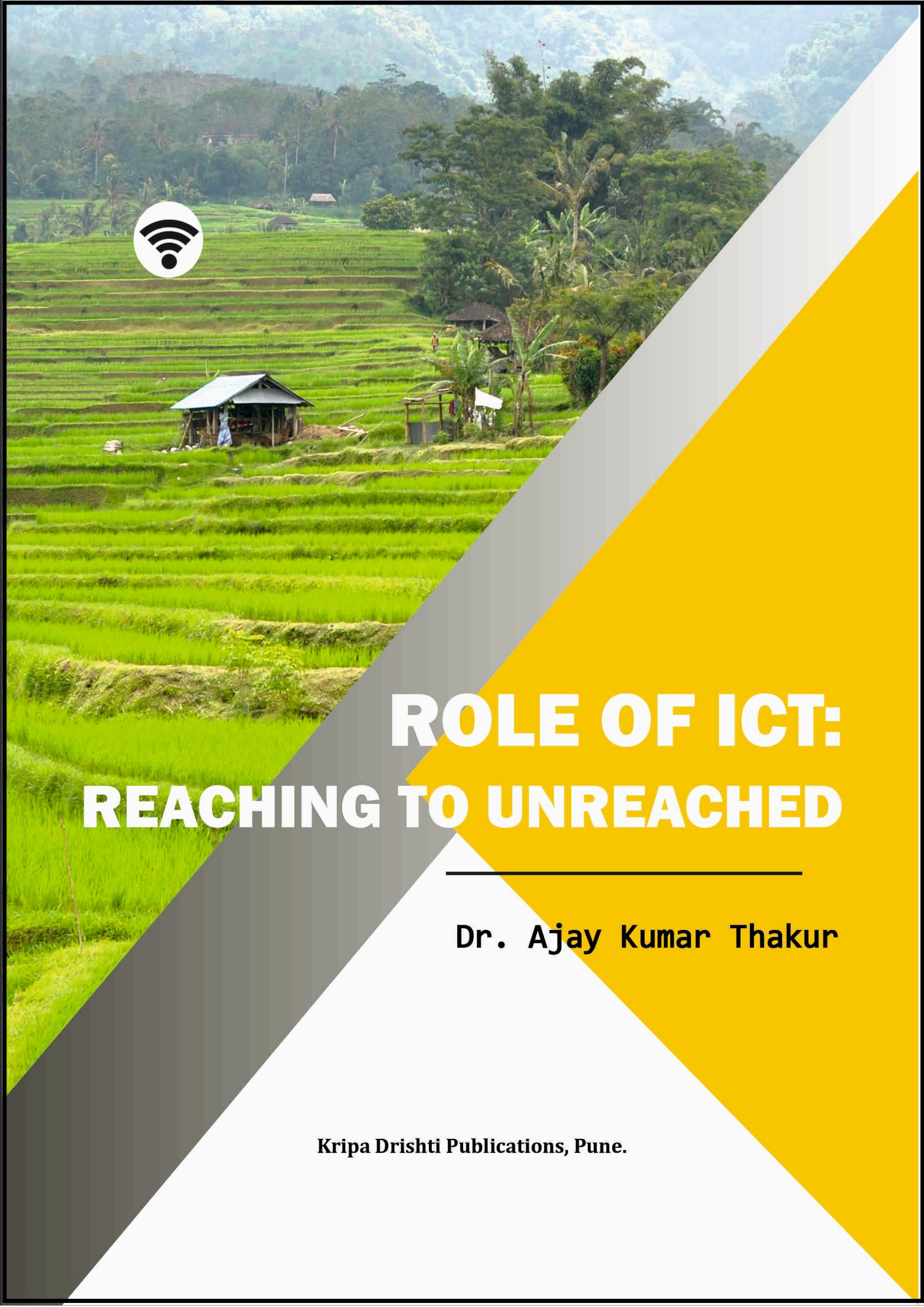

ROLE OF ICT: REACHING TO UNREACHED

Dr. Ajay Kumar Thakur

Kripa Drishti Publications, Pune.

ROLE OF ICT: REACHING TO UNREACHED

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PREFACE

Role of ICT: Reaching to Unreached promises a fundamental shift in all aspects of our lives, including knowledge dissemination, social interaction, economic and business practises, political participation, media, education, health, leisure, and entertainment...This paper discusses the use of ICT for rural development. This book aims to improve rural information delivery by providing technology information, marketing information, and information advice. This paper focuses on the digital divide and poverty eradication, as well as good governance and the role of the internet in rural development.

In India, ICT applications for rural development include Warana, Dristee, Sari, Sks, E-Chaupal, Cybermohalla, Bhoomi, E-Mitra, Deesha, Star, Setu, Friends, E-Seva, Lokmitra, E-Post, Gramdoot, Dyandoot, Tarahaat, Dhan, Akshaya, Honeybee, and Praja. ICT provides an opportunity to introduce new activities, services, and applications into rural areas, as well as to improve existing ones. Through the creation of information-rich societies and the support of livelihoods, ICTs can play a significant role in combating rural and urban poverty and fostering sustainable development. If ICTs are used correctly and recognise the differences in needs between urban and rural people, they can become powerful tools of economic, social, and political empowerment.

This book focuses on the digital divide and poverty eradication, as well as good governance and the role of the internet in rural development. Effective use of ICT can break down geographical barriers, bring rural communities closer to global economic systems, and provide meaningful assistance to the underprivileged.

CONTENT

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1. Impact of RPA in the Banking Sector: A Case Study of KSA

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Abstract:

The advancement of technology gives rise to a new phenomenon called automation. The banking system of the Saudi kingdom is under the control of the government and is based on Islamic laws. Automation activities in the banking system ensure productivity growth at the individual level and as a whole. Robotic process automation is one of the emerging technology for the current business world, which is developed for replacing the low productivity efforts of humans with technology-supported high productivity. This research aims to investigate the impacts of Robotic process automation in the banking sector of the Saudi kingdom. RPA is a systematic software robot that works to perform high-level tasks and rule-based performance to support the banking system of Saudi Arabia. RPA is a digital transformation of the banking sector to ensure customer satisfaction and ensure the efficiency of the banking sector. Customer satisfaction is achieved by improving work quality, bringing stability in the performance of employees, fast processing, reducing chances of error, and improving productivity and staff efficiency. This research aims to develop a perspective on customer satisfaction improvement due to the emergence of Robotic Process Automation. Thus, customer satisfaction is the dependent variable, and it depends upon employees' efficiency, chances of performance error, quality of working in the banking sector, and staff efficiency.

Keywords:

Robotic Process Automation, Islamic Rules of Banking, Dependent and Independent Variables

1.1 Introduction:

IT innovation in the banking sector started a new era of development. The working efficiency of the banking sector is highly improved due to the development of innovative and creative technologies. Robotic process automation replaces the banking sector's traditional working methodologies and performs many innovative tasks based on customer satisfaction. Saudi Arabia is the Islamic Kingdom in which the banking system is based on Shariah laws. According to Shariah law banking system is operated as non-interest banking. The Saudi banking system did not take interest on loans or money deposits in the bank. But banking system always seeks to make a profit for investors. There are 12 local banks and 12 foreign bank branches are working in Saudi Arabia. Banking control regulation is responsible for the Saudi banking system and issues licenses for carrying

entities on banking activities. The dominant bankers working in Saudi Arabia are Al-Ahli Bank, Riyad Bank, Al Rajhi Bank, and Samba Financial Groups to hold the market share of Saudi Arabia (Aguirre & Rodriguez, 2017).

Traditional working in the banking sector is based on human efforts and development. According to global estimation, human error in the banking and finance sector costs $ 878,000 and 25000 hours of rework per year. The Saudi government also upgraded the banking sector to robotic process automation to avoid human error and ensure the low-cost working of the sector. Globally, different business sector upgrades their functioning towards robotic process automation and reduce avoidable rework hours. Robotic process automation consists of a robotic application that supports the finance sector and avoids human errors. Adjustment in the human error cost is high in the banking sector and requires a repetitive process for efficient working. Robotic applications to the banking sector avoid repetitive human error working and enable the employees to focus on critical tasks. It helped a lot in bringing competitive advantages to the market. Robotic automation is based on pre-programmed instructions to tackle the situation. It is a rule-driven process that works without variation and brings accuracy to work. It is considered a major drawback of robotic process automation, but the Saudi government invests in uplifting the economic standards of the banking sector.

The Saudi banking sector implements machine learning, artificial intelligence technologies, and natural language processing capabilities to handle the business sector's complex working processes. Customer satisfaction is improved due to the introduction of the RPA system in the banking sector. This research explains the impacts of robotic process automation on customer satisfaction and views the employees' performance improvement due to the advancement of technology. RPA systems have positive and negative impacts on the Saudi banking sector.

1.2 Background of Study:

The country's finance department is considered the backbone of the country's economy. Human error in the finance and banking sector disrupts the economic standards of the Saudi kingdom. Traditional banking sector working costs high value to reduce human error and is destructive in terms of money and time. The primary goal of the Saudi kingdom is to control tedious and repetitive tasks with limited resources. The introduction of Robotic process automation reduces human error and limits the processing time, increasing working accuracy and reliability. Robotic process automation, along with artificial intelligence, plays a significant role in developing the banking sector. RPA process has vast application in human life. Its implication in the banking sector is the initial stage of evolution. It assists humans while conducting their jobs accurately and effectively. If the countries control the finance sector of their development, it should be the first step towards advancement and development. Expert's views about the robotic automation process explain its importance for the current banking sector. It is a streamlined critical process that heralded the banking sector easily and extended the legacy system's life. The banking sector of the Saudi kingdom focuses on long-term advantages of technology transformation and eliminating costly disruption of business and tactical band-aids (IBS intelligence, 2019).

Robotic process automation is widely used globally in the manufacturing, healthcare, and insurance sectors. It is designed to assist the finance sector in bringing accuracy in functioning and avoiding repetitive tasks. In 2020, RPA implication increased productivity up to $ 1.57 billion. It is expected that in the coming years, the RPA system will have a stronghold in the finance sector of the business world. The implication of the RPA system in the banking system is the source of building customer interest towards the functionality and improving the country's economy.

The reason behind the implication of RPA technology in the banking sector is its interesting features. Robotic process automation allows the banking sector to scale operations. RPA process reduces the required time to perform tasks effectively. It can work without a break for hours and cut employees' expenses. In the traditional working of the banking sector, the IT department interferes by disrupting the functioning. Development of the RPA system minimizes the IT department interference and develops robotic assistance. It does not require significant infrastructure to improve functionality, and it sits on top of existing banking applications. The Saudi government also revolutionized its banking sector by introducing Robotic process automation and ensuring a high productivity ratio. RPA assists the Saudi banking sector in mortgage processing, investment management, accounts payables, knowing customer values, and report generation.

1.3 Problem Statement:

The factors that affect the banking performance of the Saudi Kingdom are management efficiency, liquidity, asset quality, earning ability, and capital adequacy. With the advancement of technology and daily emerging new ideas, the Saudi banking system is also upgraded during the last decade across the world. The banking industry and finance have immensely upgraded their policies. Banks play an important role in foreign investment and spreading country business worldwide. Saudi Arabia is the wealthiest nation globally and has world oil resources as its economic power. According to the Sariah laws, the government allowed foreign banking to expand their business and manage the country's economy. The banking system provides a competitive environment for foreign investors. Although the Saudi kingdom's banking system is based on technology, mortgage processing, investment management, accounts payables, knowing customer values, and report generation are major issues that the banking sector faces. RPA system assists the banking sector in these sectors to ensure customer satisfaction.

A performance report document comprises detailed information and is considered an error-prone task for the employees. Manual handing of payable accounts is time-consuming. To validate all the fields of the banking sector, Saudi banks require digitizing vendors. Traditional mortgage processing in the Saudi banking sector requires two months to publish the closing report. Laon officers conduct different types of inspections while proceeding with mortgage processing. Human error chances exist, and small error slow-downs the processing process. The banking sector has to be aware of customer values. It is another time-consuming process for efficient working in the Saudi banking sector. Knowing customers eat up $ 388 million and 1000 full-time equivalent hours to perform the task in compliance.

The banking sector requires professional analysts to review customer values. It has a bad impact on loyal customer values and disrupts the proficient functioning of the banking sector. A major problem in the banking sector is anti-money laundering compliances. Data collection about money laundering consume 75% time of skilled analyst and affect their functioning. Anti-fraud practices of customers and employees increased disrupt the banking reputation badly. So, there must be a digital system to control the mess and ensure the accuracy of services. Robotic process automation generates daily, monthly, and yearly financial reports of the banking sector. It enables the banking sector to tackle challenges and generate accurate performance reports. RPA system has optical character recognition ability to handle the payable accounts. It is necessary to develop robotic process automation to accurately evaluate the banking sector's performance and control payable accounts (IRPAAI, 2018).

A. Research Questions:

Following are the questions that are investigated in this research.

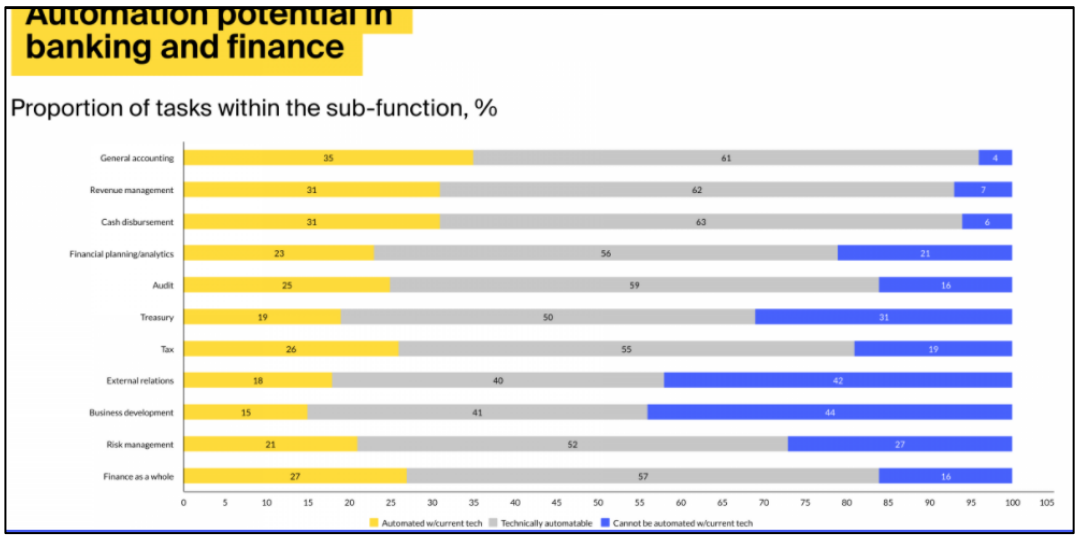
- What are the consequences of robotic process automation in customer satisfaction in the banking sector?
- Does adaptation of RPA in the Saudi banking sector improve staff efficiency and productivity?
- How is the performance stability of employees affected by the implication of the RPA system?
- What is the role of RPA in fast processing and reducing chances of error in the banking sector?
- What is the role of robotic process automation in improving the work quality of the banking sector?

B. Research Objectives:

The main objective of the research is to investigate the impacts of robotic process automation in the banking sector of Saudi Arabia. The development of the banking sector is based on customer satisfaction and the accuracy of working employees. The manual process of the banking sector costs highly for employees development and ensuring customer satisfaction. There are always chances of human error that disrupt accurate working and make the process time-consuming. Robotic process automation is the digital transformation of the banking sector with limited sources.

Customer satisfaction is increased by bringing technology innovation into the business sector. It is necessary to measure the effectiveness of the RPA system in preventing serious losses in the banking sector. RPA is a tool that allows quick automation processes and requires a centralized IT department. Capturing customer interest and initiating the development process requires digital advance support. For developing customer satisfaction, the banking sector requires to focus on independent variables of customer satisfaction. This research work develops a tentative framework to investigate the independent variables of customer satisfaction. It is a way of developing a relationship between customer satisfaction and a robotic process automation system.

Although the actual effects of the RPA system are not investigated yet, it has become a valuable tool in the banking sector of Saudi Arabia (Asatiani & Penttinen, 2016).



This research aims to develop a theoretical and tentative framework based on the technology used and the technology acceptance model in response to research questions. Independent variables of the research are investigated by viewing the employee's reaction toward robotic process automation. Internal analysis of the banking sector is conducted to evaluate the impacts of robotic process automation. Management reviews explain robotic system automation's role in improving staff efficiency and productivity. RPA system fasts the process of automation and improves the work quality of the banking sector. It is also to understand the impacts of RPA on customer satisfaction from the management point of view. The dependent variable of the research is investigated by conducting customer reviews about the services of the banking sector. The Saudi Banking system is based on the Islamic System but has not fully implemented Islamic rules to run a successful banking system. The current framework of the banking system of Saudi Arabia does not permit Islamic Banking. Most banks use only selective activities of the Islamic rule of banking. Many amendments are required to turn the Saudi Banking system fully towards the Islamic system (Lacity & Willcocks, 2018).

1.4 Definitions of Key Terms:

A. Robotic Process Automation:

Digital transformation of technology that automates the execution of the business sector's manual and repetitive intensive activities is known as robotic process automation. It can communicate with other software, process transactions, and manipulate the data to advance the business sector. It interrupts the existing software of the banking sector and develops ways for assisting the system in ensuring an accurate working and reducing human error. It is supported by machine learning and artificial intelligence and replaces humans to handle high-volume tasks.

Finance maintenance in the banking sector requires repetitive tasks to ensure accuracy in the work. The automation process of these tasks reduces the labor cost, eliminates human error, increases accuracy and productivity, and manages the process's execution time.

Like other economic supportive industries of the Saudi kingdom, the banking sector is also looking to increase profitability and stay competitive. Robotic process automation is an effective solution for the banking sector to focus on employees efficiency, working accuracy, and customer satisfaction (Institute for Robotic Process Automation & Artificial Intelligence: Definition and Benefits. , 2019).

B. Islamic Banking Rules:

The Islamic banking system is based on the Islamic faith and its relation to commercial transactions. The principles of Islamic banking are derived from the Holy Quran and the teachings of the Holy Prophet PBUH. The legal code of Islam is Sariah. All the dealing, either banking or business, occurs according to this. Rules of Sariah related to the banking system are known as Fiqh al-muamalat. People working in Islamic banks are entrusted and do not deviate from the principle of the Holy Quran and Sariah while conducting business dealings. In case of query, bankers are recommended by Islamic scholars for the guideline of banking rules from the Quran or allowed to use independent reasoning based on customary practices. Thus, innovative practices of the Saudi banking system require focusing on its custom values set by Allah Almighty.

C. Dependent and Independent Variables of Research:

Customer satisfaction is a dependent variable of the research, which depends on the banking sector's ease of facilities. The independent variables of research work are improved work quality, fast process, performance stability, improved staff efficiency and productivity, and less error. These variables collectively play a role in investigating the answer to research questions. The manual transaction model and customer policies affect customer values in the banking sector. Application procession, data preparation, transferring data, knowledge management, and saving data are a few processes that affect the accurate working of employees and cause hindrance in achieving customer satisfaction.

D. Justification of the Study:

Robotic process automation contains structured data that prevents bank employees from redundant and repetitive tasks. There are three development stages of the RPA system. It includes automation, enhanced process automation, and cognitive automation. The banking sector develops basic automation processes through rule-based programming and ensures that repetitive tasks and transactions are automated. The banking sector recognizes unstructured data patterns during the second stage and utilizes machine learning techniques for limited decision-making automation. The second stage of the RPA process is also known as decision-making-based tasks. The banking sector develops a cognitive automation level after developing basic automation practices in the business model and limiting the decision-making process.

During this level banking sector evolves as machine learning, artificial intelligence, and natural language processing to ensure accuracy in the functioning of the banking sector.

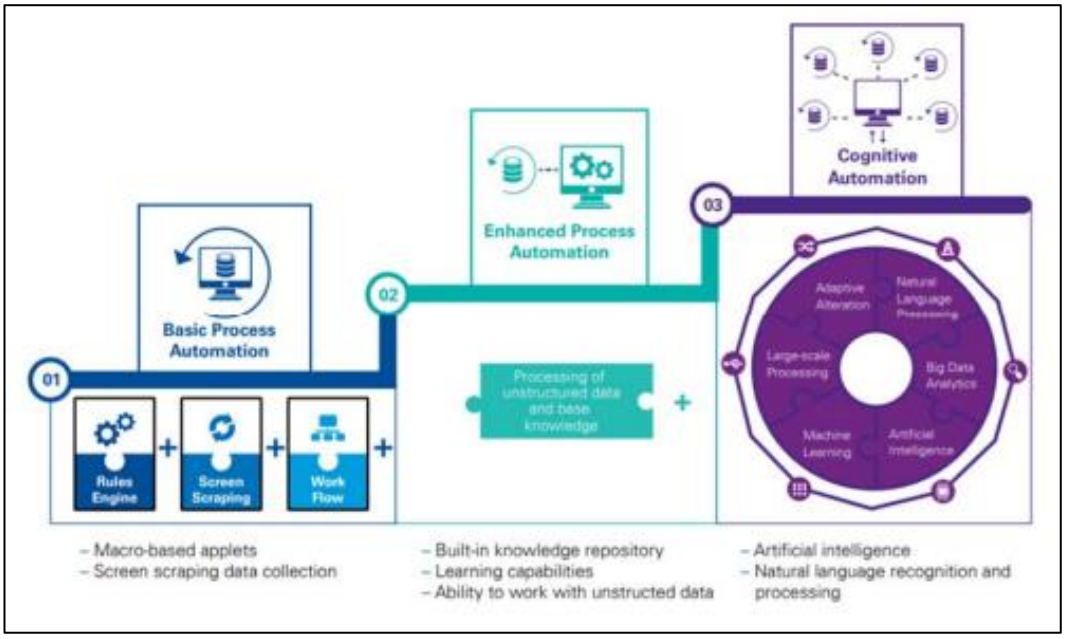


Figure 1.1: Three classes of robotics process automation (KPMG International, 2016)

Most of the business sector relies on basic automation processes to uplift the economic standards of their organization. An organization like Arago and Ipsoft develop themselves as intelligent automation stage to ensure innovative and digital transformation practices in the business model.

Cognitive automation practices of Google Deep mind, Alpha, IBM Watson, and Wolfram ensure the success of the business sector. These organizations communicate with the employees and enable understanding of the RPA process. Artificial intelligence in the business approach enables the banking sector to develop a strong communication channel with the employees and fulfill customer requirements. RPA system is significantly important for the banking sector.

The implication of advanced and cognitive automation systems is dependent on the nature of the industry. It performs different functions according to the working nature of the industry. Legal services, HR, Finance, IT, Accounting, and many other fields where RPA serves the business sector. The banking sector provides ease of human error and increases profitability. The major functionality of the banking sector comprises credit card issuance, loan information system, financial industry, and fraudulent claim detection. RPA system controls the general business affairs of the banking sector. Anti-money laundering practices of the banking sector are also controlled through the implication of the Robotic Process Automation system. Insurance payment claims also utilize the RPA system to ensure customer satisfaction (Romão, Costa, & Costa, 2019).

E. Scope of the Study:

Robotic process automation software is an easy approach to reducing the time cycle of customer performance. It performs rule-based performance more effectively than other finance controlling software. Automation in the banking sector saves $ 2 trillion yearly. It is estimated that 455 industries implement automation practices in the business model on the global network. Advantages of the RPA system to the business sector are not limited to efficiency ensuring and cost-saving.

It is also a=beneficial for agility, case of deployment, and speed. Ancient business sectors adopt business process management schemes to control efficiencies of the business sector and cost-saving. The extra features of the RPA system rapids deliver the value of the banking sector, digitize the process, and give sustainable values by reducing overall risks of policy failure. RPA system enhances cost optimization and efficiency of the banking sector in limited time availability. It allows to save considerable human resources cost and reduce full-time employees.

Human resources of the banking sector cost 1/3rd of total labor cost. Controlling human resources through the RPA system ensures the effective development of the Saudi banking sector. Robots offer non-stop work to the sector and enhance productivity significantly. The robotic system can improve the performance of the banking sector and continuously improve the learning process (KUMAR & BALARAMACHANDRAN, 2020).

Robotic process automation improves data analytics in the banking sector. It can process the transaction in real-time and centrally manage the data flow. Another benefit of the robotic system is defining structures and rules to retrain itself to ensure functioning accuracy. It can process immediately against newly updated data and increased outcomes. It increased the operating speed of the organization, improved quality and quantity, and ensured the definite success of proposed business values. A newly developed concept about the emergence of technology merges artificial intelligence with the robotic automation process. Working dynamics of the banking sector are improved and ensure customer satisfaction towards the services. Hence, it has shown that the banking sector improves wealth advisory, fraud mitigation, loan processing, right from customer experience, and digital transformation initiatives with Robotic process automation.

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2. Applications of ICT in Agriculture

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Abstract:

The use of information and communication technology (ICT) in agriculture is becoming more essential. E-agricultural is a new field that focuses on improving agricultural and rural development through improved information and communication systems. E-agricultural, in particular, entails the conceptualization, design, development, assessment, and deployment of novel ways to employ information and communication technologies (ICT) in the rural domain, with a primary focus on agriculture. The phrase "e-agriculture" is relatively new. E-agriculture is one of the action lines highlighted in the World Summit on the Information Society's statement and plan of action. The United Nations Food and Agriculture Organisation (FAO) has been tasked with organising activities connected to the action line C.7 ICT Applications on E-Agriculture. Crop Cultivation, Water Management, Fertiliser Application, Fertigation, Pest Management, Harvesting, Post Harvest Handling, Transporting of Food/Food Products, Packaging, Food Preservation, Food Processing/Value Addition, Food Quality Management, Food Safety, Food Storage, Food Marketing are the major phases of the agriculture industry. To handle these phases properly, all players in the agriculture industry require information and expertise about them. Any system used to obtain information and knowledge for decision making in any industry should provide accurate, complete, and concise information on time or on time. This paper will explore ICT Applications in Agriculture.

Keywords:

Information, Communication, Technology, E-Agriculture, Design, Development, Primary Agriculture, Water Management, Fertilizer Application, Fertigation, Pest Management, Harvesting, Transporting Food, Food Products, Packaging, Food Preservation.

2.1 Introduction:

ICT in agriculture is a new field that focuses on improving agricultural and rural development. It entails the employment of innovative ICT applications in the rural domain. ICT advancements can be used to provide farmers with accurate, timely, and relevant information and services, facilitating an environment for more profitable agriculture. However, all ICT projects are not uniform, with inequalities in the degree and quality of telecommunications, information, and the effort of individuals, public and commercial organisations, and the diversified nature of farmer demand in different places. [1]

As a result, there have been numerous successes, failures, lessons learned, and years of experience gained. While these initiatives are intended to address farmers' needs through ICT, their actual usage and ability to have a significant impact on farm productivity and socioeconomic development of the intended beneficiaries actually use the facilities provided for them to meet their needs. [2]

Common obstacles in rural ICT adoption include ICT illiteracy, the availability of relevant and localised information in their own languages, easy and affordable accessibility, and other issues such as rural peoples' understanding and willingness to use new technology, among others. As shown in various ICT-driven efforts, one essential feature in the use of ICTs for farmers and their groups is the engagement of the human interface at the last mile, demonstrating that there is human dependency in the transfer of Information Knowledge to farmers.

As a result, there is a need to evaluate how far ICT projects can fulfil farmers' demands so that better solutions can be developed to address those unmet needs. The proposed research will look at important ICT initiatives in agriculture from the past and current. [3]

Information and communication technology in agriculture (ICT in agriculture), often known as e-agriculture, aims to boost agricultural and rural development by enhancing information and communication operations. E-agricultural, in particular, entails the conceptualization, design, development, assessment, and deployment of novel ways to employ information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture. ICT devices, networks, mobiles, services, and applications [4] span from cutting-edge Internet-era technologies and sensors to pre-existing aids such as landline telephones, televisions, radios, and satellites. E-agriculture includes the provision of standards, norms, techniques, and instruments, as well as the development of individual and institutional capacities and policy support. [5]

Many ICT in agriculture or e-agriculture solutions have been created and tried around the world to assist agriculturists in improving their livelihoods by increasing agricultural output and revenue or lowering risks. [6] Some useful resources for learning about e-agriculture in practise include the World Bank's e-sourcebook ICT in agriculture - connecting smallholder farmers to knowledge, networks, and institutions (2011), ICT uses for inclusive value chains (2013), and Success stories on information and communication technologies for agriculture and rural development, which has documented many cases of ICT use in agriculture. [7]

Regardless of the animal, automatic cleaning systems are the most extensively used technology in animal husbandry. These devices aid in the removal of waste and runoff from animal enclosures such as pens and stalls and transporting it to a mound that can subsequently be moved by machines. The benefits of this technology are self-evident. Dairy farming has evolved tremendously in the last few decades. Farmers no longer spend hours milking each cow by hand. Dairy farmers have enhanced the daily quality of life for their herds as a result of technical improvements. Cows are milked using a suction technique in dairy production. Vacuums in a parlour are contained within separate milk machines. [8]

With this method, multiple cows can be milked at the same time. On dairy farms, automatic milking systems, commonly known as "robots," are becoming increasingly popular. To maintain their herds healthy and produce milk, most dairy farms rely on cutting-edge technology. Farmers may now control their productivity and animal health using computers and mobile apps. GPS for navigation and location finding, mobile phones for trade, information exchange, and emergencies, Satellite Remote Sensing (RS) for fishing forecasts and cultural site selection, and radio for communication, particularly in the fishing industry, are all examples of how ICT is widely used. [9]

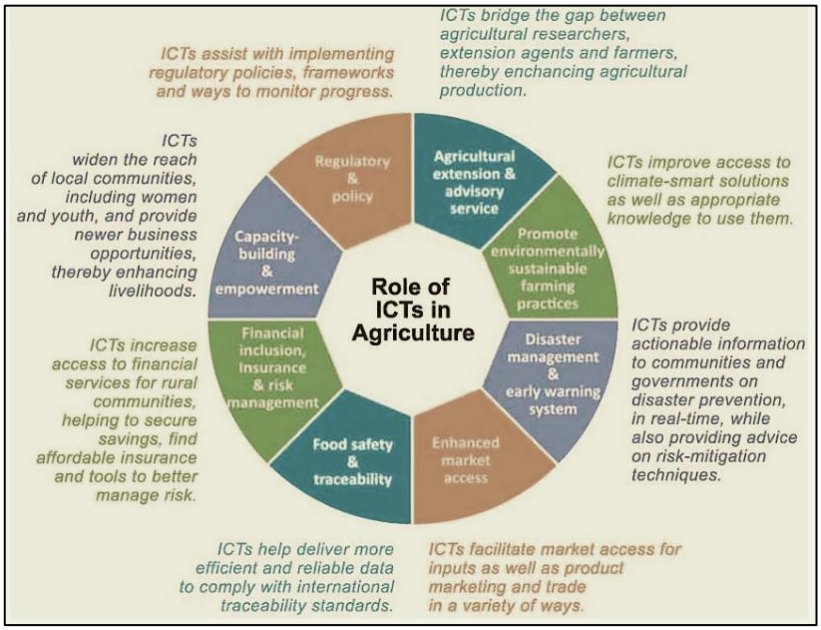

Figure 2.1: Role of ICT in Agriculture [10]

Farmers and the food industry as a whole can benefit greatly from ICT. ICT is especially important for crop and environmental monitoring, supporting sustainable development, and enhancing supply chain logistics. Chemical fertilisers, insecticides, herbicides, advanced farming machinery, and artificial selection have all increased food output. Satellites are used to monitor agricultural progress, identify crop diseases, and assess the need for extra fertiliser. So, these are the ICT uses in agriculture in today's dynamic world. [11]

2.2 Role of ICT in Agriculture: Harnessing Modern Technology for Farming:

Information and communication technologies (ICT) have swiftly altered numerous industries around the world, including agriculture. ICT in agriculture is becoming a significant field, employing modern technologies to streamline farming practises, cut expenses, and optimise productivity. The breadth of ICT applications is enormous and ever-evolving, ranging from sensor-based systems to mobile apps.

2.2.1 Mobilizing Agriculture With ICT:

When considering ICT in agriculture, mobile technology is another key role. Mobile applications enable real-time access to vital information such as weather predictions, market pricing, and expert advice. These applications also promote knowledge-sharing and collaborative problem-solving within the farming community.

Figure 2.2: Mobilizing Agriculture With ICT

2.2.2 The Power of IOT in Agriculture:

The Internet of Things (IoT) elevates agricultural ICT to a whole new level. The Internet of Things entails the usage of sensor-based systems and smart gadgets that connect and interact with one another. These systems collect and analyse information on weather, soil quality, crop health, and livestock behaviour. IoT has a wide range of applications, including automating irrigation systems, optimising fertiliser use, and forecasting possible pest or disease outbreaks. IoT devices can monitor animal health and behaviour in livestock production, offering early warning indications of disease or discomfort.

2.2.3 ICT And Big Data in Agriculture:

Big Data has found its way into the agriculture industry, thanks to the constant influx of data from many sources. The combination of ICT and Big Data delivers intelligent analyses and projections that can improve agricultural decision-making processes. Agriculture ICT applications can handle, interpret, and derive insights from massive data sets, enabling for better production prediction, cost efficiency, and risk management. [12]

2.2.4 Role of ICT in E –Agriculture:

Communication and Information Technology refers to any communication device or application, such as television, radio, mobile and computer, network hardware, fixed phones, satellite systems, and software, that is required for the delivery of information

from Point P to Point Q in the form of data, image, audio, video, and so on. ICT refers to all technology techniques of handling information and facilitating communication. The dissemination of information to farmers has grown more integrated with ICTs. [13]

Many corporate, cooperative, government, and public organisations have also worked to assist technology transfer in the agriculture industry. A novel notion of agricultural informatics that has resulted from the rapid development of information and communication technology, as well as the internet. Rural telecentres give agricultural, educational, and healing tissue information, as well as computer skills and basic literacy to rural citizens. The role of information and communication technologies in promoting communication and access to information for rural development and agriculture is critical. [14]

ATV shows and radio broadcasts also provided agricultural information. Because of its popularity and widespread use, information and communication technologies are having a significant impact on the rural economy. It may appear odd that modern technology, which is associated with developed-country markets and capital-intensive techniques of production, has any relevance for a country like India, where many millions of people lack basic necessities. Nonetheless, many attempts are being made in India and other developing nations to demonstrate the actual benefits of ICT for rural populations and to do so in a cost-effective manner. Following are some examples of ICT applications. [15]

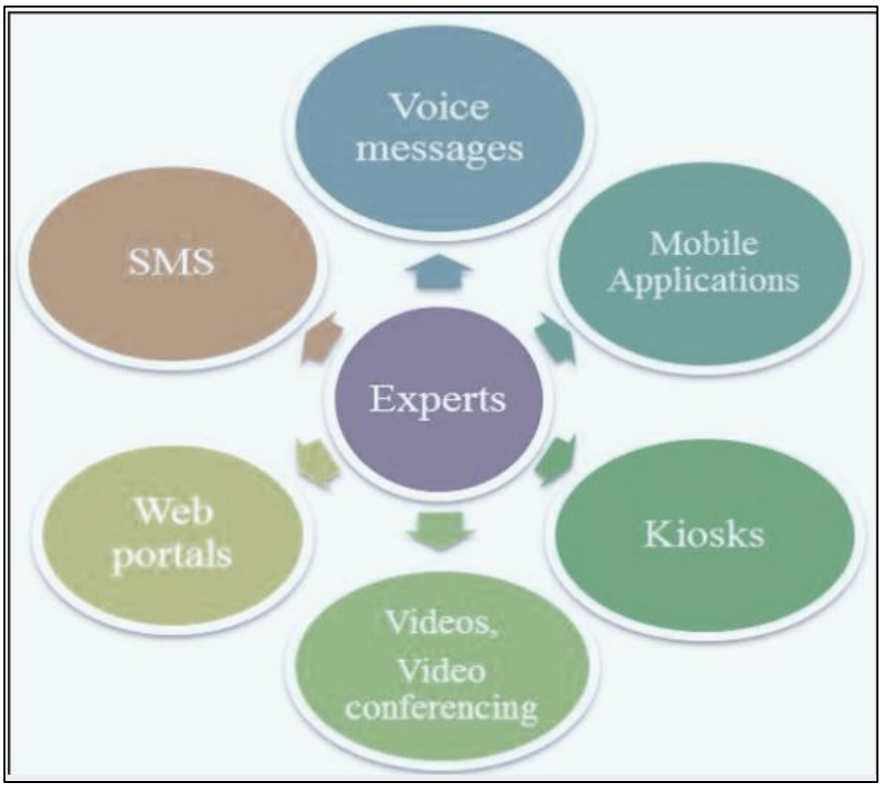

Figure 2.3: Some Application of ICT [16]

2.3 Advantages of ICT in E-Agriculture:

Advantages of ICT in E-agriculture are following.

a. Increased farmer productivity and profitability with ICT and E-Agricultural facilities.
b. Effective resource utilisation and management
c. The farmer receives timely rain and other crucial information.
d. By utilising tools such as GIS, it can help policy and decision-making information and evaluation on optimal farm production, agri-environmental resource management, and so on.
e. It can also generate new agricultural and rural businesses such as rural tourism, real estate for satellite offices, e-commerce, and virtual corporations of small-scale farmers.
f. It can give a more pleasant and secure rural life with amenities comparable to those available in urban areas, such as telemedicine, distance education, remote public services, remote entertainment, and so on.
g. Creation of Decision Support, Knowledge Management, and Advisory Systems to improve Extension services and to be used in the Farmers Redressed System.
h. It may improve farm management and agricultural technologies through efficient farm management, risk management, knowledge transfer, and effective information dissemination, among other things, resulting in competitive and sustainable farming with safe goods. In this assistance, farmers must make key decisions such as what to plant, when to sow, and how to manage blighter while taking into account off-farm considerations such as market access, environmental implications, and industry norms. A decision support system based on information technology can undoubtedly aid their decisions.
i. It can provide processes and instruments to ensure food reliability and traceability, which has emerged as a worry with agricultural products since major contamination such as chicken flu was discovered. [17]

2.4 Future Outlook in ICT for Agricultural:

The importance of ICT and its application in agriculture for the long-term development of agriculture and the national economy cannot be overstated. The concerns listed below are critical for ICT management in sustainable agriculture.

a. Agriculture information system
b. Marketing data management system
c. Information management system for research
d. Information system for water and irrigation management
e. System for anticipating production
f. Scenarios of climate change
g. Inventory management methods
h. Database of agricultural technology
i. Price Information System for Agricultural Products
j. Access to an up-to-date bio-physical database
k. Crop zoning diagram [18]

Table 2.1: Use of Information and Communication Technology in Agriculture [19]

Type of ICT	Type of Farmers	
	No. of Small Scale Farmers	No. of Medium Scale Farmers
Newspaper	30	32
Periodical/Agriculture magazines	3	5
TV (Agriculture Programme)	15	10
Radio (Agriculture Programme)	5	2
Availability of Mobile phones	40	45
With internet	5	5
Without internet	15	20
Availability of Computer	5	10
With internet	2	5
Without internet	3	2
Information through mobile phone call	2	5
SAU website	0	0

A. ICT for Agriculture:

Information and communication technologies (ICTs) have grown increasingly significant in all parts of our everyday lives and work around the world. The World Bank argues in its newest report "Digital Dividends" that "digital technologies—the internet, mobile phones, and all the other tools for collecting, storing, analysing, and sharing information digitally—have spread rapidly." [20] In underdeveloped countries, more families own a mobile phone than have access to power or clean water, and about 70% of the bottom fifth of the population owns a cell phone. "In a decade, the number of internet users has more than tripled, from 1 billion in 2005 to an estimated 3.2 billion by the end of 2015." [21]

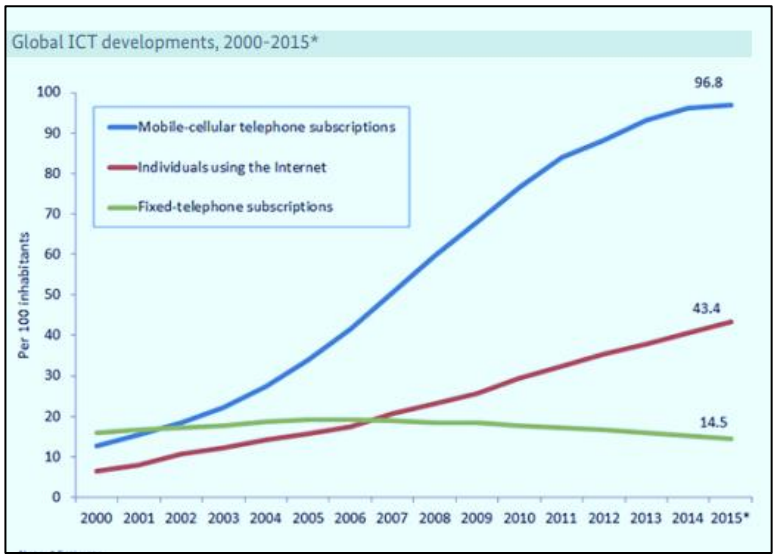

Figure 2.4: Global ICzT Developments

Impact of Some ICT-Based Initiatives:

Because the initial investment in ICT for agricultural development is costly, one of the crucial problems to consider is the potential influence ICT can have on farmers and farming. It is impossible to isolate the sole influence of ICT, but any impact evaluation would basically suggest the potentialities of ICT in employing information transmission and the following benefit of augmenting farmers' revenue by saving time and money. [22]

Yield Gain and Reduction in Cost of Cultivation:

Figure 20.1 shows that both the I kisan and Helpline programmes increased farmers' access to knowledge, allowing them to adopt improved varieties and need-based pest and nutrient management practises, as well as reducing the frequency with which agrochemicals were applied. As a result, crop yield increased by 4-5 percent. [23]

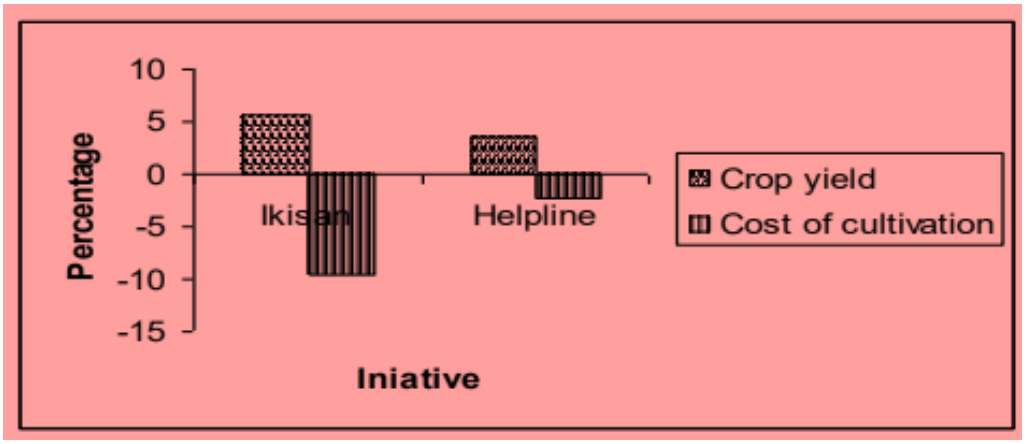

Figure 2.5: Impact of ICT on crop yield and cost of cultivation

Furthermore, the cost of cultivation was reduced by 14% and 3% in the case of the I kisan and Helpline programmes, respectively. I kisan's ICT-enabled farm management advising, i.e., visits by agricultural experts to fields and technical recommendations to farmers based on soil testing, increased farmers' knowledge utilisation level. [24]

2.5 Conclusion:

Hundreds of grassroots ICT projects have been implemented in India over the last decade and a half. Agriculture is invariably included as an essential component of the project service menu. However, we have yet to see significant increases in agricultural production as a result of ICT implementation. Because most initiatives are executed in smaller geographical areas and involve only a few hundred farmers, generalisations may be inappropriate. Much-touted ICT programmes have yet to provide results in agricultural information distribution. Despite the fact that ICTs have the potential to make a difference and accelerate information access for some farmers, most ICT projects have been implemented as pilot projects, and institutionalisation of ICTs needs to be prioritised.

ICTs for agricultural extension programmes must be objectively assessed and evaluated. Mobile phones, for example, are low-cost ICT instruments that hold a lot of promise for agricultural extension. Simultaneously, experience suggests that ICT will play a larger role in private sector agribusiness, market information, and market intelligence. Furthermore, certain types of farm information (e.g., informing government schemes) and online monitoring of governmental programme progress have proven to be successful. As a result, it is critical to identify acceptable information to disseminate via ICTs.

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3. ICT and Governance in India

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Abstract:

The revolution in the Information and Communication technology has brought a new agenda for governance in India. The advent of budget smart phones and availability of data packages in cheapest price has given a greater scope for the citizens as well as government machineries to utilize the benefits of e-Governance. With the introduction of Digital India scheme, India is witnessing a transformational digital revolution with the promises to reshape the social, economic, cultural and political landscape of the country. It promises to transform India into a digitally empowered society by focusing on digital inclusion, digital literacy, and easily accessible digital services.

However, the e-governance could not reach to all the sections of people especially in rural India. In rural India there are certain infrastructural as well as cultural barriers to achieve the goals of e-Governance.

Therefore, the government needs to address those issues and also it should make the service transfer machineries user friendly among those people. For the success of e-governance through ICT, the government needs to create a work culture of maintaining, processing and retrieving the information through an electronic system and use that information for decision making. In this paper we will discuss ICT and Governance in India.

Keywords:

Information, Communication, Technology, Citizens, Government, Digital India Scheme, Country, Digital Inclusion, Digital Literacy, People, Rural, E-Governance, Decision Making, Economic.

3.1 Introduction:

ICT in Governance:

Information and Communications Technology is a key aspect when it comes to e-governance. It has the potential to make life easy (or difficult) for the common populace if adapted in the right manner. For now, this article will focus on the limitations and the benefits of ICT in Governance.

3.2 Overview of ICT in Governance:

Information and Communications Technologies play a key role in e-governance. Through a careful analysis of data, political, socio-economic decisions can be taken up by the government. A successful implementation of ICT will be a one-stop solution for most if not all of India's governance woes.

In India, e-Governance applications in the recent past have demonstrated their positive impact in minimizing the processing costs, increasing transparency and supporting economic development by income generating ventures, increase in agricultural production, and improvements in health and education sectors, all of which promote the overall quality of life of the Indian people.

The benefits of ICT in Governance are as follows:

- Better transparency as it allows the public to be informed on government decision and policies
- Efficiency of the current system as it would have the same money and time. Better facilitation of communications between governments and businesses will be possible.
- The society is moving towards the mobile connections and the ability of an e-government service to be accessible to citizens irrespective of location throughout the country brings the next and potentially biggest benefit of an e-government service as we live in what is now termed as the Knowledge era. [1]

E-Governance:

The term e-governance focuses on the use of new ICT by governments as applied to the full range of government functions. Thus e-governance is the application of information and communication technology for delivering government services, exchange of information, communication, transaction, integration, various stands alone systems and services between government and citizens, government and business as well as back-office process and interaction within the entire government frame work.

ICT acts in speeding up the flow of information and knowledge between government and citizen and transforming the way in which government and citizen interact.

Types of Government Interaction in e-governance.

G2G: Government to Government

G2C: Government to Citizen

G2B: Government to Business

G2E: Government to Employee [2]

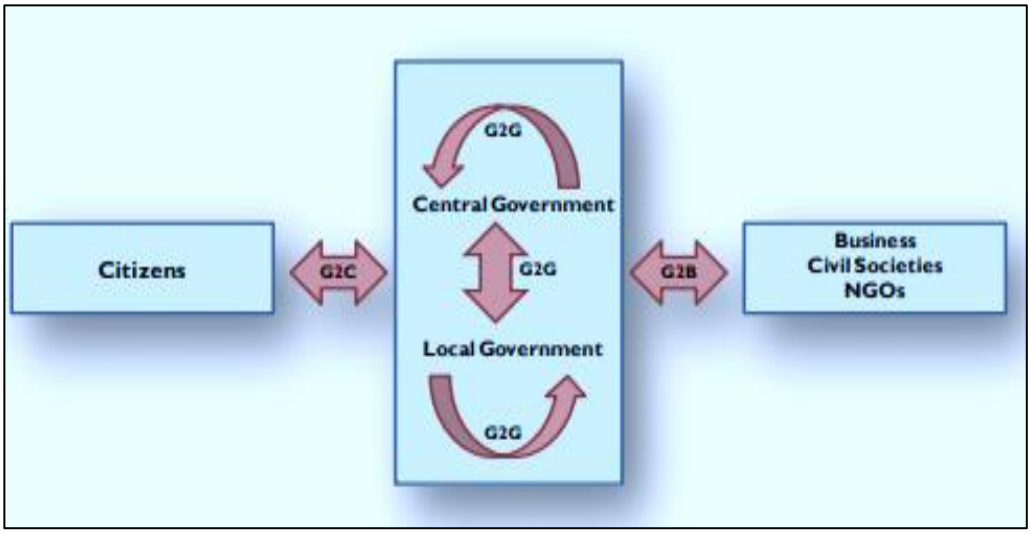

Figure 3.1: Government Interaction in e-governance

Benefits/ Outcomes of E-Governance

- Enhanced Transparency and Accountability.
- Expanded reach of Governance.
- Improved Public Administration.
- Enables Environment for Promoting Economic development.
- Improved service delivery in the form of better access to information and quality services to citizens.

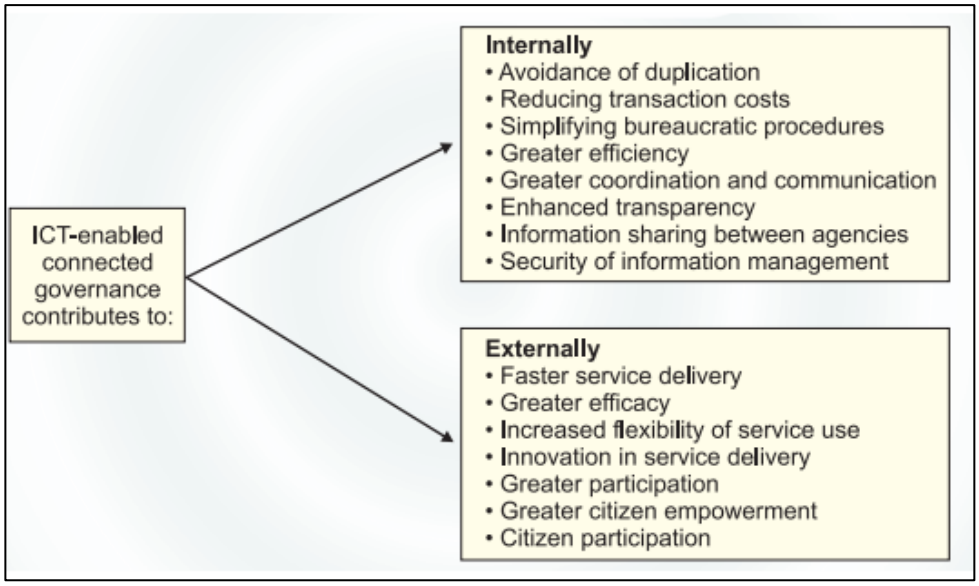

Figure 3.2: Benefits/ Outcomes of E-Governance [3]

3.3 Principles of ICT and Governance:

ISO/IEC 38500 launches six propositions for good corporate ICT and governance. These propositions talk about the behavior which is preferred for the guidance of the decision-making process.

The first principle is accountability. Individuals and groups within the organization are aware of and accept their roles in terms of both ICT supply and demand. Those who are in charge of actions also have the authority to carry them out. This is an important principle of ICT and governance.

The second principle is strategy. The existing and future capabilities of ICT are addressed in the organization's business strategy, and the strategic ICT plans ensure that the current and ongoing needs of the organization's business strategy are met. This is a crucial principle of ICT and governance.

The third principle is acquisition. ICT acquisitions are made for a variety of reasons, based on suitable and continuing analysis and decision-making that is clear and transparent. In both the short and long term, a proper balance has been incorporated between rewards, opportunities, expenses, and dangers. This is a principle of ICT and governance that holds a lot of importance.

The fourth principle is performance. ICT is appropriate for supporting the organization, offering the services, levels of service, and service quality required to satisfy current and future business requirements. This is an important principle of ICT and governance.

The fifth principle is conformance. ICT operates in line with all applicable laws and regulations. This is a crucial principle of ICT and governance.

The sixth principle is Human Behavior. ICT policies, practices, and decisions foster human behavior respect, taking into account the existing and evolving needs of all "people in the process." [4]

3.4 Information and Communication Technology Initiatives in India:

There were many measures taken to support the growth of ICT in India. In 1970, the Government of India (GOI) has established Department of Electronics and subsequently in 1977, GOI has taken the first major step towards implementation of e-governance by establishment of National Informatics Centre (NIC).

By 1980, most of the government offices were equipped with computers but their role was confined to word processing. [5]

Within the span of time and advent of ICT, the GOI has taken a remarkable step for fostering e-governance by launching the national satellite-based network (NICNET) in 1987 followed by District Information System of the National Informatics Centre (DISNIC). [6]

NICNET was the first government informatics network across the world equipped with advanced database services. India's e-governance transformation initiatives started in the 1990s. Since then, the country has made considerable progress in the information and communication technology sector. To improve ICT performance and productivity, the Government of India approved the National e-Governance Plan (NEGP) on May 18, 2006 which seeks to improve delivery of government services to citizens and private sector with the vision of making all government services accessible to the citizen in his/her locality, through common service delivery outlets and ensure efficiency, transparency and reliability of such services at affordable costs to realise their basic needs'-governance has become the basic requirement of governance at the local, regional, national or international levels. [7]

The National e-governance Plan (NEGP) comprises 27 Mission Mode Projects (MMPs) and 8 components. The MMPs are implemented by various central ministries and state governments. The major core infrastructure components include State Wide Area Networks, Common Service Centers, and Governance Service Delivery Gateway etc. [8]

With the cost of communication and IT infrastructure going downwards and demand going upwards, the e-governance initiatives took shape in the decade of 2000s. Thus, the government sponsored e-governance projects took a big leap to provide the impetus for long-term growth of e-governance within the country. Demands generated from political leadership, capacity building needs, and perceived citizen expectations have contributed to IT innovations. At the state level, many state governments started their initiatives in the same period by taking up projects to serve their people through ICT. [9]

India has played a major role in the context of ICT for development from the early 1980s at various levels. The National Policy on Information Technology formulated in 2012 focuses on application of technology-enabled approaches to overcome developmental challenges in education, health, skill development, financial inclusion etc. The policy outlines strategies to achieve the following aims:

- Creating an ecosystem for a globally competitive IT industry
- Human Resource Development
- Promotion of innovation and Research and Development in IT sector
- Enhancing productivity and competitiveness in key sectors through ICT
- Enabling service delivery through e-governance
- Development of language technologies
- GIS based IT services Information and Communication Technology and Governance 114
- Security of cyber space.

There have been an increasing number of ICT initiatives in India. Projects such as e-seva, FRIENDS, computerisation of land records, Bhoomi project, Lok Mitra and so on are aimed at bringing government services closer to citizens. The E-procurement project introduced in 2003, aims to streamline government activities that impinge upon business organisations. It aims at transparency in government procurement and reduction in tender cycle time. [10]

3.5 E-Governance in India:

India has done a remarkable start in terms of using ICT for improving government business. Several states in India – Andhra Pradesh and Karnataka being the pioneers – have been attempting e-governance solutions to improve information management and governance (see Appendix 3 for brief description of some e-Governance projects). States have set up Information Technology and Communication (IT&C) Departments to guide and coordinate the implementation of e-governance programmes and projects. [11]

These Departments also provide guidance for procurement of hardware and software by government agencies. IT&C Departments have made commendable progress in the development of e-governance applications (e.g., Bhoomi in Karnataka and e-Seva in Andhra Pradesh). The IT&C Department, Government of Andhra Pradesh has taken up exemplary e-governance initiatives like e-Seva, e-Procurement, CARD (Computer-aided Administration of Registration Department), and Fully Automated Services of Transport Department (FAST). [12]

These projects have become role models and have been emulated by other states in the country. The Government of Andhra Pradesh has also recognized the need for e-governance standards to ensure interoperability among e-governance applications. Metadata Standards and Operational Specifications titled "e-Thesaurus for Good Governance" and Data Standard Definitions titled "e-Data Dictionary for Good Governance" have been developed through the Centre for Good Governance (CGG), Hyderabad. In spite of good progress, the power of e-Governance for good governance is yet to be harnessed in India to a significant degree. States differ substantially in terms of their e-readiness and approach to e-Governance due to several factors.

Figure 3.3: Status of e-Governance in India [13]

3.6 National e-Governance Action Plan (NEGAP):

The recently formulated National e-Governance Action Plan of India attempts to address many of the key issues of e-Governance in India with a view to harnessing the power of ICT to improve governance for the common citizen. The structure of NEGP (2003-07) encompasses a set of core policies to provide integration and support, a set of integrated projects or cross-cutting initiatives, a set of Mission Mode Projects at national and state levels.

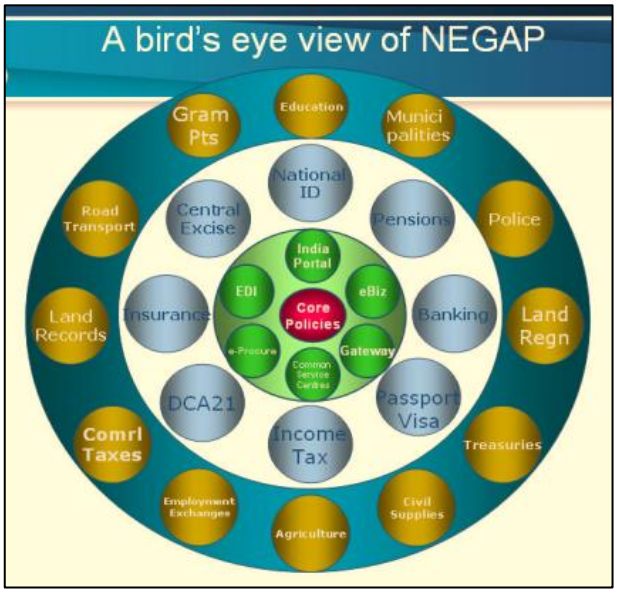

Figure 3.4: A Bird Eye View of NEGAP [14]

Table 3.1: Design of NEGAP:

Central Government Projects	State Government Projects (Sub Programme)	Integrated Projects
• National ID • Central Excise • Income Tax • DCA 21 • Passport/ Visa & Immigration • Pensions	• Land Records • Property Registration • Transport • Agriculture • Municipalities • Gram Panchayats • Commercial Taxes • Treasuries • Police • Employment Exchange	• EDI • e-BIZ • Common Service Centres • India Portal • EG Gateway • e-Procurement • e-Courts
Programme Components		
• Core Policies • Core Infrastructure • Support Infrastructure	• Integrated Services • Technical Assistance • HRD & Training	• Awareness & Assessment • Organization Structures • R & D

The National e-Governance Action Plan demands wide-ranging reforms in governance processes. Simple automation of processes does more harm than benefit. The syndrome of "garbage in – garbage out" will operate if complicated processes are automated without simplification and establishing their usefulness for the people. Thus, process reforms hold the key to successful e-Governance. This is where the NCGG can play a key role. Moreover, NCGG will be the national center of knowledge on governance with significant application of ICT for networking with state and international knowledge centers and governments. It would make effort to document and propagate e-tools for good governance while addressing capacity building and change management issues.

Knowledge is power. Harnessing the power of ICT for e-governance has the power of transforming government and making knowledge-based good governance a reality. While the challenges faced by governments are colossal, the new technologies provide tremendous opportunities for enhancing the power of governments to handle data, take better informed decisions, and provide transparent, cost-effective and accountable solutions and services to citizens and business. Good governance requires process reforms and input-output-outcome-impact tracking. Automation of reformed processes and tracking systems can assist in the delivery of good governance to citizens in developing countries. As good governance is the single-most important factor for socio-economic development and poverty reduction, e-Governance can make a distinct impact on the development scenario, especially for the poor and weaker sections of society, including women. There is an urgent need to address the issues of using new technology for transformation of governance and leapfrogging development. [15]

E-governance is regarded as the ICT-enabled route to achieving good governance since it integrates people, processes, information, and technology in the service of governance initiatives. Information and Communication Technologies (ICTs) play a key role in development & Economic growth of the Developing countries of the World. Political, Cultural, Socio-economic Developmental & Behavioral decisions today rest on the ability to access, gather, analyze and utilize Information and Knowledge. [16] ICT is the conduits that transmit information and knowledge to individual to widen their choices for Economic and social empowerment. People around the Globe from few years from now will be carrying a handheld computer connected to the Web to get the information about the World at their fingertips. Government of India is having an ambitious objective of transforming the citizen-government interaction at all levels to by the electronic mode (e-Governance) by 2020. [17]

Information and communication technology (ICT) does not average the wireless computer connected Internet alone; it also includes radio, telephone, electronic brail writer, and a wide assortment of tools such as operating systems, databases, emails etc. They are not to be used alternatively of other tools, but complement what subsists to reach a goal, be it better e-Learning, amusement, etc. In today's world, the most dominant Information and communication technology (ICT) device. [18]

Information and communication technology (ICT) is very utile for women are who has not literate and it is access the info of all types like computer, Agriculture, cooking etc... Government of India launched the many of projects for literacy in rural areas with the help of ICT. It is very useful for rural women also.

With the help of Information and communication technology government issue the many people educated in rural areas. It is very effectual for citizen in India. [19]

A lot of the substance on the Internet has not been highly-developed to reference the inevitably of female in developing and developed nation's nor is it usable in the linguistic communication they talk.

Technology has also been used for torment of women in the kind of erotica, vender and marauding e-mails. Patch sex raw men have through lots to advance gender just substance intent, full addressing this content can only be through when more women become software engineers, content manufacturer and enterpriser fill the big demand for these resources. There is a growth commercial market, yet importantly underserved in the development global. [20]

Educated women addition opportunities for their family unit. Information Communication and Technologies is a significant tool for e-learning, as well as a series of production about which one inevitably of learning. Facets to the E-Governance are Information Technology enabling the governing - something alike to Backoffice mechanization, Web-enabling the administration so that the peoples will hold a direct accession. Up Governance so that nakedness, accountability, truth, speeds of operations, effectivity and efficiency may be reached. The Government of India have adoptive some Strategies for increasing women Literacy. The primary strategies adoptive are National Literacy Mission for conveyance functional literacy, Universalization for simple Education and Non-Formal pedagogy. [21]

3.7 Conclusion:

Corporate governance of ICT is defined by ISO/IEC 38500 as "the framework that directs and governs existing and future ICT usage." This includes assessing and directing how ICT is used to help the organization, as well as monitoring how it is used to carry out plans. Therefore, the corporate governance of ICT is important to form good governance. The main purpose of the present research is to explore the possible effectiveness of information and communication technology (ICT), infrastructure development, exchange rate and governance on inbound tourism demand using time series data in India.

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4. Recent Advancement and Future Perspective of 6G Communication

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Abstract:

A number of intelligent applications are being integrated with the advent of 5G wireless communications technology. However, the 5G specs strongly fall short of the demands of new, developing technologies. Data rate, capacity, latency, resource sharing, and energy per bit are a few of these. Research is concentrating on 6G wireless communications, which is allowing many technologies and creating new applications, to satisfy these demanding requirements. The integration of terrestrial, aerial, and marine communications into the sixth- generation (6G) wireless communication network is anticipated to result in a strong network that is more dependable, quick, and capable of supporting a sizable number of devices with ultra-low latency needs. Researchers from all across the world are putting forth cutting-edge technologies including blockchain, terahertz and millimetre wave communication, tactile internet, non-orthogonal multiple access (NOMA), tiny cell communication, fog/edge computing, and artificial intelligence/machine learning. As the foundational technology for the development of communications beyond 5G and 6G. We give a thorough analysis of the 6G network dimensions with air interface and related prospective technologies in this post. More precisely, we emphasize the various characteristics and use cases of the planned 6G networks. We also go through the B5G/6G network's key performance indicators (KPI), difficulties, and potential future research areas.

Keywords:

6G, Machine learning, Artificial intelligence, Quantum communication, Blockchain, IoT, Cloud.

4.1 Introduction:

A new communication system has been launched almost every 10 years, enhancing QoS and adding new features and technology. Although 5G has not yet been formally released, 6G communication system is the focus of current research. The rationale is that 5G offers a high- standard infrastructure that makes a range of technologies possible, including self-driving cars, artificial intelligence, mobile broadband communication, the Internet of Things, and smart cities. The use of smart gadgets, however, is expanding year over year and will continue to dramatically rise as time goes on, placing limitations on the 5G communication network.

The focus of research on 6G mobile cellular systems has started now that the launch of 5G systems is well underway. It is anticipated that a 6G system will be standardized, with deployments beginning around 2030, continuing the history of a new generation of cellular system every ten years or so. It is time to start looking into novel technology components for 6G as it frequently takes more than 10 years for a unique technology to become commercially viable.

The goal of this work is to develop a vision of future communications that will serve as guide for future research. We make an effort to present a comprehensive picture of communication requirements and technology in the 6G era. Some of these needs could already be able to be satisfied by integrating new technologies into the 5G framework. In general, we anticipate that any changes that can be made to the 5G framework in a backward-compatible manner and at a fair cost to satisfy new performance needs will be implemented as part of the 5G evolution.

On the other hand, the next generation will include changes that represent a fundamental shift and are incompatible with the current 5G architecture or can only be implemented at a significant cost to the network or devices. In addition to providing customers with improved mobile broadband, it is anticipated that 5G would allow Industry 4.0 by digitalizing and connecting all objects, large and small the fundamental framework of the future digital world will be made up of digital twins of diverse items that were formed in edge clouds. Future digital services will be built on an essential foundation that will include digital twin worlds of both biological and physical things.

It will take a tremendous amount of capacity with low latency to realize a full digital world that is an accurate and complete depiction of the physical world at every spatial and temporal instant. The emergence of new virtual worlds with digital representations of made-up items that may be integrated in various ways with the digital twin world to create a mixed-reality, super-physical world will also be made possible by the advent of digitalization. With the development of wearable devices like smart watches and heart rate monitors as well as ingestible, implantable, body arm or skeleton, and brain activity detectors, human biology will be precisely mapped every moment and integrated into the digital and virtual worlds, opening the door to new superhuman abilities. User interfaces for augmented reality will make it possible for humans to effectively and intuitively govern all of these worlds, whether they be physical, virtual, or biological. Along with the new communication requirements, the following key new themes emerge when considering such a future: (i) end devices evolving from single entities to a collection of numerous local entities working together to create the new man-machine interface; (ii) ubiquitous universal computing distributed among numerous local devices and the cloud; (iii) knowledge systems that store, process, and transform data into actionable knowledge; and (iv) precision sensing. Several publications have recently expressed their opinions on 6G. We use a special and broader viewpoint, concentrating not only on the technological developments but also the expected human transformation in the 6G era, which aids in giving an understanding of the performance specifications and design concepts for 6G. Our perspective on the changes in technology begins with the current state of 5G networks, moves to how they are changing, and then considers what may drastically change after that. We also discuss potential changes to the type of standards required in an era of open platforms.

4.2 Related Work:

Deep learning for network anomaly, fault diagnosis, intrusion detection and prevention, network configuration, and optimization has been investigated, Muhammad Waseem Akhtar et al. [1].

6G has the option to send data with the highest level of security. The aforementioned security issues will be made worse by the addition of the Internet of Everything to 6G and the provision of additional management, including smart homes, emergency clinics, transportation, smart grids, etc, SamarElmeadawy et al. [2]. We can easily make our drones smarter by utilizing artificial intelligence and 6G connection. Smart robots will be able to share their knowledge and provide faster online data transfer since they will be equipped with drone-to-drone and drone-to-infrastructures for communication, SamarElmeadawy et al. [3].

Following the 6G vision and service specifications, some use case concepts for the 6G, including autonomous vehicles, smart cities, flying networks, holographic, telemedicine, and tactile internet, are described, Ashish Kr. Gupta et al. [4]. The possibility for autonomous 6G wireless systems is offered by AI technology. Intelligent agents are capable of actively and automatically identifying and fixing network problems. AI-based network management helps maintain network health by monitoring network status in real-time. Additionally, AI approaches can give edge devices and edge computers intelligence, enabling them to have the ability to understand how to resolve security issues on their own. Also anticipated with 6G are autonomous applications like autonomous robots and autonomous aerial vehicles, Zhengquan Zhang et al. [5]. Some technologies, such as index modulation, artificial intelligence, intelligent surfaces, simultaneous wireless information, power transmission, etc., are highlighted in existing studies as potentially crucial for 6G. Our paper discusses the benefits and drawbacks of these technologies and provides recommendations for further research on 6G applications, Amin Shahrak et al. [6].

Few recent research on 6G offer an overview; instead, they concentrate more on speculating on potential future technologies. Our study examines virtually every 6G vision currently in existence and offers a comprehensive overview, covering both physical and network layer technologies. Furthermore, we give a complete understanding of the current technologies that might be used in 6G based on how well they satisfy the requirements of a potential 6G network, giving a thorough awareness of each technology's specific advantages. Additionally, 6G wireless communications connect the communication systems from the sky to the deep sea using the space-air-ground-sea integrated network (SAGSIN) in order to achieve the goal of global coverage, Ashish Kr. Gupta et al. [7].

Additionally, because blockchains are immutable, unaltered decentralized databases, they are utilized to manage and share the spectrum resources, which may do away with the need for a central authority, Guangbin Xu (CIC Senior Member) et al. [8]. Various candidate technologies have been proposed to overcome the bottleneck of existing wireless communication systems to meet 6G’s requirements. For example, artificial intelligence (AI) is expected to enable a significant paradigm shift in 6G wireless networks, including machine learning, deep learning, etc, Hutesh Baviskar et al. [9].

4.3 Application:

Every communication system opens the door to new features and applications. 5G was the first generation to introduce AI, automation and smart cities. However, these technologies were partially integrated. 6G is introducing more technologies and applications providing higher data rates, high reliability, low latency and secure efficient transmission. Figure 4.1 shows the main applications, trends and technologies introduced in 6G. In this section, some of these technologies and applications 6G are discussed.

Figure 4.1: The main applications, trends and technologies introduced in 6G

4.3.1 Tera Hertz Communication:

The RF band is almost full and it is not able to support the increasingly growing demand in wireless communications technology. The THz band, ranging from 0.1 THz to 10 THz, will play a crucial role in 6G supplying more bandwidth, more capacity, ultra-high data rates and secure transmission. The THz band will support the development of minuscule cells in nanometre to micrometre dimensions supplying very high-speed communications within a coverage area of up to 10 m and supporting the Internet of Nano-things. Technologies using frequency bands below 0.1 THz cannot support Tbps links, therefore, 6G will be the first wireless communication system supporting Tbps for highspeed communication [4].

4.3.2 Cell-Free Communication:

Unmanned Aerial Vehicles (UAV) were proposed to be used in other generations in places where there is no infrastructure. However, this technology will be fully used in 6G allowing cell-free communication. When the user equipment (UE) moves from one cell coverage to another, the user ‘s call should be transferred to the other cell.

This handover might be unsuccessful and, in some occurrences, the user ‘s call is terminated and the QoS will be reduced in the system. 6G will end the problem of cell coverage as the UE will be connected to the whole network, not a specific cell. Using UAV will allow integrating different technologies allowing the UE to utilize the technology having the best coverage without any manual configurations on the device [6].

4.3.3 Artificial Intelligence:

Artificial Intelligence (AI) was not involved in 4G or any previous generations. It is partially supported by 5G making difference in the telecommunications world opening the doors for emerging remarkable applications such as. However, AI will be fully supported in 6G for automation. It will be involved in the handover, network selection and resources allocation improving the performance, especially in delay-sensitive applications. AI and machine learning are the most important technologies in 6G [2].

4.3.4 Holographic Beamforming (HBF):

Beamforming is using a directed narrow beam with a high gain for transmitting and receiving using antenna arrays by focusing the power in a minimized angular range. It offers better coverage and throughput, higher (SINR) and it could be used to track users. Holographic beamforming is an advanced beamforming approach utilizing (SDA). Holographic refers to using a hologram to achieve beam steering by the antenna, where the antenna is like a holographic plate in an optical hologram. SDAs are cheaper, smaller in size, lighter and require less power compared to the traditional phased arrays or MIMO systems. As C-Swap are considered as the main challenges in any communication system designs, using SDAs in HBF will allow flexible and efficient transmitting and receiving in 6G [8].

4.3.5 Extended Reality:

Extended reality (XR) is a new umbrella term including Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR). VR is a computer-simulated reality experience using a headset that generates sounds and images creating an imaginary world. AR uses the real world and adds to it using a specific device such as the mobile phone.

Audios, videos, Global Positioning System (GPS) could be used to create an interactive environment. Pokémon is a well-known example ´ of AR. MR merges between the real and the virtual worlds creating a complex environment. XR is all the real and virtual environment combined. 6G will be very useful for this feature due to the strong connectivity, high data rate, high resolution and low latency [4].

4.3.6 Blockchain Technology:

The data in the blockchain technology are represented as distributed blocks connected to each other and cryptographically secured. Blockchain will be used in managing and organizing big data and in managing huge connectivity in 6G.

It will be used also in spectrum sharing allowing the users to share the same spectrum solving the problem of huge spectrum requirements in 6G and guaranteeing secure, low cost, smart and efficient spectrum utilization. Integrating the blockchain with AI and using Deep reinforcement learning will improve the QoS allowing smart-resources sharing, implementing an advanced caching scheme and making the network more flexible [1].

4.3.7 Automation:

Currently, researchers focus on automation, robotics and autonomous systems. 6G will support these technologies providing direct communication between them and the server and direct communication between them, i.e.: robot to robot communication and robot to the server communication. Full automation will be provided by 6G including automatic control processes, automatic systems and automatic devices. 6G will support the existence of Unmanned Aerial Vehicles (UAV) which will be used in wireless communications providing high data rates instead of the traditional base stations (BS) [2].

4.3.8 Wireless Power Transfer:

Wireless energy transfer will be involved in 6G, providing suitable power to the batteries in devices such as; smartphones and sensors. The base stations in 6G will be used for transferring power as Wireless Information and Energy Transfer (WIET) uses the same fields and waves used in communication systems. WIET is an innovative technology that will allow the development of battery fewer smart devices, charging wireless networks and saving the battery life-time of other devices [2].

4.3.9 Wireless Brain-Computer Interface:

Recently wearable devices are increasingly used, some of them are brain-computer interface (BCI) applications. BCI applications involve smart wearable headsets, smart embedded devices and smart body implants.

Using BCI technologies, the brain will easily communicate with external discrete devices which will be responsible for analysing brain signals and translating them. BCI also will involve affective computing technologies, in which devices will function differently depending on the user's mood.

BCI applications were limited because they require more spectrum resources, high bit rate, very low latency and high reliability. However, 6G will support more applications such as the five-sense information transfer, in which 6G will transfer the data generated by the five senses of the human allowing the interaction with the environment [5].

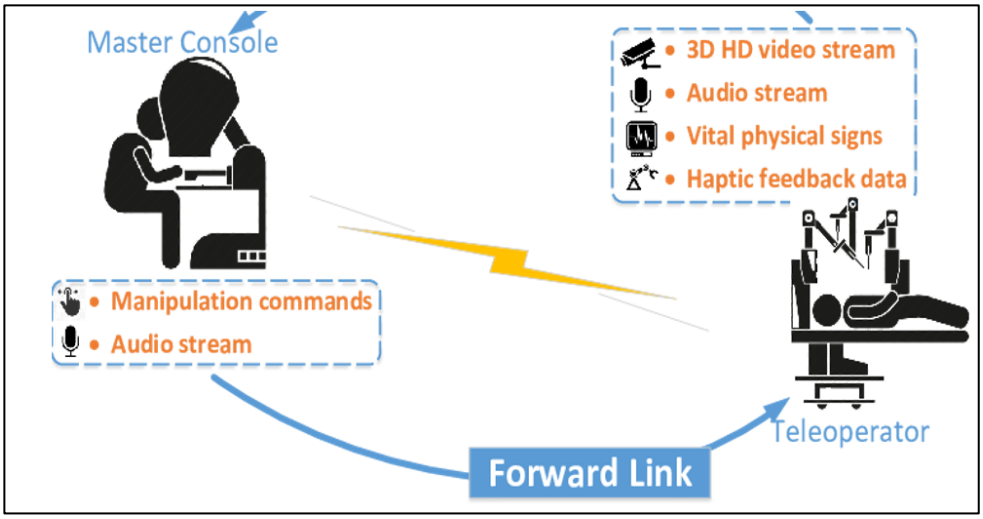

Figure 4.2: A loop explaining the communication between the master console and tele-operator

4.3.10 Healthcare:

The lack of electronic healthcare in other wireless communication technology was because of low data rate and time delay. 6G will provide secure communication, high performance, ultra- low latency, high data rate and high reliability enabling the full existence of remote surgeries as in Figure 4.2 through XR, robotics, automation and AI. Also, the small wavelength due to the THz band supports the communication and the development of nano sensors allowing developing new nanosized devices to operate inside the human body [4].

4.4 Requirements:

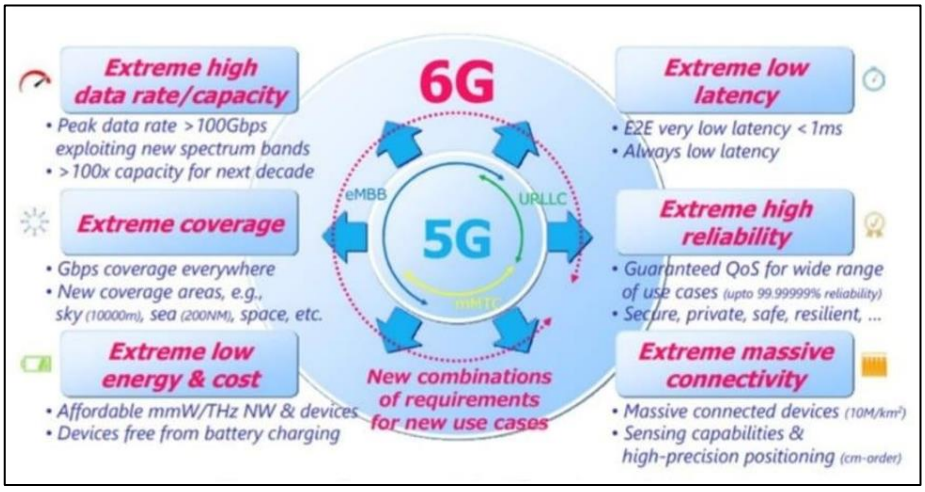

Figure 4.3: The primary requirements of 6G networks

6G System Architecture:

6G mobile networks target ubiquitous intelligence, computing power, and high-speed wireless connectivity throughout air, space, and sea. The vision to achieve this objective is integrating underwater communications and satellite communication networks to provide network coverage throughout the globe [5,13].

There is a need for a super speedy service in 6G mobile networks with data speed close to about 1000 Mbps [11,14]. Some of the requirements of 6G can be listed as – holographic communication, ultra-high broadband, multi-sense transmission, ultra-high throughput, reliability, low latency, etc. [5,15]. Figure 4.3 shows the primary requirements of 6G networks [16].

Probable solutions can be using smaller cell sizes and higher frequency bands. However, smaller sizes of cells will lead to more power consumption and high operational costs, and high frequency bands can suffer path loss. Therefore, we have to put a limit to decrease the size of cells and increase the frequency bands. Fully-decoupled radio access network (FD-RAN) architecture has been proposed, where the network functionalities are fully decoupled and will be deployed by every independent network entity. Implementation of multi-point coordination and centralized resource management can obtain an elastic resource cooperation in a fully decoupled RAN. The control base station of FD-RAN co-ordinates with decoupled uplink and decoupled downlink in a centralized way, which has a similar architecture as cloud-RAN [14].

6G will use a very wide variety of computing, networking, communications, and many sensing technologies to offer smart applications. The key enablers are AI, edge-intelligence, blockchain, homomorphic encryption, network slicing, and integrated network for space, sea, and ground. Fig3: shows the requirement of 6G wireless connection.

4.5 Technologies & Recent Advancement:

4.5.1 Evolution of Earlier Mobile Networks:

A. Evolution from 1G to 4G:

In the 1980s, the 1G network was initially intended simply to provide voice communications. It does not adhere to a specified wireless standard and instead transports data using analog modulation methods. There are a number of problems facing this generation, including handover, security, and transmission. Digital modulation techniques, such as TDMA, are utilized in the second generation of mobile phones to supply voice and text messaging services. The GSM mobile communication method is widely used in our day and age. 2G authentication employs the challenge and answer method. Since its introduction in 2000, the 3G network has offered users download and upload speeds of up to 2Mbps. Today's technology makes it possible to access services like TV streaming, internet browsing, and video streaming at a speed never before possible in mobile communication.

B. Evolution of 5G:

Data speeds may improve as the 5G network approaches commercialization due to complicated systems and high-security architecture. The ability of 5G to connect a growing number of devices while yet providing higher-quality services to all network users makes it unique.

C. 5G Timeline:

A initiative to construct Internal Mobile Telecommunications (IMT) networks for 2020 and beyond was launched by the ITU-R in 2012. In 2013, the European Commission provided funding for 5G networks as a part of its Horizon 2020 program. Verizon's own 5G radio technology was tested in 2016, while the ITU-R published their vision for IMT-2020 in 2015. In 2016, the US FCC allowed high-band spectrum for 5G wireless services, and the first 5G release was approved by the 3GPP in 2017[7]. Leading Chinese carriers tested 5G in urban areas, and 5G applications were on display at the Pyeongchang Winter Olympics. In 2018, the UK spent £1.4 billion on 2.3 GHz and 3.44 GHz spectrum, and AT&T launched a new mobile 5G service in significant urban areas. 2020 saw the completion of the 5G standard, Release 16 (NR Phase 2), with China having more than 100 million subscribers. The COVID-19 epidemic prevented the 3GPP Release 17 standards from being finished in 2020. In Japan, 5G technology will be used for smart city applications during the 2021 Summer Olympics in Tokyo. In 2022, Release 17 is anticipated to be finished. Three billion 5G mobile users, or 28% of all mobile subscribers, are expected by 2025. In April 2021, the 3rd Generation Partnership Project (3GPP) announced 5G Advanced, an update to the existing standard that would add capabilities and improve efficiency. 5G Advanced, according to Nokia's Bell Labs, delivers high capabilities, extreme connectivity, and high security. enhanced significantly MIMO 5G Advanced enhances Massive Multiple-Input, Multiple-Output (MIMO) performance in a 5G network. When several antennas are utilized at the transmitter and receiver, data transmission speeds may be enhanced. Massive MIMO is the practice of expanding a system's transmitters and receivers to accommodate a large number of users [11]. Bell Labs predicts that base stations that can manage 64 to 512 transceivers will be necessary for 5G Advanced and subsequent standards. As a consequence, commercial networks using 5G Advanced technologies will be better equipped to support networks with lots of high-throughput data users. Below, we go through the advanced 5G's plans and features that have been realized. decreasing capacity Release 17's standard will include RedCap (Reduced Capacity). RedCap, a 3GPP modification to Release 17's specification, outlines how 5G-capable devices would consume less bandwidth under the new standard. RedCap allows wearable and IoT devices to operate on a 20 MHz channel as opposed to the 100 MHz channel that 5G NR typically uses. While the bandwidth requirements for RedCap devices are decreased in Release 18, reliability with current 5G NR and RedCap devices will be preserved. By supplying time references directly from the network, 5G Advanced seeks to increase accuracy in milliseconds. The upgrade freeze for 3GPP Release 17 will affect enterprise customers and is anticipated to persist until the second quarter of 2022. By enhancing cellular positioning accuracy to under 10 cm, 5G Advanced will also improve. 5G Advanced will facilitate communication in extended reality (XR) and increased energy efficiency.

Release 18, which is scheduled for implementation in 18 to 24 months, will include system updates from AT&T Labs, including vertical services. It is anticipated that the current 5G phase would significantly enhance data speed, location, time, and coverage, laying the groundwork for the development of 6G [3]. Future lifestyles, industries, and civilizations will depend on next-generation wireless networks since future 6G applications will have higher requirements and a larger network capacity than existing 5G networks. Wireless communication will significantly advance by the year 2030, with 6G serving as a crucial communication and informational backbone. For demanding applications like virtual, augmented, and mixed reality, the next generation of wireless networks should enable high data speeds, reduced end-to-end latency, higher dependability, large cell capacity, and wider coverage area. A very low latency communication, a peak data rate of at least 1 Tb/s, high mobility, huge capacity owing to IoE, reduced energy consumption, a data rate nearing 10 Gb/s, spectrum efficiency, and strong 3D coverage extension are among the requirements that the future generation should meet. Future 6G scenarios include intelligent society, intelligent life, and intelligent production. Three categories—smart production, smart life, and smart society— are used to group these scenarios. After 2030, the digital economy could outgrow itself, and 6G will enable intelligent production through automation, virtual reality, and information technology. Through twin body area networks and intelligent interaction, smart life will alter our daily lives, and smart society will greatly expand public service coverage, bridging the digital barrier across locations. Numerous research has been conducted on 6G networks, with current articles concentrating on 6G's fundamental technologies, long-term goals, use cases, and needs. From the standpoint of the client, some authors have forecast a quick and large cost reduction, while others have talked about probable long-term issues with the rollout of the 6G network. In conclusion, it is anticipated that 6G networks would improve social governance and provide the groundwork for a better society. Figure 4.4: shows the evolution of 6G Technology [2]. The advancement of wireless communication of new technologies and applications, as well as the ongoing research and development in the field.

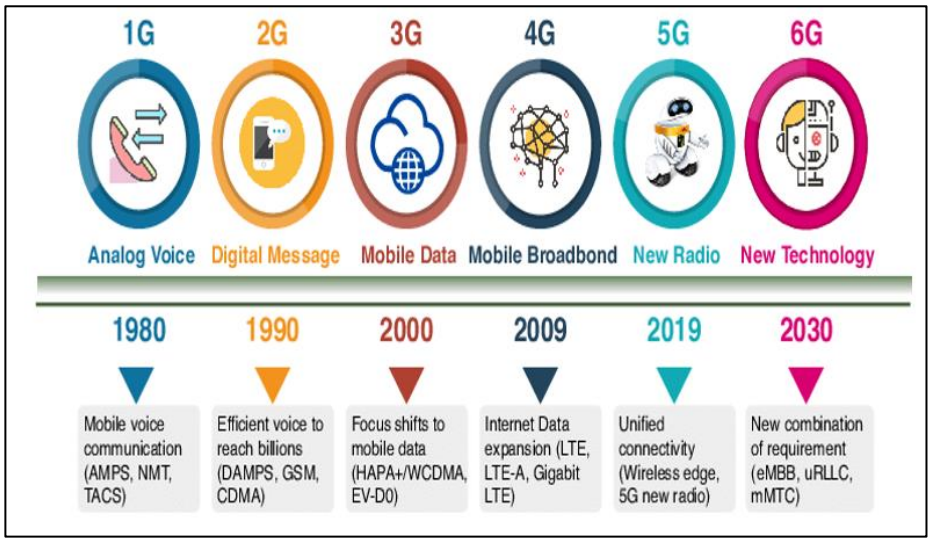

Figure 4.4: The evolution of 6G Technology

4.6 Future Perspective:

Machines, gadgets, robots, and even humans will be connected in factories with the arrival of IoE and B5G/6G. Additionally, in certain industries, specific scenarios won't involve any human engagement. The majority of factories nowadays need to be quick, clever, automated, and secure. These facilities help improve the manufacturing process. They are capable of intelligently balancing the market's supply and demand [1]. They can foresee when 'machines' will require repair. Through global control canters, large multinational corporations may remotely supervise their plants. Based on previously gathered data, the businesses may also intelligently forecast the success and failure of a product line flow.

The COVID-19 epidemic prompts a hasty creation of the concept for the factory of the future in an effort to limit the number of employees within factories. Future wireless communication is expected to provide several difficult applications, with the factory of the future being one of them. To remotely manage industries, sophisticated XR tools and human senses identification procedures are needed. For the provision of equipment, gadgets, robotics, and networks, digital twins will be deployed. Huge amounts of data will be sent between devices and gathered by operators in control canters. Accurate localization is required for many vehicles, including freight trucks, robots, and drones [12]. Self-healing factories are a necessity. Due of these difficulties, specialized wireless networks with high data throughput, dependability, and low latency are required. However, this calls for brand-new solutions, which 6G can handle at the level of the communication system. D2D will be made available in 6G to address latency and capacity problems. According to Xiao and Zeng, digital twins will use big data-based, real-time analytical applications methodologies. Furthermore, sophisticated artificial intelligence techniques like explainable AI, distributed AI, layered AI, etc. would be necessary to manage this dynamic and extremely complicated system. Advanced localization and method backed by the 6G network will be necessary for high-accuracy positing (1 cm).

4.7 Conclusion:

Technology has a great impact on the lifestyle of human beings. Wireless technologies have revolutionized businesses, living standards, infrastructure, and many other aspects of human life. Mankind is in a constant struggle to find elegant solutions to various problems and is in search of new avenues to progress. Tis desire of mankind has evolved wireless communication from 1G to 5G. However, this development has not stopped here. The researchers around the world are working hard for the development of 6G communication network, which is expected to be rolled out by 2030. In this paper, we covered various aspects of 6G wireless networks with different perspectives. We provided a vision for B5G/6G communications, 6G network architecture, KPI requirements, key enabling technologies, their use-cases, and network dimensions that will landmark the next generation communication systems. Furthermore, a way out is discussed how these potential technologies will meet the KPI requirements for these systems. Finally, the opportunities and research challenges such as hardware complexity, variable radio resource allocation, pre-emptive scheduling, power efficiency, the coexistence of multiple RATs, and security, privacy and trust issues for these technologies on the way to the commercialization of next-generation communication networks are presented.

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5. Role of ICT in Rural Development in India

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Abstract:

Rural development is one of the many elements that affect the economic development of a country. The growing socioeconomic gap between rural and urban areas is exerting significant strain on the social and economic structures of many developing countries. This essay's objective is to assess the need for future improvements to urban and regional planning methods in light of the growth of information and, more especially, the effects of information and communication technology (ICT). Both new and conventional ICTs were used to efficiently deliver information to rural areas. ICTs may provide rural populations a voice and give them the power to participate in development. Rural communities can improve their living conditions and become more motivated to the point where they can make decisions about their own development through education and social interaction. This essay focuses on the issues facing India's rural economy as they relate to ICT. Its main goal is to investigate how technology and/or ICT impact rural development and progress. This essay will discuss the role of ICT in India's rural development.

Keywords:

Economic, Development, Information, Communication, Technology, Rural, People, Agricultural, Backward, Rural Isolation.

5.1 Introduction:

Governments from all over the world are becoming increasingly interested in rural development. India is a country of villages; as a result, the development of the rural inhabitants is associated with that of India. India is the second-most populated nation in the world, yet due to the slow expansion of agricultural employment opportunities, a sizable section of this population experiences economic instability. For two very important reasons, rural development is particularly important in the Indian context.

First off, the majority of people still live in villages, and as long as rural areas lag behind metropolitan ones, progress is difficult. Second, the underdevelopment of the rural sector would provide a considerable challenge to the expansion of the economy as a whole. India has an agrarian economy, and the bulk of the people works in agriculture. The rural sector is significantly underdeveloped in terms of output, social structure, and political mobilization even though rural populations engage in traditional agriculture. The wealth gap has also grown as a result of technical developments in agriculture. [1]

As a result, rural areas are essentially obsolete. The all-India Rural Credit Review Committee stated in their report that "if the fruits of development continue to be denied to the large sections of the rural community, while prosperity accrues to some." "The social and economic tensions may not only sabotage the rural economy's process of orderly and peaceful change, but may even thwart national efforts to establish agricultural production. Therefore, it was judged crucial to establish programs for the distribution of development's benefits to the social strata that reside in underdeveloped and disadvantaged rural areas. As a result, we might draw the conclusion that rural areas usually lack or lag behind urban areas in terms of essential infrastructure and services including transportation, health care, education, and government services. Attempts to achieve inclusive, sustainable growth can suffer from rural poverty and isolation. ICTs are able to work around many infrastructure restrictions. Through ICTs, people in rural areas can connect with the national economy. ICTs can also be used to spread knowledge and solicit input, giving rural citizens a say in the nation's sociopolitical affairs. [2]

Rural and village regions are among those where the development of information technology is necessary. Information technology adoption has a huge impact on rural communities' economic, social, cultural, and political prosperity. Because Indian minds have long been recognized, information and communication technology (ICT) is a well-known service field in the world that India may employ to become a leader. The rural population would be able to actively participate in India's overall growth through the acceleration of rural development, which is essential for the nation to meet its GDP target. Nearly 600,000 villages are located in rural areas, where numerous problems exist and numerous techniques are employed to support rural development. However, none of the policies are now directly addressing the issues of rural communities due to a lack of understanding and awareness. The phrase "information and communication technology" (ICT) refers to a wide range of constantly changing elements, such as computer hardware, software, kiosks, television, radio, mobile phones, and personal computers, as well as the rules and laws that govern these media and tools. [3]

ICT has contributed to the fusion of knowledge and technology, simplifying the information acquisition process for the rural populace. Knowledge is information for an individual, but it also has positive effects on the entire community. The 1960s information exchange with farmers on new production techniques was a major factor in the green revolution's success. Rural economies can benefit from ICT by placing an emphasis on social production, social consumption, and social services (Malhotra, 2001). However, Sen (1999) convincingly argues that the development goes beyond macroeconomic growth. He proposes a different definition of development, stating that it is the expansion of peoples' total and quality of options for pursuing their life and means of survival.

Everyone should be given fair and equal possibilities to select their own means of subsistence, according to the equity idea. Rural residents should be free to decide how they want to move forward in their lives. ICT is the umbrella term encompassing a number of electronic technologies, such as transmission and display, that facilitate information processing and communication. ICT encompasses more than just the internet, computers, and phones. The majority of contemporary technology, including slide projectors, mobile phones, personal digital assistants, and digital cameras, can be linked together to share and exchange data. These devices are all currently categorized as ICTs.

Undoubtedly, having access to information is essential for successful development. Any nation's socioeconomic development is closely related to the expansion of communication and access to information. [4]

5.2 Applications of ICT in Rural Sectors:

5.2.1 E-Governance:

Reduced poverty and improved environmental conditions can be achieved through ICT-enhanced better governance. Information and communication technologies (ICT) are being used by governments increasingly frequently to offer services in places where citizens may easily access them. Bringing cooperative unions, state and local government agencies, and central government departments to the doorsteps of villages is the aim of rural ICT applications. [5]

5.2.2 Lokvani Project (Uttar Pradesh):

In the Sitapur area of Uttar Pradesh, a project known as Lokvani was launched in November 2004. This project aims to provide a single-window, self-sustaining e-Government solution for handling grievances, keeping track of property, and providing various essential services.

5.2.3 Ministry of Health & Family Welfare (MoH &FW):

The Ministry of Health and Family Welfare has put in place an Integrated illness Surveillance Programmed network that connects all district hospitals with medical colleges of the state to facilitate tile-consultation, tele-education/training of health professionals, and tracking illness trends. On a national level, it has helped fund a few pilot tele-ophthalmology and rural telemedicine projects. [6]

5.2.4 Tele-education:

The right to education is a fundamental right for every Indian person. All children up to the age of 14 must obtain an education, according to Article 45 of the Indian Constitution. Several Indian States still struggle to offer high-quality education after their 64-year independence. Over a million rural schools are located in 6,38,000 communities throughout India. Schools are promoted in rural India in an effort to raise the country's literacy and educational standards. [7]

5.2.5 ICT Empowering Rural Life:

The most important function that ICT plays in empowering people is the supply of accurate and timely information that is acceptable in terms of quality and cost. Access to credit and rural banking services is facilitated for the benefit of rural areas. Recent initiatives in mobile banking increase local business and cut costs. About 70% of the poor people in India live in rural areas and rely on agriculture for a living.

Using ICTs, farmers may be given pertinent information on matters such as crop maintenance, animal care, inputs for fertilizer and feedstock, bug management, seed source, and market prices. The degree of education and literacy is one of the most important factors in development in rural areas. ICTs are successfully applied in the classroom to improve student learning results. It's important to underline the value of implementing ICT-enabled activities in rural schools. Teachers have access to additional educational programs. [8]

Economic development fundamentally depends on connectivity to the outside world, and ICTs are essential in bridging the information divide between rural populations and the outside world. The successful use of ICTs can aid in connecting rural communities to international economic systems. Information and communication technologies (ICTs) have the potential to greatly enhance both individual and public health care. By providing new and more efficient ways of accessing, communicating, and storing information, ICTs can help close the information gaps that have emerged in the health sector of developing countries—between healthcare professionals and the communities they serve as well as between the authors of health research and the practitioners who need it. Through the development of databases and other applications, ICTs can help improve the performance of the healthcare system and lower medical errors. [9]

5.3 ICT Applications in Rural Development:

Rural residents may learn and innovate more efficiently with the use of ICTs, assisting them in resolving problems and improving their quality of life. They educate these communities and increase the efficiency of their development efforts in order to achieve the objectives of poverty eradication, food security, and sustainable development in rural areas. However, metropolitan areas in our country only account for the majority of technical applications. Rural communities haven't benefited from them sufficiently. In order to ensure the sustainability of the economy, the environment, and the best possible use of local resources, it is crucial to develop and implement appropriate "green" technologies along with reliable delivery methods, with an emphasis on rural people's technological competence. Rural residents may learn and innovate more efficiently with the use of ICTs, assisting them in resolving problems and improving their quality of life. They educate these communities and increase the efficiency of their development efforts in order to achieve the objectives of poverty eradication, food security, and sustainable development in rural areas.

However, metropolitan areas in our country only account for the majority of technical applications. Rural communities haven't benefited from them sufficiently. In order to ensure the sustainability of the economy, the environment, and the best possible use of local resources, it is crucial to develop and implement appropriate "green" technologies along with reliable delivery methods, with an emphasis on rural people's technological competence. Acquire and imbibe knowledge of technologies appropriate to their needs and environment;

- Upgrade their traditional skills and capabilities;
- Minimize fatigue and reduce drudgery; and

- Be innovative.

A. Equally ICT Should:

- Be capable of easy assimilation;
- Generate significant and assured added value to existing methods of operation;
- Generate employment and use local resources, both men and materials;
- Need low capital investment and result in low-cost production of goods;
- Be capable of replication and adoption; and
- Blend harmoniously with existing ecosystems leading to tangible improvements in the living conditions and self-sustained development of the rural people. [11]

In order to create local capability, find solutions to the problems listed, and improve the lives of rural people by improving their surroundings and daily activities, appropriate or green technology with the aforementioned characteristics may be important. The focus must be on equipping individuals with the information and critical thinking necessary to use technology in a way that fosters independence and the ability to decide what is in or out of their best interests. They will have greater access to affordable, environmentally friendly technologies as a result, and major jobs that boost the local economy will also be produced. However, participatory systems that take a practical approach—or the effective permeation of technology from the perspective of people's acceptance as well as the capacity to make suggested interventions sustainable for them to manage—are the key to the development and adoption of such green technologies. This requires:

- Need identification/assessment of the people by local voluntary or science and technology-based field groups;
- Identification of ideal technological options, as per location specific needs, skills, and resources available;
- In-house technology appropriation or with assistance of nearby technical institution to a scale and level, which is acceptable to the people for long term sustainability;
- Technology back up for 2-3 years through continuous handholding to people; and
- Establishing backward and forward linkages for long term sustainability.

The field team can gradually withdraw once the complete system and technology package is in place and transfer duties to locally founded people's groups and organizations for ongoing use and distribution. [12] With the aim of reaching the majority of people who live in the vast rural areas of India, a number of grassroots level organizations with scientific and technological capabilities are supplying crucial links between the emerging new developments in knowledge and technology, as well as aiding in the strengthening and diversification of the local economy, utilization of local resources, and improvement of the skills of artisans, landless laborers, and other disadvantaged sections.

By using the aforementioned strategy, these organizations have developed tested and practical models of a variety of green technologies for socio-economic upliftment through skill upgradation, revenue production, drudgery elimination, sustainable resource usage, etc. Such initiatives have noticeably altered the way of life in rural areas and have the potential to extend to other parts of the country. [13]

5.4 ICT and e-Governance for Rural Development:

Several governments are constructing State Wide Area Networks (SWAN) to allow residents of remote areas to access state and district administrative services online. Information and communication technologies (ICT) are being used by governments increasingly frequently to offer services in places where citizens may easily access them. Bringing cooperative unions, state and local government agencies, and central government departments to the doorsteps of villages is the aim of rural ICT applications. These apps employ ICT to offer more efficient and cost-effective processing and networking alternatives. With the computerization of land records, ICT has been used for rural development with great success. Land records are highly valued by contemporary socioeconomic imperatives, and it is essential to update and revise them in order to reflect changes in rural social dynamics. Land records are an essential part of rural development. The CoLR (Computerization of Land Records) program was introduced by the Indian government in 1988–1989 with the following main objectives:

- Creating database of basic records
- Facilitating the issues of copies of records
- Reducing work load by elimination of drudgery of paper work
- Minimizing the possibilities manipulation of land records, and
- Creating a land management information system

CoLR substantially helped the farmers. The farmers have immediate access to information about their property and may obtain all relevant records whenever they are required. These records are also free from human arbitration, quick to update, and free from harassment. [14]

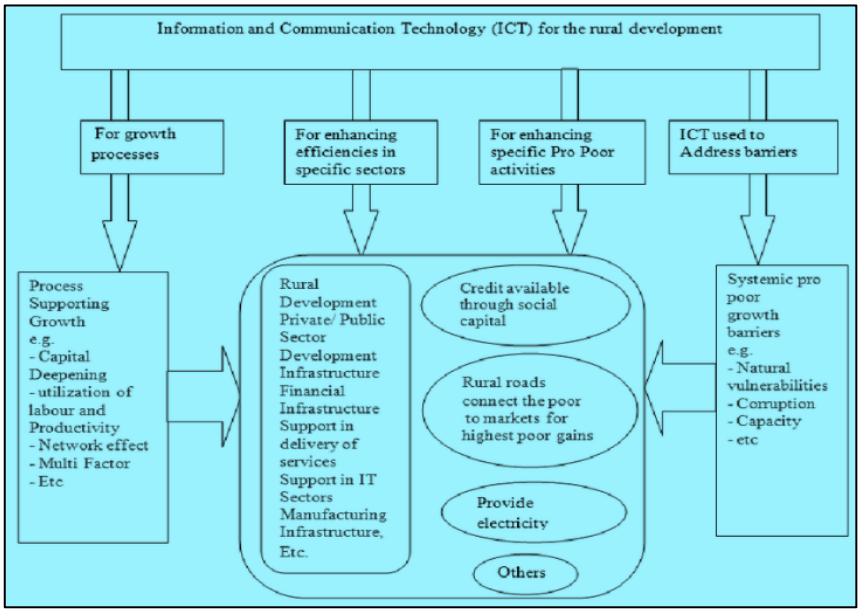

Figure 5.1: ICT as a key for rural development

5.5 New rural development policy paradigm in the information economy:

Rural development policy nowadays needs to deal effectively with a number of challenges that are relating to the:

- Differentiation of rural regions based on both resources and history, tradition, values, etc. of local societies, the effective exploitation of which calls for a place-based multi-objective approach, falling into the general planning goal of sustainable development.
- Shift from an agriculture-based rural development approach to a multi-sectoral development perspective that will pursue the sustainable exploitation of the whole range of resources available in rural regions (e.g., small-scale food processing, new alternative forms of rural tourism, non-agricultural rural economy), which calls for a cross-sectoral approach.
- Need to establish interaction among sectors in order to develop synergies and reap the benefits out of them for the whole region, which calls for an integrated approach.
- Need to mobilize all actors involved (citizens, businesses, administration, institutions, etc.) by establishing proper communication platforms for the exchange of ideas, seeking for a wider consensus on future rural development paths, which calls for a society-empowering approach, based on participation.
- The need to get access to information and knowledge sources that will increase knowledge capacity in rural regions, which calls for an inclusive information and knowledge society approach. In Figure 5.2 below is presented the shift from the traditional to the new rural development policy paradigm. [15]

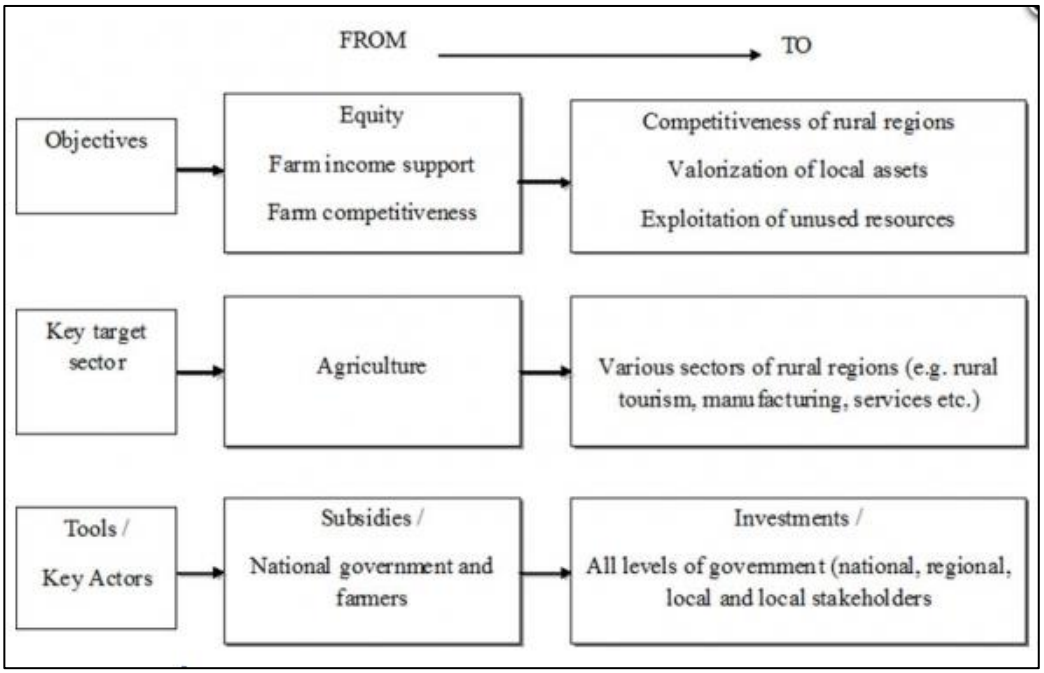

Figure 5.2: From traditional approaches to a new paradigm of rural development policy [16]

5.6 Challenges:

Like anything else, information and communication technology for the rural sector has a price. Fantastic career opportunities and efficient e-governance are made possible by technology, but it also makes individuals more vulnerable, unfair, hazardous, and unstable in society. When seeking to bring ICT to the rural people, the government meets formidable obstacles because the majority of them do not have access to the internet, creating large gaps that must be filled. According to studies, utilizing ICT to deliver services exposes societal disparities and isn't always inspiring. ICT use by the government could exacerbate the problem. Insufficient infrastructure, a lack of capacity, inaccurate and insufficient information, language barriers, computer resources, and poor phone connectivity. Social differences can persist despite technology's greatest efforts to bring people together. arise as a result of technology. [17]

According to a World Economic Forum study, India has the greatest digital gap. Another major problem in India is a lack of accountability; starting services won't help the country until accountability is upheld. ICT-based growth will only be accomplished if it is suited to the requirements and desires of the local community. People closest to the action should be involved in formulating and implementing ICT policy on the needs of the people since they are the most knowledgeable about it. This initiative will provide employment opportunities and involve rural inhabitants in the development process. One of these issues is that jobs in this sector frequently require native English speakers, and rural areas with poor educational opportunities are left behind the key reasons why rural areas have not benefited from ICT. Indeed, as computerization advances, many workers will lose their jobs. Because the vast majority of the workforce is left behind, they lose their jobs, which decreases their income and standard of living. ICT has a lot of promise to improve rural residents' quality of life, but it hasn't done so yet. Rural poor are at a disadvantage since they do not have the essential skills for the industrial or tertiary sectors. Power outages and insufficient electricity supplies are two other major issues in rural areas. There are fewer active users because of connectivity issues and the tiny number of people using ICT in rural areas. Due to the absence of conveniences and luxury, few people want to work in rural areas, which results in a shortage of technical resources for supporting rural populations. The lack of quick action or money for technical improvement at the municipal level is the final but not the least issue. [18]

Need to Focus on Indian Rural Communities: Even after 57 years of independence, India still has a severe problem with its rural poor and how to increase their level of income. The population distribution by rural-urban areas in India and a few chosen states is shown in Table 1 (Census of India, 2001). Out of a total population of 1027 people, 742 million live in rural areas, while 285 million reside in urban areas. (102.7 crore). There are 600,000 villages in India, totaling 27.60 lakh square kilometers. The lack of roads, power, clean drinking water, healthcare facilities, educational institutions, and communication networks in these communities contributes to the poverty of the rural population.

According to India's inaugural Social Development Report, a sizeable portion of its population—26%, or over 260 million—remains below the poverty line (193 million in rural and 67 million in urban areas). Concentrations of poverty are growing both in terms

of geography and among specific social groups. Kerala has the highest rate of poverty (12.72%), followed by Haryana (8.74%) and Punjab (6.16%), according to data from 1999-2000. The states of Orissa (47.15%), Bihar (42.60%), and Assam (36.09%) have the highest rates of poverty. Despite a decline in poverty, there are still 43.8 Scheduled Tribes, 36.2 Scheduled Castes, and 21 Other Backward Classes that are considered to be poor.

Table 5.1: Rural-Urban Distribution of Population – India and Select States [19]

India/State/Union Territory*	Population			% Rural population
	Total	Rural	Urban	
India	**1,027,015,247**	**741,660,293**	**285,354,954**	**72.22**
Jammu & Kashmir	10,069,917	7,564,608	2,505,309	75.12
Punjab	24,289,296	16,043,730	8,245,566	66.05
Delhi*	13,782,976	963,215	12,819,761	6.99
Uttar Pradesh	166,052,859	131,540,230	34,512,629	79.22
Bihar	82,878,796	74,199,596	8,679,200	89.53
Assam	26,638,407	23,248,994	3,389,413	87.28
West Bengal	80,221,171	57,734,690	22,486,481	71.97
Orissa	36,706,920	31,210,602	5,496,318	85.03
Madhya Pradesh	60,385,118	44,282,528	16,102,590	73.33
Maharashtra	96,752,247	55,732,513	41,019,734	57.60
Andhra Pradesh	75,727,541	55,223,944	20,503,597	72.92
Karnataka	52,733,958	34,814,100	17,919,858	66.02
Kerala	31,838,619	23,571,484	8,267,135	74.03
Tamil Nadu	62,110,839	34,869,286	27,241,553	56.14
Pondicherry*	973,829	325,596	648,233	33.43

5.7 Factors Preventing Rural Communities to Reap Benefits from ICTs:

There are a number of significant barriers limiting rural communities in developing nations from utilizing ICTs to their full potential. Without creating access models that can take these considerations into account, rural populations will lag significantly behind metropolitan residents who have access to more digital options. Table 1 lists the basic metrics (2004 population growth, GDP, and teledensity) as well as the IT indicators (number of hosts, users, and PC penetration) for selected regions and nations. [20]

Table 5.2: Indicators for Basic and IT for Select Regions/Countries

Regions/ Countries	Indicators					
	Basic			IT		
	Population (in millions)	GDP per capita (in US $)	Tele-density	No. of Hosts	Users (in k)	PCs per 100
Americas	869.94	15,249	76.51	205,480,386	245,752.2	12.52
USA	293.66	36,273	122.71	195,138,696	161,632.4	65.89
Europe	801.31	14,353	111.58	29,040,707	250,239.4	28.48
UK	59.80	26,369	158.51	4,173,453	37,600.0	60.02
Asia	3,717.79	2,361	33.56	27,986,720	305,242.2	6.39
India	1,081.23	560	8.44	143,654	35,000.0	1.21
China	1,299.88	1,096	49.74	162,821	94,000.0	4.08
World	6,359.70	5,528	46.41	267,541,177	841,757.3	9.63

5.8 Conclusion:

According to the findings of my study, ICT technology breakthroughs have significantly increased the amount and speed of information transit while decreasing the cost. By enhancing information access, expanding local markets, generating more job opportunities, and enhancing access to governmental services, ICT in rural areas is unquestionably the solution to gradually remove the traditional development barriers. India's economy is among the fastest growing in the world, and the country is making progress in a number of sectors, including rural development. Urban growth is faster than rural development. Rural development is remains sluggish even though the government is putting several programs and policies into place. According to observation, a lack of information and awareness of the programs and resources available is the main factor leading to the underdevelopment of rural areas. India must make it possible for its rural citizens to access and use IT in order to include them in the development of the country's economy. Rural citizens are the nation's most valuable resource due to the agrarian structure of the Indian economy, but they receive few benefits. In this study, a few ICT innovations that were built expressly for rural applications while taking into account connections, cost, and end user potential were presented. This article also discussed the multiple ICT applications in the rural sector, such as e-governance, telemedicine, agriculture, risk management, and women's empowerment. A review of the many national and state-level measures the Indian government has taken to promote the use of ICT for socioeconomic development in rural areas is being done to determine the effectiveness of the programs.

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6. Use of ICT in Geography Teaching

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Abstract:

This chapter explores the profound impact of Information and Communication Technology (ICT) in the field of Geography education. As technological advancements continue to shape modern education, ICT tools and resources have emerged as potent catalysts for enhancing teaching and learning experiences in the domain of Geography.

ICT offers a wide range of interactive and multimedia resources, including Geographical Information Systems (GIS), Global Positioning System (GPS), Remote Sensing, Virtual Maps, Satellite Imagery, and Online Databases, enriching the learning process and providing real world context to geographical concepts.

The use of ICT (Information and Communication Technology) in geography helps students learn by providing access to large quantities of information on people, places and environments. It also provides the framework for analysing data to investigate patterns and relationships in a geographical context. Once students have made their findings, ICT can then help them organize, edit and present information in many different ways. Moreover, the study discusses the role of ICT in promoting cross-culture awareness and global perspectives.

Through virtual exchange programs and online collaboration, students can interact with peers from diverse geographical backgrounds, fostering cultural empathy and enriching their understanding of the interconnectedness of the world.

Keywords:

ICT, Geography Teaching and Learning, GIS, GPS, Remote Sensing.

6.1 Introduction:

Geography is the study of the Earth's landscapes, environments, and the relationship between people their surroundings. It examines the physical features of the planet, such as mountains, rivers, and oceans, as well as the distribution of plants, animals, and human populations across different regions. Geography also explores the interactions between human societies and the natural world, including how human activities impact the environment and how the environment influences human behavior. It's a broad diverse field that helps us better understand the complexities of our planet.

Geography education has a rich heritage of content and teaching, a sustainable background of theory and research in both geography and pedagogy, and opportunities to apply both practical fieldwork and electronic media with which to engage students in problem solving and inquiry. Geography is an interdisciplinary and dynamic subject. Geography is related to all faculties. In today's age of technology, modern technology and ICT should be used in learning and teaching. The use of information and communication technology is needed in the study and teaching of geography. In the era of sustainable development, it is important to use ICT quickly and effectively.

In this 21st century, the use of modern Information and Communication Technologies (ICTs) has greatly enhanced the excitement of geographical learning. This includes the use of communication networks, computers, software, digital data storage and audiovisual systems. Students can benefited greatly from appropriate use of ICTs, particularly geospatial technologies which support spatial thinking and also make the acquisition of knowledge more efficient and engaging. Geography provides a rich and varied context for the use of new technologies to enhance both learning in the subject and to reinforce existing ICT skill. ICT can help students investigate, organize, edit and present geographical information in many different ways.

6.2 Importance of ICT in Geography:

Information and Communication Technology (ICT) plays crucial role in geography for various regions.

A. **Data Collection:** ICT enables the collection of huge amounts of geospatial data through remote sensing, GPS devices and geographical information Systems (GIS), allowing for more accurate and comprehensive analysis.
B. **Data Analysis:** Geographical Information Systems (GIS) and data visualization tools help geographers analyze and interpret spatial data efficiently leading to better insights and informed decision making.
C. **Communication and Collaboration:** ICT facilities communication and collaboration among geographers, researchers and policymakers, enabling the sharing of data, findings and ideas across the globe.
D. **Mapping and Visualization:** ICT allows for the creation of interactive and dynamic maps, making it easier to present geographical information in a visual appealing and easily understandable manner.
E. **Environmental Monitoring:** Through ICT, real-time monitoring of environmental changes, such as climate patterns and natural disasters, becomes possible, aiding in disaster management and environmental conservation efforts.
F. **Education and Awareness:** ICT tools enable the creation of educational resources and interactive platforms, fostering better understanding and appreciation of geographical concepts among students and the general public.
G. **Planning and Development:** Geographic Information Systems (GIS) help in planning, resource management, and infrastructure development, ensuring more efficient and sustainable use of resources.

Overall, the integration of ICT in geography enhances the field's capabilities, making it powerful tool for addressing various environmental, social and economic challenges.

6.3 Major Function of ICT in Geography:

A. **Geospatial Data Collection:** ICT allows for the collection of geospatial data through various technologies like remote sensing, GPS devices and Ariel surveys, providing a wealth of information about Earth's surface and its features.
B. **Geographical Information Systems (GIS):** GIS a core component of ICT in geography. It enables the storage, analysis and visualization of spatial data, allowing geographers to create maps, conduct spatial queries, and perform complex analyses.
C. **Global Positioning System (GPS):** GPS technology enables accurate location tracking, mapping, and navigation, supporting various applications in Geography, from field data collection to vehicle tracking.
D. **Web Mapping Services:** ICT has enabled the development of web-based mapping platforms like Google Maps and Open Street Map, making spatial data accessible to a wide audience and promoting user-friendly map interactions.
E. **Data Visualization:** ICT tools allow geographers to visualize and represent geospatial data through interactive maps, charts and graphs, enhancing the understanding and communication of complex geographical information.
F. **Spatial Analysis:** ICT provides advanced tools for spatial analysis, enabling geographers to perform sophisticated operations like spatial statistics, interpolation, and modeling to derive meaningful insights from data.
G. **Environmental Monitoring:** ICT helps in real-time monitoring of environmental parameters, such as weather conditions, air quality, and water levels, facilitating better understanding and management of natural resources.
H. **Mobile Application:** Geography related mobile apps utilize ICT to offer location based services, geo-tagging and augmented reality experiences, enhancing field data collection and navigation.
I. **Crowd Sourcing:** ICT enables crowd sourcing platforms where the public can contribute geospatial data, enriching the available information and fostering citizen engagement in mapping projects.
J. **3D Visualization:** With ICT tools, geographers can create 3D visualization and fly through of landscapes and urban environments, providing a more immersive understanding of geographical features.
K. **Data Sharing and Collaboration:** ICT facilitates easy data sharing and collaboration among researchers, organizations and governments leading to more comprehensive and collaborative geographic studies.

These features highlights how ICT has revolutionized the field of Geography, enabling better data driven decision making, promoting environmental awareness and enhancing our understanding if the world around us.

6.4 Advantages of using ICT in Geography:

The use of ICT (Information and Communication Technology) in Geography offers numerous advantages, making it an essential aspect of modern geographical studies. Here are some compelling reasons for using ICT in Geography.

A. **Data Collection and Analysis:** ICT enables efficient and accurate collection of geospatial data through remote sensing, GPS devices and Geographical Information Systems (GIS). It also provides powerful tools for data analysis, allowing geographers to uncover patterns, trends and relationships within spatial data.
B. **Improved Mapping and Visualization:** ICT allows for the creation of interactive and dynamic maps, enhancing the visualization of geographical information. These maps can display multiple layers of data, making it easier to understand complex spatial relationship.
C. **Real-Time Monitoring:** ICT facilitates real-time monitoring of environmental conditions and changes, such as weather patterns, natural disasters and land-use changes. This monitoring capability is crucial for disaster management, environmental conservation and urban planning.
D. **Efficient Resource Management:** Geographical Information Systems (GIS) aid in resource management, helping organizations and governments optimize the use of land, water and other natural resources.
E. **Enhanced Communication and Collaboration:** ICT tools enable geographers to share data, research findings and maps quickly and easily, fostering collaboration among researchers, policymakers and the public.
F. **Citizen Engagement:** With crowd-sourcing platforms and citizen science initiatives, ICT encourages the participations of the public in mapping and data collection efforts, increasing community involvement and awareness.
G. **Geospatial Decision Support:** ICT provides decision makers with valuable geospatial information and analysis, supporting evidence based policy and planning in various sectors like transportation, agriculture and urban development.
H. **Environmental Conservation:** ICT aids in monitoring biodiversity, deforestation and habitat changes, contributing to conservation efforts and sustainable development practices.
I. **Educational Opportunities:** ICT offers interactive and engaging educational resources for student and educators. It provides tools for virtual field trips, interactive maps and data visualization, enhancing geography learning experiences.
J. **Location-Based Services:** ICT enables location-based services on mobile devices, such as navigation, local business search and geo-tagging enhancing the convenience and functionality of everyday life.
K. **Urban Planning and Smart Cities:** ICT plays a vital role in urban planning, facilitating the development of smart cities that use data driven solutions for transportation, energy management and public services.
L. **Disaster Management:** ICT aids in disaster preparedness, response and recovery by providing real-time data on affected areas, helping emergency responders and relief organizations make informed decisions.

6.5 Key Benefits of Using ICT in Geography:

A. ICT can make geography more authentic and relevant.
B. ICT allows more time for observation, discussion and analysis.
C. Using ICT increases opportunities for communication and collaboration.

6.6 Use of ICT in Geography Teaching:

ICT (Information and Communication Technology) can greatly enhance geography teaching and learning. Here are some common uses of ICT in geography education.

A. **Interactive Maps:** ICT allows teachers to use interactive maps and Geographical Information Systems (GIS) to illustrate geographical concepts, display data and help students visualize different locations, landforms and region.
B. **Online Resources:** The internet provides access to a vast array of geographical resources, including articles, images, videos and interactive simulations, which can enrich students understanding of various topics.
C. **Virtual Field Trips:** Through virtual reality and online platforms, students can virtually explore distant places and environments, providing them with an immersive learning experience without leaving the classroom.
D. **Geospatial Technology:** Students can learn how to use geospatial technology such as GPS (Global Positioning System) and Remote Sensing to collect and analyze geographical data.
E. **Collaborative Learning:** ICT facilitates collaboration among students through online platforms and tools, allowing them to work together on geography projects and research.
F. **Geographic Data Analysis:** ICT enables students to analyze and interpret geographical data using software like spreadsheets and statistical programs, making their research and analysis more efficient.

6.7 Conclusion:

It is concludes by emphasizing the need for educators to embrace ICT as an integral component of Geography teaching, recognizing its potential to empower students and prepare them for an increasingly technology driven global landscape.

However, it also acknowledge the importance of thoughtful integration and pedagogical planning to ensure ICT complements traditional teaching methods, rather than replacing them. The use of ICT in Geography enhances the field's capabilities, promotes data-driven decision making and contributes to addressing various environmental, social and economic challenges. It empowers geographers nd stakeholders with valuable tools to better understand and manage our ever changing world.

By interacting ICT into geography teaching, educators can create dynamic and interactive learning environments, fostering student's curiosity and understanding of the world around them. Overall, the integration of ICT in Geography has transformed the way Geographic Information is collected and disseminated, enriching our understanding of the world and supporting informed decision making. As Geography and ICT continue to converge, geography students can look forward to a future filled with innovative technologies, rich dataset and diverse career paths that contribute to understanding and solving the world's complex spatial challenges. Embracing ICT in their studies and professional development will be essential for staying competitive and making meaningful contributions to the field.

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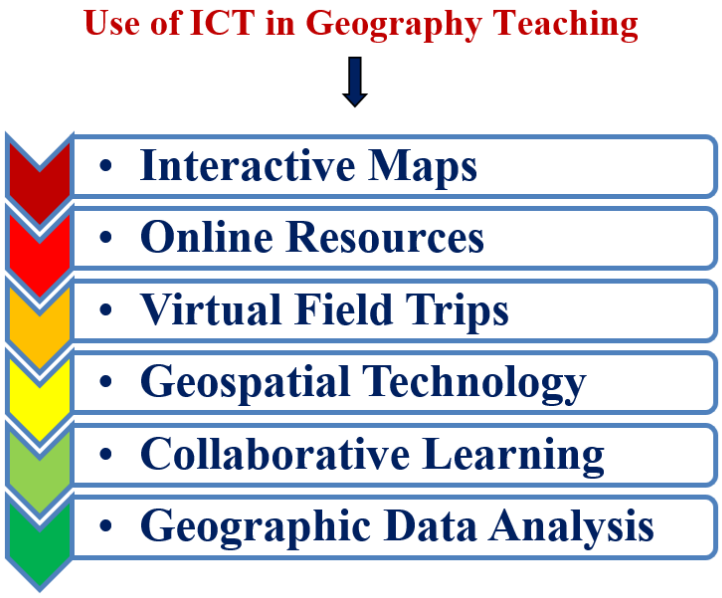
Figure (s) & Table (s):

Figure 6.1: Use of ICT in Geography Teaching.


Use of ICT in Geography Teaching
• Interactive Maps
• Online Resources
• Virtual Field Trips
• Geospatial Technology
• Collaborative Learning
• Geographic Data Analysis

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7. Impact of ICT in E-Commerce

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Abstract:

Information and communication technologies (ICT) are regarded as a fundamental component of e-commerce (EC) and have been from the start of the industry. This is because ICT advancements directly influence e-commerce's development. The Internet is utilized in online commerce for data interchange, promotion, e-mail, conversation, give-and-take, and consumer counseling. There are two types of electronic commerce: business-to-business and business-to-consumer. The cost of creating websites and providing gadgets is the biggest barrier to using information technology. Although there is great potential for e-commerce to expand in underdeveloped nations, the absence of ICT infrastructure is impeding that expansion because ICT is a prerequisite. The sexpansion of ICT infrastructure is a key factor in e-commerce's growth. The expansion of the e-commerce business has been accelerated by the use of smartphones and the Internet. This essay intends to analyze the role of ICT and its services in promoting the e-commerce sector in developing nations like India as well as the impending switch from e-commerce to e-commerce. The potential for e-commerce to flourish in developing nations is quite strong, but as ICT is a prerequisite, a lack of ICT infrastructure slows the expansion of the industry. The expansion of ICT infrastructure is a key factor in e-commerce's growth. The market for smart phones and the widespread use of the Internet have proven to be strong drivers for the e-commerce sector. We shall talk about the impact of ICT on e-commerce in this paper..

Keywords:

E-Commerce, Information, Communication, Technologies, Applications, Business-To-Customer, Business-To Business, Growth, Smartphone, Market, Internet, People.

7.1 Introduction:

E-commerce and computers are becoming an essential aspect of daily life. For the majority of individuals, especially those living in urban areas, having access to e-commerce platforms is not a luxury but rather a necessity. Almost every facet of our lives has an alternative e-commerce platform available, from buying common home things to trading shares and commodities online. "E-commerce" is the use of information and ICT to support all business activities and spheres, according to its definition. Since a few years ago, the idea of e-commerce has expanded and has contributed to the economic expansion

of several major and emerging economies. ICT is one of the main elements driving the expansion of e-commerce. ICT and e-commerce go hand in hand since they are both essential to the operations and growth of the e-commerce sector. Since the idea of e-commerce is so open-ended, it encompasses all potential applications of information and communication technology.

Although the goods are ordered electronically, online payments, as well as the delivery of goods and services, are not required. The increased use of the internet, high educational standards, changing lifestyles, daily living, and the country's economic development are a few of the main factors driving demand for e-commerce tools and strategies. Among these strategies, online buying is essential.

The exponential growth of e-commerce and online shopping is mostly due to the expansion of the internet and its growing penetration into India's rural areas. The e-commerce industry is expected to be driven by the growing penetration of technology enablers like Internet connections, software, broadband and third generation services, laptops, smartphones, mobile phones, tablets and dongles, Wi-Fi, as well as the rising acceptance of the concept of virtual shopping. [1]

Information and communication technologies (ICT) are important for the development of e-commerce, and given how quickly technology is developing today, it is inevitable that more businesses, especially SMEs—which, by the way, account for 97 percent of all businesses worldwide—will adopt e-commerce in some capacity. Particularly in the commercial sphere, electronic commerce is constantly being implemented.

Businesses have tested the benefits of incorporating new technology into their operational procedures and found that the profits surpass the costs.

As more people used the Internet, e-commerce became more important and gained new significance. The secret to the growth of E-commerce lies in its unique features, which include globalizing business, doing away with time and place restrictions, lowering the cost of sources for purchases, increasing the amount of dealing, doing away with time and place restrictions in transactions, having easy access to information, lowering transaction costs, lowering chronological transaction costs, and many other benefits.

Since it has been expanding for a while, the idea of e-commerce has contributed to the expansion of several developed and emerging economies. ICT is one of the main factors influencing the expansion of e-commerce. ICT and e-commerce go hand in hand since they are both essential to the operations and growth of the e-commerce sector.

Since the idea of e-business is so open-ended, it encompasses all potential applications of information and communication technology. Although ICT infrastructure and services are not a major concern in wealthy nations, they occasionally appear to be a barrier to the expansion of electronic commerce in emerging nations like India. E-commerce refers to the exchange of products and services over the internet or through TV channels. Electronic ordering of the goods eliminates the requirement for online payment or service delivery.

The increased use of online resources, high educational standards, changing lifestyles, and the nation's economic expansion are a few of the main factors driving demand for e-commerce strategies and solutions. Among these strategies, online buying is essential. [2] The most important cause for the exponential rise of e-commerce and specifically online shopping is the expansion of the internet and its growing penetration into India's rural areas.

The e-commerce business is expected to be driven by the emerging availability of technology facilitators including Internet connections, broadband and third generation services, laptops, smartphones, tablets, and dongles, as well as the rising acceptability of the concept of virtual shopping.

The B2C sector appears to be the most promising and is anticipated to dominate the e-commerce business in the near future. In addition to the expansion of ICT infrastructure, additional drivers of this growth include simple payment methods and creative legislation. The industry intends to provide far more ground-breaking services in the future, such as access to virtual trial rooms and mobile money transactions. [3]

7.2 Classification of E-Commerce Business:

Business to Business (B2B): B2B refers to online transactions between businesses, such as those between a manufacturer and a wholesaler or a wholesaler and a retailer. [4]

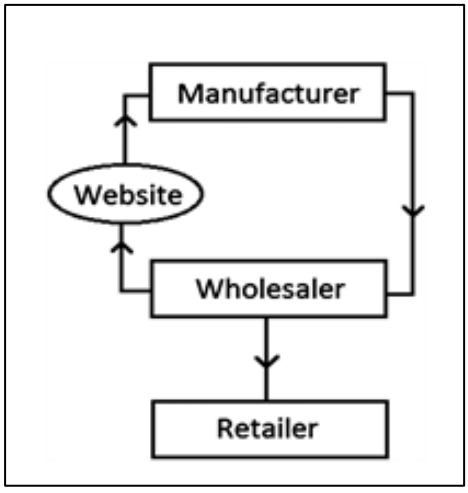

Figure 7.1: The e-commerce Business to Business model

Business to Consumer (B2C): B2C refers to business-to-consumer transactions conducted online, such as those between a store or manufacturer and a customer. It can be viewed as an e-commerce paradigm that involves the selling and buying of goods and services between businesses and consumers over the Internet. It also facilitates the sharing of goods and services between business organizations and final customers in a retailing transaction. Additionally, it involves firms selling their goods directly to the people who will actually use them. [5]

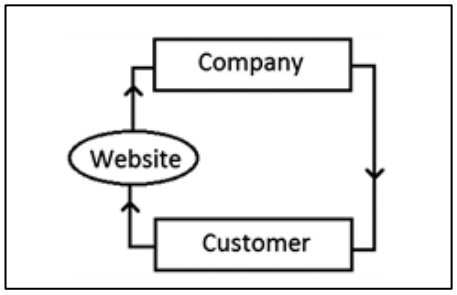

Figure 7.2: The e-commerce Business to Consumer model

Consumer to Business (C2B): E-commerce firms in which private individuals offer to sell goods and services to businesses ready to buy them. This company strategy deviates from the conventional B2C approach. By providing venues for such commercial transactions to occur, this kind of e-commerce enables both business owners and customers of goods and services to have a neutral meeting ground where prices of goods and services are discussed. [6]

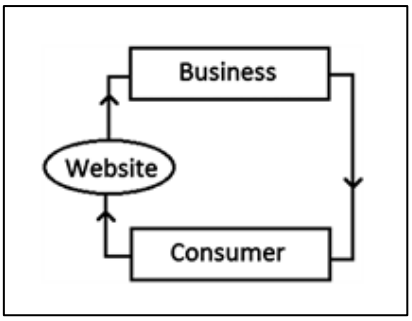

Figure 7.3: The e-commerce Consumer to Business model

Consumer to Consumer (C2C): Individual customers offer to sell goods and services to other people who are willing to buy them through C2C e-commerce enterprises. In a virtual marketplace known as cyberspace, this sort of e-commerce involves customers interacting and conducting direct business transactions with other consumers.

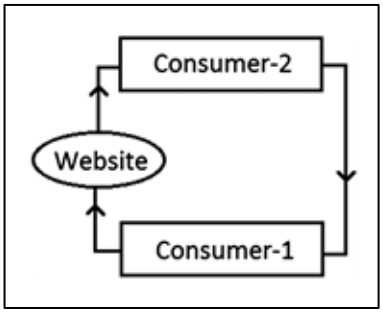

Figure 7.4: The e-commerce Consumer to Consumer model

when a customer offers products and services directly to another person without using a business as a middleman. Faster transactions are completed. Due to the usage of the already-existing IT infrastructure, small and medium-sized businesses can now implement it.

Organizational cultural modifications are needed for its application. Considerations for implementing e-commerce include: Strategy evaluation To decide the tactics to use, we must first conduct an examination of the Internet as a communication tool. The following traits apply to the Internet as a whole: Creativity Segmentation of Notoriety Only four factors need to be prioritized for network success: One: Create a superior good or service Create a website that works well for business, second. technical facets of internet hosting. 4. Drive targeted visitors to the website. [7]

Figure 7.5: ICT in E-Commerce [8]

E-commerce is the practice of conducting business operations using computer systems and communication networks. E-commerce mostly takes place between businesses, not between businesses and customers. Trade activities have been impacted by the expansion of technology use through electronic networks in daily life. Cross-continent trading has been practiced by humans since the dawn of time. This involves traveling between continents using basic means of conveyance. Technology advancements are incredibly beneficial to people and make life easier for them.

Trading over electronic networks is the collective term for any business transaction operations carried out using computer-based internet network access. Businesses have created information technology for three reasons: (1) Supporting business operations; (2) Managerial Decision Support; and (3) Competitive Advantage Strategies. Because it gives managers access to additional information through a decision-making system (Decision Support System, or DSS), information technology has an impact on the process of formulating marketing strategy. Information technology has the power to bring together disparate elements of the company and give managers access to a wealth of data. For instance, executive information systems (also known as EIS) have an impact on the vertical information flow throughout the business. Top management parties have more access to information and rely less on intermediate management as a source of that knowledge. Information may move simply and swiftly between many departments and divisions thanks to telecommunication networks. Information technology also affects how organizations interact with their external environments, including their suppliers and consumers. [9]

Through the usage of e-commerce technology, ICT applications in business transactions have transformed the world into a global marketplace. Many firms in Nigeria have adopted e-commerce into their daily operations as a result of the quick expansion and use of ICT in business today. This is done in order to satisfy the pressing need for current technologies and innovations from their clients. Previous studies have shown that Nigeria has made significant progress and development in the ICT sector during the first decade of the twenty-first century. This is largely because the nation experienced a lot of ICT-related infrastructural development between the years 2000 and 2009. Nigeria is still lagging behind in terms of digital growth when compared to its rival rising economies of the world, despite the apparent amount of improvement in its ICT sector.

Ten Summoner's Tales, Sting's fourth album, was the first product to be successfully sold and purchased online in the year 1994 thanks to e-commerce.

E-commerce has become widespread worldwide twenty years after it was first introduced, and in 2014, it is expected to be worth $1500 billion globally. Despite all of e-commerce's contributions to the growth of the world economy, the Middle East and Africa were said to be lagging behind other regions in terms of e-commerce development. [10]

The most notable application of information technology (IT) that has recently transformed the world's economies is still e-commerce, which is unmistakably linked to all procedures that either directly or indirectly involve the exchange of goods and services over computer networks and the Internet.

Benefits need to outweigh investment and maintenance expenses for small businesses to use e-business and e-commerce strategies and solutions. Adoption is driven by commercial concerns and prospective rewards. Not all SMEs will necessarily "catch up" with major enterprises once they reach a certain level of connectivity (PC, Internet access, online information, or marketing), simply because e-commerce may not provide significant benefits and SMEs will stick with traditional business methods.

The availability of ICT competences within the company, as well as the cost and availability of suitable, interoperable small-firm systems, network infrastructure, and support services for the Internet, have all been identified as additional impediments. Cross-country legal and regulatory disparities as well as a lack of trustworthy trust and recourse procedures make international business transactions difficult. Policies that are intended to enhance the network infrastructure, the legal and regulatory environment, promote technical diffusion, and generate a positive business climate will have an impact on the adoption and use of e-business techniques. In addition to these broad framework policies, the ICT and e-business awareness programs, business consultation services, and management and employee training to improve ICT and managerial skills have been the focus of particular policies for SMEs.

E-commerce refers to the marketing, distribution, and exchange of goods and services using electronic networks such the internet, television, or other computer networks. Electronic data transfers, automated inventory management systems, and automated data collection systems are all examples of e-commerce activities.

According to the information technology sector, e-commerce activities include the use and application of e-business (e-business) related to commercial transactions, such as: electronic fund transfers, supply chain management (SCM), e-marketing (e-marketing), or online marketing (online marketing), online transaction processing, electronic data interchange (EDI), etc. E-business, which covers e-commerce as well as other aspects like customer service, job openings, and collaborative business partners, has a wider scope than just commerce. E-commerce also needs database or database (e-mail) technology, e-mail, and other non-computer technologies like the shipping system and payment methods in addition to internet network technology. [11]

Figure 6 depicts the outcome of the examination of small and medium-sized business industry distribution. Figure 6 shows that there are the most wholesale and retail businesses, accounting for 26% of SMEs. The total number of these businesses is 7771.

The real estate, leasing, construction, service, and banking industries are further significant industries. For small and medium businesses, electronic commerce has both internal and external effects.

By implementing e-commerce, businesses can increase the effectiveness of their internal operations and build complete management information systems. E-commerce can increase product sales by expanding the external sales channels and removing intermediary intermediaries. As a result, SMEs must grow their e-commerce sectors if they are to compete effectively. It is also a crucial strategy to boost revenue and operational effectiveness. [12]

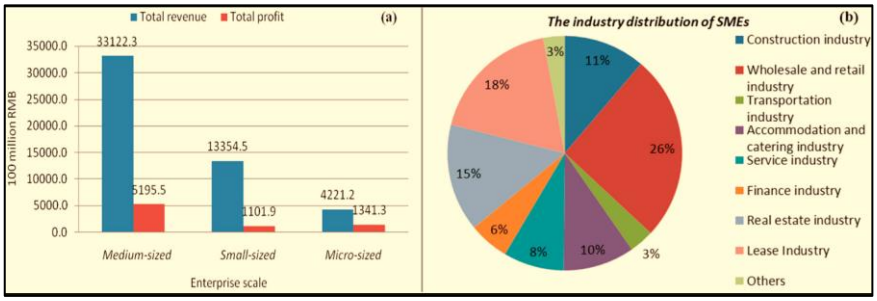

Figure 7.6: (a) The scale and profitability analysis of SMEs; (b) The industry distribution analysis of SMEs.

The development of e-commerce is linked to sociotechnical developments. Users are drawn to a medium more and more as it becomes deeply ingrained. Markets grow as users do as well. More commercial organizations are drawn to the expanding markets. As more firms grow, competition increases. Competition spurs innovation, which in turn propels the development of technology and supports the expansion of e-commerce.

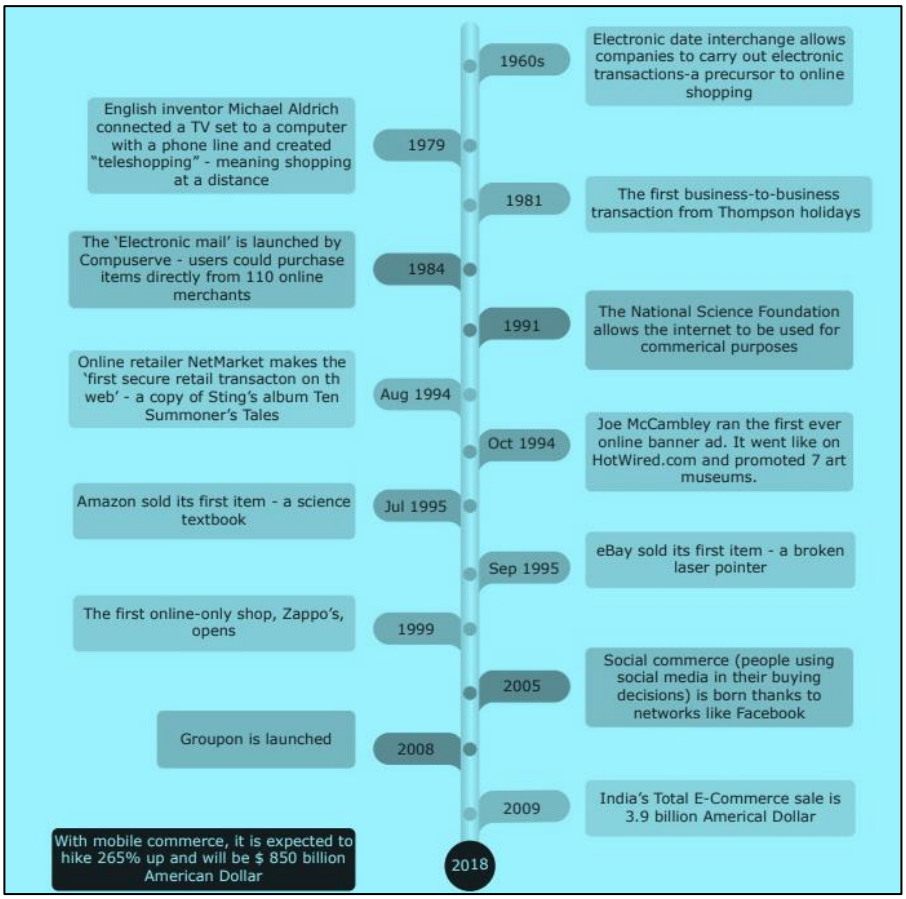

Figure 7.7: The growth of E-Commerce

7.3 E-Commerce Industry in India:

India has the fastest-growing economy in the world in terms of e-commerce. Indian e-commerce is anticipated to expand from $30 billion in 2016 to $120 billion in 2020, at the highest yearly rate in the world (source: Assoc. Ham-Forester study paper). With $680 billion in online retail sales in 2016, China is the world's largest e-commerce market, followed by the United States and India. Although e-commerce was used in India before the 1990s, their contributions were incredibly small. Blue-chip PE firms have recently made considerable investments in India's e-commerce due to the market's enormous potential and possibility for success. B2B e-commerce is allowed for 100 percent FDI in India, which demonstrates the government's commitment to the country's e-commerce business. The e-commerce industry in India is strongly dependent on the aforementioned supporting elements, which have an effect on the Indian economy. Some of these elements include: [13]

- Participation of niche companies in online trading
- Unmatched FDI
- Uniform GST

India is one of the biggest developing economies of the world. There is substantial utilization of web among Indian natives.

The fundamental essential target of this exploration paper is:

- To examination the present patterns of online business in India
- Government activities and diverse plan in development of online business in India
- Impact of online business on education rate and work rate in India

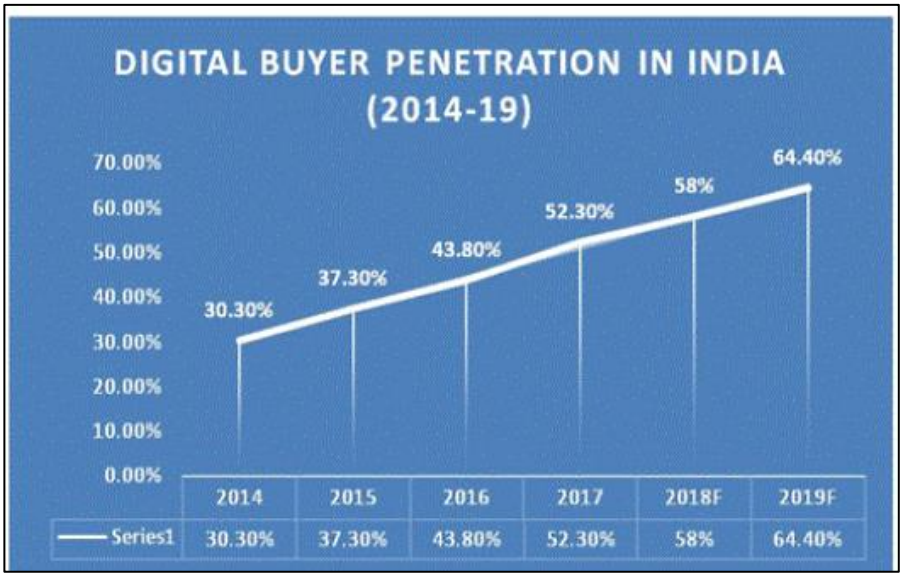

Figure 7.8: Digital Buyer Penetration in India

With the rise in mobile phone usage and the widespread accessibility of the internet, web-based businesses are becoming an increasingly important part of the Indian economy.

The graph above shows the increase in digital infiltration in India, which went from 30% in 2014 to an extraordinary 64% by 2019. The availability of a large number of electrical devices and its good effects have contributed to this developing pattern. According to (analyst), we should be able to identify where the population went and what they did as a result of the increase in digital admission.

According to analyst studies, Indian digital citizens in January 2017 were divided into numerous subsections, which largely had an impact on India's online industry. [14]

7.4 Conclusion:

E-commerce was created and has evolved as a result of information technologies, and as a result, it will continue to follow ICT in every step of the way. The essay goes on to describe how having an understanding of ICT and using it effectively can aid businesses in achieving their main objective, which is to cut costs and boost success. E-commerce has had a significant impact on the world economy in recent years, largely as a result of the enormous potential it offers to boost economic growth and corporate expansion on a global scale. The strategic use of information technology has become a critical factor in determining the success of a firm due to the globalization of markets and industries and the changing role of IT within corporate organizations. Employees can access their bank accounts from anywhere in the world. Since the population is young, enthusiastic, and receptive to the innovative methods of shopping made possible by Information and Communication Technology in commerce or e-business, the e-commerce industry is expanding quickly in developing nations like India and other countries.

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8. Impact of ICT on Education Social and Economic Development

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Abstract:

Two kinds of participants in the educational process have been identified by the study: those who supply educational services (teachers, professors at universities and other educational institutions, trainers, consultants), and those who receive educational services. The way goods and services are manufactured, delivered, sold, and purchased is drastically altering as a result of the Internet. It results in an ever-increasing number of individuals and organizations being digitally linked and prepared to participate in and contribute to the knowledge economy. The importance of information and communication technologies (ICT) as a catalyst for widespread social and economic development is starting to be emphasized by the international development community. This has sparked initiatives to use ICT to accomplish a range of development goals, including poverty reduction, expanding access to government services, extending health care, and expanding educational opportunities.

ICT has the ability to have an impact on a variety of societal and economic activities, including GDP growth, employment, productivity, eradicating poverty, improving quality of life, and improving education and healthcare. Although the literature offers a wide range of socioeconomic development definitions and components, it tends to concentrate on theoretical conceptualizations from many disciplines and the effects of isolated individual projects.

The effect of ICT on socio-economic development, in particular, has not been thoroughly investigated from the perspective of the ultimate stakeholder, the citizens of a country, who are the technology's final customers. By emphasizing the perspective of the general public in characterizing ICT-driven socio-economic development in a developing nation, this study closes this gap. The mounting obstacles and issues brought on by the expanding usage of ICT in the sphere of education under pandemic conditions are highlighted. It is acknowledged that it is critical to research the socioeconomic implications of implementing ICTs in the delivery of educational services while subject to quarantine constraints. The identification of social factors of the activation of ICT use in education has been done using the example of Ukraine, and it has been found that there are notable differences in terms of gender, age, and geographic features. We shall talk about the impact of ICT on economic, social, and educational development in this essay.

Keywords:

Social, Economic, Development, Educational, Institutions, Trainers, Information, Communication, Technologies, Government, Services, Growth.

8.1 Introduction:

The goal of this study is to undertake a theoretical analysis of the contribution of ICT and education to economic development and progress. The relevance of education, globalization, and human and social capital across time are the main topics of the first study. The effects and opportunities that ICT has on the educational process have been studied.

The expansion of education's economic production and its contribution to the inventory of human and social capital were then underlined. The effects of the rise in educational production on the expansion of human and social capital and, ultimately, the improvement brought about by all these elements on economic growth and development, were then thoroughly explored on a theoretical basis. [1]

8.2 Importance of Education:

The foundation of education is scientific humanism, which emphasizes the application of scientific and technology advancements to develop democracy and the welfare of people. Education for Scientific Humanism is worth reading since it places a strong emphasis on personal choice and advantages, in contrast to many following pronouncements.

The following is a summary of the generally recognized findings that emerged from many research on the economies of emerging nations about the impact of learning and education on the economy: [2]

- While the rate of return decreases while funds are being invested in the learning and educational process, as a result of the process's success, the rate of return rises across all relevant countries as well as in the various regions of those countries.
- • In developing nations when there is a shortage of trained labor, primary education is the degree of education that provides the best rate of return.
- • To raise the level of skilled labor, developing countries invest "between" 1.4% and 10.4% of their national income in learning and education.
- • In industries where competent workers are in high demand, possibilities for on-the-job training result in lower labor costs due to the improvement of the learning experience; thus, the growth of efficiency. On the other hand, from the perspective of the employees, on-the-job training offers chances for faster compensation rises.

Technology advances at the same time as skilled labor becomes more productive. The capacity of individuals to create and use knowledge by using physical capital is enhanced by investments in training and education in the areas that are needed by the sectors operating in the economy. In this way, the new inputs are both harmonized and used effectively, and the efficiency is increased in all sectors. [3]

8.3 Educational Development:

The process of education, which lasts a lifetime, starts at birth and continues until death, or from "cradle to grave." Continuous instruction and training are passed down from parent to kid, teacher to student, student to student, and obviously from the environment to the learner. Knowledge acquisition and skill development are the core components of education. An important component of the development process itself is societal change, which is something that education as a topic of study addresses as well as the method of instruction delivery. In other words, it focuses on a person's ability to stand on his own and make decisions autonomously, as well as how well he integrates into his community, supports his socio-cultural ideals, and contributes to the growth of his local environment. [4]

8.4 Social Transformation:

Should society remain imprisoned by its traditions and customs or embrace the global information technology revolution that has swept through all countries in the previous 25 years? There is a pressing need for societal change in order to put this subject in the proper perspective. [5]

Therefore, social change can be effectively characterized as the tidal waves that altered social patterns, customs, and values, as well as political and economic interactions, and had an impact on local communities and the experience of the country. According to this notion, technology has made the entire universe into a global village, speeding up the rate at which people and goods move across nations. When this occurs, a certain area or feature of society can be easily changed. Social transformation is a synonym for social change; it is a change made for improved quality of life, which denotes development, progress, or modernization. Values, beliefs, and religion can all be reflected in social transformation. It can also reflect on material conventions such as family, transportation, and constructed environments (architecture, planning), as well as material behaviors such as technology.

The foundation of a country's development is thought to be education. Therefore, education is the key to transforming society; self-realization is possible through education if there is proper and effective integration of the individual into society through a process of socialization that is specifically tailored to the individual; developing economic, political, scientific, cultural, and technological processes. Education serves as a change agent in a society where the only thing that is constant is change, thus it must be welcomed by everybody. In this contemporary, sophisticated, and industrialized society, education plays a crucial social function by acting as a catalyst for social development and transformation.

It serves as both a catalyst and an engine for development. When educators from around the world convened in Thailand in 1990 for a conference titled "Education for All," they did so as a result of realizing the value of education for development. Nigeria was one of the countries that signed the proclamation for the abolition of illiteracy. Numerous connections exist between ICT and education, which have been amply shown in the

world's affluent nations. ICT has been incorporated into a variety of learning settings, including formal, informal, and non-formal education. [6] In industrialized cultures, for instance, a large number of individuals have access to ICT devices, which they use to obtain a lot of information that affects them or influences their decision-making. In industrialized nations, ICT is employed in formal education to get good results. In the United Kingdom (UK), instructors are now better able to highlight the practical application of mathematics than ever before because to the use of microcomputers in the classroom. Due to the development of information, communication, and technology (ICT), remote education programs have become a widely accepted alternative form of education in non-formal education. [6] In industrialized cultures, for instance, a large number of individuals have access to ICT devices, which they use to obtain a lot of information that affects them or influences their decision-making. In industrialized nations, ICT is employed in formal education to get good results.

In the United Kingdom (UK), instructors are now better able to highlight the practical application of mathematics than ever before because to the use of microcomputers in the classroom. Due to the development of information, communication, and technology (ICT), remote education programs have become a widely accepted alternative form of education in non-formal education. [7]

8.5 Key themes in ICTs for inclusive Social and Economic Development:

There are various opinions on the effects of these changes in the acceptance and usage of ICTs on social and economic growth, as was mentioned in the first section of this introduction. The larger development community does not yet share the ICT/ICT4D professionals' enthusiasm and confidence in the development potential of ICTs, which was forcefully stated at WSIS. The remainder of this section of the article presents eight topics in discussions of the influence that ICTs have had on development policy and practice. It also reviews opinions on that impact. ICTs are multipurpose technologies, which means that their value and influence come primarily from their use in various economic and social spheres. For the development of the economy and society, three qualities are particularly crucial. ICTs:

- enable greater efficiency in economic and social processes;
- enhance the effectiveness of cooperation between different stakeholders; and
- increase the volume and range of information available to people, businesses and governments. [8]

Information and Communication Technology (ICT) Function Education IT has been renamed to information communication technology (ICT). It offers telecommunications access to information and is modern and interactive. Over the past few decades, it has given humanity a wide range of communication skills and transformed society into a global village. Through unified communications and the incorporation of telecommunications, computers, the internet, software, middleware, storage, wireless network, telephone, instant messaging, audio, video conferencing, social networking (Facebook), voice over IP (VoIP), and other media, it emphasizes the function of smart building management systems.

Processing, extracting, editing, sending, and receiving digital data are all included. Through a variety of technical instruments and services, ICT effectively and efficiently manages knowledge and discreetly helps to the growth and development of society. ICT is acknowledged as a change catalyst on a global scale and has the ability to have an impact on all facets of society. It altered the working environment, working conditions, business, entertainment, handling information, exchanging information, education, teaching methodologies, learning approaches, scientific research, and how people obtain information.

A. ICT in teaching and learning:

ICT in education refers to simply using ICT for instruction and learning. It has developed into a crucial component of the educational system. This plays a crucial role in the educational system. It has gradually changed the world from a scholastic to a knowledge-based society, and as a result, the economy has changed into a knowledge-based economy, helping to boost wealth creation across nations. This is a novel and all-encompassing approach to technology that has a big impact on the educational system. It has improved productivity, altered the entire design and operation of the educational system, and altered its governance. It has also brought about qualitative changes.

It has made, is making, and will continue to make a significant contribution to the improvement of education. It is also a universal truth that instructors cannot be replaced by technology since they are an essential component of effective instruction and without them, technology cannot work. Only the technology, way, method, and mode of instruction may be altered, amended, and improved. All educational participants were compelled to think futuristically as a result of these new ICT advances, and educational institutions, administration, and teachers had to choose their own responsibilities, strategies, and goals as a result. [9]

B. ICT and Social Work Ethics:

ICT has an impact on social workers' careers. Social workers that work with clients are even reliant on ICT. Social workers must focus on the changes made to the infrastructure and health care system as well as how clients use technology because there have been so many technical advancements across all disciplines. Social workers should be knowledgeable about ICT if they want to make a difference in society by taking action, especially if they have to cooperate with other professionals from different disciplines who strategize and use ICT. [10]

Even the workplace environment and social dynamics have changed as a result of the use of ICT. The use of ICT will increase as networking continues to develop and become more complicated. ICT is necessary for social worker training, providing social work services to the underprivileged, and even for social work research. Effective usage of ICT will benefit a large number of individuals.

ICT unquestionably plays a significant part in the human relationships that social workers focus on. The majority of individuals use ICT in one way or another, including social

networking sites like Facebook, SMS text messages, and electronic messages (email). Instant messaging services or video chats, such as Skype, are further examples. The importance of ICT for their customers must be understood by social workers.

The communication techniques used in face-to-face and online interactions differ from one another, but social workers must be aware of this. Relationships today are formed online. The organizations that share a goal unite; many of them receive education online; others receive social support; etc. Even the names electronic groups, forums, or mail groups are used to describe them. Both beneficial and negative effects of ICT exist, including cyberbullying. Social workers should place more of an emphasis on relationships that take place online rather than only in person. [11]

ICT is employed as a social development instrument. In villages, farmers use smart cards for a variety of transactions. Client credit history is stored on the smart card. NGOs use ICT as a platform to raise awareness about issues such as sanitation, early childhood development, and HIV/AIDS. NGO's also address issues of gender inequality by emphasizing the empowerment of women through ICT. To boost their confidence, even local women are taught the fundamentals of computing.

ICT is crucial in raising public knowledge about AIDS and sexual education. The public can easily access knowledge online.

C. ICT for Social Change:

ICT can be employed to effect social change. To advance their cause, people can build websites, Web pages, and blogs. For instance, the Women's Learning Partnership website connects the use of ICT to end women's marginalization.

Women are given access to technical skills through training and a variety of activities to support gender equity and human rights. ICT is the only medium that raises people's awareness of social issues and allows them the chance to participate in social change initiatives like the fight against cyberbullying, the advancement of feminism, the elimination of slavery, or the industrial revolution. [12]

Draw conclusions from the research on economic, social, and educational development, as well as from case studies, to present the possible outcomes of such a matrix-filling exercise in Table 8.1.

Consider the scenario where a lower middle-income nation assembled a high-level cross-ministry, cross-sector commission to assess the current economic and social condition and create a 15-year development plan for the future.

They pinpointed specific advantages, issues, and trends in their investigation. They were encouraged by the country's slow but steady economic growth over the past ten years, which was mostly driven by the eco-tourism sector and a developing light manufacturing sector that produces consumer items and small appliances for a middle class that is itself modest but growing.

As a result of its shared linguistic and cultural heritage, the nation also boasts a sizable, though traditional, film industry as well as a thriving entertainment sector. [13]

Table 8.1: Examples of the relationships between Growth Factors and Types of Development

Growth Factors	Types of Development			
	Economic Development	**Social Development**	**Educational Development**	**Educational ICT**
Deepening of Physical Capital	Target tourism, light industry, entertainment, and agriculture. Extend ICT infrastructure and support the deepening of private capital.	Target rural areas; build community technology centers; support private acquisition of ICT; facilitate Internet cafes.	Build and modernize school facilities, particularly in rural areas. Community technology centers in rural areas.	Invest broadly in school ICT equipment and networking but particularly at the secondary level and in rural areas.
Improvement of Human Capital	Upgrade labor; develop technology use, application, and production skills.	Strengthen education and social services, particularly employment transition and community development in rural areas.	Focus curriculum and pedagogy on understanding, real world problem solving and creativity. Include technology skills. Upgrade teachers' content, pedagogical, and technological knowledge.	Develop students' skills in using ICT to solve real world problems. Develop teachers' ability to integrate ICT into the curriculum.
Knowledge Creation and Technological Innovation	Strengthen intellectual property laws. Support of invention of new products and services in targeted clusters; research in agriculture.	Increase knowledge and best practices information on education, adult literacy, and modern farming practices.	Increase pedagogical knowledge and best practices on teaching for understanding and problem solving and on technology use.	Collect best practices on the application of ICT for understanding, complex problem solving, and the production of creative products.
Organizational Networking and Knowledge Sharing	Develop participation of SMEs in light industry, tourism, entertainment, and agriculture. Support networking between urban, rural, and regional resources and markets. Expand agricultural extension services.	Develop community knowledge sharing and collaboration; open government and education organizations to community and parent participation.	Decentralize decision making; foster teacher professional development communities and knowledge sharing, particularly between urban and rural schools.	Use of ICT to support communication, collaboration and knowledge sharing by students and teachers. Assess impact of ICT on learning.
Monitoring and Evaluation	Monitor effectiveness of government policies on key economic indicators.	Monitor effectiveness of government policies on social equity indicators; obtain community feedback.	Monitor indicators of high-level student learning; assess application of knowledge to solve problems.	Use ICT to support school effectiveness and efficiency; use ICT in assessment.

Their expanding light manufacturing sector somewhat offsets a sharp drop in the heavily government supported heavy manufacturing sector. The two largest cities in the nation are home to the majority of these economic resources. Although their corporate offices are in cities, ecotourism is located in distant places.

Due to a sizable population that is largely illiterate and depends on outdated farming practices, there are considerable discrepancies in the distribution of income and social conditions.

The group reached agreement on a future vision for the nation based on this analysis, one in which the development of physical and human capital would promote sustained economic growth and the eradication of social disparities.

The end result of their analysis and planning is the filled-in matrix in Table 8.1. The table demonstrates the commission's hypothetical decision to prioritize agriculture modernization and the growth of three industrial clusters.

Specifically in the sectors of tourism, light industry, entertainment, and agriculture, the plan would put into place policies that support the development of physical and human resources.

Public funds would be heavily invested in rural development, innovative capability, and education. For displaced heavy industry workers, shorter-term expenditures in training and unemployment benefits would be given to aid in their transfer to designated industries. Policies would promote both public and private investment in the ICT infrastructure, which is related to physical capital.

The privatization of telecommunications and the elimination of government support for the increasingly uncompetitive heavy industry would be used to finance public investments in the development plan. [14]

ICT is now a significant component of the economy. Computers and Internet connections are used by almost all businesses and individuals for financial activities like selling goods and services, enhancing product quality, and giving customers access to a wider variety of products. Evidently, throughout the past 20 years, there has been a rapid expansion of ICT and its effects on economic growth in both developed and developing nations.

Despite the recent global economic crisis, ICT use indicators show an increasing trend. Country data on computer, cell phone, and Internet users, however, show varying ICT diffusion rates across nations and regions (Figure 8.1).

For instance, the continual increase in mobile cellular subscriptions is apparent; by the end of 2009, there were 67 subscriptions for every 100 people worldwide. This demonstrates that despite having limited resources, consumers are still prepared to spend some of their disposable income on mobile services. [15]

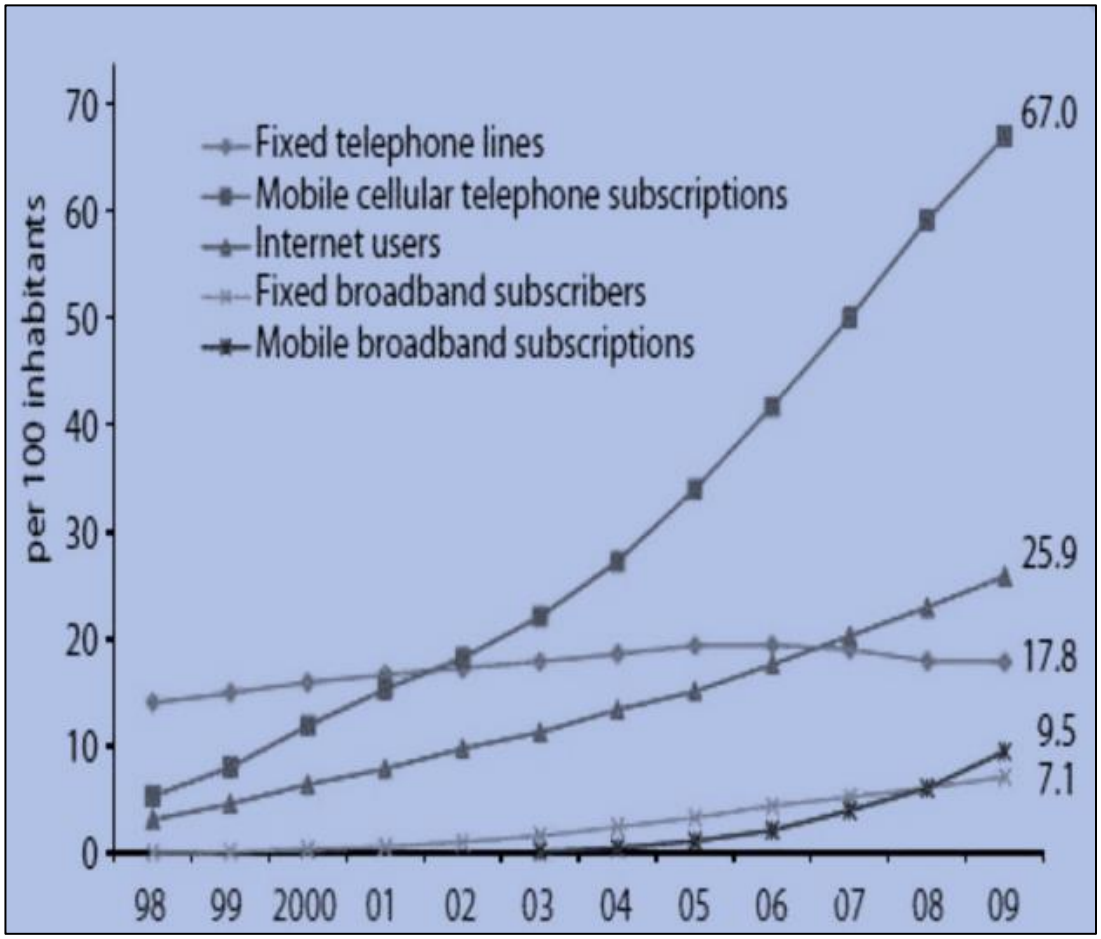

Figure 8.1: Global ICT Developments, 1998–2009.

In addition, many growth economists have been interested in the productivity boom that occurred in the late 1990s and early 2000s. ICT is currently regarded as the industrial society's main engine of economic growth and serves as a symbol of the technological revolution. The definition of ICT is the most crucial factor in determining how much ICT contributes to economic growth.

ICT is defined as a notion that encompasses computers, peripheral equipment, and other information-related office equipment (photocopiers, cash registers, calculators), as well as computer software. It also includes communications equipment and instruments. [16]

8.6 Conclusion:

Globalization serves as a background for studying economic and social transformation. It is thought that the global economy and education are interconnected. While the objectives of education are dependent on the economy, the quality of education is a factor in global economic competition. In these conditions, education evolves together with changing economic demands. This study investigated how common people in a developing country

see the idea of ICT-driven socio-economic growth. Although many authors and commentators have expressed their own opinions about socioeconomic growth, the "people's" perspective is of utmost importance and cannot be disregarded because it has the greatest impact on their daily lives. Our study adds a number of things. To begin, we developed a theoretical model of how ICT affects socioeconomic development. It is impossible to undervalue the role of education as a fundamental tool for modernisation and social change. The quality of education in a community determines its level of growth, so for a country to be on par with others, it must give citizen education substantial consideration. To fully benefit from the advantages of ICT, people must be literate.

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9. Information and Communication Technologies in Entrepreneurship

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Abstract:

Many human beings will agree at the concept that entrepreneurship is one of the maximum vital commercial enterprise concepts in latest days. In addition, it is said that we are experiencing the fourth business revolution (or "enterprise four.0). Records and conversation technology are one of the key factors of this period. Consequently, some statistics approximately these components, "entrepreneurship" and "statistics and communication technologies", are given and the viable and sturdy relationships between them are discussed in this take a look at.

Keywords:

Entrepreneurship, Entrepreneurial behavior, innovation and Intrapreneurship.

9.1 Introduction:

From the beyond to nowadays, it's been discussed with the aid of scholars of numerous examine of fields (for instance in strategic control (Barney, 2002; sales space, 1998; Eryılmaz, 2016), in business enterprise concept (Davis & Marquis, 2005) and in enterprise records (Kurt, 2016)) that whether or not the sphere is converted into an academic subject or no longer. In a comparable vein, some early (e.G. Vesper, 1988) and recent (e.G. George & Wadhwani, 2006; urban, 2010) studies in the subject asserted that entrepreneurship won status of an academic field.1 at some stage in this have a look at, historical heritage of entrepreneurship field will be examined. Then, a few discussions and empirical studies on antecedents and effects of entrepreneurship may be shared with readers. The study will continue with a section that specializes in the link between entrepreneurship and records and communication technology. Then, they have a look at will provide a few statistics on current developments and feasible future tendencies inside the subject. Subsequently, the examine can be ended with a conclusion element.

9.2 Information and Communication Technologies and Entrepreneurship:

"Information and Communication Technologies (ICT)" can be defined as 'electronic means ofcapturing, processing, storing, and communicating information" (Heeks, 1999: 3). ICTs may be input, output or a part of entrepreneurship processes. As an input, ICT may be used to increaseentrepreneurial competencies.

For example, Sinkovics *et al.* (2004) suggest that candidates of entrepreneurship need three different competencies such as intra-personal, inter-personal and organizational competencies to be successful. Some ICT tools such as mobile phones, internet discussion groups, video conferencing and computer simulations can enable competencies to be gained by students. According to Sinkovics *et al.* (2004), uses of ICT tools in international entrepreneurship education provide some benefits to students such as being familiar to values of counterparts in other countries and being familiar to new ICT tools. In addition, ICTs can create new business areas for entrepreneurs. For example, one of the newest concepts associated with ICT is "nomophobia". According to a definition, "nomophobia is the modern fear of being unable to communicate through a mobile phone (MP) or the internet" (Yıldırım, 2014: 8 cited from King *et al.*,2014: 28). Some health centers were founded in United States to treat addiction of people to mobile phones (Karahasan, 2012).Finally, ICT may be output of an entrepreneurial process as well. Some organizations may choose to produce either tangible (components, computers and networks) or intangible (software, web pages) ICTs as an output (Heeks, 1999). WhatsApp that were bought by Facebook in 2014 is a good example of ICT as an output of entrepreneurial processes.

Over the past few years, ICT has played an important role in lot of aspects of modern businesses. ICT is an abbreviation for Information, Communication and Technology. It is a broad term that encompasses the use of computers and other electronic devices (e.g., smartphones) to perform all forms of information processing.ICT has become a vital component of business operations and marketing strategies for companies in many industries. In fact, it is estimated that over 90% of companies today use ICTs to help them run their businesses more efficiently. This includes all aspects from sales transactions to customer support, accounting, scheduling etc. Every sphere of human effort has been impacted by ICT. from the fields of commerce, instruction, politics, science, and religion. Understanding the role of ICT in modern businesses is very important in the modern society in various ways.

From a marketing perspective, ICT has increased customer retention rates through its ability to deliver information about products and services faster than ever before. This allows businesses to respond more quickly when customers have questions or problems with their orders or delivery. It also allows customers to track their orders throughout the process and communicate with businesses at any time of day or night. From a production perspective, ICT has allowed companies more flexibility in how they produce goods (e.g., more efficient production lines). This means that companies can produce more products with fewer workers and less equipment than ever before.

From an administrative perspective, ICT has allowed companies to better manage their operations by tracking inventory levels and costs across various departments and locations within an organization. From a service perspective, ICT provides new ways for people to interact with each other (e.g., social media platforms such as Facebook). For example, these platforms allow users around the world to connect.

The evolution of ICT over the years, have become stronger. Companies have begun to understand the importance of ICTs for the labor market. They also know that ICTs can be a great tool in training and development of their employees. It allows them to reach

more people at once, making it easier for them to disseminate information regarding job openings or other important matters. In addition, companies are now using ICTs in order to provide better service. They are now offering various services online such as social media platforms where they can communicate with their customers through their own website or blog. This has made it possible for companies to respond faster than ever before when encountering customer issues or complaints.

Moreover, companies are also using ICTs in order to attract new customers and promote their products on social media platforms such as Facebook and Twitter. This helps them make more sales by reaching out to potential customers who might not normally visit their stores because they don't find what they need there. The use of ICTs by social entrepreneurs allows them to reach out to a wider audience and promote their products while allowing them at the same time gather feedback from clients and consumers which will help them improve on products or services being offered.

Information and communication technologies (ICT) can aid social businesses, as well as other groups working on issues of global sustainability and in the field of human development in general, in enlarging their social effect.

ICTs are important tools for social entrepreneurs because they enable them to build a strong online presence, interact with customers and donors more effectively, and reach out to new audiences. They also help social entrepreneurs develop better strategies for their businesses. The potential of ICTs in fostering social entrepreneurship is not limited to just information management. A wide range of applications can be used by social entrepreneurs to increase the impact of their work at all levels.

In recent years, there has been an increasing interest among social entrepreneurs in using technology to create more effective ways of doing business. Many organizations have started to adopt new technologies like blogs, podcasts, videos and social networking tools like Facebook or Twitter to promote their products or services and raise awareness about socially relevant issues.

9.3 Conclusion:

In this study, the relationships between two popular concepts, "entrepreneurship" and "informationand communication technologies", were discussed. According to the study, ICTs can be input, output or as a part of entrepreneurial processes. On the other hand, when ICTs are used in a negative way, they can be harmful for entrepreneurial success as well. Therefore, appropriate uses of ICTs must be guaranteed.

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10. Impact of ICT tools in Chemistry Education

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Abstract:

The use of ICT can improve both the learner's and the facilitator's capacity for learning. Several areas in chemistry require computational techniques to master. The application of ICT in some chemistry-related topics is the topic of this article. In order to grasp the many concepts, such as stereochemistry, IUPAC nomenclature, and other organic chemistry topics, we attempted to get past the traditional chalk and talk method. This study examines how students' academic achievement is affected by teachers who use both traditional methods and ICT tools. It also looks at how students feel about the subject of chemistry, how they feel about using ICT tools to teach and learn the subject, and how ICT tools affect students' written communication skills. In this study, ICT tools refer to the use of digital devices for all facets of instruction and learning. Video tapes, audio tapes, CDs, DVDs, television broadcasts, video cassettes, computer-based learning materials, teleconferencing, video conferencing, the internet, web conferencing, etc. would therefore be the components of ICT. We will talk about in this essay. ICT tools' effects on chemistry education.

Keywords:

Education, Chemistry, Computational Technique, Skills, Digital Equipment, E-Learning, Molecular Structures, Information and Communication Technologies, Animation, Videos, Stereochemistry

10.1 Introduction:

The foundation of all other scientific fields is thought to be chemistry. It is a creative science that is necessary for enhancing our way of life and sustainability. The goal is to describe the goals and associated ICT activities, such m- and e-learning, which enhance education.

To help students understand and for their own benefit, chemistry professors must be well aware of the ways in which ICT is employed as a teaching and learning tool. Using ICT to help students visualize spatial three-dimensional (3D) elemental and molecular structures is one of the opportunities for teaching and learning chemistry. It also enables collaborative, synchronous and asynchronous interactions between students and teachers. ICT is regarded as a reliable source of theoretical knowledge and scientific data, and it provides a workable way to assist real-world chemistry learning.

In order to enhance students' comprehension of chemistry concepts and theories in a variety of contexts, the breadth of knowledge available on the Web and in other ICT-based cognitive tools, together with virtual labs and simulations, should be included into chemistry education nationwide. [1]

ICT can answer issues from everyday life in the classroom that were previously unsolvable in a traditional classroom setting. Students have more options for research, interaction, cooperation, and collaboration thanks to the adaptability of ICT and the internet in particular.

Thanks to the placement of interactive educational resources that boost student motivation and facilitate the acquisition of basic skills, ICT improves education. For students of all ages, using various multimedia resources including TV, records, films, and computer programs creates a more engaging and demanding atmosphere for learning.

We will be greatly impacted by the recent and rapid improvements in ICT, especially on the Internet. It is nearly difficult to envision information and communication technology (ICT) at the close of the 20th century, let alone as we begin the 21st.

We are already beginning to see how these developments are transforming our perceptions of just-in-time learning, remote learning, traditional schooling, and the value of lifelong learning. The amount of knowledge available to our students as they study for their classes and enter the workforce will greatly rise thanks to advances in ICT, but this shouldn't be the upper bound on what we expect.

We need to think beyond just imparting facts and information to our pupils if we want to give them a top-notch education. We need to consider the findings of educational research, which indicate that students learn best when they build on prior knowledge and engage in active learning while comprehending and utilizing a metacognitive approach. [2]

Idea of ICT Information and communication technologies are defined for the purposes of this study as any digital tools, resources, information, and devices that can be used to achieve the objectives of teaching and learning as well as system administration.

The application of digital devices to all facets of teaching and learning might be interpreted as the study's use of ICT tools. Consequently, the following would be considered ICT components: computer-based learning materials, teleconferencing, video conferencing, the internet, web conferencing, audio and video tapes, CDs, DVDs, television broadcasts, and video cassettes. The following ICT tools were employed in this study:

- Internet
- Power point Presentations
- MS word
- MS Paint
- CD ROM

ICT has a broad and evolving potential application in science education. This is shown by the possibility that different ICT technologies offer to supply an enormous array of excellent resources that are pertinent to science education.

A large body of research suggests that when learning is assisted by ICT, students are more highly motivated, and ICT also gives teachers the chance to be innovative in their approach to teaching. [3]

10.2 Review of Literature:

A key component of the Indian government's emphasis on ICT-enabled teaching and learning is the use of virtual labs, which offer lab experiences in online learning environments to individuals unable to perform their lab experiments in person.

In addition, the government has implemented many measures to enhance the quality and efficacy of education, such as the e-PG Pathshala platform, which includes multimedia self-learning modules that provide students with access to valuable and high-quality resources (Osborne, 2003). [4]

Presenting different kinds of courses is now possible for teachers thanks to the development of interactive technology and other free web-based applications. Computers have shown to be the most effective tools for fostering students' curiosity and bolstering science education as information technologies have advanced.

Computerized modeling and animations are used in science education to describe, clarify, and forecast scientific processes. The ability to reason, explain, and engage in higher level thinking are critical for learning science, and these transitions may foster these abilities (Barak, 2009). [5]

10.3 Objectives:

- To examine the extent of ICT tool utilization in supplementing chemistry learning among students.
- To assess the frequency and patterns of ICT tool usage in accessing resources and information for chemistry studies.
- To explore the engagement and collaboration facilitated by ICT tools in chemistry education.
- To evaluate the perceived effectiveness of ICT tools in aiding comprehension and understanding of chemistry concepts

10.4 Research Methodology:

The overall design of this study was exploratory. The research paper is an effort that is based on secondary data that was gathered from credible publications, the internet, articles, textbooks, and newspapers. The study's research design is primarily descriptive in nature.

10.5 Result and Discussion:

Elucidation of chemistry with the help of Information and communications technology:

The idea that chemistry is a challenging subject in part due to the fact that a single piece of information can be viewed from multiple perspectives at once is one of the main guiding concepts in research on chemistry education. There are three levels of information analysis in chemistry: macroscopic (visible), submicroscopic (invisible), and symbolic (structural formula).

The term "three levels of chemistry" is commonly used to refer to these three stages. It is relatively simple for an expert (a chemist, a teacher) to think of the visible world in terms of structural formulas and dynamic processes occurring at the microscopic level, but modeling is challenging for a beginner (a student, a pupil).

We therefore require methods for concretizing the links between various levels of information and for visualizing it. ICT provides the required visual aids for this task. Animations, simulations, videos, and molecular modeling in chemistry are the most often utilized tools for visualizing various levels. [6]

An animation is a collection of images that can be used to produce moving images. Animations are a great tool for explaining chemistry phenomena and processes. In terms of pedagogy, they are a flexible kind of media. In addition to having students produce their own animation, teachers can also utilize animation to communicate information.

Like animation, videos are digital files, but they are not the same when it comes to the chemical information they contain. While the macroscopic level of phenomena can be presented on the movies, the microscopic level of phenomena is investigated in chemistry animation.

Video processing allows for the editing of video recordings, which in turn links macro-level videos and micro-level animations. Multiple movies and animations can be studied simultaneously in a single video presentation by connecting video documents in a leveled manner.

While simulations can handle bigger systems, molecular modeling is limited to the modeling of single molecules or small static systems. Molecular modeling differs from simulations in that simulations study dynamic processes.

In molecular modeling, the user takes an active part and is given the freedom to construct, compute, and visualize the system anyway they see fit thanks to the software. Users' rights are restricted considerably in simulations. Since the simulation is dependent on data that has been generated in advance, the user frequently does not execute the calculation. The essay has up to this point discussed how various ICT tools can be used to visualize the three levels of chemistry.

We then need to consider how ICT may be used to concretize links between various levels. For example, concept maps work well in this type of task (Novak & Cañas, 2008). Using a linking word to illustrate how concepts relate to one another, a concept map is a method for outlining information.

Although idea maps can be created by hand, it is simple to add other types of information to electrical concept maps, such as links to other documents and pictures, sounds, videos, and animations. A straightforward concept map on isomerism is shown in the accompanying image (Figure 10.1), which provides an example of each isomerism category on a submicroscopic level.

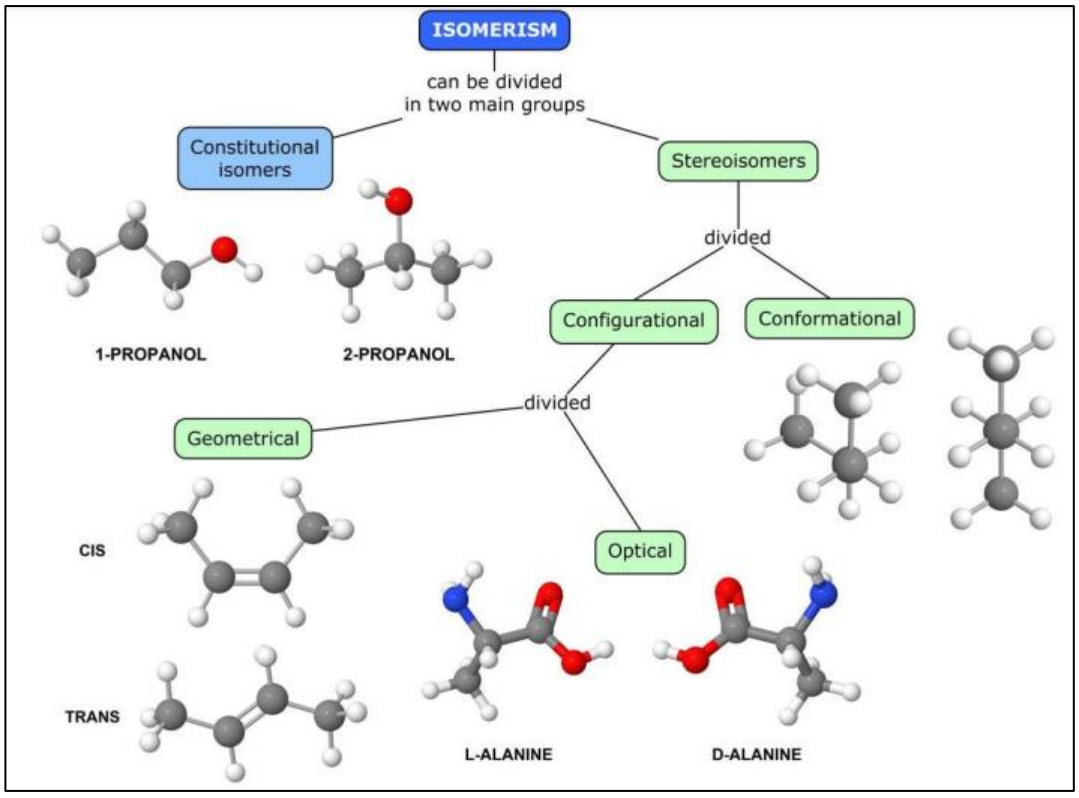

Figure 10.1: A simple concept map of isomerism. This map has been made with the CmapTools software.

Concept maps are designed to be cognitive aids. Constructing idea maps makes it easier for students to present, critique, and expand on their understanding of a subject by visualizing their knowledge structure. Additionally, creating concept maps engages a variety of higher order cognitive abilities.

ICT in Chemistry ICT in chemistry education has the potential to improve the quality of chemistry education by offering answers to many of the issues that the field faces. As everyone knows, traditional classroom instruction essentially uses the talk-and-chalk approach.

Additionally, even while a teacher wants his students to have a thorough comprehension of the subject, there is pressure on them to complete the syllabus on time. [7]

There are so many topics which can be covered with the help of chemsketch.

1. Aromaticity
2. 3D structure optimization
3. Tautomeric forms
4. Auto renumbering
5. Calculation of Molar Refractivity, Surface tension, Parachor, Index of refraction, Density, Polarizability and dielectric constant.
6. IUPAC Nomenclature
7. Import and export of molecule
8. Conversion of 2D into 3D
9. Advance form of periodic table
10. Structure of Carbohydrate
11. Structure of Fullerene and other bigger molecule
12. Editing of molecule structure

Stereochemistry:

The study of chiral compounds is a key area of stereochemistry research. March of 1985 As "three dimensionality" is implied by the word "stereo-," stereochemistry is often referred to as 3D chemistry. Teaching stereochemistry using the chalk-and-talk approach is always an exhausting endeavor for teachers because it necessitates a lot of three-dimensional structures for molecules, which cannot be drawn on a black board. Several free sketching tools are accessible online that make it simple to draw three-dimensional objects and determine several additional types of information, such as bond angle, angle strain, chiral carbon, etc.

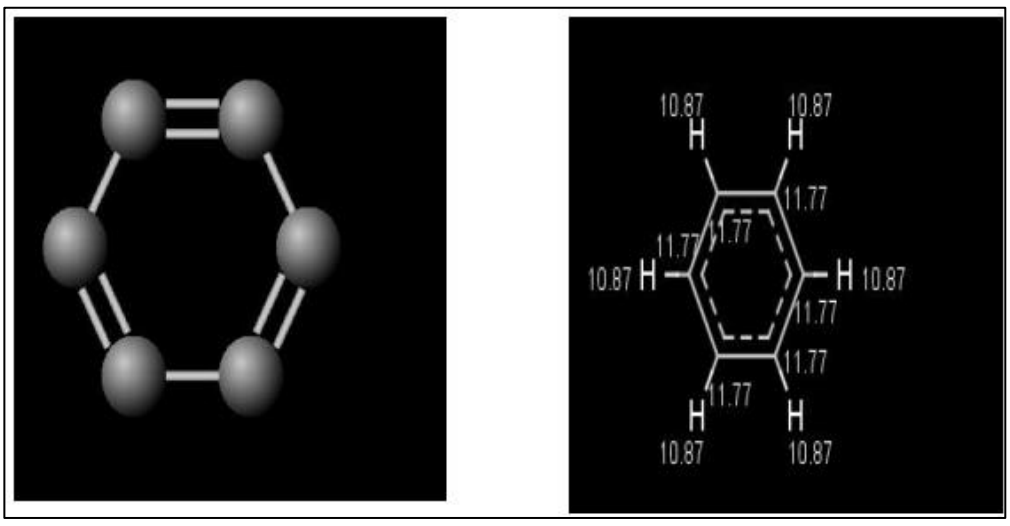

Figure 10.2: Stereochemistry of benzene [8]

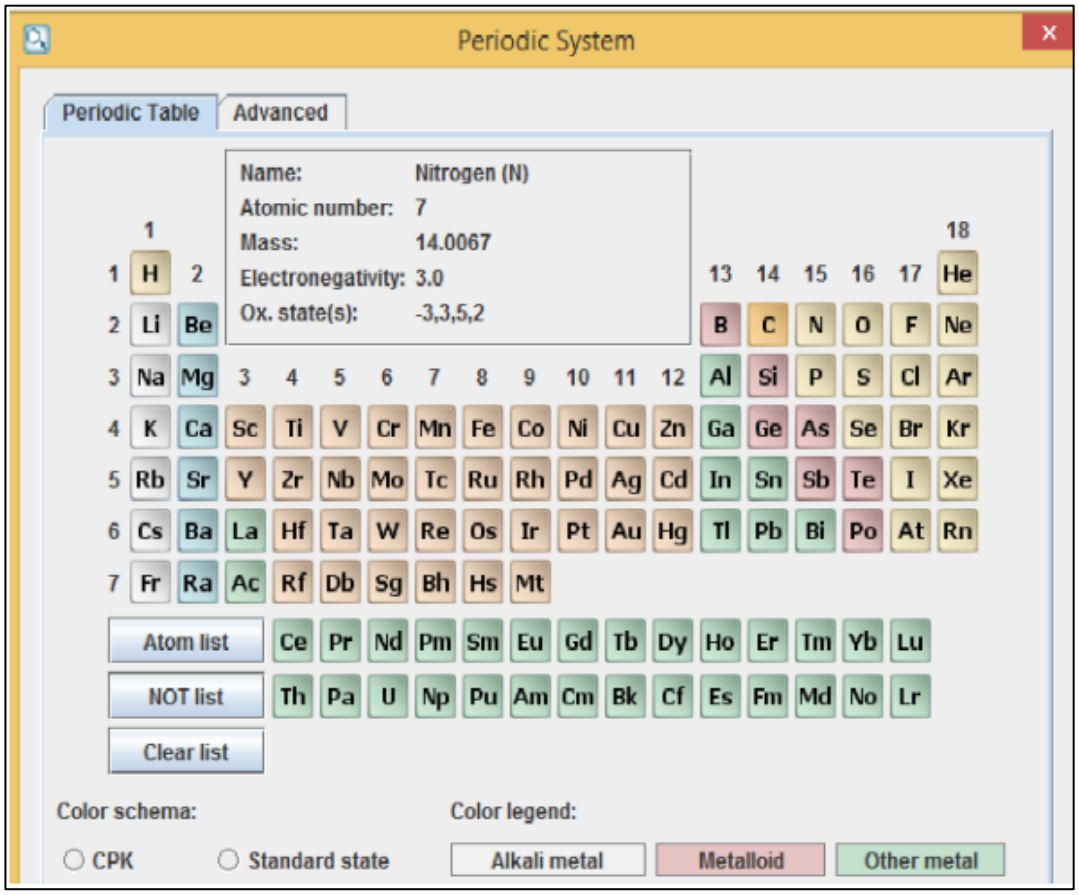

Figure 10.3: Snapshot of Periodic Table

Periodic Table

Every facet of chemistry makes use of the periodic table concept. Whether it is pharmaceutical, drug, or medical chemistry, or organic, inorganic, and physical chemistry. But remembering every property in the periodic table is a constant struggle. We can teach the periodic table more effectively with the use of this tool.

Every element from atomic number 1 (hydrogen) to 118 (ununnoctium) has been found or created; on December 30, 2015, the IUPAC certified the existence of elements 113, 115, 117, and 118 (Chemistry: Four elements added to periodic table". BBC News) The periodic table is set up in the form of a large grid. Because of its atomic structure, each element is positioned in a particular way.

The periodic table has rows (from left to right) and columns (from up and down), much like any other grid. Every column and row has distinct properties. For instance, whereas potassium (K) and calcium (Ca) from row four have different properties, beryllium (Be) and magnesium (Mg), which are found in column two, have some similarities.

IUPAC Naming:

The International Union of Pure and Applied Chemistry (IUPAC) recommended the nomenclature of organic chemical compounds in 1971 through The Commission on the Nomenclature of Organic Chemistry, which is a systematic approach to identifying organic chemical compounds in chemical nomenclature [9].

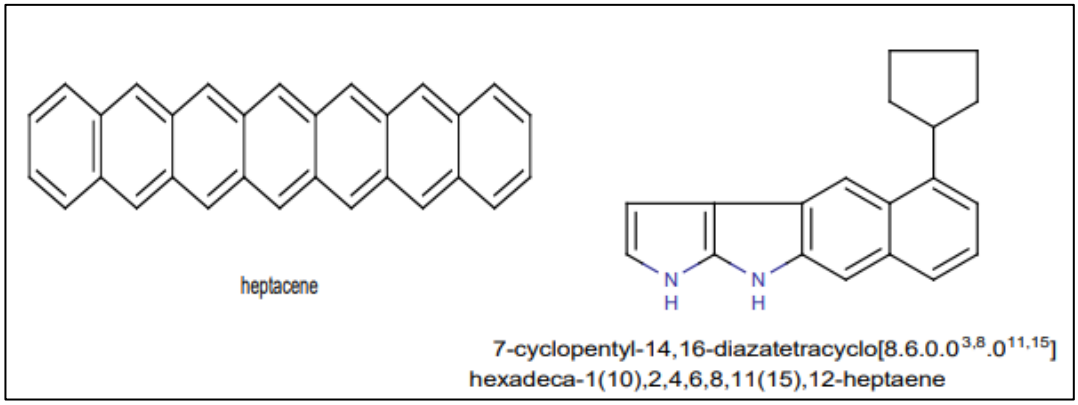

Figure 10.4: IUPAC Nomenclature

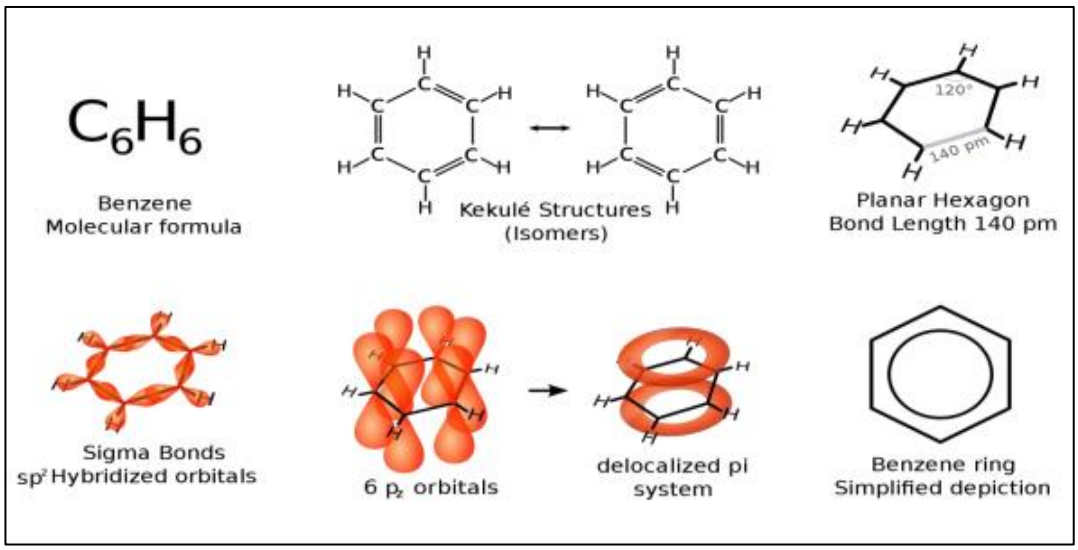

Figure 10.5: Various Possible Structure of Benzene

Various Chemist Software tools and programs for chemistry researchers and teachers are being designed with the aid of information technology. This section discusses a small number of them.

A. Chem Draw: This drawing tool is the most commonly used for research in chemistry. It is a part of the ChemOffice family and is available on Windows and Mac. With the

help of this tool, we may sketch chemical structures and see 3-D structures in addition to learning about the properties of chemicals. It provides precise IUPAC names for the chemical structures and creates accurate structures based on the chemical names.

B. Chem Doodle: This tool offers sophisticated mechanism sketching capabilities to illustrate bond arrow notation, a single electron, and two electrons. It is the only ICT tool for chemical drawings that can easily create chemical text and atomic notations through the use of subscript and superscript merge formatting in text.

C. Chem Sketch: This tool aids in the illustration of polymer, organometallic, and organic chemistry chemical structures. For example, it can calculate molar refractivity, density, and molecular weight. It is employed for both 2D and 3D structural viewing. This molecular editing tool is used to create and edit chemical structure images. ChemSketch is a readily understood chemical structure drawing tool with over 20 lakh users worldwide.

D. Chem Window: John Wiley & Sons publishes this chemical structure sketching molecule editor. It is utilized for bond length, angle, and other computations as well as 2D and 3D visualization of structures. Chemists utilize it to create accurate process flow diagrams.

E. Chem3D Pro: This part of the ChemOffice package is also available. It enables the analysis of molecular attributes, such as name and molecular weight, and the drawing of chemical structures as well as the visualization of 3D structures. Windows OS is used to execute it.

F. Marvinsketch: It is a desktop toolkit that may be used to import, export, publish, and draw molecular structures. Additionally, it allows conversion between several graphical and chemical file types. It is a molecular editor designed to enable research to be accessed on all platforms. It supports practically all common chemical file types and translates chemistry into a digital environment.

G. BK Chem: This Python-based sketching use for chemists is free. It can just establish each element's fundamental structure and relationship to its associated symbols. This cross-platform program allows you to sketch molecular structures and chemical compounds. It is used to create ready-to-use templates for molecular charts and graphs, bond by bond drawing. Chemical researchers can utilize BKChem to show complex diagrams with usefulness.

H. J Chem Paint: Chemistry Development Kit created this molecule editing tool for 2D chemical structures. It is open-source Java software that works with Windows, Mac OS, Linux, and UNIX. It can be used to import and export data in plain-text forms in addition to drawing chemical structures. J Chem paint makes it simple to draw and remove different types of chemical bonds. It can be downloaded for free. There are ring templates that range in size from three to eight atoms.

ICT Tools for Chemistry A wide range of chemical software is widely available and can be utilized as an ICT tool to help improve chemistry learning.

While some of them have economic value, others are freely available. You may use Chemsketch and Marvin Sketch to draw molecules. Along with the object, these tools offer a variety of other details. [10]

10.6 Conclusion:

In order to recruit and keep the greatest talent and support their professional development, the current paradigm for chemistry education in our nation needs to be changed at all levels. The teaching profession needs to be made more appealing in order to achieve this goal. In the form of fellowship and awards, educators and researchers alike ought to be appropriately acknowledged for their achievements. The goal is to present teachers' perspectives on ICT integration into the teaching-learning process and their experiences with it, as well as to identify any perceived barriers to such integration. It is imperative that the current paradigm of chemistry education in this nation be changed to attract and retain top talent while also fostering their professional growth at all educational levels. The teaching profession needs to be made more appealing in order to achieve this goal.

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