoolNet Thailand Project in 1995 with the joint effort of the Telephone Organization of Thailand, the Communications Authority of Thailand and the Ministry of Education to expand the universal access to include content development in the Thai language. It built a network infrastructure for education in Thailand that connected 152 local secondary schools to the Internet and commissioned Kasetstart University and the Institute in September 1998 for the promotion of teaching science and technology to create Thai language websites on secondary school-level mathematics, physics, chemistry, biology, engineering, the environment and computer science; it also developed an easy-to-use web authoring application called the Digital Library Tool Kit that allowed teachers to create Web-based lessons in Thai. The major achievement of the project was that there were approximately 4,000 schools in its network with over 900 of these with their own web pages.

Based on the interpretive research methodology using the theory of institutionalism and semi-structured interviews by email or telephone a study was conducted on nine academics actively involved in research in the fields of Business Studies (4), Management of Information Systems/ Technology (3) and Education (2) were first sought in Saudi Arabia's main universities and institutions from two private institutions; viz., Dar AlHekma College and Effat College; and four public universities; viz., King Abdulaziz University, King Fahd University, King Saud University and Taybah University of Saudi Arabia's three main regions; viz., Najd, AlHijaz and AlShargiyah between the months of July and August, 2005 to look at the extent to which access to electronic journals has empowered the Saudi academic community in their research. The findings suggested that although the majority of the academic community agreed that academic research engagement was important, a majority of them engagement in both regular academic research and especially accessing electronic journals via the Internet was limited due to being not directly linked to faculty evaluation and promotion criteria, and overloaded with teaching responsibilities. The tendency to avoid using electronic journals via the Internet for academic research was highlighted by three issues, such as generation gap, limited technical skills and language barriers. They believed that it could not replace traditional means of research which needed the localization of knowledge and resources. Furthermore, their limited engagement with ICTs for academic research was shaped by various contextual constraints of Saudi Arabian educational institutions including the perceived role of such institutions as places of instruction rather than research.

Using qualitative approach, a study examined the influence of gender role on the usage pattern of Internet of five academicians three females and two males from middle- age category of 30-52 years in a private university in Malaysia at home in terms of usage frequency, knowledge and experience on the Internet, purpose of information searching at home and usefulness of e-mails as a communication tool. The study showed that the female participants were junior lecturers having one to three children and the male participants were senior lecturers with one and two children respectively. The experience in Internet usage ranged from nine to fifteen years. It derived five themes related to respondents' experience and Internet usage pattern as well as about the influence of gender role on the Internet usage pattern, such as understanding of the Internet, experience with Internet, purpose of Internet for information seeking, frequency of Internet usage, e-mail is perceived as a communication tool and the influence of gender role on the Internet usage pattern. The gender role influences Internet usage pattern at home and women were seen to have more limitations compared to men to access to Internet at any time due to family commitment and proper maintenance of household chores.

Web-based education is a growing concern in most European countries and there have been efforts on its application into language teaching or complementing the traditional system with virtual learning and teaching. One of the major obstacles on the implementation of such systems into English Language Teaching (ELT) in Greece has been the disinclination of the teachers and instructors to adopt Information and Communication Technologies as an effective tool in language teaching. A study explored the attitudes of 44 English teachers – 4 men and 40 women, (mean age 29 years) in primary education toward the integration of ICT into the web-based ELT. A questionnaire including 40 questions adapted by the University of Warwick on ELT were sent to English language teachers in Greece. The findings revealed that all teachers had computer at home and had access to computer facilities in 78% of the schools; 91.3% teachers had positive attitudes towards ICT who liked using computers for teaching purposes, felt confident using the Internet and were willing to devote their time online; with focus on language and communication, foreign language teachers were continually searching for better ways of accessing authentic materials and providing experiences that would improve their students' knowledge and skills and majority of them expressed the pressing need for a teacher-friendly website to supply web-enhanced English language learning resources and activities. Mostly young teachers tend to use ICT applications and resources, such as the Internet, CD-Rom and power point presentation. Meanwhile, search engines, e-mail, chatting software, blogs and online resources appear to be rarely used by EFL teachers (Dogoriti).

Thus, the evidence shows that several interrelated and positive factors have been found to encourage the adoption and development of Electronic Theses and Dissertation (ETD) programs in university libraries in the world including the Arab Gulf States; such as, the appreciation of the benefits of ETD programs, awareness of these programs, and effective promotional and advocacy work that lead to cultural changes related to views on ETD programs. On the other hand, some negative factors have been found to discourage the adoption of ETD programs which include technological factors, legal issues and other administrative issues. The study concludes that most issues influencing the adoption and development of ETD programmes can be resolved by undertaking appropriate promotional and advocacy activities.

The digital divide is the gap between those with regular; effective accesses to digital technologies, in particular the Internet, and those without. The global digital divide is a term often used to describe the gap between more and less economically developed nations, while at the national level, there is often an urban-rural divide. In developing countries, most Internet users gain access through public access points like Internet cafés. A study has taken a closer look at the digital divide within

Tanzania. Based on a survey among 265 Internet café users in five towns of rural, semi-urban and central regions of Tanzania and previous in-depth interviews with business owners as well as with users which prepared the ground for developing a questionnaire in the Kiswahili language, it was found that the divide is mainly a question of finding venues with technology to access the Internet. The survey was executed during two periods in 2004; viz., January/February and September. The Internet users and usage at the different sites are surprisingly uniform, however, with a few significant differences.

Based on face-to-face semi-structured interviews with 17 respondents, 10 MBA (Masters in Business Administration) students (full and part time) and 7 staff from the university's computer services and library management, the students' association and the School of Education, the Media and Learning Technology Services and the Management School, an empirical study of the Wireless Local Area Network (WLAN) technologies, such as Wi-Fi in the University of Edinburgh, Scotland, explored the adoption processes of the new technology by both the university, and students and staff and considered factors behind the decision to offer wireless and response of students and teachers in 2004. It was found that although the wireless network was available to all MBA students at the Management School, it was used by less than half of them. Students' ownership of the laptop with Wi-Fi (Wireless Fidelity) ready together with the amount of time spent at the school affect wireless use within the school. E-mail was used between students for educational and socializing purposes, and with teaching and administrative staff for course-related communication. The access to the school's student portal which acted as the notice board and gateway to MBA-related resources including teaching material, past exam papers and e-mail was also used extensively. Online access to academic journals held by the university, researching course-related material in newspapers and on commercial and government websites were reported as popular uses together with research on post-MBA careers. Students appeared satisfied with the resources available online. The study suggested that both e-learning and m-learning were relatively underdeveloped.

An empirical study was carried out on undergraduate degree course in Information Systems Management consisting of the creation and broadcast of 13 podcasts, distributed over four months in which 90 distance students took part. Information Systems Management was a compulsory subject worth 4.5 (comparable to 45 class hours) taken during the first year of the degree in Industrial Engineering, and taught on a distance basis during the Fall semester. This course was offered by the Universitat Politècnica de Catalunya at the School of Engineering ETSEIAT. The findings suggest issues in distance courses, such as (i) podcasting is a powerful tool as a complement to the traditional resources on a course, but not a substitute for

them, (ii) the characteristics of podcasting increase the impression of permanent contact between students and teachers, increasing students' motivation and (iii) the use of podcasting allows for a diverse range of student skills and learning methods.

An empirical study on a sample of Jordanian distance education students into a requirement model addressed the need of such education at the national level by using questionnaire on a sample of 100 students enrolled at two universities offering open distance education. The study showed that distance education was offering a viable and satisfactory alternative to those who could not enroll in regular residential education. It also showed that the shortcomings of the regular and the current form of distance education in Jordan could be overcome by the use of modern information technology.

Another study explored into the role of weblogs in supporting pre-service teachers from the Bachelor of Education (B. Ed.) program at the University of Hong Kong and the key factors determining their engagement with weblogs. It was an integrative approach that puts weblogs alongside with other popular media, such as e-mail, Instant Messenger (IM), phone and face-to-face (F2F) meeting, in use. 13 participants were purposefully chosen on class basis by using survey method. It was found that weblogs were perceived as valuable in relieving isolation, documenting their experience and expressing their personal feelings; Instant Messenger and phone were rated as the most frequently used media. The study deepened the insights into the distinct benefit of weblogs as educational media and informs the future development of an online community with weblogs.

A multiple case study design was applied in two distinct Bhutanese communities, the rural community of Tangmachu and the urban Bhutanese community of Thimphu, in 2006, to examine the relationships that exist between gendered access to education and the ways in which mobile phones, fixed phones and the Internet are perceived and used in these communities. Its purpose is to deepen the understanding of how gender relations, organized education and the appropriation of technology interact with one another. Fifteen, each, semi-structured interviews were conducted in Thimphu and Tangmachu for a total of 30 from respondents of 18 years or older. Besides, 11 key informant interviews (KIIs) were conducted with individuals from NGOs and government offices and private sector representatives. The findings organized by levels of literacy reveal similar patterns in ICT perceptions and use across the two communities. The role of literacy and numeracy were found to be influenced by existing gender norms and the increased opportunities stemming from higher levels of education included broader social networks, enhanced employability and increased mobility.

A longitudinal study with mandatory use of a course management system WebCT 6 was conducted to understand 145 college student evaluations of WebCT 6

at a major northeast university in the US. Two data sets were collected during the Fall 2006 semester. Participants were asked to rate their current attitude toward WebCT 6 and toward using WebCT 6 and their behavioural intention (BI2) to continue using WebCT 6. Findings showed that attitude toward behaviour was a strong predictor of intention; attitude toward object (ICT) influenced intention indirectly through attitude toward behaviour and intention during initial use had a strong positive effect on intention during continued use. In addition, the roles of previous attitudes on current attitudes were dependent on whether the current attitudes were about initial use or continued use (Zhang 2007).

The advertising industry is a lucrative business in Malaysia. However, government intervention in the industry has to certain extent regulate the content of the advertisement messages. This in turn has impacted the formation of consumers' attitude towards advertising. As such, it is crucial to identify the determinants of their attitude. The aim of this research is to investigate the determinants of consumers' attitude towards advertising among tertiary students in a private higher education institution in Malaysia. A total of 263 undergraduate business students from a private university in Malaysia were administered through the questionnaire. The outcome shows that credibility, informative, hedonic/pleasure and good for economy positively relates to consumers' attitude towards advertising.

To ensure the success of online business, it is important for the retailers to understand their targeted customers. This study examines the significance of attitude towards online shopping. The two fold objectives of the study were to determine relationship between attitude towards online shopping with shopping orientations and perceived benefits scales. The second section investigates factors that influence peoples' attitudes towards online shopping. A five-level Likert scale was used to determine students' attitudes towards online shopping. A self administered questionnaire, based on prior literature, was developed and a total of 370 post-graduate students were selected by random sampling. The regression analysis demonstrated the determinants of consumers' attitudes towards online shopping. Additionally, utilitarian orientations, convenience, price, wider selection influenced consumers' attitudes towards online shopping.

Another study reported the impact of the Internet on the lives of men and women. A content analysis of 200 postings from men and 200 from women on the topic of "Has the Internet changed your life?" invited by the BBC News website on 24th July, 2006 was undertaken to examine the gender differences. Results showed more women's postings mentioned having made new friends and having met their partner, renewing old friendships, accessing information and advice, studying online and shopping and booking travel online while more men's postings mentioned that the Internet had helped and given them a career, positive socio-political effects and

negative aspects of the technology. The results were interpreted as supporting the view that the Internet represented an extension of broader social roles and interests in the offline world. Gender differences showed that the perceived impact of the Internet broadly reflected the concerns and motivations associated with men's and women's gendered social roles.

The impact of information technology on productivity in the private sector has been extensively researched. But the study of the impact of information technology expenditures in schools has been limited. This study of 1090 California schools and including over 6,000,000 students attempts to address this issue through an analysis of IT expenditures at the school level and the effect on standardized reading and mathematics test scores. Thirteen other factors were also included in this analysis of the 2001-2002 academic years which included public school grades two through eleven. The results indicate that socio-economic status as measured by the percentage of students receiving free or reduced meals was the most significant factor in determining test scores. Also significant was percentage of fully qualified teachers. Information technology as measured by a number of factors did not show significant and positive effects on student performance.

Another study on the impact examines and discusses the problems, challenges and benefits of implementing E-Learning in Nigeria by reviewing the consciousness and willingness of the selected Universities and adopting the survey research method and questionnaire for the data collection. The findings of the study show that out of the 18 universities selected from different specialization areas, i.e., three universities from each Geopolitical zone, only 12 responded with usable answers; awareness of e-learning among the universities was very high but investment and commitment to develop an e-learning application was very poor and below expectation; most of the staff and students in the universities only used Internet related e-learning site just for the sake of finding related information for their researches. The study also found out that some of the universities had web page and others were in the trend of creating a web page, which was usually for advertisement of the universities but not for the e-learning activities; staff and the students had also been using e-mail and Internet in addition to developing web pages for transaction of students; the universities were planning to invest number of funds in future in the selected areas of the e-learning application; there were significant differences across both forms of e-learning activities and type of universities in Nigeria.

Using both questionnaire and constructive interview the data were collected from two sample groups; viz., students in Sripatum University and IT experts and e-learning teachers to study the effect of organizational culture on the acceptance of e-learning for Thai students in higher education. The study showed that organizational culture can effect on e-learning. Both of the sample groups accepted e-learning in

high levels. Using e-learning of the students was depending on personal characteristics, motivation, interesting and attitude and also depending on the comparing cost of studying between e-learning and in classroom.

Another study was conducted at four public institutions in Wuhan and China in 2007 to examine the effect of Internet. Two classes; viz., humanities and social sciences, and science and engineering, were asked to complete a questionnaire during the class hours. Psychometric analysis was performed to assess the internal consistency, convergent and discriminant validity of the Internet knowledge was shown to be a reliable and valid construct, distinguished from Internet experience and Internet self-efficacy beliefs and had a significant effect on the intention to continue to use Internet.

Briefly, Internet is used by the academic community for accessing electronic resources in research and academic activities all over the world. There is a trend among educational institutions of different countries of developing the web pages for advertisement of the institutes. The gender role influences Internet usage pattern among women who have limited time for spending on Internet due to the family rearing and household chores. Besides, distance education or e-learning has offered a viable and alternative arrangement of study for those who could not enroll in regular residential education.

- **Use Patterns of Mobile Phone in Education**

Mobile phone came into being when American Telephone and Telegraph Company (AT&T) introduced its first network to approximately two thousand customers in 1977 (Oneupweb 2005). Since then mobile phones have been adopted worldwide at a rapid pace that the penetration rate of cellular phones has outstripped that of landline telephones and even exceeds the level for televisions. There were more than three billion mobile subscribers throughout the world which became double by the end of 2011 (Global Information Inc. 2006 and World Cellular Information Service 2008). The growth of subscribers has been rapid in the Asia Pacific region. When first introduced, mobile embraced analog technology which was an expensive service with limited capabilities and infrastructure. With the advent of digital technologies in the early 1990s and their evolution through new generations of technologies, both the capabilities and costs of mobile service have improved dramatically, thereby, hastening its diffusion throughout both developed and developing countries (Rouvinen 2006). Mobile phone has also been recognized for its expected ability to diminish the digital divide. Castells et al. (2007) noted that the key factor in the rapid diffusion of mobile communications was the embracement of this technology by the younger generation.

Mobile Learning (M-learning) has become a significant area of study in education, now-a-days. It benefits those who would like to develop and design m-learning systems or materials through learning by playing, game-based education system design and development. Studies conducted on mobile phone in education show that cell phones are a technological source for youth, age 8 through 18, in the United States and across the world. Young people across the United States and around the world have integrated cell phones and the technology that comes with cell phones into their everyday lives.

M-learning is a new tool in the pedagogical arsenal to support students and teachers to navigate the options available in the expanding world of distance learning. M-learning is learning accomplished with the use of small and portable computing devices. These computing devices include smart phones, personal digital assistants (PDAs) and similar handheld devices. M-learners typically view content and lessons in small and manageable formats that can be utilized when laptop or fixed station computers are unavailable. The first published studies focusing on M-Learning began around 2000. Sharples discussed the potential for new designs in personal mobile technologies in April 2000 issue of "Computers and Education" that could enhance lifelong learning programs and continuing adult educational opportunities.

Donna Abernathy (2001: 20-21) provides one of the first looks at the technology and how it could affect future business approaches with regard to learning initiatives. M-learning options do not necessarily seek to replace the PC as a be-all tool, but instead notes that it will help supplement corporate learning objectives with on-the-go tools. Although Wi-Fi technically existed at the time the Abernathy work, it was not fully developed or nearly as ubiquitous as it is currently. Abernathy accurately noted that the fledgling state of Wi-Fi technology could be a major stumbling block for future advances. Many studies began to appear between 2002 and 2006 that reported similar findings indicating M-learning technologies were expanding and becoming commonplace in a variety of learning environments.

Seppala and Alamaki (2003: 330-335) investigated the training and instruction of Finnish teachers using mobile technology in the classroom. Their experience and concerns with the new technology focused on several factors. First, they noted that given that 98% of Finland's university students owned cell phones in 2002, instruction via mobile learning opportunities seemed to be an important next step in the digital learning revolution. In their study of the use of Short Messaging Service text messaging (SMS) and digital pictures, content material was sent to a centralized memory bank. Each user could "withdraw" this material at any time for review and study. The teachers regarded the ability to take notes at any time and the capacity to work on materials during their daily travel time as a second advantageous feature. Feedback on educational content was offered almost instantaneously given the

characteristics of the devices being used (cell phones, PDAs etc.), and the researchers felt that this factor allowed them to be more honest in their responses and opinions about the potential of mobile learning. Seppala and Alamaki concluded that M- learning has a multitude of advantages and that this technology has a place in the teaching models of the future.

Attewell (2003: 14) tackled a question many educators and some employers have had about mobile learning, particularly in relation to younger users. Some studies have questioned whether SMS texting could actually be harmful to a student's grammatical development, e.g., vocabulary acquisition and spelling because text messages tend to be compact and often times riddled with acronyms or purposely incorrect spelling designed for speed-of-input. Attewell agreed that these issues are valid concerns. She also noted how a classroom full of students with mobile devices came together to share content and messages counteracting the assumption that cell phones have an isolationist effect.

Whitsed (2004: 273-275) reviewed the advent of M-learning and mobile computing in the field of medicine. The modern classroom environment for medical students is technologically sophisticated. Nevertheless PDA's that can access patients' charts from anywhere in the hospital provide an alternative to having to log on to a networked terminal or a laptop to recall patient details. Mobile devices allow medical interns and residents to take notes and record audio which can be studied and reviewed at a later date. Whitsed states that 28% of U.S. physicians use mobile computing as part of their daily routine.

The pervasive mobile technology is expanding now-a-days. According to Wagner and Wilson (2005: 40-43), cell phones outnumber landline phones in America and other wireless devices are gaining footholds with the help of workplace and community Wi-Fi networks. They make an important distinction between M-learning and E-learning. They argue that as different devices and new delivery tools provide educators with far more options to reach students, the education community must recognize that the model of "command and control", typical of conventional education structures, is being replaced with a chance to make learning truly collaborative.

Rushby (2005: 709-710) has explored M-learning from a workplace perspective. He compared the benefits of freedom of location with the traditional E-learning models that many companies have in place. He suggested that M-learning is superior to the older format particularly regarding employees' ability to track and discover new knowledge in whatever setting best benefits their learning style. The hindrance of this type of educational openness was the limited memory and technology of past wireless devices. The useful additions to mobile devices, such as GPS and video/audio enhancement make the possibilities of the devices themselves much more robust. Using HotLava WAP software called Learning Mobile Author

(LMA), a study was conducted to evaluate the effects of access to review and study material made available on mobile devices-primarily web enabled cell phones. Learning Mobile Author is a mobile learning software program designed by Hot Lava Software Inc. It guides the user through the development and publishing of mobile-device-ready web content. A total of 112 students in a large 'Introduction to Sociology' course at a midsized state university in the Northeast in the 2006 spring semester were selected for the study. The study found that students in this class using web-enabled cell phones to assist in their review of test materials outscored the students who used more traditional means (handouts and review lectures) to practice and review materials.

Briefly, many college students have regular access to personal computers delivering notes and study materials and exams through course management systems. It has taken more than a decade for mobile phone technology to reach the level it has. The personal computer may be a technologically more advanced medium, but it is not portable and thus, students are likely to carry around with them on a day-to-day basis. Briefly, M-learning does not seek to replace the utilization of Internet to aid in learning, but rather to supplement it with interesting new methods that use a preferred medium increasingly available to students at affordable prices and already widely in use.

ICTs IN EDUCATION IN INDIA

Many studies were also carried out on ICTs in education in India. In this section, studies conducted on the access to, uses of, attitude towards and impact of television, Internet, mobile phone, satellite television and so on are reviewed as under:

- **Internet Technology Applications of Education in India**

Sociologically, the Internet is a network of people using computers that assist the system communication and make available a vast amount of information. Internet brings a fundamental change in perceiving and conducting the teaching and learning process from the teacher-centred to the student-centred education and the traditional to the virtual classroom and it is universally embraced by teachers and students. A survey was conducted on the Internet use and access patterns among scientists in research and academic institutes in Kerala in 2005 to address whether the diffusion of ICTs like the Internet changed the practice of science in less developed areas like Kerala by examining its impact on the research careers of scientists by administering the interview schedule to 261 scientists from two organizational types; viz., the governmental and the university sector belonging to two organizational types that are engaged in conducting research in governmental and university sectors fields in Trivandrum by administering the interview schedule. The sustainable franchise model is a very widely applied model for the delivery of IT services to rural and poor

populations where limited intervention to support infrastructure and coordinate resources is combined with market-based delivery of IT services to the end user. N-Logue, an example of such franchise, has over 1000 locally-owned Internet kiosks in rural villages in India. A study seeks to assess the work of this new sustainable franchise model in practice by analyzing data from 74 of n-Logue's kiosks. It was found that gender and education did not affect success, while location and other measures of social standing such as age and caste do; and uses that villagers have for IT services were not different from those of the first world users. It was concluded that local customs and practices, such as the caste system, would not mitigate the social biases against women by good program design.

Rajasekar and Sini (2005: 93-95) conducted a study on the Internet knowledge of the research scholars of Kerala University by using the normative survey method and cluster sampling technique and an Internet knowledge test consisting of 30 multiple choice questions on 200 research scholars belonging to Arts and Science subjects in Kerala University on the basis of their residence, gender and faculty. It was found that the Internet knowledge of entire sample was relatively high; the male research scholars had relatively high Internet knowledge than female research scholars; the Internet knowledge of research scholars belonging to the Arts subjects was relatively low while it was high among science subjects and, finally, in case of residence, there was no significant difference between rural and urban research scholars of various subjects in respect of their Internet knowledge.

The Internet has been used in the open and distance education (ODL) which was originated from the need to extend learning opportunities at various levels to people who could not access traditional institutions for reasons borne out of economic, familial, spatial, temporal or geographical restrictions. The findings of a study of the e-learning technology implementation in universities in Thailand suggested that the students were used to instructions in the structured format using traditional norms of education. The key issue for the university has been to persuade students and instructors to use ICTs effectively and also to motivate themselves to integrate the learning and teaching procedures.

Another study on the Virtual University Trial Project (VUTP) which covered 65 universities and five companies and launched by the Government of South Korea in 1998 was designed to create a cost-effective virtual education system without diminishing quality. Participating institutions experimented with various technologies like satellite broadcasting, videoconferencing, video-on-demand, intranets and the Internet. But two years after the VUTP, it was found that policymakers and educators in South Korea continue to grapple with issues of quality management, capacity building, cost-savings, open access and the appropriateness of the instructional model for adult learners.

The study conducted to know challenges faced by the African Virtual University (AVU) learning centres in Ghana and the strategies being employed to ensure their survival revealed that after ten years in operation, the learning centres in Ghana are confronted with some prominent challenges, such as accreditation as a result of the termination of the AVU and the Royal Melbourne Institute of Technology (RMIT) partnership, inability of students to complete payment of fees, students dropping out, neglect and irregularity of electricity supply. The coping strategies being used are arrangements with RMIT, withholding the certificates of defaulting students and recording and downloading presentations.

In spite of various advantages e-Learning has over the conventional approach, the diffusion of eLearning is rather slow. One of the reasons for this is the lack of information and negative perception among students. Business and Engineering Education in India is booming since last couple of decades. In spite of large number of B Schools/Engineering Colleges are offering graduate and Post Graduate programs, there still exists demand – Supply Gap. The second area of concern is the quality of output. Application of Information and Communication technology (ICT) or eLearning is the only solution to address the twin concerns – Quantity and Quality. An empirical research study was carried out with objectives to ascertain the perceptions of MBA and B. E./B. Tech. students towards e-Learning; to ascertain their perceptions towards prevailing learning environment; to ascertain the computer and Internet skills level amongst MBA and B. E./B. Tech. students and to ascertain the relationships between above three. The data collected were analyzed using Descriptive Statistics, Mean Ranks, ANOVA and f tests. The findings were useful while promoting eLearning/Distance Education Technologies in developing countries. Though the study was focused on Business/Engineering Education, the findings can be generalized for Higher Education in neighboring developing countries as well.

Another study contributes to the understanding of the effectiveness of online discussion forum in student learning. A conceptual model based on theory of online learning and media richness theory was proposed and empirically tested. The current understanding of media richness theory was extended to suggest that use of multiple media can enrich the communication context and perceived learning. Hierarchical regression was applied to investigate the relationships between antecedent factors, interaction and perceived learning. The results show that the perceived richness of online discussion forum has significant positive effect on student participation and interaction, and learning, when used along with traditional classroom lecture. Implications of these findings provide important guidelines for management educators. In brief, the studies indicate that the existing inequalities do play their role in creating digital divide in Internet uses of education in India and their effect is perceptible in various components of education related to learning and teaching.

However, the implicit message is also clear that Internet technology generates equalizing effects if the opportunity of access to it is equally available to the people of different social backgrounds.

- **Mobile Telephone Applications of Education in India**

The adoption of mobile phones has grown with an average annual growth of 80 percent after their arrival in India in 1995. They have become a significant presence in the social, cultural and economic lives of the people at all levels of the Indian society. The younger generation has embraced mobile phones enthusiastically but changes in social norms have caused anxieties among some sections of the population. Some studies have focused on the uses of mobile phone in different spheres including education. Mobile phones offer a variety of media options for the people under 18 such as music, games, Internet, television, camera, camera recording abilities, social networking and individuality which are used to suit the individuality of the users, especially children and teens. The combined use of mobile phone-based cash systems and social networking websites has enabled small entrepreneurs to venture into e-commerce and helped evolve small informal markets in the information age. Mobile telephony along with telecommunications has enormous potential for augmenting the educational development through m-Learning, i.e., learning facilitated through the convergence of mobile technology and wireless technologies.

In a study conducted on the pattern of mobile uses among undergraduate agriculture students Rajput and Ansari (2008: 42-49) found that majority of male and female students in urban settings owned mobile phone and kept it for their genuine need for constant contacts with parents and other family members, being in touch with friends, seeking emotional support from parents/family members, etc. Of these, 60% students used BSNL for telephone and sending Short Messaging Service (SMS)/Multimedia Service (MMS) and in-built camera. The level of family income is not a factor for accessing and using mobile phones by the students because of the decreasing cost of mobile phones. The study concluded that the youth hooked-up on the mobile is the driving force of the emerging mobile telephone industry.

Briefly the mobile phones have become a popular commodity among the students and youth, mostly for self-expression and their use in education is also on the rise. Thus, as a result of their decreasing costs, the mobile phones are fast emerging to bridge the social divides at least in education. However, the regional variations are still persisting.

- **Satellite TV Applications of Education in India**

In India, as a result of the historical evolution of satellite communication, there have been possible the various applications of satellite communication and the growth

of business communications using the Very Small Aperture Terminal (VSAT). The educational television (ETV) was started in 1960 and the epoch-making Satellite Instructional Television Experiment (SITE) was implemented during 1975-76. In 1961 the first syllabus-based television programme was produced and telecast in India for higher secondary school students of Delhi, popularly known as Delhi School Television project. In this project, programmes were produced for Science and English to improve their understanding and knowledge of these subjects. Paul Neurath, an American Sociologist, who evaluated the impact of Delhi School Television on invitation from Ford Foundation, concluded that students from science subjects in the age group of 13-15 years in Delhi who watched school television programmes benefited from it. Though a number of similar experiments in various parts of India have been conducted, no regular evaluation reports are available to understand its impact. Hence, it is difficult to say under what circumstances educational television could be most beneficial to the higher secondary students.

A satellite is an object that revolves around a planet. In India, the space programme was formally launched in 1972 with the setting up of the Space Commission and the Department of Space. The first Indian Satellite, Aryabhata, was launched in 1975. The various applications of satellite communication and growing trends of business communications using the Very Small Aperture Terminal (VSAT) are possible as a result of the evolution and history of satellite communication. Training programmes conducted in nine districts of Gujarat to transfer professional knowledge to the grassroots level aimed at increasing competencies of its members to function with alternative models. The Self-Employed Women's Association (SEWA) used the satellite talkback communication system under the Training and Development Communication Channel (TDCC). The network consisted of the three major elements; viz., the teaching, the receiving end and the spacecraft. The experience of these programmes indicated that they were effective in reaching a large number of SEWA groups in rural communities within a limited period of time and an average of 150 questions were shared on some common issues like appointment of women talati (Secretary of the village Panchayat), absence of electric supply etc.

The educational television (ETV) was started in 1960. The Satellite Instructional Television Experiment (SITE) was epoch-making and was implemented during 1975-76. The University Grants Commission (UGC) telecast educational television programmes on Doordarshan's National Network via INSAT System through the Country-wide Classroom (CWCR) TV programmes, sponsored by the UGC from 15.08.1984. Studies on the programmes reveal that the programmes were very useful in both rural and urban areas of India as knowledge received more emphasis in all of the programmes, however, due importance was not given to understanding and application; over two thirds of the programmes were adequate in

content; the formats of near about half of the programmes were lecture, discussion and interview; the visuals of the programmes were quite clear and attractive but transmission disturbances were also observed and the voice of the programmes was distinct and normal through the language media of English.

Another tracer study conducted by IGNOU on the utility of MBA programme as perceived by students who had successfully completed the MBA programme during 1992-94 found that half of the students perceived the MBA programme as most useful for knowledge enrichment; the problems identified by the students were classified under three categories; viz., problems related to recognition of degree in their own organization, by any other organization/institute/university, interpretation of grades, etc. The students gave useful suggestions of increasing knowledge and skills, making the programme more acceptable by employers organizations, placement services which may be provided by the university, etc. Briefly, like mobile phone the satellite TV has more equalizing effect on the populations, however, gender differences are perceived in terms of attractions towards themes of programmes, perhaps, due to need-based differences. In sum, Internet, mobile phone and satellite television have touched the nook and corner of the Indian society. They have necessitated the needs of the young generation. Though these technologies have reduced the gender, regional and class differentiation in India and opened the path for emerging opportunities in education, there found to persist the division of population in terms of possession of information.



6

IMPACT OF INFORMATION AND COMMUNICATION IN LOGISTIC INDUSTRY

INTRODUCTION

To a great extent it is true that the world is surviving today on two critical sectors – Logistics and Information Technology (IT). This is applicable for both social and economic scenarios worldwide. In order to survive, people/business, either their requirements should reach them or they should reach their requirements. Either ways it involves the movement of the requirements. In other words, the requirements translates into things – raw materials for businesses, food/shelter/clothes for people or any other thing that is required by them for their respective survival strategy. At the same time, it is also important for them to get to know about the availability of these requirements – where/how/when? This is all about information sharing – personally or publicly. In today's scenario information sharing is associated with information technology. Apart from the need, another way people get to know about their requirements is through various channels. Businesses communicate information about their products/services through one/all of these channels. Once the requirement is known, people/businesses go all their way out to get it. The above illustration indicates the movement of materials/products and information from one place to another or from one person to another. In this way, logistics and IT are interconnected. This is a macroscopic view of the flow of materials/products and information. When both the industries are seen from within, a lot of interdependency can be seen. In the logistics sector, it is critical to have

right information about the product/service being moved from one place. When it is said , the right information, it means – the type of the product/service, source, destination, quantity, value, risk involved, storage requirement, estimation of time/effort/money, etc. It is not always easy to get this information as there is a need for coordination of more than one organization. This is where the IT has got a role to play in the sector.

The present business environment has been constantly going through changes owing reasons to varying market condition, changing technology trends, growing competition, uncertain customer demands, turbulent economies to name a few. As a result many organizations are finding new ways to overcome the competition. They are constantly under pressure to create and deliver competitive value to their customers. Adding to this is the ever growing technology trend, especially information and communication technology (ICT). ICT is invariably being applied in almost all the organizations, across domains, for their regular and strategic operations. ICT has helped these organizations explore new ways to collect, preserve and disseminate both internal and external information and also keep the respective stakeholders in the loop. With the world being reduced to a global village, the need for last mile delivery has increased. Ever changing business dynamics has boosted the growth of various sectors and logistics is no different. The backbone of domestic and international trade in any economy across the globe is logistics and it forms critical factor to be competitive. Apart from providing employment and moving goods, an efficient logistical network enables increase in the speed of doing business.

There are several factors contributing to the growth of the sector in India. Liberalization, Privatization and globalization in the country have helped the industries grow rapidly and exponentially. Industries such as automobile, retail, fast moving consumer goods (FMCG), e- commerce are registering tremendous growth year on year. This is fuelling the growth of the logistics sector. But the question is “Is the logistics industry in India ready for this growth?” Well, the argument continues. Some of the problems faced by the sector include infrastructure, widely scattered customer base, influencing middlemen, unable to offer end-to-end logistic solutions, storage solutions, tax structure, technology related issues, availability of skilled work force, to name a few. With all these problems, the industry is thriving to achieve one thing – “On time Delivery”. Mr. Chander Agarwal, Executive Director, TCI, mentions in his article in Transtopics that “high level of fragmentation exists in the logistics industry in India. The organized players are made to directly compete with highly unorganized operators who are more susceptible to flouting rules and regulations and even avoiding taxes”. He continues to say that the company has continuously introduced new, fresh and innovative services and has started adapting technology to offer their customers an improved experience. In this article he emphasizes on the integration of IT enabled technology in the logistics sector as this can help the organizations serve beyond geographical boundaries.

In the recent times, the logistics industry has started to realize how easy it is to access information and using it for timely communication and efficient delivery of products/services. These two are the most influencing factors that help develop and sustain global and domestic competitiveness. Having a supportive electronic logistics (e-logistics) system is very important to maintain the company's competitiveness. An unprecedented growth is seen in the use of ICT across the verticals. And to a great extent in logistics sector too. The use of computers, information systems and the internet can be seen in virtually all the activities in the industry, such as transportation, warehousing, order processing, materials management, and procurement. Last two decades has witnessed a technological revolution offering solutions to make logistics and supply chain management more effective and efficient than it has ever been. One of the three major flows of supply chain management is "information flow". It is said 'no product flows unless information flows". One of the key components to meet this requirement is the adaption of ICT. The necessity to meet ever growing customers' expectations in a speedy and effective manner has left no option for the supply chain partners but to leverage on ICT. This has enabled them to create a strong network among the participating companies to ensure continuous flow of supply and demand information. This has led to an increased level of intensity for information requirement. Logistics industry is under tremendous pressure to implement information and communication technology from their customers and other integrating partners. For better fulfillment of the customer orders, it has become the need of the day for the industry to implement ICT.

Since the industry is highly fragmented and influenced mostly by the middlemen, it becomes difficult for a customer to communicate and coordinate. Most of the large players (in terms of turnover, fleet size) in the industry have already implemented and are relishing the fruits. It is the smaller and medium sized logistic organizations that are on the cross roads. There a number of key factors that is restricting them to adopt and use ICT. Some of them include the cost involved in acquiring required technology, ambiguity over the business benefits and its consequent impacts, and the lack of relevant internal technical expertise. Apart from these, the organizations also should face constraints from daily routine challenges such as dependence on external consultants & vendors and the unreliable systems, potentially owing to technological obsolescence and technical complications⁵. There are reports about damage of goods because of low penetration of the latest technology in supply chain processes. As the industry is too fragmented that has a large share of unorganized players, there is almost zero investment in IT infrastructure as against required. Integration among the participant partners has taken a hit because of this. On the other hand, ICT has witnessed rapid development that has been strongly influencing the logistics services industry, making the

companies involved, transform themselves from 'brick & mortar' to 'brick & click' in a very short period of time. The bond between the supply chain and ICT now appears to be much thicker that it has even become difficult to establish whether ICT is a driving force or is simply an enabling factor.

LOGISTICS – A BRIEF INTRODUCTION

Logistics is basically movement of goods/services from one place to another place. The main objective is to ensure that the right product reaches the right person at the right time at the right place in the right condition and at the right cost. The word logistics was derived from the Greek word 'Logistikas'. This word was assigned to military officers to perform the duties of providing services supply & distribution of resources when the soldiers were moving from their base position to a new forward position. They were also responsible for securing their own supply location and destroying the supply locations of the enemy. Over a period of time this led to the development of present day logistics system. Logistics evolved greatly during the Second World War. The United States and their allies cut off the supply locations of the German army and also ensured that their essential services and supplies were provided on time and at the apt place. This was done in the most efficient and economical manner. Logistics has since evolved itself into an art as well as science.

Evolution of Logistics

Logistics has been an integral part in global development for close to 5000 years. More often than ever, intelligent logistics solutions have been the basis for the transformation to a new historical and economic era. The creation of large to very large cargo vessels on the oceans and seas has been the novel service systems so far during the 20th century that has witnessed this basic progress. Both these are an integral part of the current scenario in globalization. The growth of Supply chain management from 80s has made the organizations realize the importance of logistics. People, who used to consider it as a burden, started understanding how important logistics is to the overall success of a company. The supply chain management turned towards the entire logistics chain from the supplier's supplier to the end customer. Efficient logistics is creating the competitive edge for companies who are spreading their wings to global markets. Efficient logistics system along with international supply chains is fueling the development of global markets.

Logistics Industry

The logistics industry across the world rests on the pivotal idea of reducing costs for customers and providing efficient services. In India, the logistics industry has been growing by leaps and bounds. Although the Indian logistics industry is recording a steady growth, it seems to be somewhat stagnant at crossroads. Thanks to the ongoing global economic uncertainty and its impact on Indian economy. But given the

various initiatives by the Government of India (Make in India, Digital India, Smart Cities development, Establishment of Food Parks are some of the examples), it may not wonder many if Indian economy will walk past this uncertainty. Logistics industry in particular has well positioned itself to post an exponential growth owing to these initiatives, focus on developing infrastructure, proposal to introduce GST, rise in the e-commerce industry, rising investment in the sector, to name a few. This has offered an ocean of opportunities for the organizations engaged in logistics, warehousing, distribution and associated services, reports Motilal Oswal Securities Ltd.

The C and M Research report states that the total global logistics market was valued about \$4 trillion in 2013 that represents almost 10% of global GDP. The worldwide transportation services market is the fastest growing sector with more 7% YOY growth ever since 2011. And now it is projected to generate revenue of \$3.8 trillion in 2016. The United States of America currently accounts for more than 42% of worldwide transportation services sector⁹. The report also states that in the next few years the global logistics market will witness growth in demand from other than traditional Western countries to the emerging markets of India, China and other Asian economies, the Latin America and the Middle East.

The large, highly fragmented and highly populated logistics market has a huge range of incompatible companies. There are global organizations who offer a complete range of services taking lead of the industry down to a nation-wide organization offering basic logistical services. Over the last two decades, the customers are favoring a few large players capable of managing complex supply chains across the globe. It is also evident that in these two decades the market was driven by the idea of consolidation. The latest trend in the global industry is to provide value-added and customized services. There is an increased focus by the logistics providers on specific verticals like pharmaceuticals, automotive and high-technology and are often found offering value added services, in addition, that is making their services felt more close to their client requirements. New and latest technological inventions are intruding in to the sector which is expected to enhance service and improve productivity.

Logistics Industry – Indian Scenario

In India, the logistics industry has been growing by leaps and bounds. Thanks to the advancements in infrastructure, technology and new types of service providers. The Indian logistics industry was estimated at US\$ 125 billion in 2010 and that it generated employment for 45 million people. The industry is expected to grow annually at the rate of 15-20 percent, reaching revenues of approximately \$385bn by the end of 2015. The industry is also a highly unorganized and the organized sector contributes to only 6%. The market share of organized logistics players is also expected to double by 2016. India's logistics costs are approximately 10- 20 percent

of the GDP. As per the World Bank's Logistics Performance Index 2010, India is placed at 35th position, an improvement from 54 in 2014. The report also suggests that developing countries have been investing heavily in modern technologies. Arvind Mahajan, partner and national head (energy infrastructure and government) at KPMG India, says that the initiatives like Make in India and infrastructural improvements have helped the country to improve the performance of logistics sector. He also added that the growth in the availability of skilled professionals and other improvements in the technology in the field of track-and-tracing helps India narrow the gap with other bigwigs.

The NOVONOUS report, Logistics Market in India 2015-2020, projects that the Indian logistics market will grow at a CAGR of around 12% by 2020 influenced by the growth in the e-commerce, FMCG, retail and manufacturing sectors. The report goes on to tell about the Indian spending of around 14.4% of its GDP on transportation and logistics which is way above 8% by the other developing countries. It also estimates that the freight forwarding is projected to grow at a CAGR of 12% and the warehouse market at a CAGR of 10% till 2020¹³. The report also says that at present Indian logistics industry is worth \$300 billion. Aditya Deorukhkar, COO – Infinity Logistics, in his article "Challenges facing the Indian Logistics Sector", says that largely, it is an informal sector that performs logistical tasks, usually with lesser technology & support and without any dedicated warehouse area. Also, most of the logistics service providers have only a few people owning one to two trucks. As a whole, the sector is not that organized and the workload is very turbulent, that too in the big cities, where there are large number of unorganized organizations who are small truck owners and service providers offering stiff competition at very less margins. According to the 'youstory' research in the past few years, the e-commerce majors have built a strong base for the advancement in logistics. The article based on this research says that 2015 was the year of logistics for e-commerce in India, with many startups coming up in the space, and investments flowing into them. Some of the established online players backed by enough investment, such as Flipkart, Paytm, and Snapdeal have come up with innovative strategies in logistics and supply chain management. To allow for delivery with an hour of the order placed, Snapdeal launched 'Snapdeal Instant'. It went hyperlocal way to allow for this facility. Athira Nair mentions about Amazon adding eight new fulfillment centres this year that increased their storage capacity to nearly 5 million cubic feet across all the 21 centres in India in this article on 'your story'. She continues to say that "under-utilization of resources in India is not surprising as the logistics market is highly unorganized. In order to keep up with the customer expectation and satisfy the customer, it is essential to adopt the technology in operations." The article outlines the importance of vehicle tracking by saying that "For faster delivery, vehicle tracking plays an important role providing necessary

effective and controlled route planning.” Transportation expert Jaspal Singh, Partner at Valoriser Consultants, said: “In India, logistics system is underdeveloped and hence there is absence of a big player who can offer access pan- India at reasonable cost. We surely will see some strategic partnership to distribute the delivery load.”

INFORMATION TECHNOLOGY IN LOGISTICS INDUSTRY IN INDIA

Information Technology (IT) sector is one such sector that has witnessed an explosive growth along with tremendous amount of innovation, development, applicability and is welcomed with open hands and minds across the globe. It may not be exaggeration if this sector is considered as the most admired one till date. The world is witnessing something new, every alternate day, that is created keeping ICT as base. It is making people wonder about its contribution by making wonders in almost all the walks of the people’s life. ICT has virtually become a companion for life for people. Mobile devices working across the world proves this point. So far there is no stone left unturned by the sector to ensure that its presence is felt every moment. It is said that 19th century belonged to the industrial revolution and the 20th to ICT. There are many instances where this era has been addressed as a ‘digital era’. ICT has digitized almost every aspect of human life. Apart from contributing to developing convenient daily-life products, ICT, with the advancement in the wireless communication, has taken the sector to the new heights. It has literally made the world a ‘global village’. It is only the geographical distance that matters now.

Information Technology has made its way into automating the processes in every function of an organization irrespective of the domain. Across the globe, information technology is playing an important role in making the processes more efficient by offering cost effective optimal solutions. Different sectors have found the benefit from information technology differently. Some have leveraged it to the maximum, some have developed aversion towards the technology, while others are still at the cross roads to embrace the information technology.

Logistics is one such sector where one can see a gist of information technology adaption. Though at present the implementation is limited to a very few processes, the scope to adapt the information technology is huge. It is a belief at Price Water Coopers (PwC) that IT industry must play a big role in the improvement of efficiency of the supply chain and also to meet the growing expectations of the users. In spite of low penetration of IT in the Indian transportation and logistics sector, logistics companies as well as the consumers have huge opportunities to leverage it for their benefit. The report goes on suggesting that logistics companies need to adopt IT solutions not only to align to the organization’s business needs but to also help them achieve growth and efficiencies which is very important in the current technology driven environment’. It also suggests that ‘the logistics companies need to leverage on the emerging technology solutions developed on the basis of best

industry standards in order to achieve competitive advantage and also need to adopt innovative ways of analysing data, like using real time statistics, and tracking business performance parameters’.

According to the research conducted by PwC in association with the Confederation of Indian Industry (CII), the major challenge the industry is facing is that of its unorganised nature and skill shortage that has further led to non-standardised operating procedures. Another challenge identified by the research is that of scarcity of funds required to invest in technological upgradation of vehicles, including IT tools like vehicle and consignment tracking using GPS and RFID technologies.

There are certain initiatives from the Government in order to streamline the logistics activities, though they are limited to few sectors of logistics. Some of them include:

- Implementation of freight operation information systems (FOIS) – for Indian railways
- Implementation of electronic toll collection on India’s highway network to ease delays and traffic congestion at toll collection points – for road transportation

ICT has witnessed exponential development that has been strongly influencing the logistics services industry, making the companies involved, transform themselves from ‘brick & mortar’ to ‘brick & click’ in a very short period of time. This has opened up challenges among the competing logistics organizations across the globe. The scene is not as good in India. Reasons may be many. Unlike in some developed countries, the Indian logistics industry lags behind in adapting ICT. This can be attributed to constraints on investment in ICT, highly unorganized, varying levels of professionalism, traditional resistance to change, etc.

LITERATURE REVIEW ON IMPACT OF ICT ON LOGISTIC

Logistics has been performed since the beginning of civilization; it’s hardly new! Implementing best practice of logistics has become one of the most exciting and challenging operational areas of business and public sector management. Business logistics is relatively a new field of integrated management study in comparison to the traditional fields like finance, marketing and production. Logistic typically accounts for one of the highest costs of doing business, second only to materials in manufacturing or cost of goods sold in wholesaling or retailing. The challenge is to balance service expectations and cost expenditures in a manner that achieves business objectives. In final analysis, logical service is balance of service priority and cost. One universal process that all firms must successfully complete is the creation of customer value. Such value is essential in gaining and retaining a loyal customer base. One of the several competencies required to create customer value is logistics (**R. Vijayan Pillai, 2011**)

India is a place for development; it is providing space for all the new technologies and business models which is creating a new revolution all time every time. The outcomes of logistics decisions influence performance in several ways. The challenges encountered by logistics management in India are growing at a rapid speed, giving an equal competition with the actual growth of the industry. It is also identified that Critical Inventory Logistics Services, Innovative Packaging solutions, Special handling services, integrating management information system, etc. are some of the areas which need to be highlighted in the modern logistics models along with value added features so that, some of the great challenges confronting health care industries such as transportation of time dependent and temperature sensitive drugs, Long Lead Times and Delays in Procurement and Weak distribution infrastructure will be resolved. **(Adithya D Shetty, 2015)**

Firm IT resources (e.g. IT Advancement and IT Alignment) facilitate supply chain capabilities which lead to first order operational benefits and strategic marketing benefits. the competitive business environment has led to a greater extent of usage of IT. Such usage has led to greater IT Advancement (advanced technology utilization) and IT Alignment (with channel partners). The impact of such IT resources is mediated by supply chain capabilities which enhance the operational and strategic marketing benefits of the firm. These two benefits together have a positive impact on competitive marketing performance. The extent of IT usage has a greater influence on IT alignment of the firm with channel partners than IT advancement. IT Alignment influences supply chain capabilities more positively than IT Advancement. Capabilities of the supply chain like information sharing, coordination, collaboration and responsiveness are achieved more through investing in technology to align IT with that of their downstream channel partners **(Sundar, 2010)**.

The proliferation of information technologies (IT) and the internet technologies have provided impetus and challenges to the logistics. New technologies present new means to manage the flow of information. IT as a productivity tool can be utilized to both increase the capability and decrease the cost at the same time. Some of the enablers are Logistics Information System, Electronic Data Interchange (EDI), Bar coding, Real-time Communications capability, Radio Frequency Identification (RFID), to name a few **(Gurung, 2013)**.

IT will remain on top of the agenda of logistics companies for the coming years and requires proper strategic management. In this perspective, taking it as a “strategic necessity” or as a source for “competitive advantage” or stated more simply as “a pain to cope with” or as a “strategic opportunity” is consequential **(Founou, 2002)**

Most transport/logistics firms use ICT as facilitating technologies to gather, process, and use knowledge about the application of technologies that will help in making their business to be more progressive and contribute in increasing the

efficiency of urban goods transport. Impacts on costs and benefits of ICT needed an in-depth research to fully measure the effect. Moderate impact of ICT signifies that ICT is re-shaping the logistics system from traditional methods to modern logistics. Specifically, it was supported by the current types of ICT, their uses, and the applications as well the barriers presented (**LIDASAN and OBOGNE, 2005**).

The "virtual logistics network framework" addresses services in the areas such as asset management, logistics productivity, global reach, inventory chain optimization, distribution management, reverse logistics, warehouse management, transport capacity matching, transport brokerage, and real time interface with federal agencies for speedy document clearance. In addition, if all the check posts are linked with concerned government agencies the delay could be considerably reduced. These processes in turn increase the productivity of the truck and enhance the profitability of operations (**Diatha, 2001**).

ICT developments have increasingly influenced the transport and logistics services market, shifting the focus from a physical to a more electronic one and giving rise to new organizational forms for these services. Information and Communication Technology (ICT) is becoming one of the main drivers of changes in the 3PL industry, posing new strategic challenges to logistics companies. ICT developments are more and more influencing the transport and logistics service market and give rise to new organizational forms for these services. Accurate and timely information allows minimizing inventories, improving routing and scheduling of transportation vehicles, and generally improving customer service levels (**Evangelista, Sweeney, 2003**)

R. Vijayan Pillai, (2011), Logistics has been performed since the beginning of civilization; it's hardly new! Implementing best practice of logistics has become one of the most exciting and challenging operational areas of business and public sector management. Business logistics is relatively a new field of integrated management study in comparison to the traditional fields like finance, marketing and production. Logistics adds value when inventory is correctly positioned to facilitate sales. For individual firms, logistics expenditures typically range from 5 to 35 per cent of sales depending on the type of business, geographical area of operation, and weight/value ratio of products and materials. Logistic typically accounts for one of the highest costs of doing business, second only to materials in manufacturing or cost of goods sold in wholesaling or retailing. The challenge is to balance service expectations and cost expenditures in a manner that achieves business objectives. In final analysis, logical service is balance of service priority and cost. One universal process that all firms must successfully complete is the creation of customer value. Such value is essential in gaining and retaining a loyal customer base. One of the several competencies required to create customer value is logistics.

India is a large and diverse country, in which surface transportation is governed and administered by a large number of agencies, whose objectives and key result areas do not necessarily coincide. Regulation of traffic is a state subject, whilst several elements of infrastructure are controlled by the Central Government. It is also seen that in many places, railways are competing with road transportation system, even though this is an unequal match. Ideally these two modes of transportation should complement each other for their service to the nation. The four major metropolitan cities, namely Delhi, Mumbai, Calcutta and Chennai which form the vertices of the “golden” quadrilateral are about 1500 kms apart, and there is an increasing demand to connect these megacities, as also the other economic hubs, through a cost effective transport system for rapid movement of passengers and freight. Road transportation consumes some precious resources of the nation. It accomplishes a vital function of economy. In addition to the large work force employed by this industry, an enormous quantity of fuel is consumed by commercial vehicles. The damage caused to life and property through road accidents has already assumed gigantic proportions. Some countries which have addressed themselves to these problems have been able to contain this dribble away of precious life and property to a fraction of Indian levels.

N. Viswanadham, M. Puvaneswari, 2004, Logistics has huge impact on the domestic and global economy of any country. As such, the role and importance of logistics has been elevated in many business environments. This report gives an overview of logistics industry in India. The focus of the report is to present the existing and emerging practices in the logistics industry in India and to predict the future trends that are likely to contribute to its transformation. We highlight on the potential growth areas and expansion strategies for the logistics players in India to becoming highly localised world-class players. Historically, the logistics sector was clearly separated and restricted mainly to transportation and warehousing. The logistics management in today’s world however, covers all the aspects of value chain including an efficient integration of transportation, distribution, warehousing, reverse logistics, value added services such as payment collection, packaging, documentation, customer brokerage facilities, kitting, repair management, reconfiguration etc. The developments of state-of-the-art IT in recent years have further had remarkable implications for the logistics industry. The present form of logistics industry in India is still in its infancy and is highly fragmented. There are thousands of logistics companies, ranging from the international giants to the highly localised small players in the country. As the logistics industry in India is in nascent stage, there are a lot of logistics issues to be improved. Traditional transporters, freight forwarders and courier companies are rapidly transforming themselves into integrated logistics service providers by incorporating other activities like inventory management, order processing, and collection of bills, sales and excise duty documentation in order to effectively utilize their existing assets and experience.

Pankaj Chandra, Nimit Jain, 2007, Broadly speaking, the Indian logistics sector, as elsewhere, comprises the entire inbound and outbound segments of the manufacturing and service supply chains. Of late, the logistics infrastructure has received lot of attention both from business and industry as well as policy makers. However, the role of managing this infrastructure (or the logistics management regimen) to effectively compete has been slightly under- emphasized. Inadequate logistics infrastructure has an effect of creating bottlenecks in the growth of an economy, the logistics management regimen has the capability of overcoming the disadvantages of the infrastructure in the short run while providing cutting edge competitiveness in the long term. It is here that exist several challenges as well as opportunities for the Indian economy. Service reliability of the logistics industry in emerging markets, like India, has been referred to as slow and requiring high engagement time of the customers, thereby, incurring high indirect variable costs. However, the Indian logistics story is one with islands of excellence though there has been a general improvement on almost all parameters.

The results of this study indicate that the operational use of IT has developed in the last five years. In particular Internet technology and third party transaction integration services have provided companies with increased possibilities to network with supply chain partners. However, in most cases the solutions used are quite individualistic as they are developed from a single company's point of view. Of course user aspects (customer and supplier) have been taken into consideration when planning. Furthermore, only implementing IT, as such, for example in invoicing automation, is not likely to lead to higher-level business impacts. Stating this, it is interesting to observe that in the SCM context the main body of companies views IT primarily from operational perspective. A reason for this may be the relative novelty of IT, meaning that larger scale and strategic solutions are still yet to come, and after companies have installed a basic IT infrastructure. The case examples in this study demonstrate the multiple ways that IT can be deployed. There is no single way of using IT and, moreover, the broader the business area where IT impacts, the more solutions have to be customized. As applications are more tailor- made, it is also more difficult to copy a solution from one company to another. Benefits of IT in SCM are multitude and vary in the context of their implementation. Moreover, as the use of IT is closely related to process changes, most of the benefits are overlapping and interlinked. Then, it is hard to specify the origin of benefit very explicitly. Notably, strategic benefits are only achievable when the introduction of IT is coupled with process re-design. The ideas of BPR are then closely related to current study. Our study corroborates that business process re-engineering skills are vital to benefiting from IT strategically in SCM. The change in processes needs not to be total, but without any process changes, IT becomes merely an automating force, providing efficiency benefits in a limited scope.

THE CONCLUSIVE STATEMENT

It was found the challenges the industry is facing are similar among most of the respondents. Further, it can be concluded from the research that these challenges can be addressed by implementing an ICT based system as the major challenge faced was about integration among the participation partners. When an organization receives an order, it is challenging for them to find the required number of fleet to fulfill the order on time. During this time, when they try to arrange for the fleet from the co-operators in the industry, through middlemen, they are charged premium. Sometimes, they will not even get proper response.

When these organizations, whose challenges are common/similar, come together to be a part of an ICT based system, it becomes easy for effective fulfillment of the order. Users' views are very critical in identifying a solution for the challenges they face. Also their inputs will be valuable when deciding on the need based solution. It helps in avoiding any failure of the solution. Interaction among the respondents, seeking a possible solution to address the current challenge revealed about a possible models.

Logistics firms may understand the need to manage information effectively and the importance of integrating with other participating logistics organizations in order to achieve efficient functioning of several activities including inbound and outbound transportation, order procurement and fleet management, in order to streamline the physical product flows of their customers. The study insists on the importance of ICT systems to logistics, since they make available the right information, at the right time, at the right place, to the right person. The findings support the fact that ICT systems are critical for managing logistics operations and lack of timely information may lead to improper management of the above mentioned issues, impacting the overall performance of the organization.



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Dr. Hetal Mehta is having more than 23 years of experience in the field of higher education. Since 2010 she is working as a Principal in Swami Sahajanand College of Commerce & Management popularly known as SSCCM. Previously she has worked as a faculty and coordinator in M. J. College of Commerce. She is also having administrative experience as she has worked with PNR society as a Chief Administrative Officer. She has been nominated as a special invitee in IQAC of Maharaj Krishnakumarsinhji Bhavnagar University and also a member in Board of English and Member in Academic Council. She is the Recipient of prestigious Academic Leadership Award in 2018 by All India Higher Education Forum, Mumbai for outstanding contribution to higher Education through teaching, leadership and academic environment. She is Ph. D supervisor and under her guidance 16 students have completed M.Phil and 08 students have completed Ph.D. and 08 are currently working under her guidance. A very popular magazine Femina has published an article on her and her leadership role in Higher Education reforms in the cover Focus in an Anniversary issue of Femina under the title "Teaching New Generation". She is also serving National Assessment & Accreditation Council (NAAC) as an Assessor. She has chaired 15 sessions in National and International conferences and more than 120 research papers published in international and national conferences.



Dr. Poojaba V. Rana is currently working as an Assistant Professor, Department of English, Swami Sahajanand College of Commerce & Management, Bhavnagar. She has qualified M.A M.Phil and PhD from Maharaja Krishnakumarsinhji Bhavnagar University, Bhavnagar. She has 13 years teaching experience. She has attended and presented papers in many conferences, seminars and workshops. She has published 6 papers in referred/ UGC approved national and international journals.



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