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ROLE OF ICT IN INDIAN AGRICULTURE SECTOR

Parmod Kumar

H.O.D., Department of Commerce, Govt. College, Mokhra (Rohtak)

Abstract:-Information and Communication Technology (ICT) is currently being used in agriculture to know about the weather, soil condition, market rates of crops, seeds and pesticides. Filling the stomachs of about 9 billion population by 2050 is the main challenge before the agriculture sector and this target can be achieved with the help of mechanized agriculture which is possible with the intensive use of Information and Communication Technology in agriculture. Improved agriculture also has a direct impact on hunger and malnutrition, decreasing the occurrences of famine, child stunting and maternal infirmity. Increasing size of population and decreasing size of cultivable area due to increased use of cultivable land for urbanization and for industries make it necessary for mechanization of agriculture equipments with artificial intelligence. The major bottlenecks in use of ICT are poor bandwidth, slow speed of internet connections, lack of knowledge about the use of ICT among the farmers, small size of farms etc. Some of the above mentioned problems can be sort out by providing proper training to farmers about the use of ICT and initiatives of government to provide fast internet connections and proper bandwidth in rural areas while other can be solved by awareness for pooling of land with other farmers to increase the size of farms. The use of ICT not only empowers individual users rather it enriches their lifestyle & livelihood and boost the economy as a whole.

Keywords: Information and Communication Technology, Agriculture, Internet, Bandwidth, Crop, Seed, Fertilizers etc.

INTRODUCTION

Agriculture is one of the most important sectors in India and could provide tremendous benefit in bringing changes to socio-economic conditions of poor in backward areas with the application of Information and Communication Technology (ICT). Agriculture still constitutes a major livelihood sector and contribute one fifth share in nation's GDP. Even after years of industrialization and growth in services, about 65 percent population still depends upon agriculture for their livelihood. But agriculture in India depends upon the rainfall and weather conditions upto a large extent and most of the people residing in rural area earn their livelihood from rain-fed agriculture. Farmers in rural areas have to deal with failed crops and animal illness frequently and due to limited communication facilities, solutions to their problems remain out of reach. Information and Communication Technology is currently been used in agriculture to know about the weather, soil condition and to know about market rates of crops, seeds and pesticides. Updated information about the market rates helps the farmers to take advantages of the rising prices and to take necessary safeguards against the falling prices in the market. Filling the stomachs of about 9 billion population by 2050 is the main challenge before this sector and this target can be achieved with the help of mechanized agriculture which is possible with the intensive use of Information and Communication Technology in agriculture.

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Table 1. Share of Agriculture and its allied activities in total GDP at factor cost

Year	1950-51	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
% Share at current Prices	51.8	19.0	18.8	18.3	18.3	17.8	17.7	18.0	17.5	17.3
% share at 2004-05 prices	51.9	19.0	18.3	17.4	16.8	15.8	14.6	14.5	14.1	13.7

Source: - CSO year book

Table 1 show that the share of agriculture activities in nation's GDP ranges from 19 to 17.3 percent during the period 2004-05 to 2012-13 which was 51.8 percent during the year 1950-51. Hence, there is substantial reduction in the share of agriculture and allied activities in GDP of the nation. Agriculture accounts for the vast majority of the poor's livelihood activities; it is also the sector that holds the most promise for pro-poor economic growth. In fact, agriculture is around four times more effective in raising incomes among the poor than other sectors (World Bank 2008). Improved agriculture reduces the hunger and malnutrition more speedily in comparison with the improvement in industrial and service sector. The agriculture sector is overburdened due to sharp increase in population. The marginal productivity of farmers is reducing due to limited availability of cultivable land and stagnation in the productive capacity of land.

Table 2: Population and Agricultural Workers (in millions)

Year	Total Population	Rural Population	Agricultural Workers		
			Cultivators	Agricultural Labourers	Total
1951	361.1	298.6 (82.7)	69.9 (71.9)	27.3 (28.1)	97.2
1961	439.2	360.3 (82.0)	99.6 (76.0)	31.5 (24.0)	131.1
1971	548.2	439.0 (80.1)	78.2 (62.2)	47.5 (37.8)	125.7
1981	683.3	525.6 (76.9)	92.5 (62.5)	55.5 (37.5)	148.0
1991	846.4	630.6 (74.5)	110.7 (59.7)	74.6 (40.3)	185.3
2001	1028.7	742.6 (72.2)	127.3 (54.4)	106.8 (45.6)	234.1
2011	1210.6	833.5 (68.8)	118.7 (45.1)	144.3 (54.9)	263.0

Source: -Registrar General of India
Note: - Figures in parentheses represent percentage.

The table 2 shows that, total agriculture workers have been increased from 97.2 million to 263 million during the period 1951 to 2011 which shows the increased pressure of population on land available for agriculture. Also the percentage of agriculture labourers is increased from 28.1 percent to 54.9 percent of total agricultural workers. With the increase in population, this pressure will increase in future as well but the marginal productivity in agriculture is lower than the marginal

productivity in industries and service sectors. Hence, there is an urgent need for ICT based mechanization of agricultural activities to increase the per person productivity.

REVIEW OF LITERATURE

Shaik et al. (2004) in their study examined the performance of three ICT projects in India. The projects have quite different origins and purposes but all are concerned with improving the delivery of information to farmers and other rural dwellers. It was suggested by the researchers that efforts should be made to incorporate ICT in all endeavours related to agricultural development. The organizations and departments concerned with agricultural development need to realize the potential of ICT for the speedy dissemination of information to farmers. Also the government at national and state level in India has to reorient agricultural policies so that a full-fledged strategy can be formed to harness ICTs potential for assisting overall agricultural development. As part of this process, policy makers should utilized the analysis of the ICT projects given in various studies to acquaint with how such project functions.

Kumar et al. (2012) in his study concluded that the Indian Government is being made a remarkable achievement especially in the area of agriculture by giving various facilities to the farmers in which the ICT services is one among those which are helping the farmers to understand the modern cultivation methods, availability of agricultural inputs, irrigational sources, availability of pesticides and fertilizers for increasing the production and productivity of crops. India is a developing economy and agriculture forms the backbone of Indian Economy. Despite concentration of industrialization, agriculture remains in a place of pride. For a long period of time, Indian rural communities especially farmers are facing number of socio-economic problems. So, the planners and administrators of the agriculture departments of the government must consider the threats faced by farmers to protect the interests of farmers as well as the interest of the nation. By reducing the level of problems faced by the farmers, the nation as a whole will march towards a prosperous future. Sinha (2013) in his paper throw light on the perspective use, scope and advantages of use of ICT in agriculture e.g. in weather forecasting, to know about the soil condition, to know about the prevailing market rates of crops and to use the artificial intelligence for leveling & cultivation of crops etc. The author suggested the intensive use of ICT in agriculture sector to feed the large population base of India and to provide employment to the vast majority of population. The author also suggested for computerization of records of all the landholding to grant the benefits of various schemes launched by the Government of India for the benefit of farmers.

OBJECTIVES OF STUDY

The present study is undertaken to know about the role of ICT in agriculture development of India. The expected advantages, scope, opportunities and challenges of use of ICT in agriculture sector in India are also studied in the present paper.

RESEARCH METHOD

The data for the present study is taken from the secondary source e.g. Yearbook of Central Statistical Organization, RBI Hand Book and IAMAI Data Book etc. Also various web sites, journals and news papers have also been referred to find the effect of use of ICT in agriculture sector of India.

GROWTH RATE IN AGRICULTURE

The table 3 shows that the annual compound growth rate of GDP was 4.26 percent during the period 1951-2000 and 7.07 during the period 2000-13 whereas the growth rate of agriculture and allied sectors was 2.59 and 2.97 percent respectively during the above mentioned period. Hence, the growth in agriculture and its allied sectors is much lower than the overall GDP growth rate. Also the growth rate in agriculture sector is not consistent over the period. Some time it is equal or near to overall GDP growth rate and some time it goes into negative. This trend shows the dependability of agriculture and its allied sectors on other factors like rainfall and weather conditions. However, the green revolution increased the production of wheat and paddy to a substantial level in India and India

become self sufficient to fill the stomach of the existing and future population. But increasing size of population and decreasing size of cultivable area due to increased use of cultivable land for urbanization & industries and uncertainty of weather including global warming make it necessary for mechanization of agriculture equipments with artificial intelligence.

Table 3: Shows the Overall GDP growth rate and growth rate of Agriculture and allied activities

Years	Overall GDP Growth Rate (Percent)	Growth Rate in Agriculture and Allied Sectors (Percent)
2000-01	4.15	-0.01
2001-02	5.39	6.01
2002-03	3.88	-6.60
2003-04	7.97	9.05
2004-05	7.05	0.18
2005-06	9.48	5.14
2006-07	9.57	4.16
2007-08	9.32	5.80
2008-09	6.72	0.09
2009-10	8.59	0.81
2010-11	8.91	8.60
2011-12	6.69 (2nd Revision)	5.02 (2nd Revision)
2012-13	4.47 (1st Revision)	1.42 (1st Revision)
CAGR (2000-13)	**7.07**	**2.97**
CAGR (1951-2000)	**4.26**	**2.59**

Source: Central Statistical Organisation-31.05.2014

The use of ICT can be made in farms for leveling of the farms, for cultivation of crops, to know about the soil condition & need of water and to spray pesticides etc. through automatic machines equipped with Global Positioning System and Remote Sensing facilities. Some ICT based services has been started by some corporations, NGOs and Government Departments to provide necessary information to farmers about the agriculture. Some of the main ICT initiatives in India are as follows (Glendenning and Ficarelli 2012):

- 'Reuters Market Light' (RML) is a mobile-based service started by Thomson Reuters that provides short-message service to subscriber farmers in eight local languages across 13 states over subscribed farmers' phones.
- 'mKisan' portal is launched by Agriculture Department of India which provides all mobile based initiatives in the field of Agriculture and its allied sectors to bring together SMS (both Push and Pull), Interactive Voice Response System, Unstructured Supplementary Services of Data, Mobile Apps and Services.
- The 'Lifeline' project was launched by OneWorld.net in partnership with British Telecom and CISCO in 2006. The Lifeline platform is a project based on a Question and Answer (Q&A) interactive voice-response system.
- 'IFFCO Kisan Sanchar Limited' (IKSL) is a partnership between 'IFFCO' and cellular service provider 'Airtel'. It delivers voice messages with some information similar to that sent by RML, but in addition it also works as a help line. It provides five free daily voice messages to the subscribers of service.
- 'Agriwatch' was started by Indian Agri-Business Pvt. Ltd. to improve rural farm incomes by universalizing access to knowledge & information about agricultural markets and technologies

among farmers of India by providing newsletters, research reports and SMS to them.

- 'Almost All Questions Answered' (aAqua) company was launched by Indian Institute of Technology Bombay with the help of Media Lab Asia in 2006 and it works through a online interactive and open 'Question and Answer' service.
- 'e-choupal' was launched by ITC's Agriculture Division in 2000. It offers the farmers of India all the information, products and services which they need to enhance farm productivity, to improve farm-gate price realization and cut transaction costs. Farmers can access latest local and global information on weather, scientific farming practices as well as market prices at the village itself through its web portal in regional languages. Choupal also facilitates supply of high quality farm inputs as well as purchase of commodities at their doorstep.
- 'Digital Green' is a nonprofit organization with partnership of different NGOs and government agencies like National Rural Livelihood Mission. It generates video contents and upload these videos on a DG platform.
- The 'e-Sagu' platform uses the digital photos of farmers' field to provide expert advice. The local staff employed by e-Sagu takes digital photos of farmer fields and then these photographs are sent to main center for expert advice where these photos are examined by the experts and in turn the experts provide the necessary advice which is sent back to local staff for their information.
- Nokia Life Agriculture Services provide farmers with tailored crop tips, agriculture news, market prices, weather information and advisory via richly formatted messages using SMS as the delivery channel.
- Madhya Pradesh Government has started Gyandoot project.
- M.S. Swaminathan Research Foundation (MSSRF) Pondicherry has introduced 'Information Village' project for the benefit of farmers and local public.
- ISRO has started the program of 'Training of Field Extension Workers in Rural Area' with the help of satellite communication network.

Some exclusive agricultural portals are also available, such as:

- haritgyan.com
- agmarknet.nic.in
- mkisan.gov.in
- krishiworld.net
- hortnet.gov.in
- dacnet.nic.in
- dackkms.gov.in
- agriwatch.com
- acquachoupal.com

The current era is era of ICT and government can take advantage of ICT in agriculture sector to enhance the productivity. The agriculture sector can play its crucial role in poverty eradication and to cope up with the problem of unemployment. But one can see that most of the above projects have been started by private organizations, corporations and not-for-profit organizations. Government has started only a few programs for use of ICT in agriculture which shows the apathy of government to take advantages of intensive use of ICT in agriculture and its allied activities. The ICT can be used for formulation of future plans for overall agricultural development by adopting the world's best practices implemented into agriculture sector.

Expected uses of ICT in Agriculture

ICT can be used in agriculture sector to meet several objectives and some of the main objectives are as follows:

- To maintain the computerized record of land records to take the advantages of various schemes.
- To know about the weather condition, Soil Health and expected rainfall in a particular region.
- To know about the spread of crop diseases in a particular region.
- To know about the prevailing demand, supply and rates of crops in the market.

- To spread knowledge of technologies, crop cycle and suitable use of fertilizers etc.
- To develop local contents and create awareness among farmers.
- To know about the prevailing and expected rates in commodity markets and know about the impact of futures & options on the prices of crops in present and future.
- It enhances the profitability of agriculture sector by increasing the public investment in agriculture.
- To improve hassle free access of financial and banking services for the benefit of farmers.

Scope and Limitations of ICT

Out of total population, active mobile subscription is 886 million in July, 2014, which is 70% of the total population (active connections as a percentage of total population). Further at present 106 million persons are active social media users in India. But the rural subscriber base is merely 36 percent of total subscriber base in India whereas about 70 percent population resides in rural areas. In urban areas the percentage of teledensity is 168 percent means every subscriber has one and half connection but the teledensity in rural area is merely 46 percent. Out of the population of 1,256 million there are 213 million internet users in 2013 means out of every 5 Indians only 1 is connected to the internet. But the pace at which the internet users are increasing in India is exciting. In last 6 months there are 16 million new users which are 14% of the total internet users. Though India is seeing tremendous growth in user base of mobile internet but the internet speed is extremely slow. According to a study, India has the slowest Internet in Asia. Internet speed of 4Mbps or higher constitutes only 6 percent of total Internet users in the country.

Table 4: Showing the status of Teledensity and Internet Users in India

Sr. No.	Particulars	F.Y. 2010	F.Y. 2011	F.Y. 2012	F.Y. 2013
1	Total Subscriber (in millions)	621	846	951	1048
2	Total wireless subscribers (in millions)	584	812	919	998
3	Active subscribers (in millions)	NA	574	683	788
4	Active subscribers as a percentage of wireless subscribers	NA	71%	74%	79%
5	Urban Subscribers (in millions) (in percentage)	393 (67%)	538 (66%)	596 (65%)	639 (64%)
6	Rural Subscribers (in millions) (in percentage)	191 (33%)	274 (34%)	323 (35%)	360 (36%)
7	Teledensity (in percentage)	50%	68%	76%	81%
8	Urban teledensity (in percentage)	112%	150%	163%	168%
9	Rural teledensity (in percentage)	23%	33%	38%	46%
10	Internet users (in millions)	90	123	156	213
11	Percentage of population with Internet	7.50%	12.58%	17.4%	19.19%
12	Global rank in use of Internet	4	3	3	3

Source: - Cellular Operators Association of India.

The government has recognized the usefulness of applications of ICT at different levels of agricultural processes. The use of ICT in agriculture has increased the effectiveness and efficiency in production of various crops and agricultural competitiveness. The information related to market price, weather conditions and other micro and macro economic variables provides an advantage over the peer farmers who do not use the ICT in agriculture. The ICT can be used in transferring the various benefits like subsidy on fertilizers and bonus on agricultural products directly into their bank account. With the help of ICT, the information about the weather and rainfall is provided to the

farmers which are used by the farmers in planning and management of different crops at different times. It provides the information related to expected demand of different crops and their expected market prices over the time by using the time series data of previous years. The computerized land records facilitate to avail the benefits of various government schemes e.g. Kishan Credit Card, Subsidy on Fertilisers, pesticides and PVC pipes etc. It facilitates the consolidation of land holding and transfer of land from one person to another. As is evident from the records of pending court cases, the most of cases are related to agriculture land. After the computerization of land records the scope of manual mistakes will be minimized which is the main cause of court cases in India. Mobile phones can be used as an effective tool for imparting knowledge related to agriculture because mobile penetration is increasing day by day in India and now Smart Phones are also used by farmers which can be preloaded with such types of mobile applications which are helpful in climate friendly agriculture. But the implementation of ICT is affected by several factors such as knowledge of ICT tools among the farmers, poor internet connectivity, the quality and availability of suitable information contents and limitations of media. Geographic Information Systems (GIS) and Remote Sensing (RS) techniques can be used to get the information related to weather condition, expected rainfall and expected temperature in coming days etc. In future these information will be available in a single click on modern Smart Phones although some of the above mentioned features are already available in current generations of Smart Phones. The ICT can be used to protect the bad and hazardous effects of the excessive and unconscious use of insecticides, pesticides and fertilizers in the farms which are used on estimates rather these should be based upon scientific calculations. The farmers can use ICT to measure the actual need of pesticides and fertilizers in the crops. Also one can measure the need of water and manure into crops with the help of ICT. However, the excessive use of fertilizers and pesticides adversely affects the existence of wild life and people and is harmful for their health and it can be avoided with the help of ICT. Climate change and green growth are always to be at top agricultural development agenda. Agricultural productivity should not be achieved at the cost of environmental adverse effects (Sinha: 2013).

OPPORTUNITIES AND CHALLENGES AHEAD

The ICT can equip the farmers with better tools to earn their livelihood. The ICT can be used to impart necessary training and education related to agriculture. It can be used to bring more transparency in agro market mechanism and to provide information related to agriculture to farmers. It can be used to reduce marketing cost through online marketing, can help farmers by increasing their social contacts with other farmers of the nation and world and can help in taking decisions about the future planning of crops. The ICT can be used in implementation of various poverty eradication schemes and various schemes launched for the benefits of farmers.

The lack of use of ICT in agriculture related knowledge among farmers, poor connectivity in rural areas, poor speed of internet, high internet usage charges and the lesser availability of electricity in most of the villages are the major bottlenecks in extensive use of ICT in agriculture. But the major problem is related to awareness among the farmers about the use of ICT for solving their various problems which can be solved by organizing various seminars and awareness programs in villages. The other problems will be solved only when the farmers will become the users of ICT in agriculture.

CONCLUSION

ICT is very helpful in Indian agriculture sector to achieve the high pace of growth which is necessary to fulfill the requirements of increasing population and to provide employment to the rural dwellers. ICT can be used in weather forecasting, monitoring of need of water, to know about the soil condition and to use the sophisticated mechanized tools in leveling, cultivation and harvesting. With the help of ICT, the farmers can get the proper prices of their crops. They can make estimates of demand and supply of different agricultural products and can make a reasonable estimate of prices of their crops. However the poor knowledge of ICT tools, poor connectivity and low speed of internet in rural and far fling areas is major obstacle in this area. Further the small size of farms is also another big problem and obstacle in mechanization of agriculture. However, in spite of above

mentioned problems, ICT can be used in betterment of agriculture sector and government should focus on providing internet facilities in the rural and remote areas of the nation. The government should also organize awareness programs about the utility of ICT in agriculture and should provide proper training to farmers to use different ICT tools as well to bring fruitful results.

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