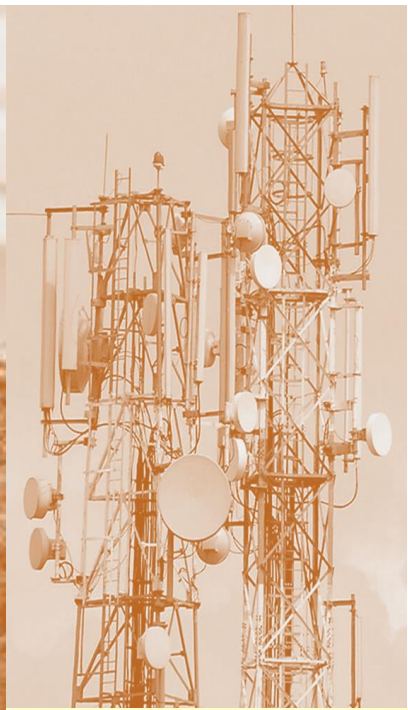




ICT : A Catalyst to Transform Rural India

(With Special Reference to Sustainable Rural Development)

Chief Editor

Dr Jitendra Singh Bhadauria



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*Information & Communication Technology (ICT) : A Catalyst to Transform Rural India
(With Special Reference to Sustainable Rural Development)*

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***Information & Communication Technology (ICT) : A Catalyst to Transform Rural India
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From the Desk of Chief Editor.....

With wide acceptance and need of information and Communication Technology (ICT) is one of the core field of innovative research & extension for development of the societies. In the age of Globalization and digitization life is not complete without use of latest communication technologies. It is an essential task to each and every person in the societies to update themselves by the recent information and communication technologies (ICTs) available in the environment where they are living and surviving. It is also a big challenge to those who are engaging in the research and investigation to set a goal to ensure the availability of cheap and simple information and communication technologies (ICTs) before the users, which is not easy without continuous research and development (R&D).

It's our prime responsibility to focus on new facts, innovations, investigations, and researches on modern & latest communication technologies for the benefit of researchers, faculties, scholars, students and all those who are directly or indirectly associated in the area of communication technologies and also for general people who are seeking to use information in their life for improvement. Now a days Information Communication Technology is an integral part of development in the area of Education, Commerce & Industries, Rural development, foreign policies, service sector such as banking, Insurance, Postal services, Telecommunication, Medical sectors, Infrastructural facilities etc. These issue and our tendency to do some valuable work, for the benefit of last person in the societies has created a motivation to take an initiative to collect relevant research findings in the area of information technology from many researchers and investigators of high repute and edited in the form of a book **"ICT: A Catalyst to Transform Rural India with Special Reference to Sustainable Rural Development"** having ISBN number, covering various aspect of rural development especially and urban development in general that is reviewed by the associated personalities of high repute in the field of communication.

In the era of "world like a globalized village" It is hoped that this publication which is the first of its kind in Bundelkhand region and possibly in other part of India, will be of great practical value to the Information technology users, Technologists, Professionals, Business Tycoons, Professors, Teachers & students of various colleges and universities, as well as those who are engaged in the field of information Technology in India and abroad.

Prayagraj, 29 July, 2021

**Dr Jitendra Singh Bhadauria
Chief Editor**

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CHAPTER - 1

Smartphone Apps - An Eminent ICT Tools for Agricultural Development & Agri-Information Dissemination

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1. Introduction

The reach of smartphone even in rural areas extended the Information & Communication Technology services beyond simple voice or text messages. Several Smartphone apps are available for agriculture, horticulture, animal husbandry and farm machinery Information about policies, good agricultural practices and market prices of commodities, current demand of commodities and various useful agriculture schemes are helpful to farmer for reaping good profits. The smartphone app is one of the platforms, where a farmer can get all solution and information in just one touch. Smartphone apps revolutionized the connectivity and used for transferring Agri-information to farmers. According to the statistics, there are two billion smartphones user across the globe in 2016. Data also concludes that India has the third largest smartphone user after China and USA which over around 167.9 million in 2015. During the past decades, agriculture information and technology transfers are mostly done by village level workers, extension personals, scientists, SMS (Subject Matter Specialists) of KVKs, SAUs etc. With the arrival of the internet, most of the information were tried to avail by web-based approach (e-based services). As on 31 July 2017 the number of telephone subscribers was 1210.71 million (1186.79 million wireless and 23.92 million fixed land line telephones) as estimated by the Telecom Regulatory Authority of India. The tele-density has reached 93.88 per cent as of July 2017. However, there is huge gap between urban and rural tele-density, 173.21 and 57.45 respectively.

According to IDC, India has the fastest-growing smartphone market in the world, accounting for 27.5 million devices sold in the second quarter of 2016, up 17 percent from the previous quarter. Mobile subscriptions are expected to reach 1.4 billion by 2021, according to the Ericsson Mobility Report of June 2016. The growth of mobile communication technology is creating a number of opportunities for social empowerment, and grassroots innovation in developing countries. One of the areas with potential impact is in the contribution of mobile applications to Agricultural and Rural Development (ARD), by providing access to information, markets, and services to rural inhabitants. Studies reveal that mobile phones have a positive impact on sustainable poverty reduction and identify accessibility as the main challenge in harnessing the full potential. According to 'The Rising Connected Consumer in Rural India', a study by the Boston Consulting Group, up to 300 million Indian consumers are expected to be online by 2020. More than half of

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the new Internet users are expected to come from rural communities. Cheaper mobile handsets, spread of wireless data networks, and evolving consumer preferences will all drive rural penetration and usage. The advantages of mobile phones include affordability, wide ownership, voice communication, and instant and convenient service delivery. Due to these, there is explosion across the world in the number of mobile apps, facilitated by the evolution of mobile networks and by the increasing functions and falling prices of mobile handsets.

2. Advantages of Mobile Apps

The main advantages of mobile apps for farmers are, easy to access information on farmers mobile. The information is stored in the mobile handset itself for easy access, for example the details of package of practices, pest and disease information and scheme related information etc. Wherever the information is dynamic in nature, for example weather details, market prices, advisory services, the mobile app requires Internet connectivity to fetch the data from the back-end server databases. The mobile services, particularly the SMS service is only a one-way information provider to the farming community. The farmer needs two-way-communication and dynamic information for day-to-day farming. Farmers need timely information in response to their specific needs. There are mobile applications that provide latest agricultural information about trends, equipment, technologies and methods being used, help identify pests and diseases, provide real-time data about weather, early warnings about storms, local markets offering best prices, seeds, fertilizers etc. In addition, farmers can also interact and get guidance from agriculture experts across the country via the apps. These apps help in providing market information, facilitating market links, providing access to extension services, farm related information etc.

The USDA'S ARS recently released the first two of a suite of mobile phone apps viz 'Land info and' 'Land cover'. It connects the agriculture producers around the world and provides them with shared knowledge on ways to maximize their land productivity while protecting its resources for future generations. Reuters Market Light (RML) is a Subscription based SMS service that provide localized information on commodity prices, crop institution and weather. Smartphone mobile apps designed and developed by Jayalakshmi Agrotech from India are the most commonly used agriculture apps in India. The mobile apps are in regional language to break the literacy barrier and deliver the information in the Simplest manner. Farmer link is a mobile solution for enabling the coconut value chain in Philippines. This was created by Grameen foundation and combine satellite data and farm data collected by mobile equipped field agents to help coconut farmers increase productivity, deals with crop pest and diseases.

3. Mobile Apps for Agriculture & Allied Sector

Various Smartphone apps for agriculture & allied sector, which will be very helpful for farmers during the Covid-19 lockdown period, are discussed below. As this a very crucial time of Indian farmers for carried out various agricultural practices & marketing, This apps provide enormous information which will be very beneficial for farming community to update with the field condition, weather condition & market condition. This app provide information about weather

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forecasting, advisory services, market prices of agricultural produces, govt scheme, subsidies & crop insurance information. Important apps are given here

- **Kisan Rath** - In recent lockdown condition in India due to corona virus pandemic, Ministry of Agriculture & Farmers' Welfare, Govt of India recently launched a mobile app "Kisan Rath" to facilitate transportation of food grains and perishables during the lockdown period. This mobile application is developed by the National Informatics Centre (NIC) to ensure farmers and traders are able to find transport for Agriculture and Horticulture produce. Kisan Rath App will greatly facilitate farmers, FPOs and Cooperatives in the country to have the choice to find a suitable transport facility to transfer their agriculture produce from farm gate to markets. This app also help farmers, traders to connect with transporters, it helps connect farmers and traders to a network of more than 5 lakh trucks and 20,000 tractors. Here are multiple types of transports available. With the primary transport, the goods can be moved from the farm to the Mandis, local warehouses or the collection centres of farmer producer organisations. As for the secondary transport, it can be used to move goods from the local Mandis to intra-and inter-State Mandis, processing units, railway stations, warehouses or wholesalers. Moreover, there are transports with refrigerators also available. In order to help farmers and transporters use the application with ease, the app even brings support for the Hindi language. During lock down, farmers are finding it difficult to book tractors and trucks for transporting their produce. This app will help them bring their commodities to Mandis and other market yards.
- **Kisan Suvidha**- Launched in the year of 2016-17. It Provides Information on Current Weather and Forecast Up to next 5 days.it also provide Information about market Prices of Crop/Commodities In nearest town.
- **RML Farmer-Krishi Mitra**-This app Provides information on Latest Commodity and Mandi Prices, Precise Usage Of Pesticide and Fertiliser , Weather forecast and advisory, Government agriculture Policy and Scheme.in this apps, Users Can Choose from 450 Crop Variety, 1300 Mandis, 3500 Weather locations, across 50,000 Village and 17 states In India.
- **Pusa Krishi** – This app is launched by Ministry of Agriculture & FW in 2016. Farmers can easily get Information about technology by IARI, which will help in increasing returns. This app also Provides Information on several of crops variety developed by ICAR.
- **AgriAPP** - This app provides complete information on crop production & crop protection. It enables Farmers to across all the Information related to "High Value, low Product" Category Crop varieties. It also provides information on Soil & Climate status of particular area. Video-based Learning is the unique feature of this app.
- **KHETI-BADI**- It is a social initiative app, which aims to promote and support 'organic farming' and provide important information related to farmers in India. This app helps farmer to switch their chemical farming to organic farming. It is currently available in four languages like Hindi, English, Marathi and Gujarati.

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- **KRISHI GYAN** -This app doesn't require the mobile no. of individual to stay connected. It provides general information on farming. As well as it enables Indian farmers to connect with Krishi Gyan experts and asks them questions related to farming and get answer within the application through notification.
- **Crop Insurance** - This app helps farmer to calculate insurance premium for notified crops and provides information cut-off dates and company contacts for their crop and location. It can also be used to get details of normal sum insured, extended insured, premium details and subsidy information of any notified crop in any notified area.
- **Agri Market** - This apps is Launched along with crop insurance app by Government of India. Farmers can get information related to prices of crops in markets within 50 km of their own device location using the Agri market mobile app.
- **CCMobile App** - "CC" stands for Connected Crops and the app tends to connect farmers with their crop. The users can read the environment metrics like temperature, humidity, wind velocity and moisture remotely. They can also compare those metrics over a period of time, say weekly, fortnightly or monthly to assess the status of their crop. The sensor readings are available through SMS / email alerts, graphing and historical data.
- **Spray Guid** - Ensuring the right composition, viscosity or consistency of pesticide or other agricultural solutions is important. The app calculates the amount of solute, the amount of solvent, the mixing time and the spraying areas so that you get the best value from your investment. Users can share their experience including data and results with others over their social accounts. This app save time & efforts as well as reduced the human error & accidents.
- **IFFCO Kisan** - Offered by Indian Farmers Fertiliser Cooperative Limited (IFFCO), the app is dedicated to farmers of India. They can seek advice from agriculture experts and scientists and explore its library to know about crops, agriculture cycle, agriculture field preparation, water management, disease control and agriculture proactive actions. They can also know about the commodity trade prices across various food and vegetable marketplaces in India and access weather forecast (temperature, RH, rainfall possibility, expected wind speed & its direction in the set preferred location) on their phone.
- **Ag Mobile** - From making the soil right to the plantation to manuring and irrigation, to harvesting and monetizing the produce, the app is to help you at every stage. Take stock of weather, related forecasts and maps, watch live commodity market prices and seasonal comparison, and capture news that can affect your agricultural endeavour. The data or insights are derived from Bar chart and Successful Farming. Also, learn commodity trading skills and listen to crop advisor, grain merchandiser, analyst, or broker, etc.
- **Machinery Guide** - This app assists the farmers with using the farm equipment for various purposes like soil cultivation (cultivator, rotator, roller, etc.), sowing, manuring, planting, fertilization, pest control, produce sorting, harvesting, irrigation, etc. precisely. The app graphically explains how to make the optimum use of the devices and keeps a watch on them via GPS connectivity

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- **RiceXpert** - This app is developed by the Scientists of ICAR-NRRI, Cuttack, Odisha. riceXpert is developed for the farmers to provide real time information on insect pests, nutrients, weeds, nematodes and disease-related problems, rice varieties for different ecologies, farm implements for different field and post-harvest operations. Other components such as information about news, announcement and advisory services, frequently asked questions on the related subject, team involved etc. are also included. The app has web-based application systems which facilitates flow of information from the farmer to the farm scientist and get their instant solution. Farmers can use this App as a diagnostic tool in their rice fields and make customize queries for quick solution of their problems through text, picture and voice that would be addressed by NRRI experts.
- **Big Haat : Agriculture App** - Big Haat is the India's largest agriculture platform. Big Haat provides agriculture inputs directly to the farmers / Kisan doorstep. Big Haat provides access to latest agriculture technology and techniques to Indian farmers. Its aim is to make agriculture more profitable.
- **Gramophone : Krishi Mitra, Agriculture App** - Gramophone is one stop solution for farmers for all kind of agricultural needs. Farmers can buy quality seeds, pesticides, crop nutrition, implements and agri hardware, Gramophone App uses modern technology to improve farm income by providing quality products and right information to the farmers. Farmers can access localised package of practice, crop advisory, and weather information. This app also provides daily weather updates and nearby mandi prices (Mausam ki jankari, mandi bhav) which helps farmers to make right decisions. Gramophone farming app provides information on all major crops. Farmers can connect with agri doctors/experts and local farming community to get answers to their queries.
- **Agri Media Video App** - Agri Media Video App is one of the most popular in mobile apps for farmers in the video category. It is an online marketplace bringing farmers, agriculture input/output, farming retail and fulfilment service on an online platform. It also provides chat service for farmers to solve their query related to agriculture with the option of upload images of infected crops. Farmers can easily chat with agriculture expert and discuss their problems. This smartphone application also provides various videos related to agriculture practice, new technologies, successful farmers, rural development, agriculture news, new govt. schemes related to agriculture etc.
- **Kisan Yojana** - This app is developed by Agriculture News Network (ANN). It provides information about all Govt schemes to Kisan. It commutes the information gap between the rural people and Govt. It also provides the schemes of the different relative states Government. This mobile application also saves the time and travel expense of Kisan to reach the state Govt office for various purpose.
- Other apps like Smart crop, Mandi trade, Kisan market are the online market space providing space for farmers to sell their produce after collecting information regarding market prices. Farm-o-pedia in Gujarat, Agri smart in Punjab, Krishi Suchak in Karnataka provide information regarding specific area.

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- **Soil Health Card (SHC) Mobile apps** - Soil Health Card (SHC) Scheme is a Government of India scheme promoted by the Department of Agriculture, Co-operation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare and being implemented in the States and Union Territories. A Soil Health Card gives soil nutrient status to each farmer for his/her land holding and also gives advice on fertilizer dosage and soil amendments needed to maintain soil health in the long run. Soil Health Card will be issued to all landholders every three years and this will enable capture of the pattern of soil fertility changes occurring due to nutrient uptake by plants or other natural causes. This will also help to take corrective measures on the soil nutrient deficiencies identified in soil health cards
- **Crop Cutting Experiments (CCE)-Agri Mobile App** - This app is for capturing crop cutting experiment data. The app works in both Online and Offline mode. Internet is required only to download this app and for registration. After that Crop Cutting Experiment (CCE) data can be entered using this app without internet connection. As and when internet connectivity is available, data can be pushed to the server
- **Bhuvan Hailstorm App** - This mobile app has been developed to capture crop loss, which has happened due to hailstorm, along with photographs and geographical locations. An Agriculture Officer would go to the field with a mobile or tablet loaded with this mobile app, and collect field data for hailstorm damage assessment.
- **Krishi Video Advice mobile app** - Krishi Video Advice project aims to provide advisory services related to agriculture and allied sector on farming issues with the help of a mobile app/smartphone/tab. The project has been conceptualized by MANAGE to bridge the information gap between the farmer and the expert. The mobile app works on all smart phones or tabs having android operating system. Any farmer/extension officer can use the mobile app to capture three images of the crop live from the farmers field itself and upload the same. The Kisan Call centre (KCC) expert will provide advise based on the crop images.
- **APEDA Farmer Connect** - This mobile app allows a farmer to apply online for farm registration and approval by state government and lab sampling by authorized laboratories. The farmer can track status of applications. An authorised State Government Officer, farmer or registered laboratory can login to access the information. The Mobile app also assists State Horticulture Departments to capture details of farmers, their farms and products & farm inspections etc. in real time straight from the field. This app has in-built GPS capabilities to identify the farm location
- **Krishi Vigyan** - This app is developed by KVK, Amadalavalasa, Andhra Pradesh. This app provides information in Telugu on modern scientific management practices for Agriculture & Horticulture crops growing in Andhra Pradesh, along with photographs. It helps farmers and extension workers in identification of field level problems like nutrient deficiency, pest & diseases and to take decisions at the right time
- **eNAM Mobile App** - National Agriculture Market (NAM) is a pan-India electronic trading portal promoted by Government of India which networks the existing mandis to create a

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unified national market for agricultural commodities. The purpose of the Mobile App is to facilitate remote bidding by traders and access to arrivals and price related information to farmers and other stake holders on their smart phones

- **Digital Mandi India** - This App helps in checking the latest Mandi prices of agricultural commodities reported from different states and districts/mandis in India. One can get commodity wise categorization or state wise categorization
- **Cane Adviser** - Cane Adviser is a mobile app for cane growers and millers. It gives details from planting to harvest with text and graphics for tropical and sub-tropical India. The features of the app include static as well as dynamic platforms. The content runs to over 220 pages with 650 digital stills relevant to the content.
- **Fisher Friendly Mobile Application (FFMA)** - The app provides vulnerable fishermen access to knowledge and information services on weather, potential fishing zones, ocean state forecasts, disaster alerts and market related information. The application is a decision support tool for the fisher community to make informed decisions about their own personal safety and the safety of their boats, as well as make smart choices for fishing and marketing their catch. FFMA is being used by fisher folk in six states including Tamil Nadu, Puducherry, Andhra Pradesh, Kerala, Odisha, and West Bengal.

Conclusion

Mobile Applications have been identified as one of the most effective innovations which benefited a large number of farming community & agricultural professional. In India, mobile applications are transforming agriculture. To make agribusiness productive, smooth and respectable it is important that, it should be linked to recent technologies. Mobile application is a one of the technology that can be used directly in agricultural growth & development. Smartphones are the example of overcoming adversity of connecting the rural-digital divide, bringing monetary advantages and acting as catalyst for social mobilization through improved communication. The smartphone apps also act as a most important tool for farmers in providing information related to crop growth status, weather forecast & advisory, farm advice, market price & post-harvest management, in every situation.

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CHAPTER - 2

Accessing the Potential of ICT in Smart Grid : Challenges & Opportunities

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1. Introduction (about ICT)

Information and communications technology (ICT) stresses the role of communications and can be thought to be an extensional word for information technology (IT), therefore it means the integration of telecommunications (telephone lines and wireless signals) and computers, also as necessary enterprise software, storage and audiovisual, middleware, that enable users to access, store, transmit, and manipulate information. The term ICT is additionally capable of the convergence of audiovisual and telephone networks with computer networks through one cabling or link system. A single unified system of cabling, signal distribution, and management is used for the large economic incentive to merge the telephone network with the computer system network. ICT is an umbrella term that has any encompassing radio, television, communication device, cell phones, computer and network hardware, satellite systems and many more, also the various services and appliances with them like distance learning video and conferencing. ICT may be a broad subject and therefore the concepts are evolving. That is it will store, retrieve, manipulate, transmit, or receive information electronically in a digital form (e.g., personal computers, digital television, email or robots). Theoretical differences between mass-communication technologies and interpersonal-communication technologies were identified by the philosopher Piyush Mathur. Skills Framework for the knowledge Age is one among many models for describing and managing competencies for ICT professionals for the 21st century.

The last century has seen unprecedented growth in technology's by mankind as compared to the previous centuries just within a century we had taken in the sky send spacecraft deep into solar system and landed on moon. We now send pictures and videos across the globe and beyond its multitude as against the simple messaging across the Atlantic which was done in previous centuries. Each aspect of our lives has seen and exponential achievement in technology. Partly because of the ease and vast availability of electrical energy this unprecedented growth in technology has been made possible. The advent of electricity has caused an era of growth

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depending on the technologies that run on electric power. Those systems which depend on electrical energy consume huge amount of energy for the technologies depending on the system. Today's computing power of the smart phones is way more than the computing powers of the computer that has once send man to the moon. Where this is increasing day by day the system size is getting reduced and cheaper-driven by Moore's law till the result it will be exponential growth of technologies in every sector. As the demand for energy is increasing exponentially since that technology is infused in our every aspect of lives the global demand for energy is expected to increase and rise by 37 % from 2013 to 2035 or by an average of 1.4 % per year. Presently the three fossil fuels namely oil, gas and coal account for around 80% of energy produced. The rest 20% is made of nuclear, hydro and renewable resource shown in Figure 1.

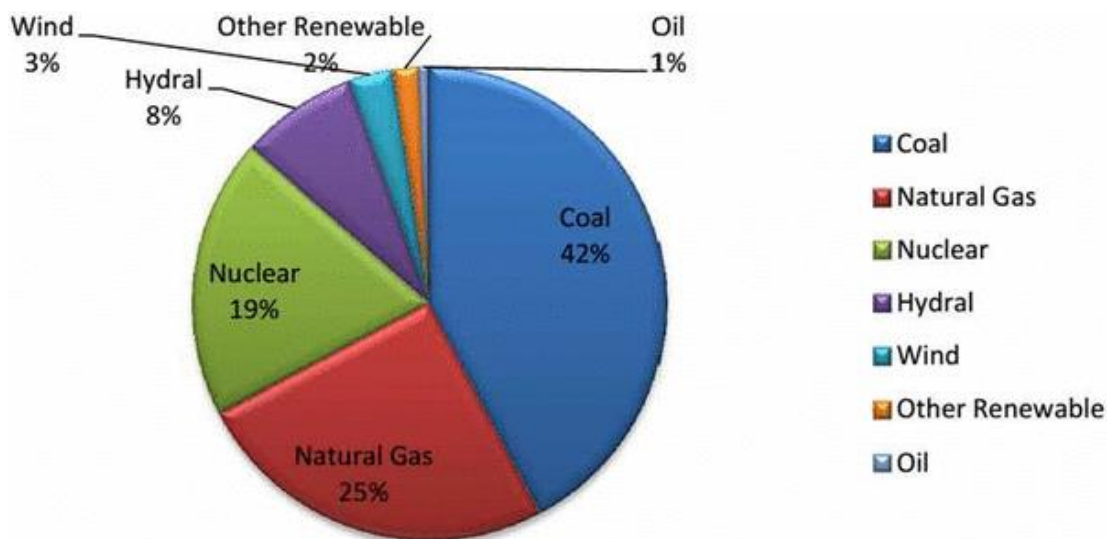


Figure 1 - Electricity generation from different fuel sources worldwide (source www.iea.org)

As the electricity is the driving force for most of the technologies its generation is of prime importance requirement for technology sectors to have a sustainable growth .as has been stated the main source for energy generated is from fossil fuels. The international energy agency IEA has given the world energy statistics as shown in the *figure 1* shows that electrical energy is produced from hydrogen nuclear fossil fuels and renewable energy sources in the ratios as shown. It can be seen that merely 5% electricity is generated from renewable energy whereas the most common fuel for world's electricity plants accounting for more than 40% of world's electricity generation is coal. 2TW was the global electricity consumption averaged in the year 2005 the energy rates used to generate 2 TW of electricity is approximately 5TW since the efficiency of a typical existing plant is around 38%. A sustainable higher efficiency of 55% can be seen in the new generations of gas fired plants. the three recent reports given by international energy agency is IEA, the British petroleum BP and energy information administration CIA of us presented a detailed review on

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the global energy outlook. It estimated that the global consumption of oil equivalent is going to double from 9 billion tons of equivalent oils in year 2002 around 1.8 billion in 2035. Produced energy is consumed by all sectors of technologies and all types of industries which includes aerospace industry, construction industry, farming sectors, transportation industry, ICT sector, mining sector, etc. This increase of energy consumption is going high on a alarming rate as was indicated in the aforesaid reports. According to the U.S. department of Energy's International Energy outlook 2007, industrial users (agriculture mining manufacturing and construction) consumes about 37% of total 15 TW of energy consumed. Residential heating lightening and Appliances uses 11%, personal and commercial transportation consumes 20%, send commercial uses (heating lighting and cooling of commercial buildings and provisions of water and sewer services), amounts to 5% of the total. The remaining 27% of the world synergy is lost in energy transmission and generation thus we can say that the mankind is paining heavily for modern technologies in terms of adverse climatic changes as well as rising financial burden. Without the energy efficiency improvement the OECD organization for economic cooperation and development Nations would have used approximately 49% more energy than was actually consumed as of 1998. Moreover these are not going to exist for long and are bound to advantage. Because of this growth in technology and consequential increase in consumption of energy there is an adverse effect on the climate greenhouse gases (GHG) emission.

The Intergovernmental Panel on Climate Change (IPCC) states that warming of the climate system unequivocal and the main cause for it is due to the increase of GHG emission because of human activities. According to this panel the warming of the climate will lead to Extreme weather events becoming more frequent and unpredictable which can be limited only by sustainable and substantial reduction of GHG emission. Beyond doubt it has been established the negative effect of global warming and the world is at a general consensus that we need to cut down on GHG emission for moving towards a green and sustainable future. Therefore sustainability of energy and energy efficiency are the prime goals for which research is underway in vast areas of science. The idea is to crave out a future where technology becomes energy efficient as much as possible and the energy requirement becomes sustainable with minimum adverse effect on climate change. The above mentioned ATM is being pursued by adopting a two-pronged approach in handling energy efficiency and sustainability which can be broadly categorized as follows:

1. To make energy efficient system innovative SMART systems and processes in every sector needs to be incorporated as far as possible.
2. To make energy requirement sustainable and green incorporating the use of renewable energy as much as possible. Without surprise ICT has a role to play in both that is making current system infrastructure smarter and energy efficient and making renewable energy viable for use at micro and macro levels.

2. Getting Smarter Through ICT

Like any other technology ICT sector has a significant contribution in global warming through CO₂ emission. Not only to indirect contribution of other sectors where ICT is employed to support their business I see it also has a direct contribution for it. The energy consumption in ICT mainly occurs at the data centers and the wireless base station BS according to a report of Gartner in 2007 cities are contributing to present towards global warming which is very less as compared to other factors such as construction and transportation. Still this technology is the fastest growing and it has the key to reduce energy consumption across all other technology sectors through ICT and ultimately becoming energy efficient. A survey of internet shows that a number of const area organizations and foundations both in private and public sectors are working around the world not only in North America and Europe with the aim that not only to move information and communication technologies towards a greener path but also to help other technologies in becoming greener.

2.1. Methods to Reduce ICT own Energy Consumption

The information and communication technology ICT sector is subdivided into three sub sectors namely device sector and telecommunication, peripheral sector and PC printers and the data centers. Over few decades the three sectors have seen progressive increase in usage and consequently the energy consumption. This increase resulted from a number of factors such as offices and businesses widespread use of computers in home vast amount of data storage exponential growth in networks and mobile connections and hide data throughout. The carbon footprint of the sub sectors sum up to an estimate of 0.83 Gt of CO₂ (Carbon dioxide equivalents) emissions in 2007 which is estimated to increase to 1.4 3Gt of emission by 2020. The figure 2 shows percentage wise share of the three sectors emission which is 31% for telecom 40% for PCs and peripherals and some 23% by the data centers.

To make the technologies energy efficient one of the ways is to make them SMART. Microsoft has build a data centre in Washington and Google did the same by building a data centre on Oregon is Columbia river to tap hydroelectric power. Financial service companies are also building their data centre for example HSBC did near Niagara falls. In US one of the state it is trying to attain datacenters with the promise to have cheaper power from coal-fired plants. The ICT sector can make significant reductions in footprints by carbide cutting smart measures that conserve energy and reduce carbon footprints. The smart ways for the sector has been outlined as follows :

1. Measurement techniques need to be standardized for measuring energy. The first requirement for energy conversation is to know how much energy e is being consumed to achieve this we need energy measurement techniques that not only effective but also

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uniform. All system and devices should have common that stick for measuring energy to ensure your correct data on consumption

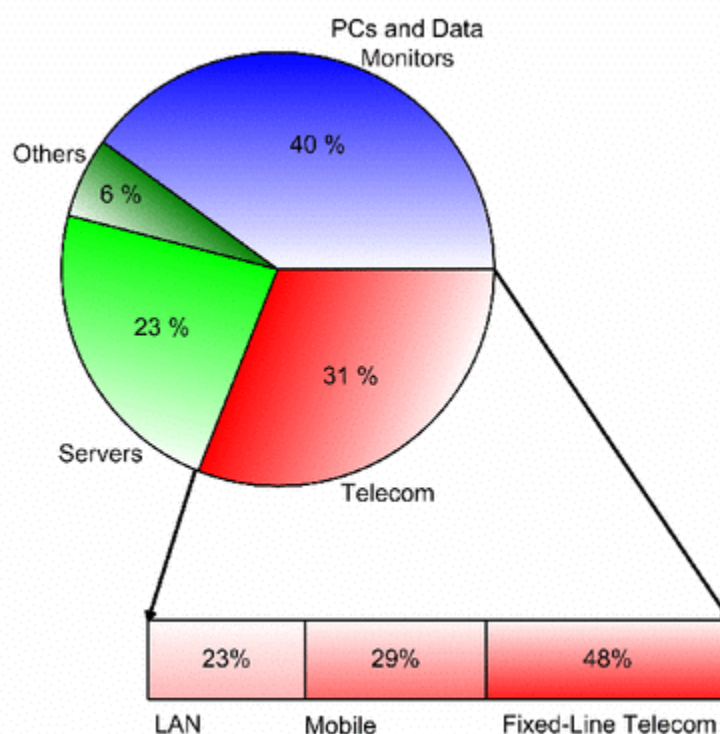


Figure 2 : Percentage wise distribution of the sectors emission

2. Across-the-board monitoring energy consumption: With the help of sensors and meters monitoring should be ensured on each and every segment of technology so that a complete and comprehensive picture is obtained.
3. At every step energy needs to be accounted: Energy is not only consumed at the end equipment or at the server but should be accounted for every node where it is being dissipated howsoever little it may be.
4. 4.Researching and rethinking innovations to reduce the ICT is emission across services and devices constant innovations has resulted in smaller and lighter ponens resulting in reduction in energy utilizations .This needs to continue through research to explore all the possible ways and means by which energy efficiency can be attained.
5. Exemplar of low carbon technology transformation of ICT sector: ICT has got the capabilities for demonstrating bigger efficient systems .It cannot only transform itself but also lead the path for others to follow to become a greener technology.

2.2. Enabling ICT Support Other Sector

Although ICT sectors on admission is going to rise as global demand for the products and the services will increase these are estimated to be 5 times less than the admission that can be minimized through enabling effects of ICT sector .the SMART 2020 report. In report it has stated that ICT has the capabilities for reducing global GHG emission by 7.8 GT by 2020 from an estimated total of 51.9 GT of total CO₂ e emissions coming from all sectors and amount 5 times greater than its own projected carbon footprints of 1.43 GT of co₂ e. As ICT operates with the cutting edge technology any breakthrough here is bound to benefit the other sectors also. For instance smart grids are considered to be the technology for reducing energy losses and increasing energy efficiency. The smart grids and electrical grid are intelligent and interconnected. Similarly smart buildings smart logistics and smart houses are also going to benefit indirectly all directly from the advancements made in the information and communication technologies as discussed below -

The information and communication technology is enabling action in making other sectors smart is largely due to it's an ambiguous natures such as capabilities into other sectors and extending ICT protocol. The ICT have become part and parcel of many other technologies as they provide them with intelligence and computational power to perform better and act smarter it cannot only provide products to analyze and support but also help to develop new techniques for or replacing the high carbon activities with low carbon activities. ICT will help in optimizing the system and process of energy efficiency. It can also help in the innovation process of the companies by simulating different company strategies and different changes in the system. Last but not the least it can help implement smart energy management approaches and promote cooperation between sectors. Some specific examples can be studied to understand the ways and means to have buildings, logistics, motors and grids become smarter. These ways and means can be characterized and categorized in three main areas namely device ,management system and software's .Software and computers can be used for or applications that can help in variety of energy efficiency is such as:

- Real time processing of data,
- Energy accounting in grids and buildings
- Design and modeling software for systems/infrastructures
- Load analysis software for machines and systems
- Load analysis software for buildings and plants
- Smart billing/IP based billing
- Real time route optimization software
- On-line/ off-line power fault analysis software
- Simulation of system performance

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- Demand response software for load management
- Protocols for interoperability between systems

Various ICT devices and products are employed in every sector to help these in conserving energy such as:-

- Data recorders
- Data loggers
- RFID tags for asset tracking
- Chargers and controllers
- SMART meters
- Sensors for remote measurement
- Chips and controllers for monitoring
- Interconnectivity between systems
- Alarm systems
- Contingency alert systems

The third aspect through which ICT can bring about energy efficiency into the other technology sectors is through its management and information systems such as:

- Maintenance, repair and operations (MRO) platforms
- Operation support systems for energy management
- CO2 emissions tracking platforms
- Internal and external communications systems
- Automation systems for buildings, plants, machines and transport
- Work-flow management systems
- Vehicle/fleet tracking and global positioning systems

3. Getting Greener through ICT

All the technological sectors heavily depend on the use of electricity does an obvious way to reduce the carbon footprint due to electricity consumption is to use renewable energy as far as possible. These sectors must produce electricity from green resources as far as possible and introduce renewable sources into their systems and products. A case in this point is the cellular base station of the ICT sectors which can be converted on green energy by installing renewable energy sources on the sites. the first step in using the renewable energy is to harvest the energy embedded in nature and to store it for the further use .the next step is to distribute this among the consumers and users by effective means. Then come it incorporation into the system for various applications. Managing this energy e for sustainable growth and effective use is the last step. The overall desired impact is to have working models which are greener they have a lower carbon footprint and are diffused into the industry as well as society at the required scale.

3.1 Harvesting and Storing

The paramount important thing of the renewable source is its harvesting and storage for sources like solar and wind energy. The other renewable energies include biomass, hydro and ocean but these are not widely applied as the wind turbines and PV panels. The energy harvested from wind and solar is unpredictable and unstable by nature for stop because of which the following aspects of are of utmost importance for such energies. The maximum amount of these energies should be harvested as possible and a system should be made to effectively Store these energies for regulated reuse. The maximum efficiency of a wind turbine is 59% known as the betz limit, which means that 59% of the wind kinetic energy can be converted into the electrical energy at Max on the other hand a photovoltaic cell can only be 33% efficient as per Shockley queisser limit (commercial PV panels are about 15% efficient). This will explain the need for the larger number of wind turbines and solar panels required to produce sufficient amount of electrical energy.

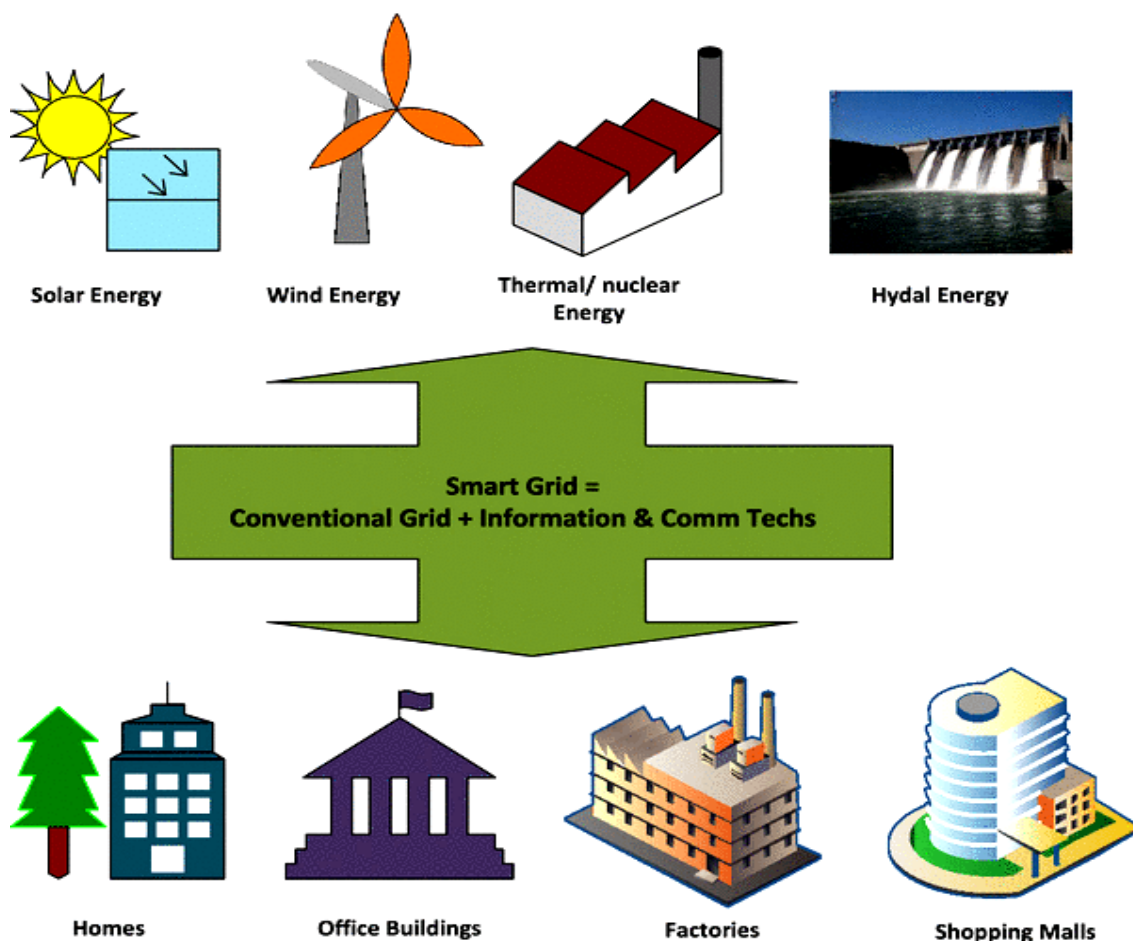


Figure 3 : Smart Grid shown which can be defined as ICT Enabled Distributed Generation of Electricity with Demand Side Management

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As technology related to renewable energy sources like the PV cells and the wind turbine are maturing there are various models and designs which are emerging for a specific applications and deployments. Harvesting from other ambient energy sources like thermal and RF is also studied increasingly as advancements in microelectronics and micro electro mechanical system MEMS is on increase.

The storage of renewable energy is a critical concern because of the large scale storage is a serious impediment in the use of renewable energy. For medium and small scale applications like the solar power homes and solar lights rechargeable battery banks are used that has its own useful life. Particularly for the ICT sector harvesting the energy is very lucrative for the applications which heavily depend on battery power like medical implants and radio handsets. ICT industry has now taken up the challenge of producing high density low cost batteries that are very critical for renewable energy applications as well as many other applications. The energy storage for community and Mass level utilities can be done by storage in water reservoir as storage using flywheels storage in underground caves use of cheap large capacity batteries and employing smart grids.

3.2 Distribution of Renewable Energy

The generation and utilization of renewable energy is of greater concerns and is required equal to tension therefore the distribution of renewable energy should be a area of research. That is why nowadays research is being directed towards the policies and the infrastructure of distribution networks. The key to the distribution energy are smart grids and does the focus of special interest by the researches. There is a study on integrating the present grid with right communication infrastructure to make them develop new grid design or to make them smarter than communication technologies used in to them. The distributed generation is closely associated with energy generation and smart grid this concept has many terminologies and definitions in the industry which have been amply. It basically means generation of electrical power within a distributed network for the customer site as has been shown in the figure.

DG is classified according to the electricity generations of a plant which usually ranges from tens of kilowatts to few megawatts of electricity. The other characteristics of DG are usually different it based on its purpose the technology the location the mode of operation and the power delivery areas. DG uses technologies that can be broadly classified as renewable distributed generation combined heat and power (CHP) distribution generations and modular distributed generation. ICT enabled distributed generation of electricity is a smart grid .for making it intelligent and easing its computational power ICT is used which makes the distributed system more effective and controllable.

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For achieving demand responsive smart grids it primarily depends on the capacity of business stakeholders to collaborate effectively in order to give rise to new generation of reliable innovative and secure smart grid services. For an environment of increased collaborations the success will depend on four strategic challenges at the intersection between the energy infrastructure and ICT

- **Interoperability** : This is required for ensuring convergence of transmission bracket greed protocols and ICT for enhanced communication and cooperation.
- **Reliability and security** : This is required for achieving trusted provisions of services and enhanced resilience
- **Decentralization and self-organizing architecture**: This is required for more flexible grid control and management and for increasing resilience through self-healing
- **Innovative business models** : This is required for the increased participation by the stakeholders (Example : users, telecom operators, utilities, DSO, etc) for releasing investment which is required through infrastructure upgrade.

4. Integration Challenges

4.1 Through Enabling Technologies and Standards Enhancing Interoperability

Interoperability this means the ability of devices and processes for exchanging information and for doing the useful work together is vital to the design of decentralized smart grid. Interoperability is going to promise greater reduction in the cost of modification, designing replicating and implementing systems. Indus 300 smart grid standards which IEC has listed most relevant found are those focusing on common information models and transport communication protocols. The standard development for smart grid which has traditionally focused on network interoperability dealing with communication between connected applications and devices found in the area of distributed computing. In the recent road maps standard institutions NIST has knowledge the need for inter application interoperability. Even though standard are Central to interoperability support in the long term and midterm one of the crucial. The availability of enabling technologies .therefore the initial success depends on openness of the new standards in integrating existing devices which could be based on outdated standards or none at all.

4.2. Key Enablers of Future Smart Grid Business Services Security and Reliability

In smart grids physical and cyber security has become a critical factor for reliability and quality of supply (QoS) as more and more distributed energy resources are getting integrated with the grid. Intelligent market processes ,smart control systems, demand responsive management and advanced metering infrastructure (AMI)with directional flow of information and energy along with the ability to receive and act upon price control signals contribute to the enhanced reliability

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and efficiency but this may also create many new vulnerabilities if not deployed with correct security controls. The rise of high degree of connectivity between the smart components as well as between market processes and the vulnerability will rise. As the grid becomes more distributed and intelligent and as communication capabilities example broadband, 4G, Wi-Max increases there is a need for secure authentication and transaction at every interface between devices / subsystems and processes. Hence security will be considered as a ubiquitous requirement and need to be integrated with most if not all activities within smart grid ecosystem which is highlighted in recent industry and government communications in Europe and USA.

Many standardization efforts on smart grid cyber security are underway and are closely interlinked with the efforts of interoperability. The three main layers of a smart grid security are

- Secure authentication
- Secure communication
- Information security management

Secure authentication usury deals with various interfaces example home to grade-H2G, building to Great-B2G, industrial to Grid-I2G, transmission and distribution and d and business and policy-b and p and it is based on many existing standards. Efforts such as ISO 17799 federal information processing standards FIPS 201, data encryption algorithm 3D ES and advanced encryption standard are offering least cost options for a strong security and high performance and can be used in the various scenarios depending on the communication resources being protected. For the diverse communication requirements in smart grid there will be requirement of different standards implementation example triple 802.11 and 802.16e for wireless links, where is wide links can be secured with firewalls and virtual private networks within technologies such as IPS as well as higher security mechanism such as secure shell and SSL/TLS. Information security management on the other hand deals within IAS/IEEE 627002 which provides best practice recommendations for implementing initiating or maintaining information security management systems ISMS and is aimed at prevention of confidentiality availability and integrity.

4.3 Decentralized and Self Healing Grid Architecture

For experiencing the benefits of distributed computation and communications for delivering real-time information and to enable the near instantaneous balance of demand and supply the centralized grid needs to be transformed into multilayer information and control system architecture, where power transmission and distribution layer will be in synergy with ICT layer. This will require a move from the traditional hierarchical topology with distributed data acquisition but Central decision making to a decentralized and dynamic decision-making. Figure 4 illustrates various grid architectures, from the centralized in which data and power flows are

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unidirectional to dynamic in which data and power flow can be bidirectional example from IEA to the centralized database to or from a substation to substation.

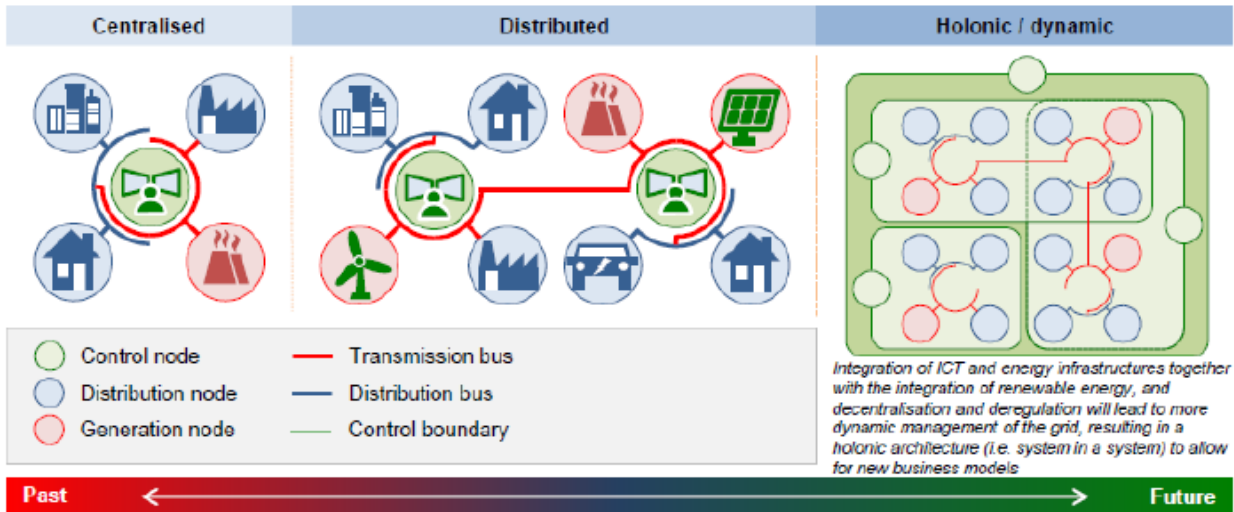


Figure 4. Evolution of smart grid control and management architecture, from centralized to dynamic and decentralized

The Holonic Architecture based upon the concept of Holon which is inspired by example of recursive organization in nature, which ultimately is a logic control entity that is both a whole and a part and can take decision autonomously in a cooperative way. Multiple Holons can amalgamate to form a higher level matter for Holon, leading to recursive architecture and scalable form highly suitable for the 21st century grid. For example can be a Holon that is an entity which is aggregated in the grid which can make autonomous decisions as well as corporate with other holons to make multiple optimal decisions. The recursive participations of a Holon is dynamic based upon utility optimization that is Holon dynamically organized in complementary manner and coherent manner. Examples of clustering objectives are Iceland Inc global / local energy balancing and blackout prevention. The transition to Holonic grid architecture is going to require rethinking in the way decision-making problems are formulated and results are visualized and or decisions are made. The global balancing is concerned with the matching of supply and demand globally and is mainly and showed through electricity markets in world in energy providers and their customers.

The challenges are to provide the stakeholders with a reliable real-time picture of the portfolio of customers and supply means and to enable them to react effectively to the variations in the market especially in their portfolio. This is going to require advanced predictions and optimum strategies utility / aggregators and telecom operators. Visualization of the solution/optimization landscapes and decision making will be challenging as is often encountered in other engineering

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documents. Local balancing is dependent upon local production storage and consumption and they are optimized locally. This is needed for ensuring that electricity is as much as possible consumed decreasing the energy losses due to long distance transportation of electricity and above all to enhance network resilience. This will become even more important with the integration of BRS and in particular small-scale household integrations of intermittent PV (<4kwp) and wind (1-20KW) which results in high amplitude variations of energy provisions on the network. Resilience should be insured if the network can self heal by dealing with local issues timely to avoid problem propagation on the wider network.

4.4 Innovative Cross-Sector Business Mode

Reduction in the electricity sector energy and CO₂ emission, this is in association with improved grid and power system management which was made possible by control information and pricing strategy implemented by great operators are producers / suppliers as well as action taken by end users with access to smart meter information.

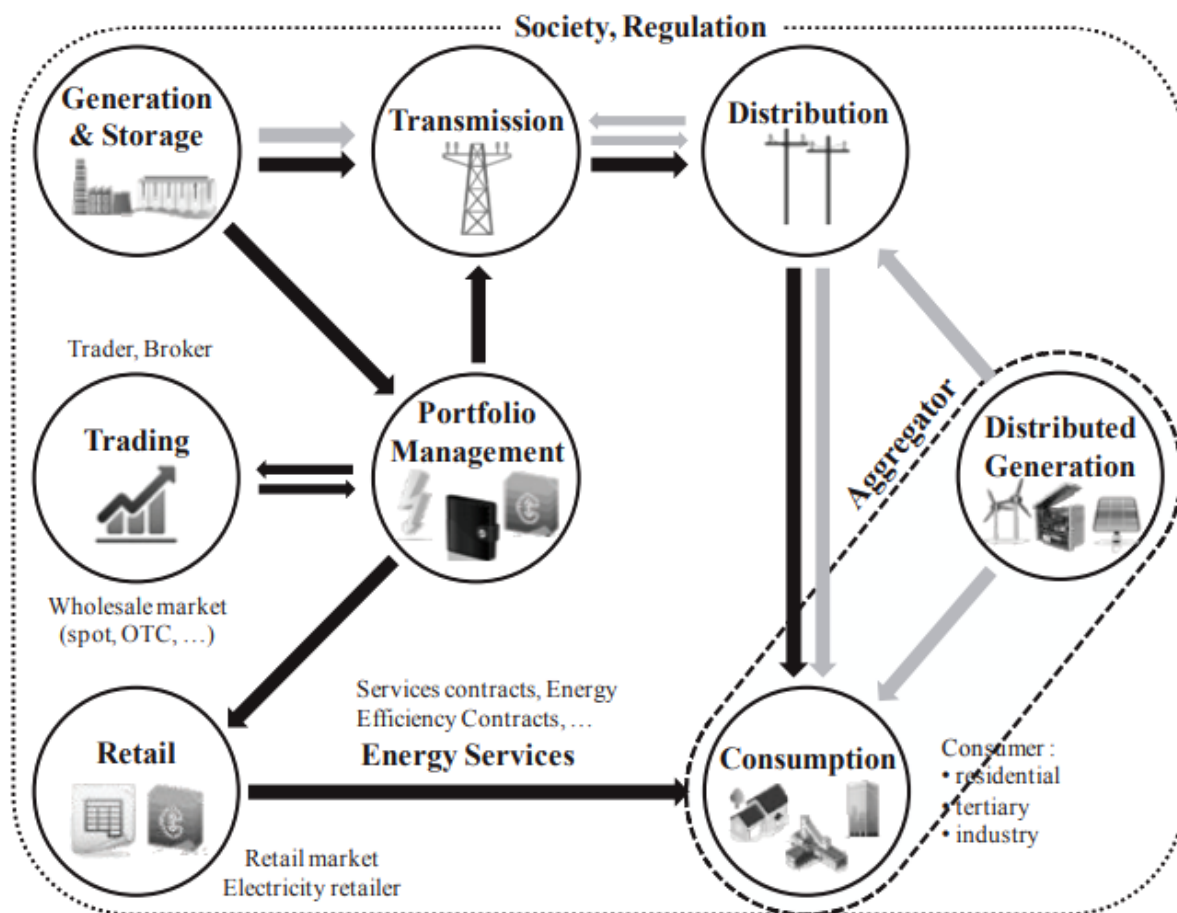


Figure 5 : Energy value chain in a smart grid

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The biggest indirect benefit probably from increased monitoring of the low voltage distribution network is likely to be the exponential growth of the market for hardware and service providers typically operating in telecommunication and other vertically connected sectors. Assess the understanding will increase of consumer behavior there will be new opportunities for development and marketing of user-centric value added products and services. Not only is this consumer going to benefit from the increased competition in a liberalized energy market that is integrated with other infrastructure ensembles. Investment incentive is putting smart grid infrastructure in place. To unlock the full potential of involving energy value chain buy-in from all stakeholders is essential as shown in Figure 5.

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CHAPTER - 3

Technology Based Education in Rural Development: A Nostrum during COVID-19 Pandemic

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1. Introduction

Technology, communication & ICT applications have presented our generation with numerous opportunities. Technology has touched each and every field in some or another way. Education through e-learning applications have opened up horizons of e-learning from distance, efficient method of learning, and added quality to knowledge sharing activities & some technology experts had developed an application for e-meeting for working people too. There has been a significant amount of research by scholars, academicians & technology experts with technology at its prime focus but the effectiveness of e-learning and e-meeting in extensively shaping the future of students and employees & adding quality to their thinking & values has not been discussed much. Therefore, reviews the literature that is available on online & offline sources in the form of books, scholarly articles, and research writings from peer-reviewed journals.

The aim of the literature review is to understand the scholarly works on the topic of e-learning and e-meeting both from the technological point of view and for its effect on the students as well as on employees during a covid-19 pandemic. This chapter will help us to know the technology-based education in rural development with the effect of e-learning as well as e-meeting on students and working people as to know how they cope up with the continuity of knowledge during coronavirus pandemic.

Coronavirus is also a deadly virus called Covid-19. It has deeply affected the entire global economy. The disaster did not leave the education sector untouched. Educational institutions have performed full locks that have continued during the closure phase. Education experts fear how the study session will take place this year. Many investigators have expressed concern that it seems unlikely that the person will return to the instructor at any time immediately. The barrier to social segregation is an obstacle and creates a negative impact on the entire ecclesiastical group. All educational institutions are trying to find alternative ways to deal with these unusual situations. This makes us realize that there is an urgent need for concrete planning to address this challenge. Many issues have been raised about electronic learning. Adoption, accessibility, learning doctrine, and policy are some of the issues related to the online approach. It is thought that online learning platforms are easily accessible and accessible to everyone. It is considered flexible as the student can schedule a time to complete the course of his or her choice. The online learning method is more expensive as it reduces travel costs and other institutional costs as well. In addition, an integrated learning approach enhances the quality of the learning process.

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Government is also now recognizing the impact and effectiveness of technology-based education in this rapidly changing environment.

This puts us in the view that thanks to COVID 19 technological advancement can provide a solution for all of us to face this issue with renewed vigor and reach new territories even at this stage of the epidemic. The purpose of this study was to determine rural awareness among students and standards regarding student acquisition, use, and information sharing during the learning and teaching process.

The following results were obtained:

1. The conditions for access to information, use, and sharing by students during the teaching and learning process are high.
2. Female students use the internet in a way that works better than men.
3. The levels of learners accessing, using, and sharing information during the learning and teaching process vary.
4. The level of online sharing, use, and information varies between departments of education.
5. Internet access, use, and information sharing differentiate depending on the type of education.
6. The views of faculty members and students differ on the level of access to information online, but differ on the use and sharing of information.

2. Technology in Education

Technology has the ability to enhance relationships between teachers and students. Technology helps make teaching and learning more meaningful and fun. Students are also able to collaborate with their own classmates through technological applications. There are countless reasons why technology is a key aspect of learning in education. Whether we like it or not, technology is everywhere; and in order for students to survive in higher education and the business world, they must know technology. To narrow it down, we came up with some reasons for the importance of technology in education;

- **Access to a variety of resources** : With the help of technology, it is easy to provide audio-visual education. The learning resources are widening and widen. Now with this vivid and vast technique as part of the IT curriculum, learners are encouraged to regard computers as tools to be **used in all aspects of their studies**.
- **Enhancing learning environment** : The entirely new learning environment is changing the process of teaching-learning by adding elements of vitality to learning environments including virtual environments for the purpose. Critical thinking, research, and evaluation skills are growing in importance as students have increasing volumes of information from a variety of sources.
- **Anytime & anywhere learning** : With the help of technology, the pace of imparting knowledge is very fast. One can study whenever he wills irrespective of whether it is day or night and irrespective of being in any part of the world. Internets support thousands of

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different kinds of operational and experimental services one of which is an online library that can be used to get plenty of data.

- **Classroom-based distance learning:** This kind of technology became very popular in the late nineties and remained in use throughout the last decade. Satellite beaming of live classes or VSAT, study centers equipped with hardware where students interacted with a teacher teaching remotely became very common for a lot of private sector tutorials. Even the Indian government has tried to promote this model in the past with help from IITs and EDUSAT was a venture in this line. However, while low cost and high speed of internet have made this technology more viable and VSAT unnecessary, infrastructure cost of study centers and real estate prices work as a restraint on this model.
- **Social platform for a classroom to interact online:** Peer-to-peer learning can be very important, and a class should continue to interact and learn collaboratively even after class hours. This idea led many social learning platforms to come up. Many social learning platforms like Grockit, remixlearning.com have achieved tremendous success. In India, pagalguy.com is a good example, but there are not too many other instances of social learning, especially for primary and high school education. The school boards can definitely do a lot in this respect.
- **Mobile-based learning management systems:** Typically, in India, more people have access to smartphones with the internet as opposed to computers with broadband connections. This is a big cause of investing significantly in mobile-based learning technology. There is no doubt that putting learning resources in the phone itself turns it into a very useful tool. Mobile based courses have to be optimized for a smaller screen, lower computing power, and slower internet. This is a difficult task, but several Indian start-ups have got this right.
- **Learning apps:** Educational apps are very popular with millions of android and iOS device users all over the world. There are apps that can help one to increase reading speed, or reduce the fear of mathematics. The fact that the price of tabs and smartphone is coming down significantly over the years and mobile internet is becoming very cheap – is very significant in this respect. How amazing it will be if Indian kids are able to learn skills and improve their linguistic, mathematical, and cognitive abilities effortlessly and get access to a world-class education at a very low cost through apps. However, what needs attention at the moment is that Indian kids get access to content that is relevant to India, localized in its context, and something that Indian children and their parents can connect to and solve their problems. This is where a significant gap remains and Indian entrepreneurs and teachers must be encouraged to participate in the process of developing such India specific apps and content.

3. The Role of Education in Rural Communities

Education is important for everybody, whether they are learning new facts, skills, or trades. Having the opportunity to learn always benefits the individual. Over the past years, we have seen a focus on providing education to females all over the world, arguing that girls receive an

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education no less than men. However, if we take a step further, we can think about educating communities, specifically rural communities.

Educating communities means developing schools and educating children and leaders. By doing so, rural communities will lead to a healthier and more sustainable future. An education system in rural communities has the opportunity to build capacity and knowledge in the rural populace, helping them to make informed decisions about their farms and to innovate in agricultural affairs. Education also exposes the masses to information and helps prevent the misinterpretation of information. Education can lead to many positive outcomes, such as an improved ability to understand policies, procedures, rights, duties, government schemes, legislation, available benefits, and protection laws.

It is important to understand the need for good quality education in rural areas, as it helps keep rural areas populated. Young people move to urban areas for better opportunities in education and employment, improved rural education is one possible strategy for keeping them in rural areas. It was recently documented that 69% of India's population lives in rural areas. Quality education is a pertinent tool for enhancing the quality of life, creating awareness and capability, increasing freedom, and improving overall holistic human development for the people and the nation.

Education is considered a vital element in the development of a society, a system, and a country. I am convinced that a well-supported, easily accessible education system is an efficient means to make people economically conscious, and thereby, make them actively participate in their economic prosperity and cultural development. As an educator, I insist that education should be given first and foremost in the service of democracy, which demands not only to be protected against decisions but to be a part of decisions that influence society in a positive way.

In the long term, education in a rural setting should be focused on making rural people responsible for their participation in the following elements of rural development -

- **Employment and income opportunities:** increasing the quality of education in rural areas can significantly impact the development of employment opportunities. Studies have shown that the availability of skilled labour, transportation infrastructure and local markets are prime factors in selecting a community for an industrial placement.
- **Increase in productivity of the rural labour force:** education can improve labour productivity in rural areas, increasing the wealth of a region or area.
- **Education develops leadership:** with education, individuals gain confidence, knowledge, skills, and experience — all factors that increase an individual's ability to effectively and efficiently lead a group of people towards success. Education helps to identify and develop those leaders in our communities who will battle against low-quality education, and poverty, leading to a successful and strong community.

Education plays a critical role in rural development, as it is a key factor in developing the people of the rural area, the community, and the land itself. With education, there is always a bright

future in store for rural communities. As a student and educator, I believe that the past shows us that education is an important factor in bringing about rural development in any country.

4. Technology Driven Teaching is Necessity and not an Alternative

People resist change without understanding its importance and importance and when a situation arises they must all adapt to change willingly and unwillingly. This is a situation that has happened in teaching the brotherhood again. Indian institutions of higher learning have used a variety of teaching methods to innovate, develop and engage students. Many forces are opposed to this change when asked to take student classes. In the midst of all this mixed learning and online learning have proven to be the solution to this epidemic. COVID 19 has made a difference in traditional learning in online learning mode. It has also changed the strong thinking of an educational institution that was reluctant to learn modern technology. Indian learning process standards The online platform offers us the opportunity to connect with a large number of students anytime, anywhere. It is expected that all educational institutions will use technology-driven and accessible classes. Online learning platform and many universities have fully worked on automation. Technology-based education has become a demand for an hour in this chaotic environment. So raising the quality level has become very important in this phase.

Change has become a necessity and this change will only help educational institutions to grow and develop during this difficult time. How institutions respond to new changes will be a judging parameter in educational institutions. This will also force them to maintain high quality and maintain this quality. The credibility of educational institutions is at stake. Only time will tell when and how well they are recorded in accepting the changes because in this moment of time switching from a traditional platform to an online platform is the only thing available to us. But yes it will be a huge challenge for the institution as it would not be possible to transform their entire curriculum into technology all night long. As accessing and teaching about personal education will be a major challenge. Acceptable and innovative solutions can be a real help in overcoming this crisis.

5. Technology-based Learning and its Impactful Practice

There is no doubt that technology-driven education has been around for a long time but the COVID 19 epidemic has provided a new dimension for it to grow and flourish. The truth is that thinking about teaching and learning online has been a matter of time. There have been many studies done over the past few years and moreover in the last few months during this epidemic. Students are interested in using shared learning strategies in addition to traditional learning strategies. Several m-learning surveys have been conducted in the USA, UK focusing on graduate students, especially subjects such as engineering, arts, mathematics, science, etc. in the context of Indians. In considering why online education is so important in a study by. It emphasized the following reasons: -

- Provide opportunities for human resource development opportunities.
- Increasing access to learning and training as equals.
- Improving the cost of education resources.

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- Improving the quality of the existing education structure.
- Measuring inequality between ages.
- Capacity building of educational institutions.
- Expanding new study areas.
- Problems associated with online teaching and learning

There are many educational tools available online but sometimes they create a lot of difficulty for us. These problems are related to modern technology from download errors, installation errors, login issues, audio, and video problem, and so on. Sometimes this teaching platform becomes boring for students. Because of the great flexibility, the common excuse is that we here build students that they have time to do. Lack of concentration and attention is also a major obstacle. The learning process of teaching is only effective when there is direct two-way communication that at the same time makes it difficult for online teaching. Teaching cannot be fully accessible until students practice what they have learned because sometimes content with online instruction is a totally superstitious belief that does not allow students to think about creating an influential idea. The content of general courses is also a matter of concern in many parts of the country and in many universities. Lack of readiness for the type of online platform used is another major concern that hinders the provision of quality education in many parts of the country.

6. Suggestions

It is a well-known fact that many stories are associated with an online learning process but there is also the fact that its benefits cannot be overlooked especially during this epidemic. If there is a problem, there should be a solution to it and we all know this. What is needed is an effort to put in place. Assessing key concerns about rights-based development that AI policy and program framework must address in support of quality, inclusive and global education in India. When teaching on an online platform there should always be a good support system so that the learning process is not interrupted. It is imperative that online teaching methods be more appealing and interactive. The successful integration of these technologies into classroom activities poses a challenge to teachers and administrators that teaching staff and administrators have a strong desire to integrate ICT into teaching and learning processes.

New features introduced by ICT in the teaching process includes : E-learning, e-communication, instant access to information, online student enrollment, online advertising, reduced copy retention, communication with skilled people, etc. all of these factors have increased the potential for better integration of ICT into the teaching and learning process. Therefore, the training of teaching staff in teaching and management in management should be enhanced if teachers and administrators are convinced of the importance of using ICT in their learning and teaching process. Technical barriers can be solved in a way. Hypocrisy in the classroom, before the recording of the presentation, will be possible. Different communication platforms can be used to communicate as modern students are very familiar with it because communication is said to be the only solution. Students can do their own learning and improve their skills.

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In all of this the missionary team is also needed to spend quality time exploring new technologies that are based on technology. The use of technology in the educational context will only work if the content, studies, and technology are closely aligned. It is strongly recommended that the curriculum redesign of teacher training programs should be incorporated. It suggests that in order for teachers to use technology in their teaching, they need to be proficient in all three disciplines. Try to explore new types and modern technologies. to think about how to redefine teaching methods so that eventually students benefit the most.

Conclusion

COVID 19 has taught us that disasters can strike at any time and that a catastrophic natural disaster like this completely transforms the entire human race. But yes, some tragedies also give us a strong sense of motivation to bring new changes to you. The same thing has happened with this one. We have all moved forward using technological advances. The education sector has used this handful of technological advances to move especially to remote areas. As a result, we are able to stay in touch with our readers through various online platforms. In order to make electronic learning methods clear and effective, there is a need to focus more on the adoption and adoption of technology. For the implementation of any type of technology-based education, there must be appropriate research conducted on its pros and cons. The need and requirements of all educational institutions differ from each other. Therefore, there should be a conceptual acceptance of the appropriate technology. Teaching about modern technology sounds very exciting but has its drawbacks. There is therefore a great need to evaluate the pros and cons of technology-based learning. A natural disaster like the COVID 19 popularly known as CORONA VIRUS has left the whole nation in a state of massive insecurity and uncertainty in the minds of everyone. It can therefore be well assessed that there is an urgent need to embrace technology, to maintain and maintain a balance between uncertainty and certainty.

I would like to conclude by saying that this chapter is not a place for old-growth in any online educational forums. My intention was simply to make a big difference that the entire education team is going through in terms of technical education in rural development. Much work is being done by an educational institution and we should be proud to be a part of this noble work which is certainly a self-sacrificing service to humanity.

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CHAPTER - 4

ICT Applications and e-Health Solutions for Rural Area

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1. Introduction : ICT, Healthcare and e-Health

Over the last few decades, the Indian health care delivery system has gradually moved from public health care to a more private system which offers multiple models for quality health care. To deliver e-health, the Indian Government has worked with private entities to deliver various services and applications. All groups agree that e-health is the single most powerful gadget to care for all of Countries population, to simultaneously improve infectious diseases rates and long-term care. We begin our report by looking at the state of health care in India and government led initiatives using information and communication technologies to promote better healthcare. India's health care system can be classified into three tiers.

- **Primary level** - This includes Primary Healthcare Centres (PHCs) and subcentres at the village level equipped with a practitioner and facilities to provide first-aid or basic medical checkups. However, many centres lack qualified practitioners, adequate medical supplies, specialty solutions, medical beds, or connectivity.
- **Secondary level** - This includes district level hospitals, small private clinics, nursing homes with some equipment and facilities limited to providing basic medical diagnosis. Also included are Community Health Centres (CHCs)—30 bed hospitals, one in each community development block, having basic specialties and equipment, providing medical coverage to approximately 100,000 patients. All of these lack specialty treatment facilities, adequate number of beds and a high-end medical equipment.
- **Tertiary level:** This includes medical colleges, big private chains of hospitals and corporate hospitals situated in large urban areas. Facilities include high-end medical equipment, well-qualified medical staff, etc. These institutions, however, service a small segment of the India's wide population.

Currently, India has several health care policies such as the Central Government Health Scheme (CGHS) and the Employee's State Insurance Scheme that provides limited social security health plans for its citizens. There are public-private partnership health insurance plans, including Aarogyasri in Andhra Pradesh and Chiranjivi in Gujarat for the population below the poverty line (BPL). Ambulance and emergency services under the public-private partnership Emergency Research Institute (EMRI) are also running successfully in five states, providing effective pre-hospitalization care. Bharat Bhatia, Regional Director-Asia, Motorola Global Government Affairs, says an integrated emergency response service programme, similar to a 911 approach, should be

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nationally implemented as quickly as possible, To build a strong health system in India, Bhatia stressed, “India urgently needs an efficient, integrated emergency response service in all parts of the country, including remote villages in India.”

2. e-Health in India

The term e-health is here supported by a broad definition. e-health is an evolving field combining medical informatics, business and public health, pertaining to health services and knowledge delivered or enhanced through the web and related technologies. In a wide sense, the term characterizes not only a technical development, but also a state-of-mind, an attitude, some way of thinking, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide with the help of information and communication technology. For practical purposes, we distinguish between the subsequent two aspects of e-Health

- Telemedicine systems: the use of different digital imaging technologies (video conference or image sharing, web based solutions for public or patient use)
- The use of standardized electronic message exchange integrated in electronic patient records (EPR using broadband or other networks)

e-Health, as explained by the United Nations Foundation, is “using information and communication technology (ICT)—such as computers, mobile phones, and satellite communications for health services and information”.

e-Health will be understood as a term for collectively describing the utilization of electronic information and communication technologies within the health care sector. e-health refers to technologies used across the value chain within the health care industry from clinical trials to educational, research, and administrative purposes, both at the local site and across geographies or regions. It has the potential to boost efficiency in health care delivery, extend health care to rural areas, provide better quality of health care at a lower cost, enhance the use of evidence-based medicine, empower patients and consumers, emphasize preventive health care, and support relationships between patients and health professionals.

While information services do not provide medical care per second, health and its extension through mobile devices can:

- Provide health information to the public (e.g. through text messages), and give the public direct access to health information (e.g. querying data bases with text or through call centers)
- Empower partially trained and trained front line health professionals with up-to-date information on diagnosis and treatment protocols
- Provide remote detection by low-skilled workers through a scope of increasingly low cost devices such as wireless based stethoscopes, fetal monitors, thermometers, pulse oximeters, ultra sound, microscopy, insulin readers etc.
- Keep track of each patient’s conditions and care with electronic health records

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- Prompt follow up and compliance with appointment and treatment reminders and messaging
- Improve supply chains through up-to-the-minute information

e-health will accept trendy technology to broaden health care accessibility in rural India; it'll be a part of the answer for India's health care woes. A vast country like India, with a population of over 1.15 billion across twenty nine (29) states and six Union Territories and ruled by a federal system, needs reasonable health care. Currently, in India's three-tier, government-supported system for healthcare delivery, states have the primary responsibility for public health care. This leads to significant disparities in quality and access to health care services in numerous regions among the states and even cities in India.

The discrepancy is much larger between urban and rural regions in India. On the alternative hand, India is technologically advanced among the ICT sector and self-sustaining in meeting its desires for hardware, software, property and services. ICTs have the potential to make an outsized portion of health care accessible and affordable, especially in rural India. This success are often further reinforced if these ICTs are integrated into existing healthcare delivery systems. Within the last decade there has been active investment for development of health in India, however considering the demographic unfold, this investment is not sufficient for such a large country.

The scale of e-health systems in India has been restricted so far to medical transcription, health awareness through portals, hospital management systems and clients service using the Internet, and a few telemedicine. Whereas globally, and significantly in Africa, advanced technologies like 3G wireless services are starting to be used efficiently for providing health care solutions to remote villages, the use of communication devices such as mobile phones or teleconferencing solutions for e-health in India has been restricted. Indeed, most e-health activity in India by the government has focused on traditional hard-wired Internet Protocol connections between health institutions in cities. For example, the government recently announced its I-HIND decide to connect all hospitals, medical libraries and medical colleges alongside a network and a shared knowledge portal. This is a significant step forward, but its application does not extend into the villages, so we try extending it in villages also as soon as possible.

3. E-Health Solutions for Rural Areas

Some government initiatives are given below:

3.1 Government Plans

Administrative angle - to require up digital India initiate ahead, MoHFW has started numerous e-Government initiatives in Health care sectors in India, the division called as e-Health division. e-Health is broadly defined as the use of knowledge and Communication Technology (ICT) in health. It will make a world of difference in India, where mobile technologies are penetrating at rapid rate. As India includes a strong presence in IT, the integrated health system serves the wants of all stake-holders, by contributing approximately 8 percent to the GDP. The e-Health initiatives incorporates a vision to delivery better health outcomes in terms of

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- Access
- Quality
- Affordability
- Lowering of disease burden and efficient monitoring of health entitlements to citizens

The scope of those initiatives are to form all medical facilities available all time from any a part of the globe through Web services, mobile services, SMS or centre services. Broadly, the intent is to hide online medical consultation, Online medical records, Online medicine supply management and Pan-India exchange for patient information but not limited to the said services.

- **Efficiency** - one among the guarantees of e-Health is to extend efficiency in health care, thereby decreasing costs. One possible way of decreasing costs would be avoiding duplicative or unnecessary diagnostic or therapeutic interventions, through enhanced communication possibilities between health care establishments, and thru patient involvement.
- **Enhancing Quality** - Increasing efficiency involves not only reducing costs, but at the identical time improving quality. e-Health may enhance the standard of health care by allowing comparisons between different providers, involving consumers as additional power for quality assurance, and directing patient streams to the simplest quality providers.
- **Evidence based** - e-Health interventions should be evidence based in an exceedingly sense that their effectiveness and efficiency shouldn't be assumed but proven by rigorous evaluation.
- **Empowerment of consumers and patients** - By making the knowledge bases of medication and private electronic records accessible to consumers over the net, e-Health opens new avenues for patient centered medicine and enables evidence based patient choice.
- **Encouragement** - A brand new relationship between the patient and professional, towards a real partnership, where decisions are made in an exceedingly shared manner is developed.
- **Education** - The physicians are educated through online resources like medical education and consumers like health education, preventive information etc.
- **Enabling information** - Exchange and communication during a standardized way between health care establishments.
- **Extending** - The scope of health care is extended beyond its conventional boundaries. It means both in geographical and conceptual sense; e-Health enables consumers to simply obtain health services online from global providers.
- **Ethics** - e-Health involves new kinds of patient-physician interaction and poses new challenges and threats to moral issues like online professional practice, consent, privacy and equity issues.
- **Equity** - To form health more equitable is one in all the guarantees of e-Health. folks that do not have money, skills, and access to computers and networks cannot use computers

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effectively. As a result, these patient populations are people who are least likely to profit from advances in information technology, unless political measures ensure equitable access for all.

(A) National e-Health Authority (NeHA)

NeHA was proposed to be founded in 2015 as a promotional, regulatory and standards-setting organization in Health Sector with the subsequent vision, goal and objectives are -

- **Vision :** Attainment of top quality of health services for all Indians through the cost-effective and secure use of data and communication technologies in health and health-related fields.
- **Goal :** to make sure development and promotion of e-Health ecosystem in India for enabling, the organization, management and provision of effective people-centred health services to any or all in an efficient, cost-effective and transparent manner.

➤ **Objectives**

- To formulate “National e-Health Policy and Strategy” for coordinated e-Health adoption within the country
- To oversee orderly evolution of e-Health initiatives (state and nationwide) and to guide adoption of e-Health at various levels and in numerous geographical and health system areas.

(B) Integrated Health Information Program (IHIP)

On a firm view to produce electronics health records to each citizens of country, Government of India intends to introduce a regular system for maintenance of Electronic Medical Records/Electronic Health Records (EMR/EHR) by the Hospitals and healthcare providers within the country. An Expert committee was founded to develop EMR/EHR Standards for adoption/implementation within the country. To provide interoperability of varied EHR systems already implemented, An Integrated Health Information Platform (IHIP) is being setup by the Ministry of Health and Family Welfare (MoHFW).

➤ **Objective of the program**

To enable the creation of standards compliant Electronic Health Records (EHRs) of the citizens on a pan-India basis together with the mixing and interoperability of the EHRs through a comprehensive Health Information Exchange (HIE) as a part of this centralized accessible platform. IHIP is envisaged to enable better continuity of care, secure and confidential health data/records management, better diagnosis of diseases, reduction in patient re-visits and even prevention of medical errors, better affordability, optimal information exchange to support better health outcome, better decision network, and thus eventually facilitating improvement within the reforms of treatment and care of public health at National-Level. Benefits from IHIP

- Stimulates consumer education and patients' involvement in their own health care
- Increases efficiency by eliminating unnecessary paperwork
- Improves public health reporting and monitoring

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- Provides the backbone of technical infrastructure for leverage by national and State level initiatives
- Reduces health related cost

(C) E-Health Initiatives from States across India

List of e- Health initiatives in Gujarat

- ❖ **Gujarat Hospital Management data system (GHMIS)** - GHMIS is state-of the-art healthcare solution to produce better care to patients by addressing all the foremost functional areas of the hospital & the whole gamut of hospital activities. the most aim is to keep up electronic Health records of Patients.
 - **Objectives of the program**
 - Pro-active monitoring of quality health service indicators
 - Integrated state-level holistic view of the resource utilization
- ❖ **e-Aushadhi** : that is frequently supply chain control application that offers with Purchase, Inventory Management & Distribution of various drugs. 'e-Aushadhi', which offers with the management of stock of various drugs, sutures and surgical objects required via way of means of different district drug warehouses. The most aim of 'e-Aushadhi' is to establish the wants of assorted district drug warehouses specified all the desired materials/drugs are constantly available to be supplied to the user district drug warehouses at once. This includes classification/categorization of things, codification of things, quality check of those items, etc and at last issuing drugs to the patients, who is that the final consumer within the chain.
- ❖ **MukhyaMantri Amrutam (MA)** : the aim of the scheme is to enhance access of BPL families to quality medical and surgical look after the treatment of identified diseases involving hospitalization, surgeries and therapies through an empanelled network of health care providers. The beneficiary is any below personal income (BPL) family, whose information is included within the district BPL list prepared by the government rural development department and concrete development department. The eligible family must come to the enrollment station, and therefore the identity of the household head has to be confirmed by the authorized official.
- ❖ **E-Mamta (MCTS)** : E-Mamta could be a technological platform, that might account for tracking of every pregnant woman and youngsters by name based registration, is provider interactive (village wise list to due beneficiaries-work plan) and beneficiary interactive (SMS to the beneficiary) may be a new phenomenon publically Health, where primarily reporting was supported numbers and evaluation i.e. reaching bent beneficiary was considered a mammoth task. The target advantage of this initiative is Pregnant Ladies, Mothers & New Born Child. The most purpose is maintaining database of Pregnant Women, newborn child and mothers.
- ❖ **School Health Program:** School Health (SHP) may be a single, largest time framed health program operating within the State of Gujarat since 1997. SHP covers all 26 Districts & 18,568

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villages (including 7 Corporations) of the State. The most purpose is maintenance of health records of kids and adolescents.

(D) List of e- Health initiatives in Rajasthan

- ❖ **Asha Soft** - The ASHA programme was introduced as a key component of the community process intervention and now it's emerged because the largest community medical examiner programme within the world and is taken into account a critical contribution to enabling people's participation in health. ASHA may be a community level worker whose role is to function as a health care facilitator, a service provider and to come up with awareness on health issues Besides handing over key services to maternal baby health and birth prevention, she additionally renders vital offerings under National Disease Control Programme
- ❖ **e-Aushadhi** : e-Aushadhi could be a web-based application that deals with the management of stocks of assorted drugs, sutures, and surgical items required by different district drug warehouses of Rajasthan state.
- ❖ **Project Vision** - To enhance the standard of human life through better access of medicines to rock bottom stratum of the society.
- ❖ **Project Mission** - To supply an even platform for drug procurement, supply, storage, Issue and distribution throughout the country.
 - **Objectives**
 - To optimize the inventory turnover through efficient control of drug inventory
 - Provide an integrated platform for vendor relationship management
 - Supply required drugs to the respective scientific institutes within the state.
 - Fulfill all the provision chain requirements associated with drug distribution.

On 2nd October 2011 the govt. of Rajasthan launched a scheme for providing free medicines to any or all patients under "MukhyaMantriNishulkDawaYojana" all told 33 Districts in Rajasthan.

(E) List of e- Health initiatives in Uttar Pradesh

- ❖ **Uttar Pradesh HMIS** - This technique is developed to capture all data requirements of various programs happening within the state.
- ❖ **Features** - One stop information access portal for the GoI HMIS information requirement and GoUP internal information requirement, Minimize the manual and duplication in information capture, Data visualization for review and planning: HMIS bulletin, dashboards & dynamic reports, Decision required on Hardware & hosting to be funded through UPHSSP.
- ❖ **Human Resource Management System (HRMS)** - During this system UP will migrate to ManavSampada (Himachal Pradesh NIC developed software) to hide all three key aspects of HRMS. The software is implemented across all verticals of Health department including permanent and contractual staffs.
- ❖ **Hospital system (Gorakhpur)** - This method is developed to form the method of hospitalization easier for patients.

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➤ **Features**

- On arrival on hospital patient will fill the available patient's form.
- Then patient give the shape to data operator and operator will register the patient with UID number and can mention the UID on the shape.

Patient will produce the shape (containing UID) to doctor for further prescription.

- Doctor may refer patient
- Doctor may write the prescription
- Doctor may advice for medical tests (Lab/X-ray/etc).

❖ **ASHA Mobile Application** - This application is employed by 257 ASHAs in 2 blocks of Kaushambi district to assist the ASHAs to try to systematic and specific counseling of the pregnant women, postpartum mothers and their families on pregnancy, Immunization module & postpartum. This application provides overall supports the ASHAs to try and do case management, counsel and referrals.

❖ **Mobile Kunji academy** - It's designed to facilitate conversation between government and public and use audio visual multi-media materials for better understanding to the masses.

(F) List of e- Health initiatives in Chhattisgarh

❖ **HRMIS (Human Resource Management Information System)** - HRMIS is largely a tool to manage the HR related tasks that are being performed within the health department. This project captures or contains collective information of Health Department's employee. this can be implemented for contractual further as regular employees working within the health department. Various facilities in Chhattisgarh's Districts including CMHO's are using HRMIS to induce their personnel Details.

❖ **Kayakalp** - Ministry of Health And Family Welfare, Government of India, has released a countrywide initiative on fifteenth of May, 2015 to push cleanliness and enhance the standard of public health centers. the goal of this initiative is to recognize and realize their effort to make a healthy environment. The call of this initiative is "KAYAKALP". The aim of Kayakalp is

- To promote cleanliness, hygiene and Infection Control Practices publicly Health Care Facilities
- To incentivize and recognize such public healthcare facilities that show exemplary performance in adhering to plain protocols of cleanliness and infection control
- To inculcate a culture of ongoing assessment and critique of performance associated with hygiene, cleanliness and sanitation

❖ **Nearest consultation room** - Nearest Health Facility is that the e-Health Initiative started with the goal to locate user's modern role and become aware of the available health centers close by and for the usage of GPS (Global Positioning System) co-ordinates. Features of this service

- GPS based Positioning.
- Providing facility call with approximate distance from modern role.

- Provides Navigation to the ability using Google map.

(G) List of e- Health initiatives in Andhra Pradesh

- ❖ **eVaidya** – Telemedicine Project Pilot In Urban Health Centers (PPP) The State has given Urban Health facilities in Vijayawada and Visakhapatnam on pilot to eVaidya, a tele, ePHC concept. 60-70 patients are being catered to at those centres. Various diagnostic checks are being conducted.
- ❖ **Rashtriya BalSwasthya Karyakram (RBSK)** - Rashtriya BalSwasthya Karyakram (RBSK) could be a new initiative geared toward screening over 27 Crore children from 0 to 18 years for the 4 Ds - Defects at birth, Diseases, Deficiencies and Development Delays including Disabilities. Children identified with illnesses shall acquire follow up including surgical procedures at tertiary level, free of price under NRHM. The RBSK program has been enabled through a cloud based, Tablet PC system, providing dashboard based reports for various levels of administrators/doctors in any respect levels. Role based access management system has been designed, which helps officers at various levels to test reports as per the hierarchy.

3.2 Electronic Health Record Standards for India

EHR standards have been first notified in September 2013 by the MoHFW and a Scripture was later released on 31 December 2016 after taking feedback. The MoHFW has also made standards like Systematized Nomenclature of medication – Clinical Terms (SNOMED CT) available free to be used within the country.

3.3 mHealth

The government is functioning with organisations, both government and personal, to supply intuitive and interactive modes of communication, treatment, information transmission, and retrieval to doctors/hospitals and patients using.

3.4 Mobile Apps and Websites

- **Public angle** - e-health offers many benefits that is why the government is encouraging the healthcare sector to produce more e-health services. The advantages of e-health include:
- **Time saving** - Tele-health can save time. as an example, patients can schedule their own appointment with their care provider online, and that they do not even must leave their home if they will arrange a web consultation (by video link, for example).
- **Insight into own health** - someone digital healthcare environment gives people more insight into their health. If they need, they will share all or a part of their data with a healthcare provider or informal caretaker, so that they do not should repeatedly relate their overall case history. this permits the healthcare provider to figure more effectively, determine the proper treatment more quickly, And avoid faults. Patients gain more control over their own health because of a greater understanding of their health situation.

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- **Lower administrative burden** - Doctors have less paperwork and may share information securely and simply with colleagues.
- **Cheaper** - e-health can cut the prices of health tasks and processes. as an example, telemedicine can reduce the requirement for travel and therefore the need for referral to a secondary or tertiary health institution, this cuts costs for both patients and therefore the health systems. e-Health systems employed in immunization can save wastage of vaccines.

e-health can enable health processes to handle more cases without raising staff numbers or associated costs. for instance, computerized systems can help patient registration and medical records staff to deal with increases in patient numbers.

4. Economic Evaluation for State Plans in E-Health Solutions - The idea of cost cutting and Technology used economic evaluation is given below:

- ❖ **Cost cutting** - Remote analysis and monitoring services and electronic data storage significantly reduce healthcare service costs, saving money for you, your patients, and insurance organizations. Telemedicine also reduces unnecessary non-urgent ER visits and eliminates transportation expenses for normal checkups. Recently, the American hospital Association reported on a telemedicine program that saved 11% in costs and quite tripled ROI for investors.
- ❖ **Technology Used** - Despite the gradual adoption of technology by the healthcare industry, not many are able To reduce healthcare expenses and gain good margins due to the fact they are not leveraging technology to its fullest potential [5]. With growing labor expenses, demographic shifts, and an unsure regulatory climate, the time has come for the healthcare sector to embrace the globe of smart technology to chop healthcare costs – without sacrificing the standard of care. Smart technology and other rapidly emerging technological solutions designed to spice up operational efficiency can have a considerable impact on hospital bottom lines while providing a key edge for early adopters to attain a position over others. Here are five ways within which smart technology can help reduce healthcare costs.
- **Lowering administrative expenditure** - Every healthcare provider uses a slew of systems to store data, treat patients, and manage day-to-day operations. However, operating these systems and trying to urge access to the information needed to create critical healthcare systems is not only time-consuming, but it also costs hospitals lots more in administrative expenditure – with the tendency to end in physician burnout. Using smart technology to integrate these systems into a unified system and mix the information into one repository can help in quicker diagnosis and treatment, giving organizations to start a replacement era of forward-thinking methods. Such interoperability will help enable doctors to grasp the precise needs of the patient, share data between systems and also the cloud, and drive efficient analysis which will cause better patient care.
- **Cutting down the necessity for specialists** - For any healthcare provider, interacting with patients to know their symptoms could be a massive undertaking. It requires patients to go to

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the hospital or care center physically and clearly articulate their condition and doctors to diagnose symptoms and supply precise treatment. The overuse of specialists for diagnosis and treatment and therefore the ever-increasing doctor fees make healthcare very expensive. Smart technology within the style of healthcare wearable's can use information from sensors and supply an array of advantages on all levels – ranging from in-patient treatment to remote health monitoring. Wearable can automatically gather necessary information from patients, send critical healthcare data a unified system, and permit doctors to urge real-time alerts when conditions transcend normal – thus drastically bringing price down.

- **Eliminating room expenses** - In a traditional healthcare setting, patients are required to trip the healthcare organization to urge any reasonably treatment. the value incurred not only includes doctor fees, costs of treatment, lab fees, and value of medicines, but also insurance cost and also the cost of traveling – especially for patients living in remote areas. As healthcare spending per person is gradually increasing, smart technology like remote patient monitoring are helping keep healthcare costs in restraint. The accessibility and affordability to primary telemedicine tools is becoming widespread that might considerably cut healthcare costs. Through the utilization of advanced tools, it allows healthcare to remotely monitor patients in real-time and adjust treatment plans accordingly – thus eliminating travel costs, room expenses, and exorbitant doctor fees.
- **Lowering staffing costs** - In any healthcare organization, labor accounts for a large portion of operating expenses. And with turnover at an all-time high, staffing issues put immense strain on healthcare providers. Either staff has to work overtime, or managers should extend their hours to combat unexpected patient volume and fill the gaps of shift coverage. However, with efficient staffing strategies in smart scheduling applications, hospitals cannot only curb rising healthcare expenses but also positively impact patient outcomes. they will effectively allocate human resources, permitting healthcare corporations to satisfy their needs – without resorting to expensive alternatives like paying for overtime or investing in temporary hires. By integrating data on past shifts and current patient needs and understanding the expertise of existing staff, these apps can perform real-time labor analysis and predict labor demands supported the quantity of incoming patients, the amount of open beds, hospital room capacity, equipment status and more.
- **Streamline claims processing:** Another major contributor to skyrocketing healthcare costs is that the insurance claims process – that is not just time-consuming but also labor-intensive – for healthcare providers and insurance organizations alike. Thanks to how complex processing and managing claims is and the presence of several bureaucratic strategies, slow reaction times significantly affect patient experience while giving them the impact that delays are intentional. Smart technology can streamline claims processing, reduce expenses by an oversized margin, and significantly enhance turnaround times. The technology can automate facts collection and communication strategies while proving the events that reason a claim – main to decrease healthcare expenses furthermore as a much higher customer experience. Because the technique is automated, healthcare companies can similarly enhance on price

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performance and force massive savings – each in staffing and compensation turnaround times. The use cases for lowering healthcare expenses through smart technology are many.

4.1 Revenue

Beyond the overall cost-savings, tele-health can help boost revenue by turning on-call hours into billable time, attracting new patients, reducing no-shows, and even reducing overhead for physicians who conceive to switch to a versatile work-from-home model for a part of the week. Eliminating time consuming processes related to healthcare delivery in a very traditional clinic setting is in a different way health systems can increase revenue.

4.2 Current Scenario of E-Health Solutions

Start-up ecosystem of India is that the third largest within the world after UK and US. At the present rate, there'll be over 12, 000 start-ups in India by 2020 and it'll create employment for 250,000 professionals. India has made large strides in Healthcare sector since 2010. The govt. has made several landmark steps like NRHM, the Clinical Establishment Act together with new initiatives like Make in India, Startup India – Standup India. The personal sector has grown throughout the worth chain. an outsized number of Indian e-health startups are visible mushrooming within the market. Hospital groups have emerged as stand-alone company entities, as have diagnostic providers. There are tremendous working possibilities inside the industry. The industry is not any longer only about hospitals, doctors, medicines, and patients; it is transformed to include much promising working environment.

5. E-Health Solutions Effect on Sustainable Development Goals

According to World Health Organization, “Good health for Well Being” is one out of seventeen Sustainable Development Goals said by United Nations in 2015. physiological state unleashes capacity of taking an honest decision. It motivates and energizes in performing every physical and mental tasks with ease. Technology could be a powerful medium for information flow, to unravel all sustainable goals literacy are one strong solution. Therefore to attain any goal technology plays strong role. we are able to provide solution in style of software tools and services. Mobile technology has been successful in replacing use of technologies like desktop & laptops. Internet use is widely spread thanks to availability of itinerant and smart technologies embedded within. Achieving solutions for solving any problem big or small mobile technology are going to be an ideal platform.

In Health Informatics E-Health could be a new term. it absolutely was quoted sometime near 1990s. Telemedicine was in boom at that point. But it closed a barrier that telemedicine didn't suffice. that's “Telemedicine only focused the medical solutions or treatment to patients. Use of telemedicine was just for doctor patient relationship. But E-Health provided intuitive answers breaching this barrier. some of those solutions are HealthCare data sharing among doctor. patient and associated bodies for tracking medical traits, disease diagnosis results, diagnosing practices for similar diseases, platforms for private doctor-patient discussion, diagnosis, alarms and notifications systems for checkup appointments, medicine intakes, injections and laboratory checkups, etc. Globally, different nations have implemented frameworks and platforms of E-

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Health Solutions. With this good outcomes like “conversion of paper based medical access device to virtual platform, tracking of medical anomaly (epidemics and risks tracking, birth and dying rates tracking), control of Medical Inventory and human resource availability, alarming people in taking daily hygienic diets and exercises, and so on has been achieved.

e-health and mobile technology mixed together can play a main role in attaining sustainable development goals. In worldwide level E-Health solutions can reach each rural, deprived nukes and isles of globe. But it will take a long time. With sufficient use of healthcare technologies and e-health we are able to achieve physiological condition which is one out of seventeen sustainable goals. But this may play a vital role in achieving remainder of the event goals.

6. Challenges for E-Health in India

The challenges in rural regions is obvious inside the plain geographic factors including isolation and tiny dispersed populations, restricted transport and road infrastructure[6], and thus the resultant, long distances to hospitals. There are significant difficulties in recruiting qualified and experienced personnel in rural health care services. this can be compounded by the increasing centralization of specialist secondary care services and therefore the increase within the proportion of the elderly population relative to the overall population.

The challenges for a sustainable, efficient e-Health system are numerous:

- 1) Incentivisation** - Incentivizing all the stakeholders involved could be a major challenge and raises the question of who pays the bill since the price of infrastructure, medical drugs, doctors’ fees, and other operating costs might be very high. Hence, there is a requirement to divide these costs among different entities.
- 2) Cost Containment** - Providing health care to India’s population is dear, and introducing ICT would require extra upfront investment. there is a necessity to manage the prices in such the way that the cost of health care goes down. this might be achieved if the final health care budget includes extra cash for ICT. An e-Health programme would need to urge large numbers of beneficiaries for costs to be justified.
- 3) Information Exchange** - Health information exchange must be demand driven, with proper access and control mechanisms in situ. The challenge is to motivate and encourage key stakeholders patients, medical service providers, insurance companies and thus the government to pull also as push the right quite information from the system. David Thomas, administrator and Head of worldwide Health at the Matrix Knowledge Group, UK, said, “Informatics is also a serious challenge in India and telematics could also be a significant challenge in government hospitals.”
- 4) Adoption and Resistance** - In India and across the world, there is reluctance on the part of patients and doctors in fully adopting e-health. the proper quite technology must be utilized within the right way so patients yet doctors feel comfortable in adopting e-health practices. Companies not only must prepare the only technical systems but also confirm that they are

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easy to grasp and use. Success would force numerous public awareness programmes on the benefits of e-health

- 5) **Staffing at Different Levels** - health is not almost having technology in situ. It should even have an identifiable, approachable and well-qualified human interface. Getting the correct people to use these technologies so as to produce proper health care services is extremely important. Hence, there's a desire to rent the correct people and train them properly so they're well equipped to hold out the task of providing health care to remote areas.
- 6) **Evaluation** - Evaluation of the strategies must be honest and done by an unbiased third-party observer. There is a requirement for benchmarks to trace progress. These can be taken from best practices from local projects or from notable projects in other countries like Sweden, Singapore, etc. An independent body could be created for this purpose which could provide ratings. The resulting evaluation would offer endless learning loop that could also inform the e-health framework itself.
- 7) **Power Sharing** - the whole system of health care should be such it is often driven by both central and regime. Power, responsibility, accountability, rewards and risks must be defined beforehand so on avoid any conflict of interest.
- 8) **Managing Information** - the data collected should be media rich (containing video, image, text, etc.). This information must be properly archived, retrievable, accessible, secure, and readable from remote locations using different technology platforms. "One patient, one record" must be executed, so on avoid duplication of information. Innovative and cost-effective health informatics solutions need to be created to satisfy this goal.
- 9) **Education** - e-Health is not nearly providing health care service when someone is unwell, but it should even be wont to promote preventive health care to boost the quality of living and reduce health care costs within the medium-to-long term. this may also help in upgrading and enabling higher productivity elsewhere in society. But attaining this needs bringing people into the system and educating them about the various preventive measures to avoid disease outbreaks like H1N1, or other seasonal diseases.

7. Barriers for E-Health Solutions in India

All the possible barriers for e-health solutions are given below

- **Illiteracy** - In India majority of the people living in rural areas are illiterate than urban population. Literacy rate in rural regions stand at 73.5% while literacy rate in city regions stand at 87.7%.
- **Digital literacy** - 23% of urban households and 4% of rural households possess computers. Among persons of age 15-29 years, nearly 56% in urban areas and 24% in rural areas were able to operate computer. In the same age group, nearly 25% in rural areas and 58% in urban areas reported the use of internet.
- **High cost of ICT** - Cost of ICT tools are very high, everyone cannot afford it.

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- **Poverty** - In India most of the people are living under poverty condition and does great efforts for their daily living. To them accessing the internet is a costly issue for necessary communications in the form of installing the desired smartphone lines needed for net or e-mail access is in addition too exclusive in developing country.
- **Lack of Awareness** - There is common lack of awareness concerning advantages of E-Governance as well as the process mixed up in executing successful G-C and G-B projects.
- **Poor Infrastructure** - There is acute shortage of required infrastructure like electricity, net technology and techniques of communications will have an impact on the speed which postponed the implementation process.
- **Language Dominance** - The dominance of English on the internet bounds access of non-English-speaking Population. In the case of India, maximum population does speak in Hindi.
- **Hesitate to revolutionize** - People are disinclined to change. As e-governance means remodel of the system from manual to computerize based, it's generally disliked by the workers and therefore the general public. People typically hate it as they require learning new things in it for which they necessitate to provide in extra time and effort.

8. Positive and Negative Impact of ICT in E-Health Solutions in Rural Areas

Some positive and Negative impacts are listed below

8.1 Positive Impacts of ICT Growth

- It can maintain electronic health records
- Increase in healthcare data management
- Potential to improve quality in health care
- It has the capability to increase health care
- Use of ICT on health sector leads to achieve overall development goals
- Time saving, tele-health can save time.
- Lower administrative burden, doctors have less paperwork and may share information securely and simply with colleagues.

8.2 Negative impacts of ICT growth

- Huge initial investment and transaction Costs
- Power Supply
- Lack of training and awareness
- Under funding

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CHAPTER - 5

ICT Based Education for Empowering Rural Women in India

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1. Introduction

Women play an important role in various sectors such as economic, political, social, sports, educational, enterprising etc. Women are crucial part of Indian economy. The movement of self help group plays an important role for empowering women in India. Various IT enabled services given various new trends for the market such as E-commerce, E learning, Etc. through this paper researcher want to highlight significance of this trends for promoting women empowerment in India. With the help of this trend women can acquire information about new trends, their usage and knowledge they can explore to sell or develop their products/services by using new trends of E-commerce. Knowledge of internet can upgrade the knowledge of women about political,

economical and social situation of whole word. It is universally accepted truth that information technology offer immense opportunities for development of economical, social, educational development of the people. Women empowerment is an important part for the overall national development. About 72.2% of the population lives in some 638,000 villages and the rest 27.8% in about 5,480 towns and urban area. In 2013 male to



female ratio is 940 females for every 1000 males. In 2012 total female population was 591.4 million. Hence huge women population is leaving in India and women empowerment is most important challenge in India. As women are the crucial part of Indian economy and social system of India. They are actively involved in education, sports, politics and any other field but the rate of women empowerment is not as per the expectation compared to developed countries.

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A) Role of Government of India

Government of India has taken lot of initiatives for women empowerment among them Self help Group is playing vital role. Through self help group movement women come together, share their problem, and develop solution for survival and progress. Information Technology Information technology consists of various hardware, software, internet other communication networks and media used for collection, storage, processing of the data and transmit information in the form of data, voice, text, images etc. information technology offers time and space, these offers valuable resources for women especially in developing countries who suffer from limited availability of the time ,social isolation and lack of assess of knowledge and productive resources. The movement of self help group started thirty years ago (1980s) with NGOs promoting self help groups. Micro finance is novel approach to banking with poor people. In this significant and momentum approach bank credit is extended to the poor through self help groups (SHGs), non government organizations (NGOs), credit unions etc. India now occupies a significance place in global microfinance through self help groups and the home grown SHG. This has evolved into a national



movement with the proactive role of state governments gaining recognition from all the major stakeholders. The concept of self help group services the principle “by the women, of the women and for the women”. Self help groups are voluntary associations of people with common interests formed to achieve collective social economic goals. Such groups are organized for mutual help

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and benefit. It is formed without political affiliation. They may comprise with 15-20 women and/or men although they generally consist exclusively of women members. In India 90 percent groups are formed by women members. Formation of group is done at micro or group level. The initial operations of SHGs start with collective savings from members. These groups inculcate the habit of thrift among the members. By collecting small saving huge amount can be raised. These group advances loans to the needy members. The total funds owned by the members are thus circulated in the form of loan among the members. The identification, formation and nurturing of groups is carried out by NGOs, other developmental agencies or banks with the promoters inculcating habit of thrift among members. Once the groups are trained and strengthened, they are linked to nearby banks, usually within six months of formation. Banks provide collateral free credit in increasing proportion to the groups' accumulated savings. All the initiatives such as selection of borrowers for availing credit, identification of activity, unit cost volume of loan, management of finance and procedures for repayment are undertaken by the poor segment at the group level.

Therefore it is clear that SHGs are as a plan by the people, of the people, for the people. It reflects the real people's participation in the process of development at micro level. Self Help Group in India Over the decades of planned development, the shift of emphasis of women programmes from purely welfare oriented approach to more pragmatic and development oriented. One has recognized woman as a productive worker and contributor to the economy. The origin of SHG is form the brain child of Grameen Bank of Bangladesh, which was founded by the economist, Prof. Mohammed Yunus of Chittagong University in the year 1975, to provide microfinance to rural women in Bangladesh, micro-finance as a most powerful instrument to tackle poverty. The SHGs in India were formed by Mysore Resettlement and development Agency (MYRADA), a NGO in 1985 due to breakdown of large cooperatives organized by MYRADA. Up to 1986-87 there were nearly 300 SHGs in MYRADAs projects. MYRADA then approached NABARD for an action research project on self help groups which funded the research within same timeline, Asian and Pacific Regional Agriculture Credit Association weighted options and agreed on further action for effectively increasing credit access for the poor people.

In India NABARD and a member of APRACA carried out a deliberate study which gave useful insights into the dynamics of group organization, saving potential and repayment ethics of the poor. Encouraged by the results of the study and action research project of MYRADA, NABARD in consultation with Reserve Bank of India (RBI), commercial banks and NGOs, launched a pilot project in 1991-92 for linking of SHGs with banks. Thus the microfinance activity is result of NABARDs work that started in February 1992 through an initial pilot project promoting 500 SHGs. RBI has advised commercial Banks in July 1991 to extend finance to SHGs as per NABARD guidelines all over India. Importances of information technology for women empowerment are -

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- **Social Empowerment**
 - a) New knowledge and information.
 - b) Awareness and understanding of issues.
 - c) Skills, abilities and competence.
 - d) Support, friendship and inspiration.
 - e) Participating in group activities with women.
- **Political Empowerment**
 - a) Participating in policy making.
 - b) Taking action to change your life or your community.
 - c) Networking and lobbying.
 - d) Changing stereotypes about rural women.
- **Psychological Empowerment**
 - a) Self confidence and self esteem.
 - b) Feeling more valued and respected.
 - c) Motivation, interest and enthusiasm.
 - d) Freedom to do things or express yourself.
 - e) Feelings of belonging wellbeing and happiness.
- **Technical Empowerment**
 - a) Knowledge about ICTs
 - b) Awareness and understanding about ICTs.
 - c) Skills and competence in using new ICTs.
 - d) Ongoing support and advice in using ICTs.
 - e) Access to high quality technologies.
 - f) Confidence to use and speak about ICTs.
- **Economical Empowerment**
 - a) Women's control over income.
 - b) Relative contribution to family support.
 - c) Employment opportunities.

B) Development Related Issues

Information and communication technologies (ICTs) permeate every aspect of our lives; from community radios in the most rural parts of the globe to cellular phones in the hands of women and men in every community on earth, to computers in almost every medium to large organization. The advancement of ICTs has brought new opportunities for both knowledge sharing and knowledge gathering for both women and men. To the extent that the global community can reach heretofore unconnected individuals, families, and populations to better understand their needs and challenges, ICTs can provide unlimited opportunities for economic

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development and social engagement through new innovative thinking and tools. However, a basic assumption is that all members of our global community benefit from and are part of the



growing knowledge society. ICTs have been compared to a double edged sword - advancing the knowledge society on one hand and deepening gender and social divides based on pre-existing social divisions on the other. Leaving large portions of the global community both undeserved and unengaged remains the largest determinant of success for current development efforts. Specifically, without a thoughtful policy, strategy and execution plan to ensure women's full engagement in the knowledge society, the places in which they work, the families for whom they care, and the communities in which they live and serve will not thrive. Information and communication technologies (ICTs) permeate every aspect of our lives from community radios in the most rural parts of the globe to cellular phones in the hands of women and men in every community on earth, to computers in almost every medium to large organization. The advancement of ICTs has brought new opportunities for both knowledge sharing and knowledge gathering for both women and men.

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benefit from and are part of the growing knowledge society. ICTs have been compared to a double edged sword - advancing the knowledge society on one hand and deepening gender and social divides based on pre-existing social divisions on the other. Leaving large portions of the global community both undeserved and unengaged remains the largest determinant of success for current development efforts. Specifically, without a thoughtful policy, strategy, and execution plan to ensure women's full engagement in the knowledge society, the places in which they work, the families for whom they care, and the communities in which they live and serve will not thrive.

2. Access and use of ICTs

ICT facilities such as cybercafés, or telecenters which often become meeting places for young men, and hence deter women's absorption and adoption of ICTs to access information and knowledge. Because women and girls often do not control the finances of the home or do not have sufficient personal income, they may lack the financial resources to purchase radios, televisions, or computers or to pay Internet service providers (ISPs) for monthly access to the Internet. Girls and boys may have differing access to computer skills training in primary and secondary schools. Anecdotal evidence suggests boys will often get priority access where computers are equally available, but this needs to be better measured and understood in developing countries before generalizations can be made. Finally, for the large numbers of women employed in the informal sector, there is no possibility for using office computers to access the Internet, a possibility that is more accessible for formal economy employees.

A) Usability and Literacy

Access to education continues to be a greater barrier for women than men; an estimated two thirds of the world's illiterate are women. Education in science and technology is considered a male domain in many cultures. Training in ICT skills is rarely gender sensitive or tailored to women's needs⁵ and is sometimes delivered by a male trainer who has embedded perceptions about women's capabilities inconsistent with a research-based understanding of women's competencies and contributions in these fields. Familiarity with basic computer use, including the ability of the user to establish an email account, communicate via email, navigate the Web, understand the basic etiquette of using the Web, download useful and sometimes life-saving information, use CD ROMs and other interactive materials, and the ability to use electronic forms of communication for distance education are basic learning and communication skills needed for workplace tasks by women as well as men.

B) Development and Design

Much of the content on the Internet has not been developed to address the needs of women and girls in developing and developed countries nor is it available in the languages they speak. Digital

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technology has also been used for harassment and sexual exploitation of women and girls in the form of pornography, trafficking and predatory e-mails. While gender sensitive men have done much to promote gender-equitable content design, fully addressing these issues can only be done when more women become software engineers, content producers and entrepreneurs filling the large need for these resources. There is a growing commercial market, yet significantly underserved in the developing world, to be supplied by women entrepreneurs and employees who can both capture women's knowledge for the marketplace and develop knowledge and resources to serve women, their families and communities in ways in which the male dominated field has not yet considered. This content by women for women will provide an excellent economic opportunity through the development of niche markets currently underserved. Concurrently, women can help fill the large demand for skilled labor demanded for growth by major multinationals, as well as national and local workforce needs.



3. ICT as a Development Tool for Girls and Women

An important focus is the need to move many of the carefully incubated gender policies and initiatives developed through careful thought leadership in specialized women's programs into the mainstream efforts to ensure these well thought through efforts do not inadvertently become "ghettoized" or ignored by the mainstream programs that desperately need the knowledge to enhance and achieve their outcome goals. Government leaders forming ICT policies, support good designs for ICT skills training and education programs, develop effective guidelines for good business practices including all talented workers,



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support entrepreneurship development customized to the learner and in general develop strategies to eliminate any negative impact a gender digital divide would have on development. For those who might suggest that the differences between girls and boys may be a result of competence or capability. In primary education, there are few gender differences apparent in science or mathematics, although girls excel in reading even at this early age. In secondary education, females had higher average achievement than males in mathematics and science. In tertiary education, while traditional gaps have been narrowing, graduation rates for computer science and mathematics is lower for females than males.

By engaging more girls and women in the development of ICTs, the world can better ensure there is quality content, products and services that meet the needs of girls and women as well as their families, communities and states. Concurrently, girl's passive participation with ICTs leaves them vulnerable to predators and less likely to engage in ICTs for knowledge gathering, sharing and eventually business development and careers. There is little known about the intersection of the girl child and ICTs in the developing world other than some pilot studies that provide a glimpse as to their value in education for girls as well as boys. In all cases the goal is to create both an awareness of the opportunities for the girls if they choose to study in these fields and also an understanding as users of technology of the many current and emerging applications of technology. Once awareness and interest is created, more needs to be done to encourage that interest in schools and in homes and communities where ICTs are accessible and safe. Additional considerations are as follows: Ensure educational content and curriculum is developed for girls' interests as well as boys', but avoid gender stereotypes to achieve this goal. Create safe times and spaces for girls to access ICTs where they will not be in competition with boys as research shows boys aggressive behavior tends to push girls out.

5. Women and ICTs

Women have been engaged in ICT development since its inception. It was a woman who developed the compiler, identified the first computer bug, and created the first programs. Today, example after example highlights the value of women's voices and the importance of their contributions. Women's participation in economic development through microloans to build small and medium enterprises has been well documented and publicized. Women's business incubators are emerging through the developing world in recognition of the need to provide business opportunities for women as well as men to enhance, grow, and quicken the pace of economic development. The full scale and power of many of these small and medium enterprises are yet to be fully realized, but there is a growing awareness of women's ability to use ICTs to expand their work across regions and around the world. Women from the grass roots are using ICTs to expand their mission, drive their passion to improve the world.

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There is a growing reality that women's engagement in ICTs is important for multiple forms of development, including social and political justice as well as economic development. But we do not understand well how women access, use, develop and/or design technology compared to men. This is in part because of the lack of indicators as well as disaggregated data available. This lack of information is of growing concern and organizations such as the ITU are doing a better job of gathering household data that looks at gender as a variable. There is a dearth of literature systematically evaluating the impact of ICTs on women's overall welfare. Even among major recent studies evaluating ICT impact on business development or e-government initiatives, data is not disaggregated by gender. Of those government agencies that compile, statistics, most do not provide a breakdown by gender. Second, traditional ICT statistics are either obtained from telecommunication organization or estimated based on shipment data. These organizations have their own operational or analytical reasons for maintaining the data; unfortunately gender does not factor into their considerations

6. The Role of Women's & Use of ICTs in Sustainable Rural Poverty Reduction

Women around the globe play an important role in food production and distribution. The implications of women's access to price and product information, supply chain options for exporters and freighters and connections to any information or knowledge that helps increase



their competitive power and improve earnings will lead to increased wealth and economic development. Examples of successful cases where access to information helped rural women

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increase their income may lead to an appreciation of the value of improved policies that will allow both increased ICT access to women and ensure training is provided to build women's capacity to manage the information they receive as effectively as possible.

Yet women farmers and agricultural producers have unique challenges that their male counterparts do not face. Specifically, access to the Internet in rural areas can only be possible through common access points, called tele-centers or cyber cafes. These specialized centers are usually not open for women and several cultures frown upon women who mingle with men in these locations. Policy makers and practitioners alike need to consider this when implementing their plans. Special provisions need to be created, such as women-only tele-centers or women only capacity building operations. This will allow women to benefit equally from information access and to reduce the impact of the ICT gender gap on rural development. Yet women farmers

and agricultural producers have unique challenges that their male counterparts do not face. Specifically, access to the Internet in rural areas can only be possible through common access points, called tele-centers or cyber cafes. These specialized centers are usually not open for women and several cultures frown upon women who mingle with men in these locations. Policy makers and practitioners alike need to consider this when implementing their plans. Special provisions need to be



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▪ **Broadband Access for Women and Benefits for Communities**

Access to reliable and affordable broadband provides women and men with an opportunity to access the immense sources of knowledge and learning material available on-line. While much of what is available has been developed by men for men and specifically for English speakers, there

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are still resources that allow women to learn new skills and to perfect their existing skills. They can join on-line professional networks or, where none exists, create them and meet women in the larger community in ways the current culture or deficit of women will not provide. Electronic mail provides safe means to communicate with support networks, family members and potential business contacts. Women's economic opportunities are linked directly to women's access to land, labor, financial and product markets. By allowing women to benefit from new electronic-based services, such as land title registration, women can fully participate as developers of economic productivity and wealth to support their families and their communities. Older manual, paper-based processes did not make any provision for the female citizen and instead required male relatives to fill the paper forms for land and/or other titles. For many countries the process of automating and reforming registration processes has triggered a thought reform which has worked to benefit women. By increasing their inclusion in the property titling and asset ownership activities of their localities, women's knowledge and expertise becomes another valuable resource in the community

7. The Transformative Impact of E-government Services for Women

E-government services targeting the needs of women including up-to-date and cost-free public information and services about women's rights, inheritance and family laws, health care or housing; as can be seen from the e-Seva case in India. While it is not easy to measure the impact of ICTs in the area of government, health and education, the repercussions that information and communication technologies are having in these sectors are real and a number of studies and surveys have produced some concrete results. There are a number of impacts that can be identified with regard to e-government, including improved information flows, reduction of process time and cost, and an increase in efficiency and transparency. ICT and Equal Opportunities for Women and Men" proved gender to be an important issue to be placed on the e-government agenda. There are many ways in which e-government impacts on women's lives. Women are usually in charge of communication with public administrations at the level of households and e-government services can mean less time needed for queuing up in front of doors of different departments. It may also bring the government closer to women and make it easier for them to monitor state activities and budget spending in their localities in order to influence the decisions that affect their lives. E-government can facilitate better access for Roma women and other marginalized groups, to up-to-date and cost-free public information and services in areas that directly affect them, such as health care or housing E-government processes are invaluable for all individuals who generally lack information on their legal rights and procedures to obtain required services. ICT applications can be applied to land ownership/title data bases, procurement and registration procedures to ensure accountability and transparency for women and men.

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▪ **Women's Advanced ICT Education and Life Long Learning**

Education must compliment ICT access in order to provide value to the technology. From classrooms to community radio to cell phones and family-friendly Internet cafes, technology itself provides multiple venues for women and men to learn. Further, lifelong learning provides a new formula to allow women to move out from the bottom of the career path and move to mid level and top level leadership positions. There has been significant discussion about the importance of educating the girl child as well as the boy child to ensure they fully participate in the knowledge society of the 21st century. Specifically, women need to develop skills beyond basic literacy and usability to become creators, developers, designers and innovators using ICT as a tool in that process. There are two steps to consider.

1. Applied ICT skills : The ability to use and apply generic ICT tools in workplace settings and to upgrade these skills in line with the requirements of business and industry. These skills include all aspects of information working such as web design, call center consultant, analyst programmer, information technology manager, software project manager, desktop publishers, librarians, computerized sewing, and multimedia.

2. Professional ICT skills : Encompass the specific skills required to design and develop, implement and repair ICT tools (includes hardware and software creation and design, manufacturing, electronic manufacturing, network operating systems, cabling, router programming). In developing countries today, ICTs jobs can be provided through the booming mobile phone industry. Women have job opportunities in call centers and in sales and repair services, as can be seen in the Cameroon case. Access to information and knowledge in rural areas has a significant impact on women's social and political participation and women's economic empowerment as agricultural producers. Public policy participation has a defining role to play in building up a country's human capital and knowledge endowments through promoting quality education, lifelong learning, innovation and creativity in its workforce. By consolidating national and sector policies, women can more effectively contribute to economic growth as well as serve as agents of change for political moderation and productivity. The proliferation of ICTs has four main impacts on women's work in the context of increased competition:

- A shift from manual labor to intellectual labor mineralizing the need for brute strength of workplace criteria
- A shift from automation to computerization in the manufacturing sector through the use of computer-aided design and computer-aided manufacturing
- The development of products and services (including education) needed to participate and compete in the workplace available on-line or through traditional technologies

- The introduction of the technologies themselves as a means for business opportunity development

8. The Threat of ICTs for Women

At first glance, ICTs have had an overall positive impact on women's work, livelihoods and overall opportunities but this is not easily quantifiable and there have been opportunity costs incurred. Unless gender considerations are incorporated into employment policies, ICT diffusion strategies, or national policies, strategies may inadvertently result in negative unintended consequences that compound gender and income disparities. These negative consequences include:

- **Maximum flexibility, minimum protection**

ICTs and the digitization of information enable businesses and companies to locate and manage production away from the main site. This has implications both for employment of women and for their personal investments in ICT tools as well as for the growth of clusters of small enterprises and new forms of social production. In theory, ICTs should offer women the possibilities of both flexible locations and flexible hours through tele-commuting and/or self-employment. Conversely, women's "flexibility" may also result in casual, part time, piece-rate, and seasonal employment, with little long term protection or security of income.

- **Supply chain competition**

Networks and communications infrastructures have intensified competition in unpredictable ways through facilitating decentralization of many aspects of supply to manufacturing and service industries. The miniaturization and modularization of products, intermediation and disintermediation of processes, combined with cheap mobile capital has an enormous impact on the value-add specialization in the supply chain. While tele-working has certainly offered women a range of new employment possibilities, the downside is that women can be excluded from other, better career possibilities. Another area which provides jobs of women is in the call-service sector. Gender is one of many factors that determine the impact of IT on women's working lives. Age, class, ethnicity and religion can play even greater roles in defining women's working position. Similarly, the degrees of exclusivity that arise from the information revolution sharply differentiate regions and communities.

Technological changes affect the quality and quantity of women's work. Along with women's employment benefits from new technologies there are associated health, environmental and other costs. Employment issues of concern to women working in technology relate to contractual terms, intensification of workloads, wages, training, and health and safety such as video display unit hazards and repetitive strain injuries.

9. Implementation Issues for Women and ICTs

For ICTs to have the broadest reach and the most powerful positive impact, all global citizens need to participate fully in the knowledge society from basic access through the top levels of leadership. But the opportunities women can bring to development will not be realized unless



policies for all mainstream efforts take gender considerations into account. As we accept that different economists have different strategies for addressing the global economic recession, so policy makers need to allow for a debate on the issues and arrive at a diversity of perspectives and recommendations. It is only through this natural discourse that we can hone the clear pathways needed to ensure all women and men benefit. To this end, policy makers should ensure they talk not only to the gender experts in policy, but also to practitioners, business developers, and educators that work daily with the population, as well as women themselves. Today, many developing countries are turning to the ICT sector as a new opening for attracting foreign direct investment - primarily in data entry and call center facilities. ICTs have also been seen as a means for the development of ecommerce based initiatives where women are producing crafts or hand made products to market on line.

9.1 Creating a Supportive Environment as a Critical Success Factor

Public policy has a defining role to play in building up a country's human capital and knowledge endowments through promoting quality education, lifelong learning, and innovation and creativity in its workforce. In order to promote women's participation and involvement with ICTs, sector policies need to be consolidated to support women's contribution to economic growth as agents of change. Without careful planning and the development of appropriate policy measures, ICTs may exacerbate differences between the rich and the poor and men and women. In the absence of a deliberate policy, the diffusion and use of ICTs and their intended benefits tend to follow the existing contours of income and economic divides with the poor being further marginalized or excluded. Due to socio-cultural norms, there are persistent gender inequalities in men and women's access to ICTs. Women's mobility may limit their access to Internet centers or ICT training courses may not advertise in places that women frequent.

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ICTs and policies to encourage their development can have profound implications for women and men in terms of employment, education, health, environmental sustainability and community development. Policy is needed to ensure that investment in ICTs contributes to more equitable and sustainable development as these technologies are neither gender-neutral nor irrelevant to the lives of resource-poor women. A common criticism of ICT for development projects are that they fail to build on existing systems of work in a participatory way and therefore do not achieve local input and local ownership. There is often a gap between the design of an ICT project and the reality of what can unfold on the ground and the long-term implications for women.

To avoid the recurrence of these mistakes, the introduction of ICTs into the activities of a community needs to involve the full participation of women from its very inception. This means engaging women in decisions, implementation, governance, and in benefiting from revenues, profits and cost sharing. All development interventions must work with both women and men stakeholders to ensure that woman's opportunities to utilize technologies are not inhibited by cultural dictates on seclusion, restrictions on mobility or the unequal division of labor. While there may be "lessons" to be learned, business models and case studies that suggest "replicability," in fact no two situations are ever the same. It is important therefore, to refrain from transforming models and studies into "formulated approaches" or "prescriptive measures" if we are to ensure that the innovative character of ICTs remains in the hands and control of the users themselves. Finally, it is important to involve national and international leadership in broad-based programs, but the knowledge base must be from the grassroots in order for it to be successful. Networks or collaborative have been shown to be successful in bringing multi-stakeholder groups together to both provide content and resources, as well as benefit from shared efforts and ensuring sustainability. TARAhaat of the NGO Development Alternatives in the poorest region Bundelkhand of India has lessons from which we can all learn. From micro-credit services to skill development to alternate energy sources to markets for rural products produced and procured by women, this organization has created a model of success for women to be empower socioeconomically.

10. Empowering Women through ICTs

Experience from recent policy efforts at the international level suggests that gender biases in the information society will persist for the foreseeable future. However, ICTs may give women the opportunity to be agents of their own development. Women are not 'waiting' for access to ICTs, but rather using ICTs when they are available to get around the constraints they face in politics, society and economy. There are case studies on gender and ICTs from around the world to highlight efforts by women and their organizations to negotiate the 'digital divide' independently. This situation is apparent from the case studies introduced in this book. ICTs are not 'gender

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neutral' as they take on the gender of their developer from basic content to use to economically independent.

▪ **Functionality to beneficiary**

Many women know the importance of information and the power that these technologies hold in terms of breaking out of systematic discrimination and gender violence in the household, workplace and village. They also see the new opportunities that ICTs provide for personal business development and growth. Like men, women are not waiting for policymaking to bridge the 'digital divide' but rather taking action as agents of their own opportunities using conventional ICTs such as radio, to access information sources and communication processes to achieve their development goals, both for the good of their households and communities.

Suggestions

Experience from recent policy efforts at the international level suggests that gender biases in the information society will persist for the foreseeable future. However, ICTs may give women the opportunity to be agents of their own development. Women are not 'waiting' for access to ICTs, but rather using ICTs when they are available to get around the constraints they face in politics, society and economy. There are case studies on gender and ICTs from around the world to highlight efforts by women and their organizations to negotiate the 'digital divide' independently. This situation is apparent from the case studies introduced in this book. ICTs are not 'gender neutral' as they take on the gender of their developer from basic content to use to functionality to beneficiary. Many women know the importance of information and the power that these technologies hold in terms of breaking out of systematic discrimination and gender violence in the household, workplace and village. They also see the new opportunities that ICTs provide for personal business development and growth. Like men, women are not waiting for policymaking to bridge the 'digital divide' but rather taking action as agents of their own opportunities using conventional ICTs such as radio, to access information sources and communication processes to achieve their development goals, both for the good of their households and communities.

For increasing awareness and usage of information technology Government should increase initiative for training and development of Information Technology to members of women self help groups. Maximum women are not showing keen interest for the use of Information technology; hence women members should actively participate in awareness of Information technology. Women are depended upon trainer and bank personnel for various purpose of banking they should handle this all at their own level. It is also observed that maximum women of self help groups give minimum time for functioning of self help group they should try to give maximum time so that maximum information sharing may be possible. Bank

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and trainer from NGO can give information of various new trends of banking such mobile banking, internet banking etc. to women members of self help groups. Through this suggestion maximum members of women self help groups can empower themselves.

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CHAPTER - 6

ICT Based Strategy for Sustainable Growth of Agriculture in India

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1. Introduction

Rapid innovations in telecommunications, semi-conductors, microprocessors, fiber optics and micro electronics are the engines of growth for development of countries across the world. These innovations are being referred to as Information and Communication Technologies (ICTs). ICT sector in India is growing fast with its application in various fields using different ICT tools like television, radio, telephone and others. Growth in Indian information technology (IT) in the world market is primarily dominated by IT software and services, including system integration, IT constituting, application management, custom applications, infrastructural management, software testing and web development. Agriculture is one of the most important sectors of nation, and could benefit tremendously with the applications of ICTs especially in bringing changes to socio-economic conditions of poor in backward areas. ICT offers a variety of programs both for the social development and the economic development. ICTs can directly support farmer's access to timely and relevant information, as well as empower the creation and sharing of knowledge of the farming community itself.

ICTs in agriculture have the potential to facilitate greater access to information that drive or support knowledge sharing. ICTs essentially facilitate the creation, management, storage, retrieval, and dissemination of any relevant data, knowledge, and information that may have been already been processed and adapted. Agriculture is different from others industry and plays a significant role in the economic development of a nation. India's prosperity depends upon the agricultural prosperity. India has tremendous progress in the field of agriculture over last few decades. The generation and application of agricultural knowledge is increasingly important, especially for small and marginal farmers, who need relevant information in order to improve, sustain, and diversify their farm enterprises.

Communicating information to farmers is one of the key roles that agricultural extension is expected to fulfill. As the agriculture scenario has become more complex, farmers' access to a reliable, timely, and relevant information source has become increasingly important. Farmers require access to more varied, multisource, and context-specific information, related not only to

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best practices and technologies for crop production and weather but also to information about postharvest aspects, including processing, marketing, storage, and handling. The technology development in Agricultural sciences has changed the agriculture sector in a great extent. Improved agricultural production is the major weapon in the fight against world hunger, improving rural livelihood and increasing economic growth.

Agriculture constitutes a major livelihoods sector and most of the rural poor depend on rain-fed agriculture and fragile forests for their livelihoods. The demand for fast access to accurate information on crop choice, technology, input, production practices, services and market is increasing at a rapid pace from farmers end. Agriculture can require substantial knowledge transfer to and among farmers, including information about successful farming practices, new technologies or controls of pest and disease outbreaks and new markets.

2. Current Status of Indian Agriculture

As we know the Government envisioning to up the size of the nations macro-economy to USD 5 trillion by 2024 treats agriculture sector as integral to this strategy, and the fulcrum of such a transformation. Agriculture is the primary source of livelihood for about 58% of India's population. Indian Agricultural industry, with its allied sectors, is unquestionably the largest livelihood provider in India, more so in the vast rural areas. It also contributes a significant figure to the Gross Domestic Product (GDP). The high proportion of agricultural land, diverse-agro climatic conditions for cultivating different crops are some of the factors favoring agriculture in the country. Agricultural productivity depends on several factors. These include the availability and quality of agricultural inputs such as land, water, seeds and fertilizers, access to agricultural credit and crop insurance, assurance of remunerative prices for agricultural produce and storage and marketing infrastructure, among others.

In India key issues which are affecting agricultural productivity include the decreasing sizes of agricultural land holdings, continued dependence on the monsoon, inadequate access to irrigation, imbalanced use of soil nutrients resulting in loss of fertility of soil, uneven access to modern technology in different parts of the country, lack of access to formal agricultural credit, limited procurement of food grains by government agencies, and failure to provide remunerative prices to farmers. The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. Indian food and grocery market is the world's sixth largest, with retail contributing 70% of the sales.

The Indian food processing industry accounts for 32% of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. The Indian government has set the foodgrain production target at 298.3 million

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tonnes for the 2020-21 crop year, up 2 per cent from the record output achieved in the current year, banking on forecast of a normal monsoon. India's foodgrains production is estimated at a record 291.95 million tonnes in the 2019-20 crop year (July-June), beating the target of 291 million tonnes. The ministry has set a target of 149.92 million tonnes of foodgrains production in the kharif season and 148.4 million tonnes in the rabi (winter sown) season, taking the total foodgrain target to record 298.3 million tonnes in the 2020-21 crop year. Nearly 50 per cent of India's cultivable farm-area is dependent on the monsoon. This is the lifeline of the country's rural economy and agriculture sector. The foodgrain trend from 2014-15 is given in the table given below.

Crops	Production (Million Tonnes)					2019-20 (2 nd AE)
	2014-15	2015-16	2016-17	2017-18	2018-19	
Total Food-grains	252.0	251.6	275.1	285.0	285.2	292.0
Rice	105.5	104.4	109.7	112.8	116.5	117.5
Wheat	86.5	92.3	98.5	99.9	103.6	106.2
Total Coarse Cereals	42.9	38.5	43.8	47.0	43.0	45.2
Total Pulses	17.2	16.4	23.1	25.4	22.1	23.0
Total Oilseeds	27.5	25.3	31.3	31.5	31.5	34.2
Sugarcane	362.3	348.4	306.1	379.9	405.4	353.9
Cotton#	34.8	30.0	32.6	32.8	28.0	34.9

As per the provisional estimates of national income reported by CSO on May, 2020, the share of agriculture and allied sectors in GVA (Gross Value Added) of the country at current prices is 17.8 per cent for the year 2019-20. Within the agriculture sector, the share of crops has fallen from 11.2 per cent in 2014-15 to 9.4 per cent in 2018-19. However, during 2020-21, while the GVA for the entire economy contracted by 7.2 per cent, growth in GVA for agriculture maintained a positive growth of 3.4 per cent. Gross Capital Formation (GCF) in the agriculture and allied sector was 16.4 per cent in 2018-19. The agricultural credit flow target for the year 2019-20 was fixed at 13,50,000 crores and against this target the achievement was ` 13,92,469.81 crores. The agriculture credit flow target for 2020-21 was fixed at 15,00,000 crores and till November, 2020 a sum of 9,73,517.80 crores was disbursed.

Since economic reforms began in 1991, India has remained a net exporter of agri-products, with agri-exports touching 2.52 lakh crores and imports at `1.47 lakh crores in FY 2019-20. The objective of inclusive development in India cannot be realized without the development of rural sector which crucially depends on agriculture. Agriculture and allied activities engage almost half of India's workforce and contributes close to 18 per cent of the gross value added of the country. Progress in agriculture (including forestry and fisheries) has a bearing on the fate of the largest

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low-income group in India. There is a need for a paradigm shift in how we view agriculture from a rural livelihood sector to a modern business enterprise. In this context, both production and post production in agriculture needs urgent reforms to enable sustainable and consistent growth. Increase in area under irrigation, adoption of hybrid and improved seeds, increasing variety replacement ratio and augmentation in seed testing facilities will help address low productivity concerns. Adequate storage and remunerative markets for agricultural products should be the main focus of post-production management. It is also important to integrate agriculture with nutritional outcomes by means of food fortification of staples

During the outbreak of COVID-19, the Indian agriculture sector faced major challenges, like the harvesting process, which usually starts in mid-April, was thrown completely off-balance, resulting in major liquidity issues, labor scarcity has also affected the supporting infrastructure around India's agriculture sector, movement across state borders has been heavily restricted, which has blocked the movement of crops and consequently affected the sales, lockdowns in major economies across the country have caused delays and backlogs in supply chains, exports faced transport and logistics problems, more stringent customs restrictions, etc.

COVID-19 pandemic has influenced the lives of people across the globe and India is no exception to that. The farming activities also experienced the impact of this pandemic as the COVID induced lockdowns influenced the movement of farm inputs including farm machinery from one location to other. The national lockdown coincided with the commencement of the harvesting season for the Rabi crops creating further adversity for the sector. Migration of agricultural labourers to their native places during the lockdown created a shortage of farm labourers. India's agricultural system demonstrated its resilience amid such adversities. The agriculture and allied sectors were the sole bright spot amid the slide in performance of other sectors, clocking a growth rate of 3.4 per cent at constant prices during 2020-21. Against all adversities due to COVID-19, continuous supply of agriculture commodities, especially staples like rice, wheat, pulses and vegetables, has been maintained thereby enabling food security

3. ICT Application in Agriculture

Today, agriculture has become knowledge intensive and access to right information at the right time makes a huge difference in the livelihood of small-holder farmers. More than half of the Indian population depends on Agriculture for their bread and butter, that's why we can say that Agriculture is a backbone of an Indian economy. The contribution of Agriculture in the Indian economy is approx 22%, which is the highest contribution. The rural farmer and other actors along the agriculture value chain are handicapped by the lack of information about new technologies. Information and Communication Technologies supporting the development and delivery of timely, targeted information and services can make farming more sustainable. They

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can also deliver safe, nutritious and affordable food, facilitate market integration and access to finance to make agriculture attractive and profitable. In this context, effective interventions in agriculture are essential for the fulfillment of its vital role which is to maintain economic and social stability and provide the environment for sustainable development. Use of Information and Communication Technologies (ICTs) can be a major intervention for more efficient agriculture.

The biggest advantage of ICT is that it is far more interactive and personalized that can render services, particularly the information as per the needs and requirements of end users. Such a facility makes a favorable impact on adoption and utilization of the improved and innovative techniques in agriculture. The information technologies that can be used in agriculture are Satellite Communication, Geographic Information System (GIS), computer network, video, radio and reprography. Teleconferencing, email, fax and mobile phones are some other potential technologies that could be used in effective transfer and dissemination of agricultural information to the farmers

ICT plays an important role in agricultural marketing. With improved record-keeping, more detailed cost analysis and more sophisticated marketing strategies, it can help farmers to make better decisions and earn higher profits. ICT can help to provide the information on the price distribution of key commodities over the years. Such information helps farmers and traders to make decisions on when and in what ways to market their agricultural outputs. When combined with enterprise budget data, the information can also be used in deciding which crops to produce in the next season. The information is published on a website, accessible to farmers through information centers. To reach a wider audience, information is broadcast through radio and TV and thereby creating a link between producers and traders in a region.

In recent years, short message and text services have taken up and effectively deliver prices and trading information via mobile phone to farmers. eChoupal programme support several million farmers with price information, trade and transaction facilities. In the fertilizer marketing context, ICT can play a major role in efficient sales, operations, checking the marketing costs, safeguarding market share and providing efficient customer services. A well conceived IT set up can endow decision makers at all levels with better reflexes to effectively respond to market conditions.

3.1 Robotics and Agriculture

The use of robotics in the field of agriculture is quickly becoming a thought-provoking high-tech industry, representing novel professionals, original companies and new investors. The technology is developing rapidly, not only advancing the fabrication capabilities of farmers, but also advancing robotics and mechanization expertise as we know it. In the farming sector, the multipart ranch duties are being too risky and they are performed by the robots, which are tricky for human to achieve. The robotic farmers are capable of cultivating vegetables, fruits, soybeans,

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wheat and rice, which are then packed in boxes and shipped across the country by this robotic technology. Agricultural robots are rising production yields for farmers in assorted ethnicity. From drones to self-governing tractors to robotic arms, the technology is organism deployed in original and pioneering applications.

Agricultural robots mechanize purposeful, chronic and boring tasks for farmers, allowing them to spotlight further on civilizing overall production yields. Some of the most common robots in agriculture are used for harvesting and picking, weed control, independent mowing, pruning, seeding, spraying and lessening, arrangement and packing and effectiveness platforms. Harvesting and picking is one of the most popular robotic applications in agriculture due to the accurateness and rapidity that robots can attain to progress the size of yields and diminish ravage from crops being left in the field. A robotic arm has to navigate environments with just as many obstacles to delicately grasp and place an infuser. This process is very different from picking and placing a metal part on an assembly line. The agricultural robotic arm must be supple in a lively environment and perfectly adequate not to damage the peppers as they are being selected. Harvesting and substitute robots are attractive, very trendy with farmers, but there are dozens of other novel traditions the agricultural diligence is deploying preset computerization to develop their production yields.

3.2 Internet of things (IoT) and Agriculture Activities

Internet of things (IoT) technology is anticipated to play a significant role in increasing the current agricultural productivity to cater to the growing demand for food. IoT in agriculture industry incorporates IoT-based advanced technological tools, systems, equipment, and solutions to enhance the operational efficiency, maximize yield, and minimize wastage of energy through real-time field data collection, data storage, data analysis, and development of control platform. Factors such as rise in global population and increase in demand for food across the globe have fueled the adoption of new technology to optimize the agriculture production, are expected to boost the growth of the IoT in agriculture market.

Diverse IoT-based applications such as precision farming, livestock monitoring, smart greenhouse, and fish farm monitoring, are expected to be instrumental in increasing the speed of the agriculture processes. IoT technology can address agriculture-based issues and optimize the quantity and quality of agriculture production, by connecting farms through a single platform and making them more intelligent by sharing, storing, and analyzing the information. The global IoT in agriculture market is estimated to grow at a notable CAGR of 14.7% from 2018 to 2025, due to lowered cost of technology. The global IoT in agriculture market is segmented based on system, application, and region.

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Based on system, it is classified into automation and control systems, sensing and monitoring devices, livestock monitoring hardware, fish farming hardware, smart greenhouse hardware, and software. Based on application, it is divided into precision farming, livestock monitoring, smart greenhouse, and fish farm monitoring. Based on system, the market is categorized into automation and control systems, sensing and monitoring devices, livestock monitoring hardware, fish farming hardware, smart greenhouse hardware, and software. In 2017, software was the leading segment in the global market, as it consists of numerous tools to control hardware such as yield monitors, soil sensors, water sensors, climate sensors that are used in wide range of precision farming, smart greenhouse farming, and fish farming applications. The precision farming segment dominates IoT in agriculture market in 2017, accounting for around 44.7% of the overall market revenue. Precision farming enables IoT, information technology, and communication to revolutionize the global agriculture sector, by optimizing its production and efficiency. Livestock monitoring and integration of IoT system technology for detection of livestock location and health are expected to grow significantly during the forecast period.

In 2017, the precision farming segment used IoT for field application as well as in farm equipment to collect data that can be analyzed and used to optimize production and save energy is projected to lead the market during the forecast period. The livestock monitoring segment, which includes global positioning system (GPS), and sensors is anticipated to be the fastest growing segment. IoT in livestock helps growers to monitor livestock health by detecting illness and taking the preventive measure is anticipated to drive the market growth during forecast period. The top market players in the global IoT in agriculture market include Cisco Systems, Inc., International Business Management Corporation (IBM), Telit, Hitachi, Ltd, Decisive Farming, Trimble Inc., OnFarm Systems Inc., Farmers Edge Inc., SlantRange, Inc., and The Climate Corporation.

4. ICT Based Strategy and Growth of Agriculture

ICT can be used for regulatory policy and governance of agriculture. The widespread adoption of digital technologies by agriculturists is resulting in an exponential increase in the availability of a wide range of big data that can aid better policy-making and monitoring, as well as help transform the agriculture sector. ICT is a very effective tool in agricultural extension and advisory related services. ICT in the form of innovative media platforms bridge the gap between farmers on one end and agricultural researchers and extension agents on the other. It is a more cost-efficient method to improve smallholders' knowledge of current agricultural practices and markets. ICT also enhanced market access. ICT-enabled market information services enhance farmers' access to nearby markets and their awareness of current consumer demands through the transfer of information from the traders. ICTs also foster networking among the agri-stakeholders, which facilitates increased market access for inputs and product marketing and

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trade. ICT is helpful for environmentally sustainable agriculture. Budget-friendly mobile phones, internet and other services to disseminate information, in addition, to providing rural farmers with improved access to climate-smart solutions and the appropriate knowledge to use them.

ICTs provide actionable and real-time information to governments and communities on disaster prevention and management. They also increase the efficiency of responding efforts during emergency situations and drive more effective communication by providing the people with timely advice on risk mitigation procedures. Wide application of ICTs is recognised in food safety & traceability in India. A combination of simple and sophisticated technologies, such as mobile phones, software solutions, RFID tags, data input websites, and sensors using GPS technology, among others, enable producers to capture and monitor reliable data and also comply with international traceability and food. ICT is a very effective tool for financial inclusion and risk management. ICTs strengthen rural and smallholder farmers' access to financial services, enable them to find affordable insurance schemes and tools to better manage risk, and empower them with information regarding financial services that are available to them. ICT is used to strengthen capacity building and empowerment of rural and urban community. ICTs serve as vital education tools for the development of local communities. They broaden the reach of women, youth, and other beneficiaries and open the doors for newer business opportunities to enhance livelihoods and incomes.

The use of Information and Communication Technologies (ICTs) can be, among others, one major intervention which can reduce consumer prices, support farmers to increase their production, contribute to "smarter", more efficient and sustainable agriculture. The use of ICT in agriculture has also significantly transformed agriculture and farming in developed countries at a different scale. Internet of Things (IoT), Cloud Computing, and Big Data have all had a profound impact on the efficiency of current processes. Several farm holdings manage farms remotely using sensing technologies, drones, and other devices that gather vital data on soil properties, air, crop health, and weather conditions. The data enables farmers and agribusinesses to closely monitor crop cultivation, optimise the use of agrochemicals and natural resources, and adapt quickly to changing environmental conditions.

The use of ICTs and precision agriculture tools have resulted in increased efficiency and reduced costs. It has also delivered decision-making tools that boost agricultural productivity as well as help manage natural resources effectively. IoT, in particular, has several applications in agriculture, from real-time monitoring of soil, plant, and animal health using in-situ sensors to tracking the origin of a product or agri-commodity and its environmental impact, as well as its storage environments along the supply chain. ICT farming, particularly the use of multimedia

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technology and other innovative approaches to interactive knowledge transfer processes, are transforming agricultural extension services. ICTs have been instrumental in empowering farmers through knowledge and building their capacity to achieve rural and agricultural developmental goals.

5. e-Agriculture - Farm-Specific ICTs Applications

In the 21st century, a new knowledge-based farming system is emerging that, based on farm-specific ICTs applications (e-Agriculture) can support the: profitability at the farm level; production of competitive, market-oriented, qualitative food products; decrease of environmental and climate change impacts; and energy efficiency. Knowledge and information are key requirements that enable farmers to deal with contemporary challenges, particularly as the new agricultural technologies become more “knowledge-intensive. Agriculture nowadays is an information-intensive sector, drawing upon an infinite number of sources of widely dispersed “locally contextualized knowledge” and a considerable body of research material. Moreover, it relies upon the continuous flow of information from local, regional and world markets. The rise of ICTs, with their wide variety of applications, holds a great promise for agricultural development in rural regions. ICTs farm-specific applications can be roughly distinguished into: on-farm support services; management and decision making support services; and on-site support services, all delivering appropriate knowledge and information to farmers in rural regions.

Remote rural farmers can get access to special agricultural support services by use of mobile and wireless networking technologies, integrated to the satellite broadband channel. By these means, farmers can get: access to on-farm support (consulting services) by directly linking to agriculturalists; and information on specific problems at the farm level. The end users (farmers) can be located in remote areas and, by using mobile devices, they are able to raise questions to agriculturalists; transmit digital information in real-time; and get immediate diagnostic feedback. Interaction can be either synchronous e.g. transmit digital photos of infected plants in real-time and wait for immediate diagnostic feedback; and asynchronous e.g. raise an issue, ask questions to agriculturalists or to other farmers, upload high resolution pictures relevant to the issue raised and gather knowledge on the issue at hand. Moreover, the convergence of different technologies e.g. nano-biotechnology with ICTs, has created effective new technological products that are now available in the market, which claim to resolve various kinds of problems.

6. Barriers in the Adoption & use of ICTs Applications in Rural Areas

Deployment of the necessary network infrastructure, referring to both hardware e.g. fiber optic or wireless public broadband networks, fixed wireless technology (WiFi & WiMax), mobile wireless (m-) reaching directly individual end-users, satellite networks (VSAT) for data

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transmission, local networks, hubs - terminals for public use (nodes providing access to network services), cable Interactive Digital Television (IDTV), Public Switched Telephone Network (PSTN), etc. and software. Creation of the ICTs applications and content layer, involving all applications and digital services that are best suited to the needs of each specific rural region, together with the content needed for each application, e.g. establishment of e-Government platforms for the provision of services to the citizens or e-training applications, together with the necessary content layers serving these applications. Various sector-specific applications for rural regions can also be developed in this step (e.g. health-care, tourism, training, food industry, agricultural applications). Adaption of ICT relates to the familiarization of the end-users with ICTs and their applications in order to become active members of digital affairs in the rural community. This step implies:

- The familiarization of rural population with new technologies through training on the use of ICTs that will motivate them to joint the ICT based initiatives
- The familiarization of businesses with new technologies and their potential for supporting new business opportunities and
- Preparation of local authorities and administration as pioneers of the whole effort, in terms of both getting access to the proper equipment (hardware and software) and training public servants

Ensuring accessibility of rural regions to network infrastructure is a critical issue in promoting ICTs applications in these regions. Barriers relating to the development of network infrastructure in rural regions are mainly associated with the costs involved in the deployment of this infrastructure, which, when combined with the lack of sufficient demand, render relative investments financially unsustainable in the case of remote rural areas. Diversity of ICTs applications that can serve the needs of rural regions and the respective network infrastructure requirements necessary for serving these applications e.g. e-platforms for community-specific ICTs applications vs m-platforms for personalized farm-specific ICTs applications.

Barriers relating to the development of specific ICTs applications and content in rural regions such as lack of access of rural regions to proper equipment, both hardware and software, for the development of specific applications as well as costs involved in this respect. Lack of knowledge based applications on the rural masses could be provided for each rural region due to the lack of regionally-focused and demand-driven approach to identify specific needs. Lack of skilled personnel to build and run such applications and content also needed to convert dream into reality. The other barriers are cost of content development, lack of region-specific knowledge and respective needs, and barriers relating to the management of the digital content.

Closing Remark

Agriculture is an important sector of the Indian economy and the share of agriculture in gross domestic product (GDP) has reached almost 20 per cent for the first time in the last 17 years. The share of agriculture in GDP increased to 19.9 per cent in 2020-21 from 17.8 per cent in 2019-20. It provides employment to over 41.49 per cent of the population. Indian agriculture has registered impressive growth over the last few decades. The foodgrain production has increased from 51 million tonnes (MT) in 1950-51 to 234 MT from 122 million hectares in 2008-09. The government has set the foodgrain production target at 298.3 million tonnes for the 2020-21 crop year. India's foodgrain production rose 2% in 2020-21. India stands among top three in terms of production of various agricultural commodities like paddy, wheat, pulses, groundnut, rapeseeds, fruits, vegetables, sugarcane, tea, jute, cotton, tobacco leaves, etc. In spite of this formidable growth, the huge challenges facing Indian agriculture are to further increase the production to keep pace with the ever increasing demand from growing population. The productivity is hampered due to non-availability of modern inputs, poor physical infrastructure and more so information on various issues in agriculture. Indian agrarian economy is characterised by low degree of market integration and connectivity, accessibility of reliable and timely information by the farmers on prices of commodities. To fulfill the expectations of the conscious buyers, price and quality, globalisation and liberalisation and maintain the viability of small and marginal farm to retain them in the farming, application of technology in agriculture has become inevitable. The application of Information and Communication Technology (ICT) can play a pivotal role in efficient dissemination of information. The ICT can deliver fast, reliable and accurate information in a user-friendly manner for practical utilisation by the end user. This article provide an ICT based information system to facilitate the farmers to decide what and when to plan, how to cultivate, when and how to harvest, what post-harvest management practices to follow, when and where to market the produce etc.

All agricultural business enterprises need to optimise on inputs - both knowledge and materials. Therefore, it is also essential to impart farmers with basic education and training to transform his/her role from that of a producer to an entrepreneur. The option of setting up of rural agricultural schools for hands-on training may be explored in this regard. Allied sectors including animal husbandry, dairying and fisheries have gradually become a significant source of farm income and employment. Measures need to be taken to increase the productivity of the allied sectors along with sufficient provision for marketing of their products. Another area of emphasis is the need to strengthen agriculture extension services which are extremely important as they provide technical information to the farmer about improved agricultural practices, guidance on the use of these inputs and other services in support of their production. Anything that helps

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people communicate and spread information like radio, newspaper, social media, internet, comes under the umbrella of ICT. The growth of smart phones and internet connectivity in remote rural areas has made ICT more popular. An effective use of ICTs for purpose of agriculture may ameliorate the food production and productivity in India. ICT plays an important role in improvising overall growth of farmer. Any system applied for getting information and knowledge for making decisions in any industry should deliver accurate, complete, concise information in time or on time. The information provided by the system must be in user-friendly form, easy to access, cost-effective and well protected from unauthorized accesses

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CHAPTER - 7

Role of Information & Communication Technology in Agriculture and Rural Development in India

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1. Introduction

ICT is the combination of three basic terms—Information, Communication and Technology. The representation of data in a significant way is called Information. **Information** are analyzed through the **data** collected. Information are obtained from investigation, study, or instruction. The term communication may be referred as imparting or exchanging of information by speaking, writing, or using some other means of communication.. Technology refers to methods, systems and devices, which are a result of scientific knowledge, being used for solve practical problems. Technology can be used for creation and communication of information. The term Information and Communication Technology (ICT) includes various forms of technologies that are used to create, display, store, process, transmit, share or exchange information by electronic means (UNESCO). Such a discipline which deals in the creation and communication of information is called ICT. Radio, television, and print media (Newspaper, Books, Magazines, etc.) are the popular technologies used for communication. Digitization is one of the most important ongoing transformation processes in global agriculture. ICT facilitates communication anywhere, anytime and by anyone. It has become easier to communicate worldwide through the use of ICTs, for example, social media sites and apps, blogs, wiki space, etc. The use of ICT is time saving and cost effective in various ways. ICTs can be used to create communication pieces in various forms like text, image, audio, video, multimedia, etc by the use of includes technologies such as mobile technology, desktop and laptop computers, software, peripherals and connection to the Internet that are done to fulfill Digital information is also easy to modify and share the information & easy to communicate to others.

Information and Communication Technologies for development (ICT) refers to the use of information and communication technologies (ICTs) have positive in the fields of socioeconomic development, international, national and peasant's development. ICT shows environmental, impacts on agriculture, food processing, distribution and consumption Information and Communication Technology (ICT) is used as an comprehensive term incorporating all modes of transmission like electronic gadgets, networks, mobiles, radio services and applications of all peripherals and connection to the Internet that are intended to disseminate information with the help of technology. In the recent years, ICT has proved to be extremely beneficial for farmers including small land holders, marginalized and poor farmers, and helped them in production, processing, distribution, consumption marketing, precision farming and improved profits. . It is

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aimed at bridging the digital divide and aid economic development by fostering equitable access to modern communications technologies. It is a powerful tool for economic and social development. Agriculture in India is the core sector for food security, nutritional security, and sustainable development & helpful hand for poverty. It contributes approximately 17% of GDP.

1.1 Advantages of ICT In Agriculture

Some of the advantages of Information and Communication technologies in agriculture are as follows:

- 1) It will initiate new agricultural and rural business like e – commerce, realty business for satellite offices, rural business, and virtual corporation of small – scale farms.
- 2) It will support political and analysis on optimum farm production, disaster management, agro environmental resource management etc., exploitation tools like geographic Information systems (GIS).
- 3) It will improve farm management and farming technologies by economical farm management, risk management, effective data or data transfer etc., realizing competitive and property farming with safe product.
- 4) It will give systems and tools to secure food traceability and dependableness that has been a rising issue regarding farm product since serious contamination like chicken contagious disease was detected.
- 5) It will facilitate rural activities and supply softer and safe rural life with equivalent services to those within the urban areas, like provision of distance education, telemedicine, remote public services, remote diversion etc.
- 6) Empowerment of Stakeholders (Government officers, Research, Education & Extension Scientists, farmers and different service suppliers like Community data centers.
- 7) Development of information Management, call Support and consolatory Systems to strengthen Extension services and additionally used for Farmers Redressed system.
- 8) Efficient management (Development, Conservation, allocation and utilization) of resources.
- 9) Improved productivity and profit of farmers through higher consolatory system

1.2 ICT in agriculture: Aims and Objectives

Agriculture is an important sector with the majority of the rural population in developing countries depending on it. The sector faces major challenges of enhancing production in a situation of dwindling natural resources necessary for production. The growing demand for agricultural products, however, also offers opportunities for producers to sustain and improve their livelihoods. Information and communication technologies play an important role in addressing these challenges and uplifting the livelihoods of the rural poor.

E-agriculture helps in dissemination of gathered information to the farmers, mostly lived in rural areas, to use in their routine work. These services are provided through the Internet and related technologies. This ensures the effective and efficient use of information and communication technologies for designing, implementing, and analyzing innovative and existing applications to

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help the agricultural sector. The information disseminated by e-Agriculture can be divided into several major fields or areas, which is called as services of e-Agriculture.

E-agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information & communication process. E-agriculture is a complex of automated information systems which consolidates & integrates agriculture information resources. In agriculture & rural development to share knowledge learn from others and improve decision making about the vital role of ICTs to empower rural communities, improve rural livelihood and builds sustainable agricultural & Food security.

E-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on agriculture.

The Food and Agriculture Organization of the United Nations (FAO) has been assigned the responsibility of organizing activities related to the action line under C.7 ICT Applications on E-Agriculture. The main phases of the agriculture industry include crop cultivation, water management, fertilizer application, fertigation, pest management, harvesting, post-harvest handling, transport of food products, packaging, food preservation, food processing/value addition, quality management, food safety, food storage, and food marketing. All stakeholders of agriculture industry need information and knowledge about these phases to manage them efficiently

1.3 ICT needs in areas of agricultural

- 1) Agro –meteorology
- 2) Agriculture Marketing
- 3) Agricultural Extension & Transfer of Technology
- 4) Agricultural Processing & Food Engineeringf
- 5) Credit & Coperation
- 6) Crop production & protection
- 7) Environment & Forest
- 8) Fisheries
- 9) Fertilizers & Manures
- 10) Irrigation & drainage systems
- 11) Live stock , dairy development & animal husbandary
- 12) Rural development & Planning
- 13) Soil & Water management
- 14) Watershed development
- 15) Wateland development

ICT in agriculture sector meets several objectives and thereby achieving agricultural growth, rural employment, enhanced productivity and happy livelihood. Following are some of the main objectives of ICT enabled agriculture:

- 1) To ensure ownership and develop entrepreneurship in farmers of Indian villages.

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- 2) To develop local content and create awareness.
- 3) To spread knowledge of technologies, crop cycle, suitable use of fertilizers etc.
- 4) To ensure language and cultural pertinence and active participation of farmers.
- 5) To help the villagers augment the growth of agriculture and contribute in GDP growth.
- 6) To implement a framework for agricultural development strategies, investments and programs.
- 7) To provide concrete guidance on agriculture through several motivational real time examples; telling them the success stories of farmers who have been successful using ICT.
- 8) To increase public investment in agriculture.
- 9) To provide local as well as global markets.
- 10) To improve access to financial and banking services.
- 11) To improve performance of producer organizations.
- 12) To use innovative practices through science and technology.

2. Benefits of ICT in agriculture

The economic and social benefits of ICT in agriculture are widespread and far reaching. Farmers who have better access to ICT have better lives due to the following reasons

- 1) Access to price information: Farmers will be informed of the accurate current prices and the demands of the products. Hence, they will be able to competitively negotiate in the agricultural economy and their incomes will be improved.
- 2) Access to agriculture information: ICT can help in dissemination of new agricultural information, sometimes most basic, related to seeds, farming practices, climate, diseases and pests, harvesting mechanisms, application of farm machinery, post-harvest strategies and finally proper marketing.
- 3) Access to national and international markets – Increasing the level of access of farmers is very will simplify contact between the sellers and the buyers, to publicize agricultural exports, facilitate online trading, and increase the awareness of producers on potential market opportunities including consumer and price trends.
- 4) Increasing production efficiency – due to several environmental threats such as climate change, drought, poor soil, erosion and pests, the livelihood of farmers are unstable. Thus, the flow of information regarding new techniques in production would open up new opportunities to farmers by documenting and sharing their experiences.
- 5) Creating a conducive policy environment – through the flow of information from the farmers to policy makers, a favourable policy on development and sustainable growth of the agriculture sector will be achieved.

3. Use of ICT in Agriculture

- Increasing efficiency, productivity and sustainability of small scale farms.
- Information about pest and disease control, especially early warning systems, new varieties, new ways to optimize production and regulations for quality control.

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- Better of markets resulting from informed decisions about future crops and commodities and best time and place to sell and buy goods.
- Up-to-date market information on prices for commodities, inputs and consumer trends.
- Strengthen capacities and better representation of their constituencies when negotiating input and output prices, land claims, resource rights and infrastructure projects.
- Reduce social isolation, widen the perspective of local communities in terms of national or global developments, open up new business opportunities and allow easier contact with friends and relatives.

4. Future Outlook in ICT for agricultural

For sustainable development of agriculture and national economy to emphasis on ICT and its use in agriculture is very important. The following issues are very important for ICT management in sustainable agriculture

- 1) 1.Farmer information system
- 2) Marketing information system
- 3) 3.Research management information system
- 4) 4.Water and Irrigation management information system
- 5) 5.Production forecasting system
- 6) Climate change scenarios
- 7) Stock information systems
- 8) 8.Agricultural technology database
- 9) Agricultural product Price Information system
- 10) 10.Availability of updated bio-physical database
- 11) Crop zoning map

5. Opportunities of ICT in Agriculture

Information Communication Technology (ICT) can revolutionize Indian farming sector and can benefit all farmers, including small land holders, marginalized and poor farmers. Therefore, strategies should be made to equip farmers with all kinds of information right from the seed sowing up to the harvesting and marketing of their farm produce from time to time to reduce losses and promote rural livelihood and food security. Despite the availability of farming resources in the nearby areas, there always remains a lack of agricultural information, sometimes most basic, related to seeds, farming practices, climate, diseases and pests, harvesting mechanisms, application of farm machinery, post-harvest strategies and finally proper marketing. Lack of information or untimely-given information, when coupled with other factors like environment leads to a huge loss in the crop produce or crop quality or sale price of the crops and ultimately farmer suffers heavily. Therefore, strategies should be made to equip farmers with all kinds of information right from the seed sowing up to the harvesting and marketing of their farm produce from time to time to reduce losses and promote rural livelihood and food security.

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Although Farmers in many parts of India are now becoming mobile and internet friendly day-by-day, the penetration of useful each and every minute information regarding crops, soils, climate, cultivation practices, financing, storage of produce and marketing in the farming communities is becoming easy, popular and also gaining importance. Much concerted efforts from Government, Non-government and Industry side is now a demand of high time to make our farmers ICT-friendly so that the benefits of fast developing technological advancements in farm production, storage and marketing can be equally shared among all communities and sectors of the rural society.

6. ICT Initiatives in Agriculture and Rural Development India

There are different players like Government, co-operative sector, private entities, NGOs, etc. operating in the agricultural sector with different objectives like productivity enhancement, well being of the farming community and agri-business opportunities. The availability of timely, reliable and accurate information helps to increase productivity and ensure well being of the farming community. The availability and physical delivery of information also help expansion of market for agri-inputs and developing business relations. The information itself has a business value for the role played by it in the entire production process. The importance of information in agricultural development and agri-business has encouraged various players to disseminate market information using ICT on different components.

- 1) **AGRISNET** - An infrastructure network existing at block level facilitating agricultural offices, agricultural extension services and agribusiness activities to enhance rural development.
- 2) **Digital Green** : The agri. information of local relevance is disseminated through digital video. The system consists of a digital video database prepared for farmers by farmers with the help of experts. The recordings are shown to individuals or small groups using laptops, DVD player, television and to communities through village cable network.
- 3) **3.eSagu** - eSagu provides personalized expert advice in a timely manner from sowing stage to harvest for small and marginal farmers at their door-step. The farm situation is brought to the expert in the form of digital photographs and text information. The expert advice after analysing the situation is prepared and is delivered to the concerned farmer on the same day or subsequent day.
- 4) **Warana** - The project provides access to a wide range of information including agriculture to the member of the cooperative in local language. It provides information on crops, market prices, employment schemes, educational opportunities, etc. The information is provided through the village information kiosks. The operators of these kiosks are the main linkage between the farmers and the information centre.
- 5) **IKSL** - The relevant information is delivered to the farmers on mobile phones through five voice message in local language. Customized solutions are provided to the farmers through helpline. The farmers can also speak to the experts on specific subject through special 'phone-in' programmes.

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- 6) **Agmarknet** -This initiative provides daily market price and arrival information in respect of 300 commodities and 2000 varieties in eight local languages. The wide range of information on prices, arrival and other related aspects like grades, standards, packaging, etc. is collected and disseminated by networking major agricultural produce markets operating in the country.
- 7) **iKisan** - iKisan is a one-stop solution for farmers in providing information on crops, crop management techniques, fertilizers, pesticides and other related information like market updates and weather forecasts.
- 8) **Digital Mandi** - Digital Mandi is an electronic trading platform for agri-commodities to bring the benefit of ICT to farmers and traders by eliminating geographical barriers and temporal limitation and removing cash crunch through active participation of various financial institutions. Digital Mandi is inspired by the vision of Media Labs Asia sustainable village through culturally appropriate use of new technologies.
- 9) **Akashganga** - The initiative facilitates timely collection of milk, proper payments and generates higher income for dairy farmers. The system includes weighment of milk electronically, fat testing, capturing unique ID by the software and printing of pay slip and payment settlement.
- 10) **eKrishi** - The communication network established under eKrishi is utilised to educate farmers, provide real time information on prices, arrivals and issue disaster warning and weather forecast. The aim is to enable farmers to take informed decisions on sale of their produce and bring transparency in the working of the Madhya Pradesh State Agricultural Marketing Board.
- 11) **e-choupal** - An initiative by ITC provides alternative marketing channel, information on weather, agricultural practices, input sales, etc. It is a kiosk located in a village and equipped with computer with internet access managed by trained sanchalak.
- 12) **12 e-agri kiosk** - An initiative by NABARD and Central Agricultural University. Touch screen kiosk for technology transfer among tribal farmers of Arunachal Pradesh.
- 13) **13.MSSRF** - Fisher Friend is a BREW-based application offered on a low cost CDMA handset with a graphic interface, an icon-based menu and programmable shortcut keys.
- 14) **14.FFMA** - In addition to safety and weather information, fishermen can receive the locations of fishing areas and real time market prices with one-click in their local language
- 15) **15. Reuters** - Light Reuters Market Light provides mobile phone based customized information according to the individual farmer's preferences on crops, markets, and location. The information in local language in respect of over 440 crops and varieties, more than 1400 markets and 2800 weather locations are available across 13 states through SMS.
- 16) **16.Haryali Kisan Bazar** - HKB has set up centre across different states to provide solutions to wide range of problems of farmers under one roof including agri-inputs, financial

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services, farm-output services and round the clock expert advice. The centres provide information on crops, latest technologies, weather forecast, market prices, customised services based on the farmer database maintained under the initiatives.

- 17) **KCC** - The Kisan Call Centre utilises telecom infrastructure to provide customised information on various aspects of agriculture in local language using toll free number 1800-180-1551.

7. Categorization of ICT initiatives in Indian agriculture

Table 1 - Categorization of ICT initiatives in Indian agriculture

Ownership/ Delivery mechanism	Government	Non-Government	Cooperative/Private/ Consortium
Web-based	AGRISNET, eKrishi, AGMARKNET	-	Pravara, Akashganga, iKisan, aAQUA, Mahindara Kisan Mitra, Haryali Kisan Bazar
Sanchalak (Facilitator between the user and service provider)	----	----	Warana, eSagu, iKisan, e-Choupal
Mobile/ Mixed Approach	KCC Digital Mandi,	Agri Kiosk Fisher Friend Mobile Advisory, Digital green, MSSRF FFMA IKSL, Reuters Market Light	KCC, Earik, Digital Mandi

8. Conclusion and Recommendations

It is necessary to develop ICT based agricultural services along with a communication backbone (such as a fiber optic network) in rural areas. Though the use of Information and Communication Technology in agriculture is in a nascent phase in India, and has just started to gather momentum, ICT has immense potential to standardize and regulate agricultural processes and address the needs of farmers. It will therefore definitely serve as an important tool for agricultural development in the near future. There is great transformation in Indian agriculture owing to changes in the economic and trade environment. To cope up with these changes timely, relevant and accurate information to the farmers and other stakeholders will help them take optimum decisions. ICT should play a vital role in the efficient delivery of this information. Several ICT based initiatives have been tried by different players and the same are analysed in the present paper. Based on the analysis review of the different initiatives, an attempt has been made to recommend measures to harness the full potential of ICT as given below:

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- i. Assessment of information needs of the farmers and appropriate mode of reaching them as per local conditions is crucial before developing an ICT Model
- ii. (ii) The information dissemination model should be viable and user-friendly so that the initiatives may be sustained in long-run. A string backward and forward linkage should be in place for accurate information collection and its dissemination.
- iii. (iii) Integration of various agencies under one roof for providing vital information on various components of agriculture so that it will act as a one stop solution for the needs of the farmers.
- iv. (iv) Introduction of delivery mechanism of information in the case of government initiatives like agmarknet.nic.in is need of the hour so that the information reaches the end user.
- v. (v) It is essential to create the requisite ICT infrastructure in rural areas for effective dissemination of information.
- vi. (vi) Creating awareness among farmers and other stakeholders on the importance of information and its optimum utilisation will help in the development of agriculture and overall well being of the farming community

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CHAPTER - 8

ICT and Pattern of Pedagogy required reforming new Generation Learning Environment

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1. Introduction

Education is at the heart of human progress, where educating students are driving innovation, and promoting social equity. The very best educational systems prepare people to be successful, productive, and engaged members of society. Pedagogy systems provide appropriate knowledge, skills, and experiences, enabling students to obtain jobs that promote social equity and economic growth. To prepare for the jobs of tomorrow, today's students need new skills, taught in new ways. Teachers need to develop new material and deliver it differently. Parents expect greater involvement, and administrators need to constantly do more with less. Traditional school environments are being redesigned and redeveloped into new generation learning environments. Poor acoustic standards in new teaching and learning environments continue to pose barriers to learning. These barriers include cognitive fatigue, reduced access to speech and language acquisition skills, increased anxiety and poorer learning outcomes. New generation learning environment mean that the environment where the technologies used for delivery of content, student interactions, assessment and learning and utilize the latest developments and innovations in digital technology in relation to hardware, software and Web 2.0 capabilities. In 2002, the latest in technological advancement in the classroom consisted almost entirely of laptop computers with access to the Internet in class, and the beginnings of learner management systems for the storage and delivery of curriculum material.

In 2012, the learning environment can be anywhere, as the learner may have any number of portable digital learning devices, such as a laptop, iPad, or Smartphone to engage with curriculum materials prepared by a teacher or lecturer. A previous generation was used to being passive watchers of stories at the cinema or on television. New generation has become used to being a character in the stories of video games, where they play a part in how the story ends. A previous generation used to listen to the 'top 40' songs from playlists selected by a radio station. New generation makes their own playlists for their iPods, and if you ask the students in any class what is on their iPod playlists, they are all going to tell you something different, depending on their preferences. A previous generation became literate by reading in their spare time. New generation becomes literate by writing in their spare time on Facebook, Twitter, blogs and even text messaging. On the objective of this paper is that Pattern of pedagogy required to reform for new generation learning environment.

2. Definition of Pedagogy

Pedagogy is the discipline that deals with the theory and practice of education, or the study and practice of 'how best to teach'. Its aims range from the general (full development of the human being via liberal education) to the narrower specifics of vocational education. Castro and Toro (2004) said that pedagogy is the earliest and most rudimentary types of teaching may have consisted of the ability to approve or disapprove of an offspring's behavior.

3. New Generation Learning Environment

We are living in a time of transformational change due to technology innovations. Nations are transforming workforces and moving towards employment of people, who can collaborate, communicate, solve complex problems, innovate and create new opportunities, businesses and monetary pathways. As a consequence the education sector has undergone a phase of rapid change in response to 21st Century technology innovations. This has resulted in the development of new pedagogies, defined as teaching methodologies, beliefs and practices. Traditionally, schools and classrooms have been based upon a 'cells and bells' design; long hallways leading to a series of uniformly shaped rooms. Most classrooms were composed of four walls, a door, furnished with one desk, one chair per 30 students. Traditional classroom design is driven by the older pedagogical model that children predominantly remain seated whilst the teacher at the front talks and reinforces information via visual and written representations, with an expectation that students will produce a written interpretation as evidence of learning.

The design of the traditional style classroom reflects the outdated design brief, a teacher-directed learning space with 'kids-on-grids'. Today educators are required to teach students using technology in preparation for new and emerging work skills. This has led to learning environments being remodeled into open-plan collaborative spaces to accommodate technology and 21st Century skill development. The new pedagogical model is supported by technology rich environments with mobile and fixed devices, and focuses on student-centered personalized learning. This pedagogy requires very different teaching practices, as opposed to the previous generation of teacher-centric methods. The diversity of the newer spaces, along with the diversity of students and teachers, creates numerous challenges for teachers, students and designers. Strategic monitoring of these practices, research and evaluation will ensure the performance standards of the built environment enhance this new generation learning environment.

3.1 Technologies in new generation learning environments

Many of our current school practices were designed by educators who were constrained by technological limitations. In the 1970's schools transformed into open plan environments, but by the end of the 1980's many schools had reverted back to cellular classrooms attributing excessive noise and poorer student learning outcomes as the reason for the reversal. Emerging technological innovations offer new opportunities in education. Emergent technologies such as the Apple iPad now provide an accessible mobile communication platform in the learning environment that can be used to reinforce visual and auditory information. The iPad is becoming

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a powerful tool in the education sector. A variety of technologies continue to make learning more accessible. Classroom amplification systems (sound field systems) are designed to clarify and evenly distribute teacher and student voices throughout the space. This technology can be integrated with Information and Communication Technology (ICT) and assistive listening devices to meet recently upgraded hearing access legislative requirements. Universal design is an approach to designing environments, products and communications that are useable by all people to the greatest extent possible without the need for adaption or specialized design. The acoustic environment must be appropriate to support these emerging technologies. Research on a range of benchmark standards aimed at reducing noise, increasing hearing accessibility and enhancing learning in schools is limited. Innovations in acoustic design, building materials, and legislative demands that broaden the scope of hearing access continue. Whilst the legislative changes go largely unnoticed and unaddressed by education facility planners, building design continues often using outdated models, resulting in facilities that may preclude hearing accessibility to occupants.

For example, children with hearing loss are largely managed by hearing aids, cochlear implants and personal FM assistive listening devices. Many electrical consultants specify induction hearing loops as the preferred hearing augmentation system in schools; however a significant number of younger students cannot access such systems as they do not have compatible assistive listening devices. Furthermore, even if hearing aided students have activated devices (“T” switches) so they can access compatible induction hearing loops, the physical environment may be acoustically poor and very reverberant, precluding students from receiving intelligible speech via this system.

4. Why Should Pedagogy Be Changing

According to Snape and Fox-Turnbull (2011) the education in the 21st century requires a new way of teaching and learning with technology. The last century required schools to discipline students for work and life in a society that was the result of an industrial age, but the new century requires schools to prepare students for a society that needs different skills. The skills, attitudes, values and competencies that will be needed have not always been addressed in traditional educational programmes. Student’s resilience and ability to accept and adapt to change will determine success. Different approaches and methods of teaching are what many educationalists are calling for. Students need to be engaged in authentic, real world activities, must socially construct outcomes, make connections with others, and collaborate with a range of partners.

These students will need to be prepared, willing and be determined to engage with topics that add meaning to their lives. In another study from New Zealand, Sinclair (2009) argues that teachers need to adopt a provocative pedagogy due to a cultural transformation as a result of online learning. This transformation has come about as a result of the questioning of traditional forms of teaching in lectures, tutorials and laboratories in universities. Sinclair says : “Beliefs about pedagogy will be constantly confronted and challenged by the growth of new technologies and thus requires an appraisal of and reflection on existing practices.” Teachers and lecturers who themselves were not students in a technologically rich learning environment, or who did not

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learn online, will continue to struggle in the 21st century where mobile, blended and online learning will become more prevalent.

New generation learning environments, which could be more relevant to a changing world, more effective in meeting community expectations and which manage educational resources more efficiently. One of the key challenges was to create learning environments which engaged the sensibilities of learners who are increasingly immersed in digital and global lifestyles from the entertainment sources they choose to the way they work and learn. It was also about enabling teachers to explicitly track be aware of the relationship between their pedagogical choices and their students' learning outcomes. The introduction of new technologies in schools has resulted in a paradigm shift in the way educational spaces are created and used.

Today's learning environments are flexible speaking and listening spaces where collaboration, group work, complex problem solving, digital information gathering and publishing occur. Changes in technology and legislation have highlighted the need for equitable access to learning environments. New generation learning environment mean that the environment where the technologies used for delivery of content, student interactions, assessment and learning and utilize the latest developments and innovations in digital technology in relation to hardware, software and Web 2.0 capabilities. The pedagogy was changed within new generation learning environments to promote inclusive teaching, learning and training.

Conclusion

New generation learning environments, which could be more relevant to a changing world, more effective in meeting community expectations and which manage educational resources more efficiently. One of the key challenges was to create learning environments which engaged the sensibilities of learners who are increasingly immersed in digital and global lifestyles from the entertainment sources they choose to the way they work and learn. It was also about enabling teachers to explicitly track be aware of the relationship between their pedagogical choices and their students' learning outcomes. The introduction of new technologies in schools has resulted in a paradigm shift in the way educational spaces are created and used. Today's learning environments are flexible speaking and listening spaces where collaboration, group work, complex problem solving, digital information gathering and publishing occur. Changes in technology and legislation have highlighted the need for equitable access to learning environments. New generation learning environment mean that the environment where the technologies used for delivery of content, student interactions, assessment and learning and utilize the latest developments and innovations in digital technology in relation to hardware, software and Web 2.0 capabilities. The pedagogy was changed within new generation learning environments to promote inclusive teaching, learning and training.

Educational spaces can be improved through appropriate acoustic design, opening up a world of opportunity through better educational to the students. Today's economic and social realities require changes to the ways education is delivered, and today's educators must be able to use technology to facilitate learning and help students excel. The Cisco Smart Connected initiative and Cisco Connected Learning solutions are helping many schools and other educational

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institutions meet this objective by that Pattern of pedagogy required to reform for new generation learning environment that's by students gain lots of knowledge about new technologies, recent innovative etc.

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CHAPTER - 9

For-reaching Role of ‘Meeting Software’ due to Covid–19 Pandemic (With Special Reference to Academic Activities)

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1. Introduction

The COVID-19 was detected in China in December 2019 and spread throughout the world within a few months. Covid-19 was declared a pandemic by the World Health Organization on 11th March 2020. The major part of the world is on quarantine due to the serious outbreak of this global pandemic Covid-19 and therefore many cities have turned into phantom cities and its effects can be seen in schools, colleges and universities too. Thousands of colleges and universities as well as primary and senior secondary institutions had been closed nationwide during Covid – 19 Pandemic and shift all their academic programs online. To provide a high quality of education is a main goal of any formal or informal organization educational institutions in India are currently based only on traditional methods of learning, that is they follow the traditional set up of face-to-face lectures in a classroom. Institutions were not prepared for such a transition from classroom-based education to completely online education. Most institutions initially lacked infrastructure and strategies. Although many academic units have also started blended learning, still a lot of them are stuck with old procedures.

The ability to improve quality of education may be based on sharing audio, video, combination of media or lessons. The Covid-19 pandemic has spurred the adoption of distance learning at all education levels. The COVID-19 has resulted in schools and colleges shut all across the world. Globally, over 1.2-1.8 billion children are out of the classroom. As a result, education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. The Corona Virus has made institutions to go from offline mode to online mode of pedagogy. This crisis will make the institutions, which were earlier reluctant to change, to accept modern technology. The e-learning may be based on synchronous mode and asynchronous mode. The asynchronous communication can be applied using different media like e-mail, discussing blocks and other, which may be held with the supporting of the tutor or teacher, or alone by himself. The distinguishing trait in these cases is that the participants cannot be online by the same time. The synchronous e-learning may be conducted by live web

conferencing or chat that has high potential for expansion of the power of e-learning or training. Learners and teachers become more social in synchronous e-learning by asking and answering questions in real time.

2. Current Status

With the help of online teaching modes we can sermonize a large number of students at any time and in any part of the world. All institutions are scrambling different options of online pedagogical approaches and try to use technology more aptly. Many schools, colleges and universities around the world have fully digitalized their operations understanding the dire need of this current situation. There have been a lot of advances in educational technology in the last few decades and the same proved to be immensely useful during this pandemic.

The pandemic and the lockdowns to contain it have affected the mental health of people around the world. Many students are suffering from stress and anxiety. Such psychological issues often hinder students from adapting to online education. Moreover, not all students have equal access to and expertise on, digital technologies. Although these inequalities existed earlier, the COVID-19 pandemic has exposed this digital divide. The schools, colleges and universities had suspended regular classes nationwide during lockdown which was begun in India on 25th March 2020. The academic programs of the most institutions in India are based on intense classroom and laboratory-based activities. It was difficult to move all these academic activities online immediately.

Moreover, it was assumed that the situation will normalize soon and the all campuses could be reopened within weeks or month. As a temporary measure, teachers and mentors recommended students to join online resources. But lockdown was continued for many months. In the meantime, the institutions have reorganized its teaching-learning process and the academic activities that were moved from offline to online platform.

2.1 Business Volume of Meeting Software

The video call is fast becoming an essential business tool rather than an optional innovation. The meteoric rise of video conferencing is taking the world by storm. Now days video call is a tremendous solution of everything from simple one-on-one meetings to large office meetings and ultimately to full events live-streamed and broadcast to the attendants. Even before COVID-19, there was already high growth and adoption in education technology, with global investments reaching US\$18.66 billion in 2019 and the overall market for online education projected to reach \$350 Billion by 2025. Global Video Conferencing Market Analysis noted that the video conferencing market was already on a high growth trajectory pre-pandemic and has been forecast to grow at a compound annual growth rate of 12.1% for 2018 to 2023.

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Global Market Insights now predicted compound annual growth rate of 19% between 2020 and 2026, reaching a value projection of \$50 billion USD by 2026. Whether it is language apps, virtual tutoring, video conferencing tools, or online learning software, there has been a significant surge in usage since COVID-19. According to [trustradius.com](https://www.trustradius.com) (July 2021), 69% of people agree that the COVID-19 pandemic will permanently change the nature of work. Video conferencing software will help to make this possible. The video conferencing market is expected to surpass \$50 billion by 2026. The web and video conferencing market increased 500% in the first two months of the COVID-19 pandemic. The video conferencing market is estimated at \$7.9 billion in 2021. Analysts expect that the market will grow approximately \$9.7 billion in 2022.

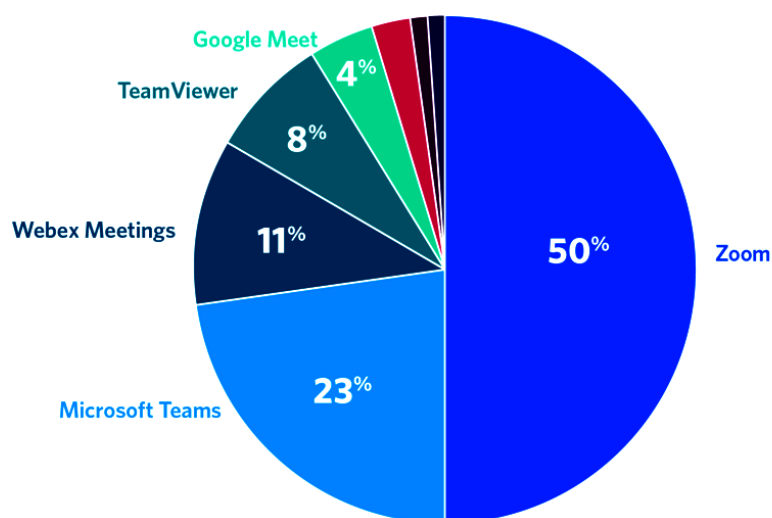


Figure 1 : Market share of top video conferencing software in 2021

3. Popular Meeting Software in Academic Institutions

Educational technologies have improved over the years. Today, there are several sophisticated online education platforms and many specialized educational resources for various courses. Some online educational tools also facilitate collaborative learning. The teachers and mentors of the institutions gradually adapted to the scenario. The professors, teachers and other academic staff of my university are now using Google Classroom, Canvas and Talent LMS to dispense course material and information related to their courses, and delivers live lectures through Webx, Go To Meeting, Zoom, Google Meet etc. The teachers and mentors typically use presentation programs like PowerPoint and MS Word, PDF and note-taking programs like OneNote to disseminate information.

Furthermore, depending on the nature of their courses, the professors, teachers, mentors and other academic staff use online tools to support problem solving, programming, designing and training including lab activities. The teachers and other academic staff deliver lectures and

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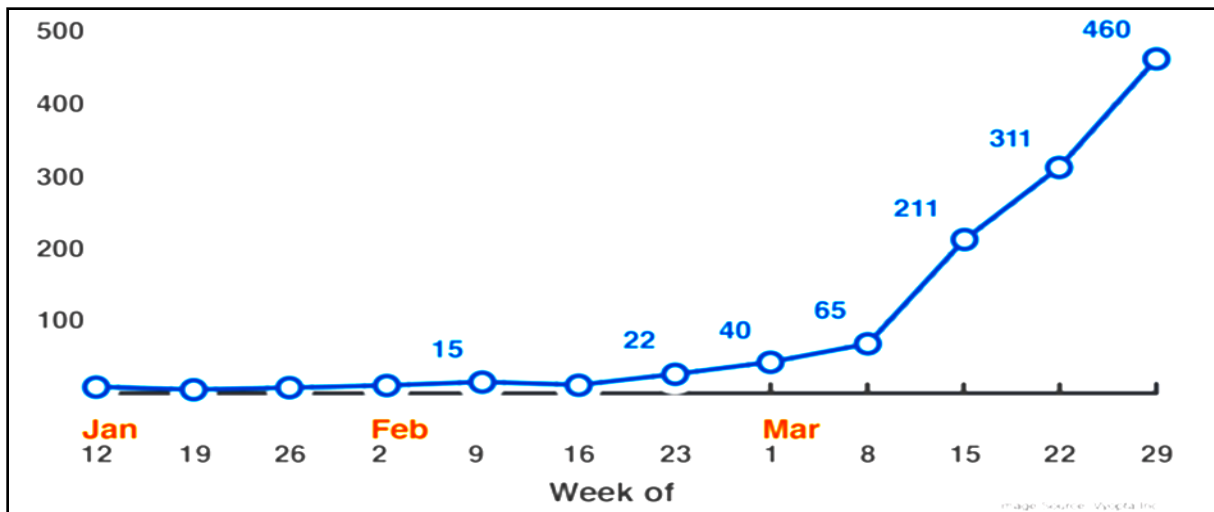


Figure 2 : Percentage growth in Video meeting Participants (2020)

practical sessions using their own computers often augmented with a digital pen. There are many meeting software/videoconferencing software which have gained publicity during Covid-19. Some of them much popular meeting software/videoconferencing software are given here -

3.1 Cisco Webx

Webex Meetings is a powerful conferencing solution that lets we can connect with anyone, anywhere, in real time. By combining video, audio and content sharing, Webex Meetings creates an effective conferencing environment, leading to more satisfying meetings and increased productivity. Webex is one of the oldest and most reputed players in the video-conferencing space. Founded in 1995 and acquired by Cisco in 2007, Webex has always attracted a select clientele, though with time and the ongoing global pandemic scenario, things have been changing. Like its oldest rivals, Microsoft and Google, and new emerging ones like Zoom, Cisco's Webex is also witnessing a surge in usage and expansion in its user base.

India is the second largest consumer base for Webex globally and the Cisco campus in Bangalore marks the company's largest presence. It was really a choice of the employees, whether they wanted to come into office physically or not. The important features of Webx is given here

- High-Quality Video Conferencing
- Cross-Platform, Functional and Geographic Versatility
- File and Desktop Sharing
- Brainstorming via White boarding
- AI Powered Functionality
- End to end security feature

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The users of Cisco's video-conferencing app Webex were 590 million in September, 2020 and in the month of October, 2020 participants clocked track over 600 million. Cisco Webex Hosted 20 Billion Meeting Minutes in April 2020. In February the amount of network traffic per second was 22 times more it normally gets for Cisco Webex service especially in China. People spent 5.5 billion meeting minutes on Webex in the first 11 business days of the month September, 2020. Cisco's Webex draws record 324 million users in March 2020. Webex had recorded 324 million meeting participants in March. Zoom disclosed 300 million daily participants in April, and Teams in April disclosed 200 million.

3.2 GoToMeeting

GoToMeeting was developed in July 2004 using the remote access and screen sharing technology from GoToMyPC and GoToAssist to allow web conferencing. GoToMeeting is a web-hosted service created and marketed by LogMeIn. It is an online meeting, desktop sharing, and video conferencing software package that enable the user to meet with other computer users, customers, clients or colleagues via the Internet in real time. GoToMeeting is designed to broadcast the desktop view of a host computer to a group of computers connected to the host through the Internet. Transmissions are protected with high-security encryption and optional passwords. By combining a web-hosted subscription service with software installed on the host computer, transmissions can be passed through highly restrictive firewalls.

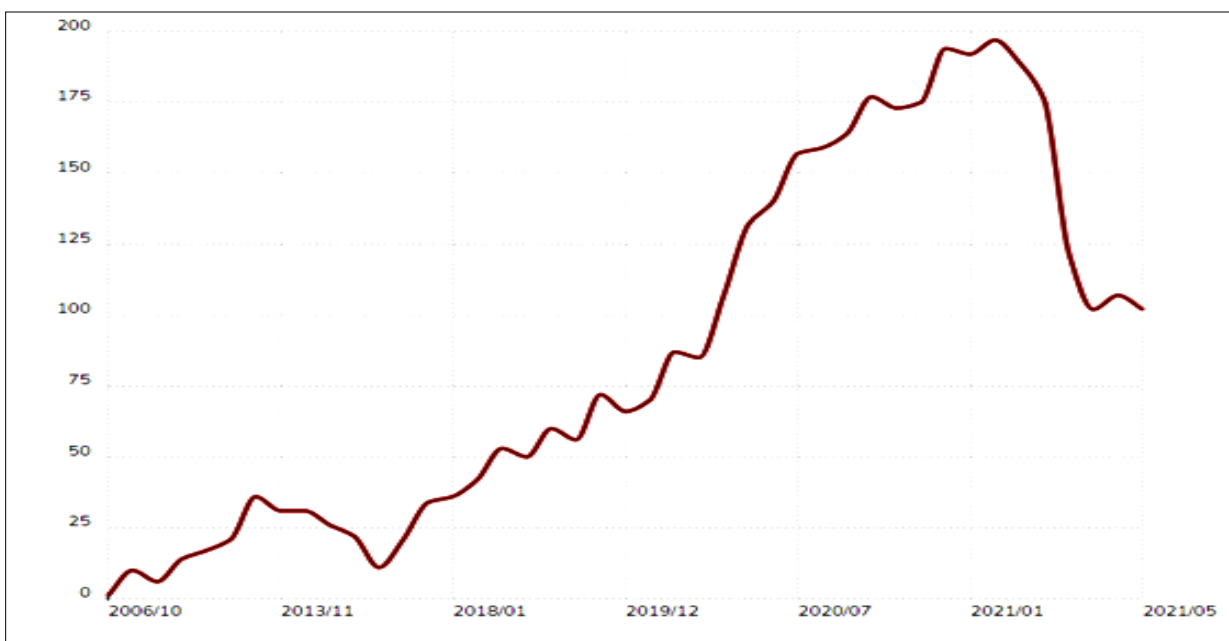


Figure 3 : Go to meeting software trend

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GoToMeeting is consistently the best remote support and technical meeting option available on the market. It offers IT teams the ability to easily support remote users and to schedule and manage meetings easily. GoToMeeting is reliable and easy to use for people at all skill levels with remote meeting software. Users can share any application on their computer in real time. GoToMeeting offers high-definition video conferencing and unlimited meetings with remote colleagues.

3.3 Google Meet

Google Meet is a video-conference-calling platform from Google designed primarily for professional use, which links remote colleagues together for real-time interaction. It's a great solution for both individuals and businesses to meet on audio and video calls. It was born from Google Hangouts.

Google Meet is available on the web, and phones and tablets for Android and iOS. Google Meet is primarily designed as a way to host video meetings. However, we can enable the camera and microphone independently, so you can just use it for audio calls if we wish. We can create ad hoc calls and invite your friends and family. One of the best things about Google Meet is that we don't need to install any software on desktop. Everyone in the call (the organizer and the attendees) simply has to be using a modern web browser

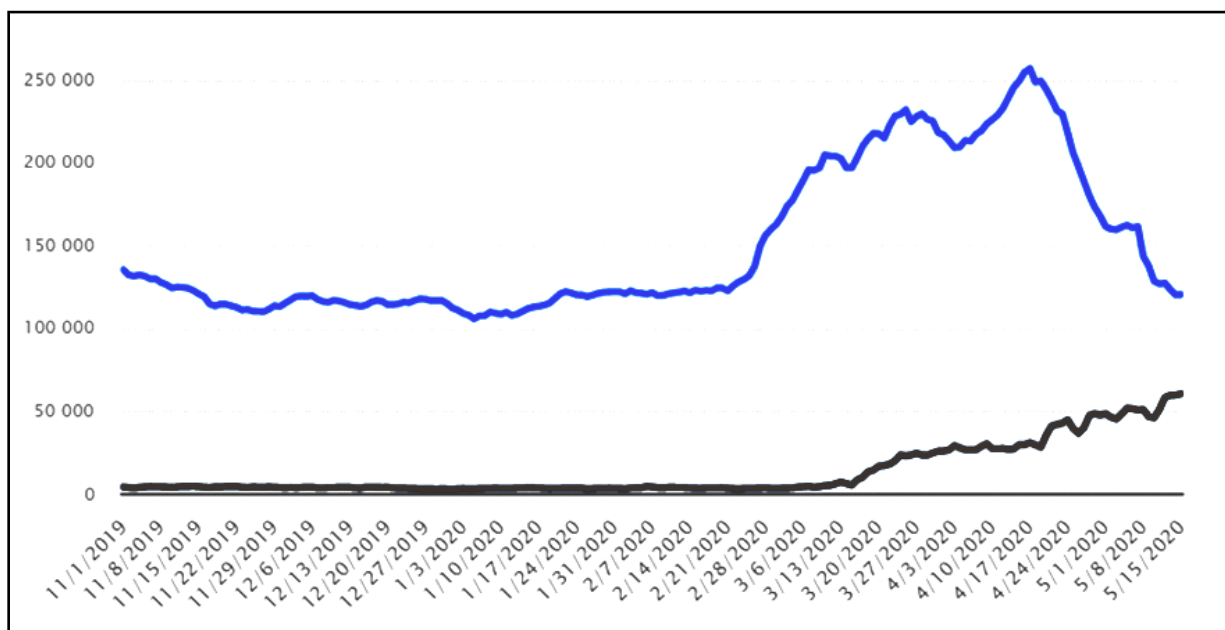


Figure 4 : Google meet software trend

Google is known for having multiple chat services that all seem to do the same thing. It often changes the name of services or retires them, which leads to even more confusion. Google Meet

does its best to filter out any background noise that isn't speech. It also has a live caption feature, which automatically captions what people say it's pretty reliable and great for accessibility. We can also share our screen to everyone on the call. This can either be a specific window or the entire desktop, and it works on mobile too.

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3.4 Zoom meeting

Zoom is a cloud-based video communications app that allows us to set up virtual video and audio conferencing, webinars, live chats, screen-sharing, and other collaborative capabilities. Zoom is an application that allows users to make free video calls with an individual or group of people. Zoom Meetings allows organizations in the educational, financial, health care, and government sectors to conduct virtual meetings and collaborate in real-time using integrated communication tools. They refer to video calls as 'meeting'. For instance, Zoom can enable a user to participate in an in-person gathering being held at a distant location, like an information session or support group. Using a personal laptop, tablet or Smartphone and a connection to the Internet at home, anyone can get a Zoom account.

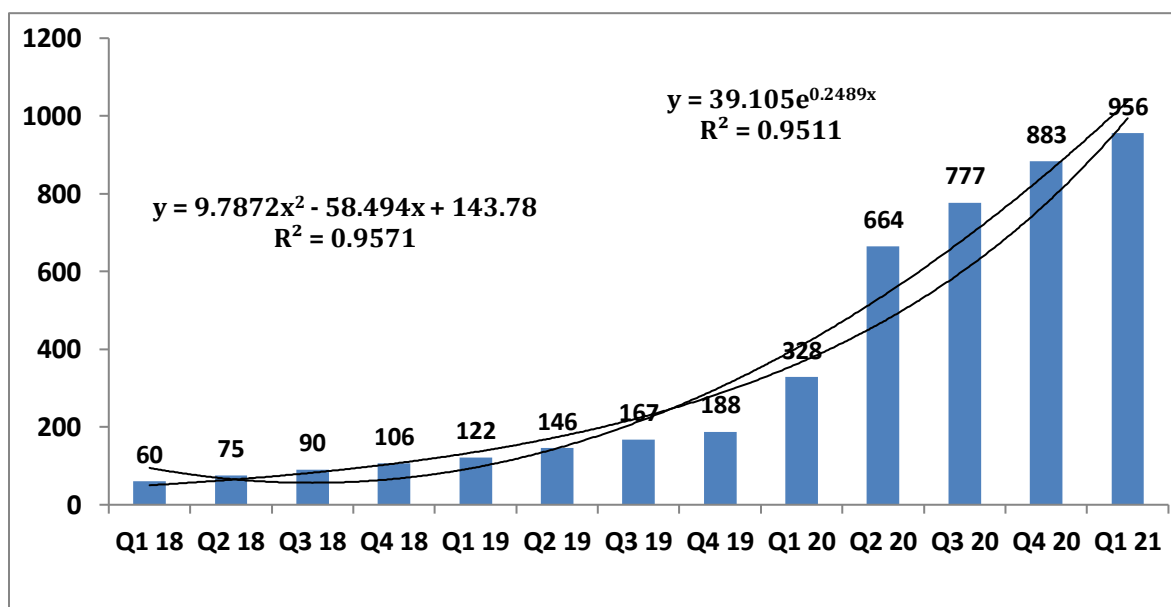


Figure 5 : Zoon meeting rising trend (user base)

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Table 1 : Zoom Business between 2018 to 2020

Year	Revenue	Profit	Date	Meeting participants	Zoom business customers
2018	\$331 million	\$7 million	Year 2019	10 million	--
2019	\$623 million	\$21 million	March 2020	200 million	82,400
2020	\$2.6 billion	\$671 million	April 2020	300 million	470,100
			December 2020	350 million	

Within Zoom we can share our screen with participants and they can share it with anybody. Screen sharing can be used for interactive white boarding, sharing a presentation, walking through a document, giving a web tour, showing software tutorials and etc. When combined with recording, Zoom's video and screen sharing capability also make it an excellent choice for basic screen casting of course materials. Zoom allows us to record your meetings. If we have a paid account we can record and save our recordings to the cloud or locally. If we have a free account we can record and save our recordings locally to our computer. Use Zoom's recording capabilities to record lectures, introductions, screencasts, guest visitors, and etc. The coronavirus crisis has accelerated Zoom's growth because of the sudden growth in the need for group video chat. It's much easier to use than Hangouts or Skype or most other messenger systems because it doesn't need a login and runs in a browser. Video conferencing in 2020, there was 535% rise in daily traffic through the Zoom application.

3.5 Microsoft Teams

Microsoft Teams is a persistent chat-based collaboration platform complete with document sharing, online meetings, and many more extremely useful features for business communications. Microsoft Teams is a proprietary business communication platform developed by Microsoft, as part of the Microsoft 365 family of products. Teams primarily competes with the similar service Slack, offering workspace chat and videoconferencing, file storage, and application integration. Having an excellent team space is the key to being able to make creative decisions and communicate with one another.

Teams are made up of two types of channels standard (available and visible to everyone) and private (focused, private conversations with a specific audience). Microsoft Teams is the ultimate messaging app for our organization, a workspace for real-time collaboration and communication,

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meetings, file and app sharing and even the occasional all in one place, all in the open, all accessible to everyone. Teams is replacing other Microsoft-operated business messaging and collaboration platforms, including Skype for Business and Microsoft Classroom. Throughout the COVID-19 pandemic, Teams, and other software such as Zoom and Google Meet, gained much interest as many meetings have moved to a virtual environment. As of 2021, it has about 145 million users

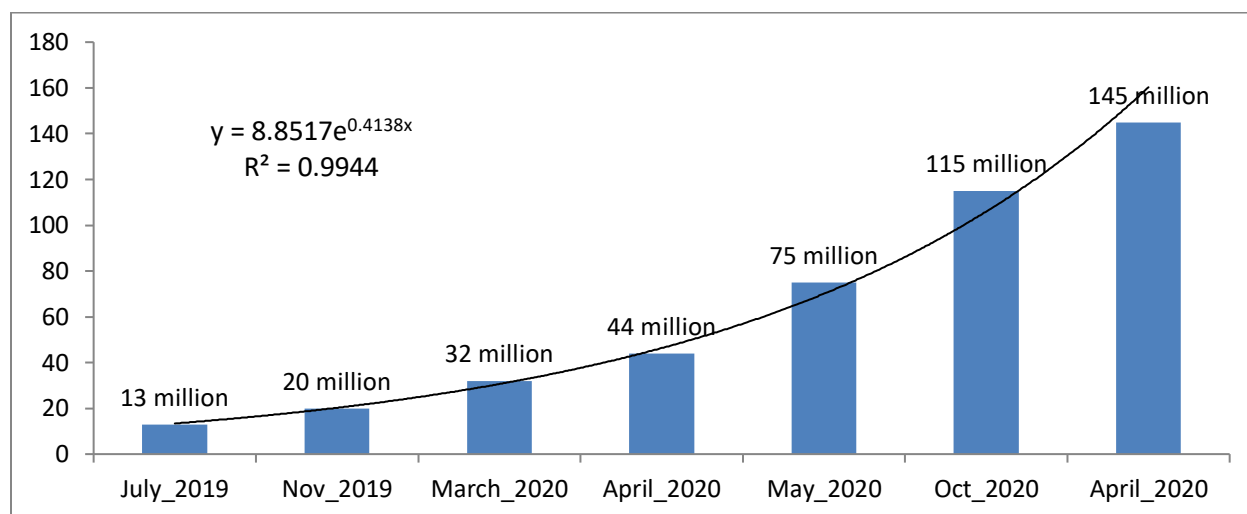


Figure 6 : Microsoft Teams user base

4. Role of Meeting Software in Academic Activities

The online educational platforms allow students also to turn on their assignments and teachers and other academic staff to keep track of the progress of the students. Videoconferencing tools, like Google Meet, Zoom, and Microsoft Teams, help in organizing online lectures and discussion sessions. Such tools typically support slideshows and a chat-box. Some institutions are also disseminating course material through their websites and learning management system (LMS). Virtual laboratories allow students to simulate experiments related to their courses online. Many online practical tools are being used for simulation and data visualization. Now day's students retain more material when learning online compared to a classroom. This is mostly due to because of the students being able to learn faster online. e-Learning requires less time to learn than in a traditional classroom setting because students can learn at their own pace, going back and re-reading, skipping or accelerating through concepts as they choose.

Online learning has become more and more common whether for comfort, adapting to work hours or just having the freedom to study from anywhere and now with the Coronavirus pandemic, as people have to stay at home, it has become more important than ever. Resistance to change will not help to grow up for any educational unit across the world. From the day online

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education got fame due to Corona pandemic the reputation of educational units is on stake and under scrutiny. How well they behave and how well they maintain the quality of their education in the midst of this crisis reflects their adaptive abilities. The shift from face-to-face lectures to online classes is the only possible solution.

There existed a digital divide between urban and rural areas, and students in rural areas often do not have adequate access to information and communication technology. Economically disadvantaged people and people living in rural areas often have limited access to digital technologies. Steady access to digital technologies is a precondition for online education. Students with limited access to digital technologies and students who are less knowledgeable about those technologies are facing problem in adapting to online education. The institutions existed in remote areas can not to deliver high-quality lectures due to availability of poor bandwidth. The digital divide existed before but the pandemic has exacerbated it.

Some students live in houses that are not enough spacious and face problem in attending online classes at their homes. There are issues in multi-student classes with regards to the bandwidth of a particular user being poor and affecting the overall class quality and also if users using mobile hotspot suffer from packet loss leading to poor video quality. For those who do have access to the right technology, learning online can be more effective in a number of ways.

5. Impact of Meeting Software in Academic life

Online learning can be coined as a tool that can make the teaching–learning process more student-centered, more innovative and even more flexible. The online education can be in form of synchronous or asynchronous environments on the basis of using devices like mobile phones, laptops, etc. with internet access. In these environments, students can be anywhere (independent) to learn and interact with instructors and other students.



The synchronous learning environment is structured in the sense that students attend live lectures, there are real-time interactions between educators and learners, and there is a possibility of instant feedback, whereas asynchronous learning environments are not properly structured. In such a learning environment, learning content is not available in the form of live lectures or classes; it is available at different learning systems and forums. Instant feedback and

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immediate response are not possible under such an environment. Synchronous learning can provide a lot of opportunities for social interaction.

The use of video conferencing increased by 48% over the last couple of years after Covid -19 pandemic. Video conferencing saves time and money. Nearly half of users have reduced business travel by using the video call options. Up to 47% of video conference users have reduced their travel costs. It was experienced that users gain improvements in communication and better collaboration when video conferencing was used by them. Improved communication and collaboration lead to an increase in productivity. Video meetings improve productivity by approximately 50%. Video calling statistics show that 76% of individuals use video calls to work remotely. Moreover video communication helps their team to be more productive and bridge the distance between physical locations and teams scattered worldwide.

Employees of different organization accept that meeting software increase in productivity and a better work-life balance, which is harder to achieve in a classic corporate office meetings oriented setup. The vast majority of workforce accepts that video conferencing helped with their job and life satisfaction. According to virtual meeting statistics for 2020, the right platform improves the productivity and happiness balance. So much so that by the end of 2021, around 30% of workers will choose to work from home a couple of days a week. Video meetings improve productivity by 50%. Video conferencing has seen a 535% rise in daily traffic in 2020. While the value of the global video conferencing market in 2021 is estimated at \$6.03 billion. Approximately 76% of employees use video conferencing for remote work.

6. Significance of Meeting Software during Covid-19

The coronavirus pandemic has shown scant respect for manmade borders and it took just three months to bring the world to a standstill, proving how intimately connected we are as earthlings. The Pandemic has changed the education sector. Educational units are struggling to find options to deal with this challenging situation. It has pushed optimization in delivery methods. Schools and education institutions have been forced to move online. A new normal has been created and it is teaching online. Various issues come in when moving offline to online learning, how does one provides informal social interactions, how to ensure student attention, or even how to ensure active participation? These circumstances make us realize that scenario planning is an urgent need for academic institutions. This is a situation that demands humanity and unity.

There is an urgent need to protect and save our students, faculty, academic staff, communities, societies, and the nation as a whole. Students are suffering from stress and anxiety because they are spending enough screen time during this pandemic.

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The COVID-19 pandemic and the closing down of the academic institutions have affected the mental health of university students. A large proportion of students are suffering from mental disorders of varying severity. Many students are suffering from depression, anxiety, distress and even suicidal thoughts. Students feel that they learn better in physical classrooms than through online education. Students miss the help they receive from their peers in classrooms and laboratories and access to library. The current situation is having a modest but persistent effect on the mental health of students. Lack of motivation and negative emotions make it difficult for many students to focus on online education. It is clear that this pandemic has utterly disrupted an education system that many assert was already losing its relevance.

Self-reflection on the part of students is extremely important in online education. We found that students feel that there is a need for periodic assessment to keep the teaching-learning process on the right track. Indeed, academic institutions would not be able to transform all of their college curricula into an online resource overnight. Distance, scale and personalized teaching and learning are the three biggest challenges for online teaching. Innovative solutions by institutions can only help us deal with this pandemic. The pandemic forced various organizations to suddenly modify their workflow strategies and adopt new technologies. In most cases, these organizations did not get enough time to reflect upon how the new strategies and the associated technologies should be introduced and integrated to their existing setup.

Meetings are a necessary evil, but sometimes, they seem less necessary and more evil than they have to be. Too many meetings destroy morale and motivation.” A majority of these meetings are considered unproductive. That's because excessive meetings tend to be draining on faculties and students and waste of quality time. Excessive meetings can also result in information overload and a sense of failure. As if that weren't enough, they're distracting and force you to multitask. All of these aren't good for your cognitive health. Factors that make meetings unproductive may include the lack of organization, lack of preparation, multi-tasking (checking emails, messages and distractions during a meeting) etc. Here are some of the most common challenges students are currently facing with online classes along with specific tips on how to address them:

- Technical issues
- Distractions and time management
- Staying motivated
- Understanding course expectations
- Lack of in-person interaction
- Adapting to unfamiliar technology
- Uncertainty about the future

Summary

To contain the spread of COVID-19, governments around the world imposed regulations to restrict physical meetings, mobility, and public life in general. While most people did not contract the infection, their lives were dramatically disrupted as the lockdown locked away their everyday contacts and activities. In this extreme situation, institutions and individuals alike responded by switching quickly from physical and location-dependent interactions to virtual interactions. Virtual meetings allow people to share information, experiences and data in real-time without the need for being physically located in the same room together. Virtual learning exhausts students, exacerbates social class differences and mirrors the gender inequities that exist in in-person classes. Such issues are widely prevalent in in-person classrooms and harm learning outcomes. Virtual classroom software empowers learners to travel around the world without ever leaving their actual classroom. We can communicate with experts from various fields in real-time and learn from them. We can participate in seminars and classes happening on the other side of the world. Online learning is harder for many reasons; from missing crucial parts of our learning, to not being able to access our education because of the internet, online learning has been a rough adjustment. Many students have struggled to make the jump from physically being at school to learning virtually.

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CHAPTER - 10

Skills Education for Employment in Digital India

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Introduction

India, like any other knowledge economy, depends on the development of its educational sector. Higher education drives the competitiveness and employment generation in India. However, research findings have shown that the overall state of higher education is dismal in the country. There is a severe constraint on the availability of skilled labor. There exist socio-economic, cultural, time and geographical barriers for people who wish to pursue higher education. Innovative use of Information and Communication Technology can potentially solve this problem.

Education is the driving force of economic and social development in any country. Considering this, it is necessary to find ways to make education of good quality, accessible and affordable to all, using the latest technology available to make it progressive in digital India. The last two decades have witnessed a revolution caused by the rapid development using different skills in digital India. Different skills and technologies have changed the dynamics of various industries as well as influenced the way people interact and work in the society. Internet usage in home and work place has grown exponentially. For example ICT (Information and Communication) has the potential to remove the barriers that are causing the problems of low rate of education in any country. It can be used as a tool to overcome the issues of cost, less number of teachers, and poor quality of education as well as to overcome time and distance barriers.

2. Challenges of the Education System

India has a billion-plus population and a high proportion of the young and hence it has a large formal education system. The demand for education in developing countries like India has skyrocketed as education is still regarded as an important bridge of social, economic and political mobility. The challenges before the education system in India can be said to be of the following nature:

- **Access to education-** There exist infrastructure, socio- economic, linguistic and physical barriers in India for people who wish to access education.
- **Quality of education-** This includes infrastructure, teacher and the processes quality.

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- **Resources allocated-** Central and State Governments reserve about 3.5% of GDP for education as compared to the 6% that has been aimed.

There exist drawbacks in general education in India as well as all over the world like lack of learning materials, teachers, remoteness of education facilities, high dropout rate etc .

Table 1: Participation of Indian students in education

Stage of education	GER (2011)	HR	Literacy
Primary	95%	Male	84.6%
secondary	69%	Female	70.30%
Post secondary	25%	Total	77.70%

(Source: Ministry of Education, 2011)

Thus, the participation rates of the Indian population in education, and especially in higher education are quite low.

3. Rationales for introducing ICT in Education

In the current Information society, there is an emergence of lifelong learners as the shelf life of knowledge and information decreases. People have to access knowledge via ICT to keep pace with the latest developments. In such a scenario, education, which always plays a critical role in any economic and social growth of a country, becomes even more important. Education not only increases the productive skills of the individual but also his earning power. It gives him a sense of well being as well as capacity to absorb new ideas, increases his social interaction, gives access to improved health and provides several more intangible benefits. The various kinds of ICT products available and having relevance to education, such as teleconferencing, email, audio conferencing, television lessons, radio broadcasts, interactive radio counseling, interactive voice response system, audiocassettes and CD ROMs etc have been used in education for different purposes.

Table 2: The four main rationales for introducing ICT in education:

Rationale	Basis
Social	Perceived role that technology now plays in society and the need for familiarizing students with technology.
Vocational	Preparing students for jobs that require skills in technology.
Catalytic	Utility of technology to improve performance and effectiveness in teaching, management and many other social activities.
Pedagogical	To utilize technology in enhancing learning, flexibility and efficiency in curriculum delivery

4. ICT in Process of Education

Today different technologies—including laptops wirelessly connected to the Internet, personal digital assistants, low cost video cameras, and cell phones have become affordable, accessible and integrated in large sections of the society throughout the world. It can restructure organizations, promote collaboration, increase democratic participation of citizens, improve the transparency and responsiveness of governmental agencies, make education and health care more widely available, foster cultural creativity, and enhance the development in social integration. It is only through education and the integration of ICT in education that one can teach students to be participants in the growth process in this era of rapid change. ICT can be used as a tool in the process of education and for employment in the following ways:

- **Informative tool:** It provides vast amount of data in various formats such as audio, video, documents.
- **Situating tool:** It creates situations, which the student experiences in real life. Thus, simulation and virtual reality is possible.
- **Constructive tool:** To manipulate the data and generate analysis.
- **Communicative tool:** It can be used to remove communication barriers such as that of space and time.

The following mediums are used for the delivery and for conducting the education process:

- **Voice** – Instructional audio tools that include interactive technologies as well as the passive ones.
- **Video** - Instructional video tools that include still images, prerecorded moving images, and real-time moving images combined with audio conferencing.
- **Print** – instructional print formats that include textbooks, study guides, workbooks and case studies.

Different skills also allow for the creation of digital resources like digital libraries where the students, teachers and professionals can access research material and course material from any place at any time. Such facilities allow the networking of academics and researchers and hence sharing of scholarly material. This avoids duplication of work.

5. Advantages of ICT in Education

Use of computer in education develops higher order skills such as collaborating across time and place and solving complex real world problems. It improves the perception and understanding of the world of the student. Thus, ICT can be used to prepare the workforce for the information society and the new global economy. E learning has the following advantages:

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- Eliminating time barriers in education for learners as well as teachers;
- Eliminating geographical barriers as learners can log on from any place;
- Asynchronous interaction is made possible leading to thoughtful and creative interaction
- Enhanced group collaboration made possible via ICT
- New educational approaches can be used
- It can provide speedy dissemination of education to target disadvantaged groups
- It offers the combination of education while balancing family and work life
- It enhances the international dimension of educational services
- It allows for just in time and just enough education for employees in organizations
- It can also be used for non-formal education like health campaigns and literacy campaigns

E learning allows higher participation and greater interaction. It challenges the concept that face-to-face traditional education is superior to it. The web and the Internet is the core to spread education through e-learning. The components include e-portfolios, cyber infrastructures, digital libraries and online learning object repositories. All the above components create a digital identity of the student and connect all the stakeholders in the education. It also facilitates inter disciplinary research

The experience of many teachers, who are early innovators, is that the use of computer and other skills are motivating for the students as well as for the teachers themselves. The use of ICT can improve performance, teaching, administration, and develop relevant skills in the disadvantaged communities. It also improves the quality of education by facilitating learning by doing, real time conversation, delayed time conversation, directed instruction, self-learning, problem solving, information seeking and analysis, and critical thinking, as well as the ability to communicate, collaborate and learn. Those skills also provide a platform for sharing information and knowledge. This can be used for the betterment of program delivery in terms of replication of best practices. It also helps researchers by provision of information, networking, online journals, libraries and data. The possibility of real time interaction in all the different aspects of the education system like teaching, collaboration, debates etc hold great promise for the future.

Evidence through practical experience in the world indicates that investing in experience contributes mainly to increasing human and knowledge capital, which benefits the industry as well. Employers gain from the increased knowledge and skills of staff without releasing them for long periods. In addition, investment in production of ICT is a more effective tool for development of the whole society. Research findings show that technology can support pedagogical, curricular, and assessment reforms, which intend to support the process of knowledge creation. Students and teachers plan their learning activities and build on each other's ideas to create new knowledge. It also facilitates monitoring of their progress in understanding

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and preparation for lifelong learning and participation in the information society. Besides cost effectiveness, research has proved that ICT is most effective to tackle problems like expanding number of students in each class and in employment also. Technologies enabled distance education provides environmental benefits, as there is a major education in the amount of student travel. Economies of scale in utilization of the campus site are generated. Student housing is not needed which further saves costs. However, cost of providing the distance education depends on several factors, which include: geography and communities targeted, breadth of courses and class size. It also depends on the technology used; amount of resources deployed in producing course materials as well as how frequently they are updated.

6. ICT for Monitoring Skill Education

E-learning allows delivery, dialogue and feedback over the Internet. It allows mass customization in terms of content and exams. E-education can provide access to the best gurus and the best practices or knowledge available. It is possible to leverage the online environment to facilitate teaching techniques like role-play across time and distance. It can also facilitate the development of scenarios, which can be rarely witnessed in practice. ICT can play a valuable role to monitor and log the progress of the students across time, place and varied activities. Differentiated skill based education can be expected to provide greater reliability, validity, and efficiency of data collection and greater ease of analysis, evaluation, and interpretation at any educational level. In absence of different skills, most of the responsibility of teaching and learning lies on the teachers.

However, with the help of ICT one can transfer the responsibilities to the students so that they can self manage. It helps to individualize the teaching or guidance method as per the student's. It also boosts the confidence level and the self-esteem of the students who acquire the ICT skills through the process of being exposed to such kind of learning also puts forth the view that computer-based registration, evaluation, and administration helps to link different levels of information and facilitate an overall view of the whole educational setup. It facilitates the evaluation and examination of the learning process and results by the students and the parents in a flexible and convenient way. The globalization process has also created a large market of offshore students. To reach them, information technology is the only convenient medium, which can offer education as a service. It increases education provision substantially and can contribute to mass education. It also creates competition among the institutions for providing education and hence improves the quality

To summarize, the following table shows the main benefits of using information and technologies in education to the various stakeholders:

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Table 3: Benefits of ICT in education to the main stakeholders

Stakeholder	Benefits
Student	• Increased access, • Flexibility of content and delivery, • Combination of work and education, • Learner-centred approach, • Higher quality of education and new ways of interaction.
Employers	• High quality, cost effective professional development in the workplace, • Upgrading of employee skills, increased productivity, • Development of a new learning culture, • Sharing of costs and of training time with the employees, • Increased portability of training.
Governments	• Increase the capacity and cost effectiveness of education and training systems, • To reach target groups with limited access to conventional education and training, • To support and enhance the quality and relevance of existing educational structures, • To ensure the connection of educational institutions and curricula to the emerging networks and information resources, • To promote innovation and opportunities for lifelong learning.

Source: (UNESCO, 2002)

India is making use of powerful combination of skills such as open source software, satellite technology, local language interfaces, easy to use human-computer interfaces, digital libraries, etc. with a long-term plan to reach the remotest of the villages. Community service centers have been started to promote e-learning throughout the country. Notable initiatives of use of skill in education in India include:

- Indira Gandhi National Open University (IGNOU) uses radio, television, and Internet technologies.
- National Programme on Technology Enhanced Learning: a concept similar to the open courseware initiative of MIT. It uses Internet and television technologies
- Eklavya initiative: Uses Internet and television to promote distance learning
- IIT-Kanpur has developed Brihaspati, an open source e-learning platform
- Premier institutions like IIM-Calcutta have entered into a strategic alliance with NIIT for providing programmes through virtual classrooms.

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- Jadavpur University is using a mobile-learning centre.
- IIT-Bombay has started the program of CDEEP (Centre for Distance Engineering Education Program) as emulated classroom interaction through the use of real time interactive satellite technology.
- One Laptop per Child (OLPC) in Maharashtra.

7. Factors affecting adoption of ICT in education and in Employment

There is a worldwide need felt for integrating into education in order to improve the pedagogy to reflect the societal change. The main goals of ICT adoption in the education field are reducing costs per student, making education more affordable and accessible, increasing enrollments, improving course quality, and meeting the needs of local employers. Low overheads and cost efficiency are attracting many private players in the field of Internet enabled education. This is also being driven by technological advances, competitive pressures and the positive experiences of many early adopters. The main factors that affect the adoption of ICT in education are the mission or goal of a particular system, programs and curricula, teaching/learning strategies and techniques, learning material and resources, communication and interaction, support and delivery systems, students, tutors, staff and other experts, management, housing and equipment, and evaluation. National vision, supported by coherent strategies and actions is the most important factor in integrating ICT in education. Successful implementation of education requires strong national support from government and local support from relevant institutions and education authorities.

The political powers of any nations affect the introduction of any new technology. Cost is an important issue that decides and guides the adoption and growth of Information and Communication Technology especially in developing countries. The institutions, which are granted public status and are supported by government funds, as well as those, that are larger in size, are the ones to adopt the new technologies to support education. However, it is also observed that since technology adoption involves high fixed costs, institutes, which implemented such technology, did not upgrade it as time progressed. The presence of skill champion is necessary at all levels of the system. The strong presence of such leadership is evident wherever education integration has been initiated successfully. Along with different skill training, one needs an technologies related support mechanism to gradually induce the integration. This is needed as many teachers in face of technical difficulties may tend to revert to the older teaching (non-ICT based) methods. Teachers need support in using and integratin into the curriculum and teaching methods. Teachers, who perceive greater ICT-related support being available to them, use technologies in their teaching much better.

8. Potential Drawbacks of using more Technologies and Information in Education

Although skills offers a whole lot of benefits and in employment but there are some risks of using more technologies in education which have to be mitigated through proper mechanisms. They are:

- It may create a digital divide within class as students who are more familiar with advanced skills will reap more benefits and learn faster than those who are not as technology savvy.
- It may shift the attention from the primary goal of the learning process to developing ICT skills, which is the secondary goal.
- It can affect the bonding process between the teacher and the student as moderated skills becomes a communication tool rather than face to face conversation and thus the transactional distance is increased.
- Also since not all teachers are experts with technologies they may be lax in updating the course content online which can slow down the learning among students.
- The potential of plagiarism is high as student can copy information rather than learning and developing their own skills.
- There is a need for training all stakeholders in ICT.
- The cost of hardware and software can be very high.

Summary and Conclusions

Changes in the curriculum do support fundamental economic and social transformation in the society. Such transformations require new kinds of skills, capabilities and attitudes, which can be developed by integrating skills in education. The overall literature suggests that successful technologies integration depends on many factors. National policies as well as school policies and actions taken have a deep impact on the same. Similarly, there needs to be an ICT plan, support and training to all the stakeholders involved in the integration. There needs to be shared vision among the various stakeholders and a collaborative approach should be adopted. Care should be taken to influence the attitudes and beliefs of all the stakeholders.

skills can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would enable development of collaborative skills as well as knowledge creation skills. This in turn would better prepare the learners for lifelong learning as well as to join the industry. It can improve the quality of learning and thus contribute to the economy.

Similarly wider availability of best practices and best course material in education, which can be shared by means of different skills, can foster better teaching. However there exist some risks

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and drawbacks with introducing ICT in education which have to be mitigated. Successful implementation of ICT to lead change is more about influencing and empowering teachers and supporting them in their engagement with students in learning rather than acquiring computer skills and obtaining software and equipment. Also proper controls and licensing should be ensured so that accountability, quality assurance, accreditation and consumer protection are taken care of. ICT enabled education will ultimately lead to the democratization of education.

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