3.1 Introduction

The term 'rural development' is an old phenomenon and presently still exists. From the very beginning effort has made for rural development and still hard to get its objectives. It is an emerging challenge in the race of development, since 75% of the country's populations are living in rural areas. It is a changeable process; the rural development efforts of 1950s or 1960s may not be similar at this hour. Its concept also varied by countries. In India rural development is the eradication of poverty, access to education, access to health facilities, access to electricity, providing job opportunities, developing skill and improving good transport and communication infrastructure, etc. Such concept of India's rural development approach may not be applicable to others countries, since the issues of development are varied by countries. Basically, the concept of rural development is framed under socio-economic condition of the rural areas in comparison to urban areas.

According to United Nation "Rural development is a process of change, by which the efforts of the people themselves are united, those of government authorities to improve their economic, social and cultural conditions of communities into the life of the nation and to enable them to contribute fully to national programme".

According to World Bank (1975), rural development is defined as "a strategy aiming at the improvement of economic and social living conditions, focusing on a specific group of poor people in a rural area. It assists the poorest group among the people living in rural areas to benefit from development".

According to Indian scenario the characteristic of rural areas is, the areas which is far away from cities and have large agricultural areas, accompanied by poor road and limited public transport, poor communication infrastructure, poor health facilities, lack of education, lack of electrification and other government institutions etc. According to India Rural Development Report 2012-2013, defines rural as not urban, urban areas are (i) Statutory town, viz. those administratively notified, such as municipalities and cantonments; and (ii) Census town, viz. those with (a) a minimum population of 5,000, (b) at least 75% of male workers engaged in non-agricultural pursuits; and (c) a population density of at least 400 per sq.km. Areas that do not meet these criteria are rural. Therefore, rural is an area or place used to denote a certain geographical area which is under developed. This place or area is politically, economically, socially, backward from other area. Typically, their main source of income is from agriculture, cultivation, fishing and other forest product, etc. Usually, the inhabitants of such areas remain backward in terms of their standard of life, thus facing prominent problems like extreme poverty, un-employment, lack of education facilities, lack of communication and transportation infrastructure, as well as insufficient medical services. Developing this area is vital for building up a strong nation which is self sufficient and self reliant. In a country like India, where agricultural sector is the backbone of the country's economy, developing rural area is of utmost important. Nearly half of the country's income is derived from the agricultural sector, which is the main occupation of the rural India. Moreover, 70% of Indian population gets employment through agriculture. Bulks of raw materials for industries come from agriculture and rural sector (Chauhan, 2012).

Development is a process of social change which intend to bring about positive achievement both materialistic and of humanistic value in a society. Development is the multi-dimensional approach which seeks to transform society by improving the quality of living standard, enjoy greater freedom and equality. According to The United Nations Development Program, development is "to lead long and healthy lives, to be knowledgeable, to have access to the resources needed for a decent standard of living and to be able to participate in the life of the community". There are various approaches or strategies for development. This approach or strategies are un-uniformed and shifted from time to time, especially in context of rural development. During the plan period there have been shifting strategies for rural development. For instance, in the first five year plan (1951-56) community development was taken as the method and national extension services as the agency for rural development. In the second plan (1956-61) the strategy for rural development was focused on co-operative farming with local participation (Planning Commission). Accordingly the government of India frames various development schemes or programmes focusing on the needs of rural people. Ironically, these development schemes of rural people are hardly reaching in the hand of beneficiaries. The fund sanctioned from ministry for a development project is hijacked by subordinate government machinery or bureaucrats before reaching to the hand of the beneficiary. On the other hand, people living in rural areas also no idea of where to claim for their rights and lack of knowledge on the scheme implement for them. The multi-step approach of governance is becoming a factor in delaying development. This traditional approach of governance has to be changed. Considering the entire negative factor in the path of development, the government of India decentralized the power in the hand of the public to be more transparency and accountability in governance. As a new strategy for development, ICTs is employed in delivering service, information and to overcome various challenges. National e-governance plan launched in 2006 is an example of such new approach of development. Among the ICTs mobile phone has proved an effective gadget of communication in development, especially in rural areas. It is the only multi-media tool which is easily accessible in rural areas in comparison to laptop or computer. Possession of computer or laptop is very limited in rural areas, as it is expensive and rural people can't afford it. Mobile phone on the other hand is very cheap and easily affordable by rural people. It has provided a variety of services in the transmission and presentation of information and knowledge in multiple formats to meet the diverse requirements and skills of people. Mobile phone can be used for texting messages, voice and video calling, as well as to send and received both still and video format of pictures, thereby, serving as a two way communication system, hence, providing more flexibility than radio and television. Social scientist and researcher has proved the effectiveness of mobile phone in rural development activities and programmes. Besides, there are various success stories of effectively used of mobile phone in rural development activities. For instance, the Grameen Bank of Bangladesh, Kittur Rural Telephony Projects of Karnataka etc. is a success story of application of mobile phone in rural development activities. Jaffrey Sachs, who directed the United Nation Millennium project, noted that "Mobile phones and Wireless Internet end isolation, and will therefore prove to be the most transformative technology of economic development of our time". As noted by the United Nations Development Programme "Mobile phones can enhance pro-poor development, in sectors such as health, education, agriculture, employment, crisis prevention and the environment, that are helping to improve human development efforts around the World (UNDP, 2102).

Mobile communication, as a part of telecommunication originates from telegraphy system. Innovation and re-innovation of technology from the earlier period led to the development of modern day mobile communication system. Today, as compare to the earlier telecommunication system and modern day telecommunication there is a huge change. In the beginning mobile phone has evolved from a simple voice device to a multimedia communications tool capable of downloading and uploading text, data, audio, and video-from text messages to social network updates to breaking news, the latest hit song or the latest viral video. A mobile handset can be used as a wallet, a compass, or a television, as well as an alarm clock, calculator, address book, newspaper and camera (Minges, 2012). Mobiles are also contributing to socioeconomic and political transformation. Farmers in Africa obtain pricing information via text message, saving time and travel and making them better informed about where to sell their products, thereby raising their income (World Bank, cited in Minges, 2012). In India barbers who do not have a bank account can use mobile phone to send money to relatives in villages, saving costs and increasing security (Adler and Uppal, cited in Minges, 2012). Through m-commercial farmers are shifting from subsistence farming to commercial farming with the expansion of markets and more access to new techniques of farming. The isolated characteristic of rural and remoteness is bridged through mobile communication and increases connectivity between rural and urban.

3.2 Mobile communication

Technically mobile communication is a process where a mobile station (MS) or subscriber unit communicates to a fixed base station (BS) which in turn communicates to the desired user at the other end. Mobile communication is a multi-step flow of communication in which more than two persons can be communicates at the same time base on the service provider. In mobile communication a sender is required, which send messages through a channel to receiver in doing so both the sender and the receiver may act either decoder or encoder. The message in mobile communication may be in the form of text, still image, video, and voice.

3.2.1 Types of mobile phone

- Basic phone – this mobile phone has the facilities of voice telephony, text-Short Message Service (SMS) and Unstructured supplementary service data (USSD).
- Feature phone- this mobile phone includes all the characteristic of basic phone plus Multimedia Messaging Services (MMS), still and video camera, MP3 music player and 2G data access.
- Smart phone- this mobile phone includes all the characteristic of future phone plus web browser, GPS (Global Positioning System), 3G data access, mobile operating platform such as iOS, Android, Blackberry, ability to download and manage applications, voice over internet protocol (VOIP), mobile TV, USB (Universal serial Bus) port and video chatting etc.

Note: The characteristic of the mobile phones is the only basic concept and not all the device may have the same feature

3.3 Mobile communication and agriculture

Agriculture is the main source of livelihood for rural people, since they derived their income directly or indirectly from this sector. In many developing countries the agricultural sector plays a significant role in the national economy. The sector employs about 40 percent of the total labor force in countries with annual per capita incomes ranging from $ 400 to $1,800 (World Bank, 2008). In India around half the country's total workforce and over two-third of the rural workforce is from agriculture sector (IRDR, 2013). However, its share in the country's GDP is dramatically reduced from 55 percent in 1950-51 to around 15 percent in 2009-10. Agriculture, which is the main occupation of the rural people has been facing a range of problems. Majority of the Indian farmers is still practiced traditional way of cultivation and are unaware of new techniques. Moreover, majority of them are small and marginal farmers which have limited resources to influence in growing and marketing their products. Infrastructure constraint, supply chain inefficiency, lack of information that could increase productivity, lack of market and price of the product they produced are the range of problems the rural farmers of Indian faces. After the green revolution in the mid-sixties, there has been no major technological innovation, which could give a fresh impetus to agricultural productivity. Insufficient extension services and poor access to information further widen the gap in the adoption of technology and lead to poor productivity levels (Mittal, Gandhi and Tripathi, 2010). The green revolution had shifted subsistence farming to water-intensive commercial farming, but by passed many farmers especially farmers in dry land areas. No new models of agriculture have been developed to suit their more specific needs (IRDR, 2013). Moreover, 85 percent of the land holdings were marginal and small farmers, or 44 percent of the total operated area. This marginal and small farmer many of them were not accessed to formal agricultural credit and have to rely on money lenders.

The problems outlined above which is come across by the rural farmers can be addressed through mobile communication. Mobile communication has the potentiality to expand the market, inform about the market price, zoom distance and reduce interaction cost between stakeholders, increasing communication between farmers and expert etc. In short mobile communication has the potentiality to help farmers starting from production to sales. For instance, farmers can get access to information through mobile communication about the good quality of seeds, techniques of cultivation and after post harvesting farmers can get access to information about market and prices of the product. Getting access to market price is valuable since the existing market price inform farmers the aggregated demand and value on any given day and changes over time. Before the expansion of the mobile networks, farmers had to rely on traders for information to determine the price of their produces. Accessing to good knowledge on uninfected seeds and new techniques of cultivation is also necessary for increasing productivity. Acquiring such knowledge will avoid poor yields caused by crop diseases and will save time, effort and money put by farmers. Timely access to meteorological information will be supportive in effective planning of the crops by acting as early warning system and avoid climate disturbances.

In china the government has invested US$1.13 billion in establishing a mobile infrastructure for about 26,000 villages through state own mobile phone company, China Mobile, to enable farmers to keep track of weather conditions or forecast and product prices. In July 2006, China Unicorn launched and agriculture wireless information project for farmers in 26 provincial districts. This program helped farmer access useful information for efficient planning (Fong cited in Mittal, Gandhi and Tripathi, 2010).

eDiary program of the Information and Communication Technology Agency (ICTA) of Sri Lanka, which was introduced in 2009 enables farmers to request veterinary and extension services (related to issues such as animal health, artificial insemination, milk prices, and construction of dairy stalls) through a simple SMS interface or on touch screen tablets. Farmers type in their personal identification code and the code of the service they need. The request is then sent to all registered suppliers, so they can contact the farmers directly. Farmers usually obtain feedback within a few hours. Prior to this eDairy program ICTA discovered that between 2003 and 2008, more than half of the country's 560,000 milk cows were not in fact pregnant at any given time, resulting in a loss of 30-35 days worth of milk. Low pregnancy rates resulted from a lack of timely access to artificial insemination and breeding services. According to Sri Lanka's Department of Dairy Foods, milk production could be increased by 30 percent if artificial insemination services were requested and supplied in a timely manner. Moreover, the ICTA estimates that farmers could earn an additional $262 per calf each year (Qiang, cited in Halewood and Surya, 2012).

In Ghana, 'Ghana Trade Net' a trading platform allowed farmers to sign up for Short message Service (SMS) for commodities and market information where farmers can sell their produce of their own choice. Furthermore, farmers could request and obtain actual and real prices about different commodities from different markets across West Africa. The Ghana Agricultural Producers and Traders organizational is a major beneficiary in 2006 this organization purchased products from farmers by using email or mobile phone contact to farmers. This organization purchases items like tomato, onions and potatoes (Oladele, cited in Chhachhar & Hassan, 2013). In a study conducted in Niger during a period from 2001 to 2006 found that the introduction of mobile communication had reduced grain price dispersion by 6.4% and reduced price variation by 12% over the course of one year. Further, the study notes that the benefits of mobile communication tend to be greater in markets that are more remote (Aker cited in Halewood and Surya, 2012).

In Indian context mobile communication has played a significant role in farmer's daily business by providing agricultural related information on modern farming techniques and market prices. The mobile communication agricultural services are also obtaining an enthusiastic response from the farming community (Chhachhar & Hassan, 2013). Several NGOs, mobile service provider and government organizations collaborate and provide a platform for farmers to access agricultural related information. For instance, IFFCO Kisan Sanchar Limited (IKSL) and Reuters Market Light (RML) provide Indian's farmers information on market price, weather report, crop advisory, fertilizer availability etc.

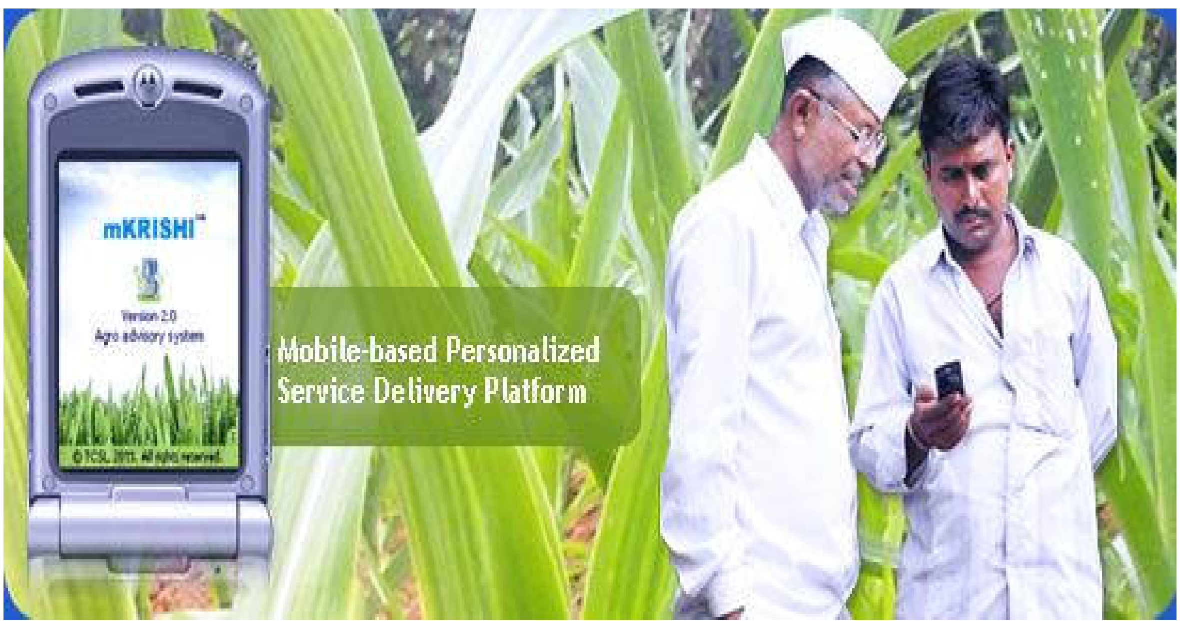
3.3.1 List of mobile communication base application for agriculture active in India

M-Krishi: initiated by Tata Consultancy Service in 2007 to deliver customized advisory services to farmers on crop productions, market information, weather forecast, etc. using voice and visual communication through mobile phone either in English or regional language. The purpose of m-Krishi is to achieve the following goals-

- To reach farmers individually to understand their needs.
- To enable farmers to receive important information about pesticides, fertilizer and soil and water conservation.
- To provide critical micro-climate, weather information in order to plan farming operations
- To facilitate better production and cultivation practices
- To improve access to markets, reining the associated economy

Under this project different kinds of sensors are installed in a farmer's field to collect information on soil humidity and weather conditions. The information related to crop, soil and micro-environment, gather by sensors, is sent to a central server using the cellular network. M-Krishi work on an automated frequently Asked Questions database to respond to the farmers questions. More specific or sophisticated questions that cannot be answered automatically are forwarded to ten experts with internet access. These experts interact with a system that resembles e-mail; there they are able to see attached photos and soil sensor information with each message and their response is sent back to the farmers by SMS. Farmers received responses to their queries through the same channel within 24 hours.

M-Krishi is also adaptable to illiterate farmers who can make a query from a mobile phone using voice-specific functions. The platform is capable of providing personalized advice on pesticides, insecticides, soil, weather, water management, market price, government policies, financial aspects, transportation, and other topics, very specifically for each farmer. M-Krishi also uses farmer feedback to validate information from disease models (Pande cited in Brugger, 2011).



Pix Source: Tata consultancy Service Limited

Fig. 3.3.1.1: Screen shot of mkrishi a mobile base application for agriculture

Kisan Call Center: The Department of Agriculture & Cooperation (DAC) at the Ministry of Agriculture launched Kisan Call Centers in 21st January 2004 across the country. The objective of the KCC has been to make agricultural knowledge available at free of cost to the farmers as and when desired. The calls are received at 13 call centers where in 116 Agriculture Graduates attend to answer the query of the farmers in the local language. 123 experts located in different parts of the country at State Agriculture Universities, ICAR institutes, State department of Agriculture, Horticulture and other developments are answering the calls at level-II.

Table 3.3.1.1 List of KCC operating in the country

SL.No	Call center location	States covered
1	Mumbai	Maharashtra, Goa, Daman, Diu
2	Kanpur	Uttar Pradesh, Uttaranchal
3	Kochi	Kerala,lakshwdeep
4	Bangalore	Karnataka
5	Chennai	Tamil Nadu, Andaman & Nicobar
6	Hyderabad	Andra Pradesh
7	Chandigarh	Chandigarh, J&K, Himachal Pradesh, Punjab
8	Jaipur	Rajasthan
9	Indore	Madhya Pradesh, Chattisgah
10	Kolkata	West Bengal, Bihar, Orissa, Jharkhand
11	Kolakata	N.E states
12	Delhi	Delhi, Haryana
13	Ahmedabad	Gujarat, Darda & Nagar Haveli

Source: Ministry of Agriculture Government of India

IFFCO Kisan Sanchar Limited (IKSL): Indian Farmer Fertilizer Cooperation Ltd (IFFCO) partnered with Bharti Airtel to form the joint venture IKSL in 2007. This company provided information on market prices, farming techniques including dairy and animal husbandry, weather forecast, rural health initiatives and fertilizer availability, etc. IKSL sends 5 free daily voice updates except Sunday in local language so that illiterate farmers can also benefit. The project also runs a 24 hour helpline to answer farmer's questions. Content is developed with inputs from agricultural universities, expert, and government departments.

IKSL is mainly targeting the 55 million farmers who are members of IFFCO. The service is marketed as part of specialized mobile tariff package only on Airtel network with an IFFCO Kisan branded SIM card. The farmers pay a one-time activation fee for the SIM card. After that, voice mail service is free, helpline queries are charged at 1Rp/min

Avaaj Otalo (Literally "voice stop"): it is a system for farmers to access relevant and timely agricultural information over the phone. The system was designed in 2008 through collaboration between IBM India Research Laboratory and Development Support Center (DSC), an NGO in Gujarat. It is an interactive, on-demand informational resource project that would complement a weekly Gujarati radio program produced by DSC targeting small and marginal farmers. By dialing a phone number and navigating through simple audio prompt, farmers can record questions, review and respond to others, or access content published by agricultural experts and institutions. The project has a Question and Answer Forum, Announcement Board and Radio archives. Question and Answer Forum allow users to record a question, provide an answer, or browse the existing list of questions and answer. After recording a question, the farmer could call back later to check for responses. The announcement board announced information relating to agriculture, animal husbandry relevant programs, market prices and weather. Radio archives facilitating farmer to listen to the miss episodes of the radio program by browsing.

mKishan: mKishan SMS Portal for farmers enables all Central and State government organizations in agriculture and allied sectors (Including State Agriculture Universities, Krishi Vigyan kendras, Agromet Forecast Units of India meteorological Department, ICAR Institutes, Organization in Animal Husbandry, Dairying and Fisheries etc.) to give information, services, advisories to farmers by SMS in their language, preference of agriculture practices and location throughout the length and breadth of the country.

The project is designed and developed by the Department of Agriculture and Cooperation to outreach of scientist, experts, and Government officers posted down to the block level to disseminate information, give advisories and to make available advisories to farmers through their mobile phone.

Value added services such as Unstructured Supplementary Service Data (USSD), Interactive Voice Response System (IVRS) and pull SMS are employed in this project to enable farmers and other stakeholders not only to receive messages but also to get web base service on their mobile without internet. Semi literate and illiterate farmer have also been targeted to be reached through voice messages.

Reuter Market Light (RML): RML provides through SMS on market prices, weather conditions, and crop advisory services to farmers in India. To subscribe, farmers call a toll-free number to activate the service in the local language and specify the crops and markets in which they have an interest. Farmers received four to five SMS alerts with relevant information each day. It delivers customized information to India's farming sector covering over 250 crops, 1000 markets and 3000 weather locations across 13 Indian states in 8 local languages.

India: Nano Ganesh: Nano Ganesh is a mobile phone base technology for irrigation control. Indian mobile operator Tata Teleservices partnered with agro-automation company Ossian to enable farmers to monitor and switch on irrigation pumps remotely, using a low-end Nokia phone and mobile modem called 'Nano Ganesh' which is connected to the electric starter of the pump. Since the system provides audio feedback, illiterate farmers can also use it. The need for the technology rooted from India's irregular power supply; farmers routinely walk several kilometers to water their crops, and to find out electricity available to power their irrigation pumps. Through Nano Ganesh, farmers can dial a code from any phone to a mobile modem attached to the pump's starter. This informs them whether electricity is available, and allows them to remotely switch the pump on or off. The system helps to save time, water, and electricity/fuel (Brugger, 2011).

3.3.2 Success story of application of mobile communication in agriculture

3.3.2.1 Success story 1: Jagadeesh a farmer from Khanvaas village, Rajasthan owned 9 acres land sharing between three brothers. He used IFFCO Kishan Sanchar Ltd (IKSL) for enhancing his agricultural activities. For the service, he got benefits for cost savings from avoiding potential crop loss and increased revenue from higher yields.

By the weather information received from IKSL, Jagadeesh acted on timely to protect a harvest crop used for livestock fodder which was lying on the field exposed to rain. He estimated that he would lose 50 per cent of his crop, resulting in a loss of between Rs 5000 to Rs 6000.

He utilized information provided by IKSL concerning planting techniques and disease control to make changes in his farming practice. He shifted his agricultural practice from 'guess-based' actions to modern scientific cultivation practices. He attributes a 25 per cent increase in annual earnings, from Rs 100000 to Rs 125000.

Source: Indian Council for Research on International Economic Relations.

3.3.2.2 Success story 2: The farmer in the Arphal village of Maharashtra has owned 3-6 acres of land. The farmers of this village used RML service, from this service they were able to increase revenue by matching production to market demand. They had been engaged in horticultural cultivation for the past two years. Flowers are a highly perishable commodity and farmers monitor production and harvesting closely to minimize waste. The farmers received information from RML about a predicted increase in the market demand for their crop. They applied a special fast growth tonic to increase production and thus capitalized on the information received to increase their sales.

The farmers reported that the amount of daily supply taken to the market is between 800-1200 flower sticks, depending on demand. In the absence of market information, they typically would take fewer than 1000 sticks per day. These farmers have now started to adjust the quantity of output they bring to market as a result of RML market demand information, offering potential for increased revenues on high demand days.

Source: Indian Council for Research on International Economic Relations.

3.4 Mobile Communication and Rural Health Sector

Health sector in rural areas is very ill-fated; problems are varied, range from poverty, education, negligence of the health service provider and lack of health institution and infrastructure. Rural people are less aware about the health issues and the health facilities providing to them are less accessible. Due to poverty and lack of knowledge on health, rural people are less considers to their health problems.

As per National Rural Health Mission Report-

- 700 million people live in 636000 Indian villages
- Majority of the people die due to preventable diseases like diarrhea, measles and typhoid
- 66% of rural Indians do not have the access to the critical medicines
- 31% of the population travels more than 30Kms to seek healthcare in rural India

Developing health sector of rural areas is pivotal since there is a noteworthy contribution of rural people in developing of the nation. To improve the health services and to control the spread of diseases and to reduce infant mortality rate and maternal mortality rate due to lack of adequate health services, special attention needs to be given to the health sector of rural areas. The government of India also initiated various policies and programs for the development of rural health sector, but the success and effectiveness of these programs is questionable.

The health problems faces by rural people can be healed-up through Information and Communication Technologies (ICTs) like mobile phone, email and internet. Mobile phone through its multi-media functions have the potential to narrow down the health problems face in rural areas. Through mobile phone one can access to email and internet and other more mobile apps services. Recognizing the potential of mobile communication in the health sector, several organizations and government used mobile communication in the strategy for rural health planning. Under National rural Health Mission mobile phone is distributed to ASHA for facilitating communication with villagers and health professionals. For instance, the Ministry of Health and Family Welfare, Government of India also initiated mobile communication base health service delivery systems known as Mother and Child Tracking System (MCTS). MCTS used Short Service Message (SMS) to communicate with grass roots level health care service providers, health managers and health administration at different tiers of the health care delivery system. MCTS ensure delivery of the full spectrum of health care and immunization services to pregnant women and children up to 5 years of ages. A women registered in MCTS has the facility to know which of the scheduled services she has received and which of the maternal care services she still required. Similarly, parents of a child can get information about vaccines the child has already received and details of the vaccination due. In the year 2012-13, 3.8 million pregnant women and 2.2 million children have been registered (Yojana, 2012).

Another evidence for application of mobile communication in the health sector is in a program initiated by Gram Vaani, an organization which is employing mobile communication technology in several health care projects. In partnership with the White Ribbon Alliance for safe Motherhood, for a program of Merck for Mother, Gram Vaani is working to enhance the quality of maternity healthcare in India. Under this program, build up a quality-of-care checklist for expectant mothers and their families to answer using mobile communication and rate of factors such as whether they were treated with respect during the delivery, whether they got entitlement for institutional delivery, whether the transportation provided was of good quality etc. As a part of another health care program Ananya in Bihar, Gram Vanni with NGO's PATH and PCI, are mobilizing communities using voice technologies to demand greater accountability from the health delivery infrastructure. Through simple education and discussion programs on mobile phone, Gram Vaani makes the marginalized communities aware of best practices in healthcare and sanitation, and about their rights and entitlement from the health delivery system. The community members are also encouraged to engage and share their stories with each other on Gram Vaani open mobile platform.

As a part of United Nation Millennium Development Program mobile base text messaging is used to identify malnutrition among rural children in Malawi using a system called Rapid SMS. Through this system, health workers in rural areas were able to send weight and height information in two minutes instead of the two months needed under the previous system. The data entry error rate was significantly improved to just 2.8 percent from 14.2 percent in the old system. The improved information flow facilitates experts to analyze data more quickly and accurately, identify children at risk, and provide treatment information to the health staff in the field (Minges, 2012). In Kenya weekly text messages were sent to AIDS patients to remind them to take their antiretroviral drugs. Those who received the text messages had significantly higher rates of taking the drugs than those who did not receive them. The study noted that SMS intervention was less expensive than in person community adherence interventions on the basis of travel costs alone and could theoretically translate into huge health and economic benefits if scaled up (Minges, 2012). In China's Guangdong and Guizhou Provinces, China Mobile is working with partners to provide rural areas with medical services and information through intelligent self-service terminals connected via fixed and 3G/GPRS mobile networks. The self-service terminal systems have been developed to deal with a shortfall in medical resources, particularly in rural areas; the vast majority of both provinces' healthcare services is confined in cities. The terminals are helping to spread healthcare knowledge among people in remote rural areas, and providing a healthcare consultation platform and service acquisition channels.

3.4.1 Success story on Mobile Communication for Rural Health

3.4.1.1 Success story 1: mHealth Fighting Malnutrition

In Melghat tribal hilly region of Maharashtra, every year 400-500 children between the ages of 0-6 yrs die due to lack of medical service and adequate nutritional support. Increased and rapid spread of infectious diseases such as pneumonia, typhoid and dysentery are the primary cause of high child mortality in this region. During monsoon the situation worsens when the food supplies are low and the communicable diseases are at their peak. Some factors for the health crisis in Melghat include lack of infrastructure, under-equipped and under-staffed public health and ICDS centers, the tradition of early marriages and early motherhood, lack of sanitation and clean drinking water facilities and the tribal's blind faith in quacks.

World Vision India provides mobile phone pre-loaded with mobile application "Commcare" to the community health workers of Melghat. This community health worker registers woman's name and other details through this application whenever pregnancy is reported. Once the register is done, the women's expected delivery, check-up and immunization dates are made available to the health workers. The phone also has pre-recorded messages on maternal and child health care that can be played for the women. Once data are collected, it is saved on a central server of World Vision India. The information then helps in monitoring the health of pregnant women, lactating mothers and young children. To change the health scenario of this region government attention is necessary. Government should focus on delivering of basic health services through mhealth/telemedicine.

Source: healthcareindia-drruchibatt.blogspot.in

3.4.1.2 Success story 2: Delivering Patient HIV/AIDS Care

South Africa has the worst HIV/AIDS epidemic in the world, with more than 56 million population of the country were living with HIV/AIDS. In 2004, the government of the country began supplying anti-retroviral drugs, by 2006, 33 per cent of the people living with HIV/AIDS were receiving this drug. Poor health infrastructure and disparate system of rural clinic make consistent anti-retroviral treatment (ART) and patient monitoring extremely difficult. HIV/AIDS patient living in rural areas has to travel long distance to reach hospital. Frequently, they encounter a day-long wait as under-staffed and under-resourced. Sometimes hospitals run out of the necessary drugs to cope with the high demand and patients return home without medications.

Cell-Life, a non-government organization based in Cape Town, South Africa, developed its “Aftercare” program to work with the public system and its health workers to provide home-based care for HIV/AIDS patients receiving ART. The mobile technology-based Aftercare program supports the effective treatment of HIV/AIDS patients, and covers other aspects such as voluntary counseling. Each Aftercare worker is assigned to monitor 15 to 20 patients. The health workers visit the patient home and discuss the patient’s current treatment. Through mobile phone “Aftercare” workers record data and information about patient’s medical status, drug adherence, and other problems that may affect a patient’s ART therapy.

Aftercare workers then send this information via text message to a central Cell-Life database. The text message reaches the Cell-Life server, where a care manager uses a web-based system to access and examine the incoming patient information. The manager can also respond to Aftercare worker’s question and provide addition information to improve patient care. The information collected not only facilitates individual patient care, but is also used to build a database of information on the severity and prevalence of the South Africa AIDS epidemic in this region. The initial result of the Aftercare program indicates that the quality of care for patients has improved. A Women's Net and UNICEF report, Aftercare as "one of the most experienced initiatives combining mobile phone technologies and AIDS management.

Source: www.unfoundation.org/vodafone

3.6 Mobile communication and Education

Education is the healer of all the problems and issues which is come across in the path of development. It is a treasure of knowledge and without it, delays in development. Education is a major determinant in the achievement of demographic goals, be they the reduction in infant mortality rates, maternal mortality rates or the fall in female fertility rates (MHRD). The importance of education in nation building was recognized as crucial input, to achieve this objective National Literacy Mission (NLM) was set up by the Late Prime Minister of India, Shri Rajiv Gandhi in 1988. Further, to strengthen the goal of nation building, the Government of India has announced education as a fundamental right; hence Right to Education (RTE) Act 2009 came into effect on 1st April, 2010. The Act provides free and compulsory education to all children in the age group of 6-14 years (MHR, 2013). The Millennium Development goal of UN also aims to achieve universal primary education for children everywhere, boys and girls alike by 2015. Despite of all the efforts for development of education, challenges still remain. In developing countries, on average, only 54% of children of the appropriate age attend secondary level of schooling (UN, 2008). In India, according to 2011 census literacy rate of rural India is 58.7% compared to 79.9% of urban areas. The education sector of rural areas in comparison to urban areas is very unfortunate. Due to poverty and infrastructure constraint rural areas is far lack behind in education comparing to urban areas. Inadequate educational institution, lack of teachers or negligence of teachers in going to rural areas, poor road and limited public transportation, lack of educational grant or aids etc. are the problems faced in rural education sector.

Disparities in delivering of educational service between rural and urban continue to pore a major barrier in developing education in rural areas.

To some extent, the gap in establishing a good education system in rural areas can be mend-up by ICTs like computer, internet, email and mobile phone, etc. ICTs have the potential to empower teachers and learners by facilitating communication and interactions, offering new modes of service delivery mechanism, and in creating monitoring system. Mobile phone which is easily accessible in rural areas has the greater impact on advancing education system in rural areas. Through mobile phone one can access to internet and email which is the emerging key ingredients in teaching and learning process. Considering the importance of mobile phone in advancing education system, India launched its locally manufactured 'Aakash' tablet in October 2011 for widespread distribution in school. Through mobile communication teachers could contact parents to enquire about their child's whereabouts (Puri cited in Minges, 2012). Mobile phones have also been used in Uganda to track school attendance so that school administrators can see patterns in attendance, for instance by village, by day of the week, and by season. Tracking attendance for pupils indirectly also tracks absenteeism among teachers (Twaweza cited in Minges, 2012). As a program of Millennium Development Goal, a survey of teachers in villages of four African countries was conducted. According to survey one-quarter of teachers reported that the use of mobile communication helped increase student attendance.

3.6.1 Case study on enhancing education through mobile communication

3.6.1.1 Case study 1: Improving Literacy in Rural India: Cell phone Games in an After-School Program

The 'After-School Program' is a mobile phone base project for learning English language. Children from rural areas and low-income families were selected for the project. A qualifying test was conducted to ensure that children have the basic knowledge of numeracy to utilize mobile keypad as well as elementary school level literacy so that the project could target more advanced English education. In addition to this Hindi language test was also conducted.

With the support of an Indian ESL teacher, a syllabus was developed. The project targeted listening comprehension, word recognition, sentence construction, and spelling. The program consisted of 2-hour sessions that spanned 38 days. Evaluation of the project was based on pre and post-tests, which specifically targeted spelling. The project's results reveal an overall average increase in the score results between the pre- and post-tests; the mean pre-test score was 5.2 out of 18 while the mean post-test score was 8.4 out of 18.

The project authors noted the importance of the pilot project was to explore the potential that mobile phones present for out-of-school learning. The authors indicate that mobile phones provide the platform for a modality of learning that can complement formal education, one that can prove more convenient for low-income children who often have to stay at home to help their families. The project's authors also indicate that mLearning can provide enhanced learning for children in public schools in India plagued by teachers who lack adequate qualifications or who put little effort into teaching because of sentiments that pay is insufficient. The findings thus indicate that rural children who have a stronger academic foundation are better able to take advantage of the benefits afforded by mobile phone-based learning.

More attention and further research is necessary to understand how mLearning software can provide the support needed by children with less academic preparation. In regards to the particular software employed in this pilot project, the authors of the project indicate that the software could be redesigned to track learner performance to ensure that the program is personalized to the individual learners' level of knowledge and need for feedback.

Source: Kam, Shrirley, Mathur and Canny, cited in Valk, Rashid and Elder, 2010)

3.6.1.2 Case study 2: Mobile Telephone Technology as a Distance Learning Tool in Bangladesh

This pilot project investigated how mobile phones could be used to introduce interactivity and thus overcome the challenges plaguing traditional distance education in

Bangladesh, including a lack of interaction between presenters and student, a lack of feedback during presentations, no monitoring of student progress throughout the course, and no evaluation of teaching quality. Given that the cost of Internet bandwidth is high and that there is a lack of infrastructure to facilitate chat room technology or video conferencing, here mobile phones presented a promising alternative.

The project simulated a typical distance education course broadcast on the Bangladesh national television network, but included the added dimension of interaction between instructor and students via SMS technology. Fifty-two students were divided into two groups: the control group, in a room face-to-face with the instructor, and the experimental group, in a room with a projection screen on which they could watch the instructor. Those in the latter group could raise and respond to questions via SMS. To examine outcomes, the two groups were each given the same pre-test and post-test, with the face-to-face group answering the questions by pencil and the other group answering via SMS.

A t-test of the post-test scores reveal that mobile-based learning was at least as effective as face-to-face learning. This result, according to the project's authors, indicates that mobile-based learning provides a feasible alternative, one that might be particularly attractive given educational access issues in Bangladesh.

Source: Islam, Ashraf, Rahman, & Rahman, cited in Valk, Rashid and Elder, 2010

3.7 Mobile communication and Governance

In the above sub-topics the ability of mobile communication in the development of agriculture, health, education for development is discussed. In this sub-topic the potential of mobile communication in enhancing government service delivery mechanism is focused. The government has made efforts and initiated various schemes and programs for rural development. However, all the efforts made by government for developing rural areas does not reach the anticipation level. Hundreds of cores are sanctioned for rural development programs, but still delay in development. The reason for the failure of all the efforts made by the government is enormous. Some possible factor might be, existing programs are inappropriate to the rural people, wrong strategies for implementation of the program, the communication gap between the rural people and the government machinery, or lack of participation of rural people in development program or lack of participation of rural people in designing development program. Intermediary bias is also a problem in the implementation of the development program.

The challenges of governance come across in the development process can be addressed through mobile communication. It has the potential for enhancing service delivery mechanism of government and can facilitate communication between government and public. In present generation mobile communication is the fastest means of communication. It has the ability to deliver information or service to every door step of public without time constraint. SMS for public utility services initiated by Mysore government is an example of capability of mobile communication for good governance. In 2008, Mysore's municipal authorities have distributed some mobile phone number on which the citizens can SMS their grievances related to public utility services. The State government has set up a system wherein residents' complaint can be received by SMS and will be addressed within 24 hours. The system allows the complainant to call on a toll-free number regarding any civic problems. The software automatically shoots SMSes to the area engineer and contractor responsible for maintenance of water supply, drains, roads or garbage collection. After the officials receive a massage on the given cell number, an acknowledgment is sent back to the concerned person using SMS in which the name of the officials is mentioned along with the duration in which the problem is expected to be sorted out (Tomar, 2011). Mobile communication can encompass the problems of illiterate and semi-literate. Moreover, it is the only interactive media, which can be easily affordable by rural people. For accessing to internet or email either mobile phone or computer is required. Computer is expensive and in existing economic condition of the rural people it is hardly affordable by rural people. Mobile phone on the other hand is cheap and includes various multimedia features. Hence, in the context of rural areas mobile phone will be of great significant impact on development purposes.

Realizing the potential of ICTs the Government of India launched National e-Governance Plan (NeGP) on 2006, to enhance the service delivery mechanism of government and to create transparency and accountability in government service. To boost up the NeGP the government of India recently launched "Digital India" with a vision to transform India into a digitally empowered society and knowledge economy. In rural India, where there is poor economic power to afford a computer or laptop, mobile phone has the power to show technological miracle in government service delivery. Government should take up more initiatives to designed mobile base application to monitor and to take feedback on various schemes and programmes implemented in rural areas. Most of the rural people are unaware about the development schemes and how to access to it. Negligence or bias of the local level government representatives and taking time and bribe to access to the schemes often made the rural people less interest to the schemes. Such problems can be overcome by appropriate designing of mobile application which can deliver the developmental schemes on the door step of the citizen.

3.7.1 Mobile Application for governance operate in India

- The Government of India has employed SMS service in Mid Day Meal Scheme for school children, to instantaneously communicate between school Headmaster/Headmistress and Education Director. The system facilitates to disseminate information about funds released about the scheme and other details such as the amount released per head of the student. Many awareness programmes are being organized to make the Mid Day Meal scheme successful. Such awareness program give instruction on things like what the kids should be doing before going for mid day meal etc. The system facilitates the School Education Director to conduct such awareness program for successful implementation of the scheme through SMS.
- National Health Portal (NHP) has launched "NHP Health-Directory Services" a mobile phone base application to benefit the Indian citizens. This application has a database of hospitals and blood banks across India. The user friendly application accesses the user location and enables a person to find nearby hospitals and blood banks. The user has the option of accessing the list of

hospitals/blood banks by selecting the minimum distances of 5 kms and maximum up to 100 kms.

- Mother and Child Tracking System a mobile base application initiated by the Ministry of Health and Family Welfare Government of India. This application facilitates to communicate with grass roots level health care service providers, health managers and health administration at different tiers of the health care delivery system through SMS.
- Election Commission of India has launched a major initiative of 'Electoral Poll Search' at national level. Using this service the voter can find information related to polling stations in nation-wide electoral rolls. This service can be accessed through internet or mobile phone, tablets or computer and SMS.
- mKishan SMS Portal for farmers enables all Central and State government organizations in agriculture and allied sectors (Including State Agriculture Universities, Krishi Vigyan kendras, Agromet Forecast Units of India meteorological Department, ICAR Institutes, Organization in Animal Husbandry, Dairying and Fisheries etc.) to give information, services, advisories to farmers by SMS in their language, preference of agriculture practices and location throughout the length and breadth of the country.
- The Department of Agriculture & Cooperation (DAC) at the Ministry of Agriculture launched Kisan Call Centers in 21st January 2004 across the country. The objective of the KCC has been to make agricultural knowledge available at free of cost to the farmers as and when desired.
- Ministry of Rural Development Government of India launched mobile application based 'Quality Monitoring System' for Pradhan Mantri Gram Sadak Yojana. The system facilitates to monitor the quality of road, to capture the inspection details along with geo-tagged photographs and can be uploaded immediately after the completion of the inspection. The application was launched in 26th December, 2012 by Secretary rural Development Government of India.

Fig. 3.7.1.1: Screen shot of PMGSY mobile base quality monitoring system

3.8 Mobile communication and rural livelihood

Agriculture is not the only means of livelihood for rural people. Besides agriculture, there are various occupations in which villagers are engaging. This non-agricultural occupation includes carpenter, weaver, craftsman, pottery, blacksmith, labourer etc. The income generates from non-agricultural occupation has increased from nearly 32 percent in 1993-94 to over 42 percent in 2009-10 (NSSO, 2011). The non-agricultural occupation is still out of the sight of government or NGOs. Vocational training and skill development training are very less in rural areas. Villagers who own agricultural land also engaged in other occupation after the agricultural season ends. Due to lack of secure job villagers are forced to combine different occupation in a desperate bid to survive. Villagers are also seeking an alternative job in town to escape from rural confines. Moreover, they see little hope in their traditional occupation for survival. Majority of the villagers who migrate to urban areas are overwhelmingly from the poorer, uneducated and un-skill group. They face a range of problems in searching job, especially, for those villagers who are newly migrating to urban areas. In search of a job they are wandering in urban areas and also earned little amount. Half of their earnings are expending in fooding or lodging or in travelling costs. On the other hand, for those villagers who are confined in rural areas and engaged in non-agricultural occupation also face the problems of lack of raw materials, new tools for large scale production, lack of financial support, market and transportation etc.

Mobile phones contribute to reduce poverty and improve rural livelihoods by expanding and strengthening social networks, increase people’s ability to deal with emergencies, cut down travel costs, maximizing the outcomes of necessary journey, increase temporal accessibility, and amplify the efficiency of activities (Sife, Kiondo and Macha, 2010). Mobile phones can improve access to and use of information, thereby reducing search costs, improving co-ordination among agents, and increasing market efficiency (Aker and Mbiti, 2010). Through mobile communication villagers can improve their main source of earning for livelihood. Mobile communication can facilitate in expansion of market, reduce travelling costs, access to credit, expansion of communication network and provides with greater job opportunity.

Mobile communication also benefits those rural dwellers that work and earn by searching job for a particular day. They often migrate in urban areas in search of jobs. Mobile communication provides them an opportunity in searching jobs, which resulted in reducing travel cost for searching jobs and physical energy. Mobile communication facilitates them in the expansion of their communication network and provides them with greater job opportunity. Through mobile communication they are able to organize in a group and take orders instead of searching. Mobile communication increased their bargaining power and economic level. Therefore, mobile communication provides an opportunity in enhancing the economic power and social status of the rural people.