

Applications of ICT in Agriculture Sector

C. Parvathi¹

Abstract: *In modern agricultural systems farmers believe they have much more central roles and are eager to apply technology and information to control most components of the system, a very different view from that of traditional farmers. In contrast to the isolation inherent in traditional arrangements, modern agriculture tends to see its success as dependant on linkages and access to resources, technology, management, investment, markets and supportive government policies. This study follows secondary data sources. This study makes an attempt to analyze the various ICT methods for agriculture, to understand the technological issues faced by Indian farmers and to examine the importance of modern agricultural system. The study reveals that agriculture information methods should be organized and processed and disseminates right information to the right user at the right time. Dissemination of information like marketing information, package of practices through mobile and the television could create positive impact of the production system of the country. This in turn will promote the agricultural practices supporting to “make in India” endeavor.*

Introduction

In modern agricultural systems farmers believe they have much more central roles and are eager to apply technology and information to control most components of the system, a very different view from that of traditional farmers. In contrast to the isolation inherent in traditional arrangements, modern agriculture tends to see its success as dependant on linkages and access to resources, technology, management, investment, markets and supportive government policies. As a result, much of the success of modern systems depends on the development and maintenance of soil fertility through the specific provision of nutrients when they are depleted; of machine power and technology to create soil conditions necessary to promote plant growth with minimal disturbance and minimal soil loss; of the use of improved genetics for crops and livestock to enhance yields, quality and reliability; and, on modern genetic and other techniques to protect plants and livestock from losses to competing plants, diseases, drought insects and other threats. This success also depends on access to efficient, effective irrigation to supplement rainfall in many climates; on advanced harvesting, handling and storage equipment and techniques to prevent losses and to market commodities efficiently. It depends, in turn, on both public and private investment to provide access to technology, equipment, information and physical facilities throughout the production-marketing system. And, it depends on well supported commercial and financial systems and broad public policies that support effective commercial markets at all levels that generate economic returns throughout the system.

¹Assistant Professor (SG), Department of Economics, Avinashilingam Institute of Homescience and Higher Education for Women, Coimbatore.

Corresponding author: C. Parvathi can be contacted at: economic.parvathi@gmail.com

Any remaining errors or omissions rest solely with the author(s) of this paper

Modern agriculture in developed countries including the United States involves far more than farms and farmers, it depends on enormous, highly sophisticated systems that move, store and processes producers' output throughout an extensive value chain that extends to food products and final consumers. For example, these activities taken together contribute well over \$1.2 trillion to the US GDP annually and support nearly 24 million jobs. And, while farm production and productivity are the bedrock of this system, they account directly for only small shares of the system's GDP and jobs—6 percent and 8 percent, respectively. The sector's sophistication can be seen in the goods and services applied throughout the process. A key measure of its efficiency is reflected by the fact that US consumers spent only 9.6 percent of personal disposable income for food in 2008. By contrast, consumers in other parts of the world must spend 50 percent or more of their income for food, a fact that explains in large part, the wide divergences in standards of living.

Background of the study

Agriculture in India has a long history, dating back ten thousand years. It began by 9000 BC as a result of early cultivation of plants and domestication of crops and animals and with the development of agricultural implements and techniques, life has settled soon. By 2050 global per capita income is expected to increase to nearly three times the 2005 level. While developed country growth continues at less than 2 percent annually, the pace in developing countries could exceed 5 percent per year, a trend reversal that began in the 1990s. This shift has enormous implications for global agriculture, as agriculture provides gainful employment to nearly two-thirds of the population and contributes about 30 per cent to the national income and supplies raw material to various agro-based industries and earns foreign exchange primarily with the interventions of modern technologies in agriculture.

Information and communication technology (ICT) is a term which is currently used to denote a wide range of services, applications and technologies, using various types of equipment and software. ICT tools are emerging as an important tool for the economic development of the country. The ICTs are no more confined to the research and development; instead the tools are being extensively used for extension services all over the world. The services that ICT tools could offer have made significant impact on the economic development of the country like India being the world's fastest growing economy. One of the major advantages of using ICT tools for farm communication is the efficiency which has gone very high in the recent days. New businesses like banking and insurance, the entertainment industries and other industries and organizations, are all taking maximum advantage of the ICT.

Matters and Materials

India has not lagged behind in use of ICT to provide required information to the farmers. A beginning was made in the use of ICT with the designing of financial accounting information system in 1971 by Jute Corporation of India (Quasi sector) covering seven states viz., Andhra Pradesh, Assam, Bihar, Meghalaya, Odisha, Tripura and West Bengal. Later many projects like Information village center, Gyanadoot project, e-choupal, e-grama, etc., came into existence.

ICT Tools for Agriculture



Information Village Center Project started by M.S Swaminathan Research Foundation in 1998 covered 12 villages in Pondicherry region is serving rural families, particularly marginal farmers, fisherman and assetless. Gyanadoot is a community-owned, self-sustainable and low cost rural intranet project, initiated on January 1, 2000, at Dhar district. Eleven centers were started on a pilot basis and they were called 'Soochanalayas' (Information kiosks), which provided user-charge-based services to the rural people. Warana wired project, started by NIC (national informatics centre) and Maharashtra Government covers 70 villages in Kolhapur and sangli districts. Ten public service centers have been induced to facilitate sugarcane procurement and provide market information. This study is based on secondary data sources collected through various published journals and reports. This study makes an attempt,

- To study the various ICT methods for agriculture
- To understand the technological issues faced by Indian farmers
- To examine the importance of modern agricultural system

Technological Problems of Agriculture Sector in India

India has inadequate infrastructure and services because of low investment. Farming equipment and infrastructure are scarce outside the provinces of Punjab and Haryana. Because many of the farms are small, the farmers cannot afford irrigation systems that would increase productivity. Most big farms are family-owned and run and do not take advantage of economies of scale - the concept that the cost per unit falls as output quantities increase, because the problem of land absenteeism in big farms which hinders the development of land to increase productivity because the tenant who cultivates the land has little care for its development or productivity.

Rudimentary Infrastructure and Policies Leads to Slow Agricultural Growth

Slow agricultural growth is a matter of concern as most of India's population is dependent on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and lack of good extension services are among the factors

responsible. Farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation.

Low investment in big and small of farms leads to lower production, inefficiency and higher costs, one of the causes of food inflation in India. According to the World Bank, India's large agricultural subsidies are hampering productivity-enhancing investment such as agricultural research and extension, as well as investments in rural infrastructure, and the health and education of the rural people. Though trade reforms in the 90s helped to improve the incentive framework, overregulation of the agricultural domestic trade increased costs, price risks and uncertainty, and undermining the sector's competitiveness. The government intervenes in labor, land, and credit markets.

Poor socio-economic condition of farmers

Illiteracy, the root cause of farmers' poor socioeconomic condition, should be tackled vigorously. Though the government is taking the initiative by adopting policies like universal education, a highly centralized bureaucracy with low accountability and inefficient use of public funds limits their impact on poverty. Lack of technical knowledge and awareness are also responsible for low productivity, adding to the problem of poverty among farmers. Other causes are the slow progress in implementing land reforms, inadequate or inefficient finance and marketing services for farm produce and inconsistent government policy. Agricultural subsidies and taxes often change without notice for short-term political ends.

Use of technology is inadequate

Adoption of modern agricultural practices and use of technology is inadequate, hampered by ignorance, high costs and impracticality in the case of small land holdings. In India, farming practices are too haphazard and non-scientific and need some forethought before implementing any new technology. The screening of technology is important since all innovations are not relevant or attractive to all areas. It is important to screen them according to the geographical area and the local context of agriculture and let the local Kisan Vigyan Kendras (KVKs) promote it. Appropriate technologies need to be adopted.

Haphazard Development

Some initiatives have already been made to provide information technology based services to rural community. However, duplication of efforts is witnessed as most of the services revolve around limited subjects. Keeping this in view it is necessary to form a coordination mechanism to support farming community of the country.

User friendliness

The success of information technology depends on ease with which rural population can use the content. This requires graphics based presentation. Touch screen Kiosks are required to set up to encourage greater participation.

Local language

Regional language and mechanism for synchronization of the content provides a challenge that needs to be met with careful planning.

Applications of ICT in Agriculture Sector

Restrictions

Information content based on remote sensing and geographical information system can provide timely alerts to the farmers. It can have a major impact on the farmers and help them to appreciate the potential of information technology.

Power supply

In the most of rural India power supply is not available for long hours. This will reduce the usefulness of the intended services. It is useful to explore solar power as an energy source to ensure uninterrupted power supply to the farmers.

Connectivity

Reliable connectivity is pre-requisite for a successful penetration of information technology into rural areas. Cable network is possible medium for providing last mile connectivity of villages.

Band width

Since internet based rural services require substantial use of graphics, low band width is one of the major limitation in providing effective services to the farmers, and so high band width should be provided in rural areas.

Dissemination points

Mass deployment of information Kiosks is critical for effective use of internet based services. In addition to being information sources, these can handle other services of use to the people living in rural areas.

Modern Agriculture - A Step Forward in Agriculture

The modernity of agricultural systems is a characteristic well understood by farmers but not easily defined with specificity. Still, the distinctions between modern and traditional systems have powerful implications for the future development of the global food system even though it is important to recognize that few, if any, systems fall entirely into either the modern or traditional categories.

Traditional System

Perhaps the most important difference between the categories is the way farmers see themselves and their roles. Traditional farmers, for example, often say that they seek to work effectively with resources at hand. That is, they use the land, rainfall, seeds, tillage methods and power sources they have to produce what nature offers. Conventional processes are used to till the land, select and plant seeds, protect plants from competing plants and animals and gather the harvest. Surpluses are marketed through nearby outlets. Such producers frequently report only limited capacity to change these processes and some seek to avoid change.

The productivity of such systems depends primarily on the natural fertility of the soils enhanced by skillful care and on the climate. The technology and management systems involved are often characterized by lack of access to, or reluctance to use new information about production and/or management, or public or commercial assistance. Their productivity tends to grow slowly, often in response to outside developments that reduce producer isolation, increase access to markets or support investment in water and land.

Modern Agriculture System

In modern agricultural systems farmers believe they have much more central roles and are eager to apply technology and information to control most components of the system, a very different view from that of traditional farmers. In contrast to the isolation inherent in traditional arrangements, modern agriculture tends to see its success as dependant on linkages and access to resources, technology, management, investment, markets and supportive government policies. As a result, much of the success of modern systems depends on the development and maintenance of soil fertility through the specific provision of nutrients when they are depleted; of machine power and technology to create soil conditions necessary to promote plant growth with minimal disturbance and minimal soil loss; of the use of improved genetics for crops and livestock to enhance yields, quality and reliability; and, on modern genetic and other techniques to protect plants and livestock from losses to competing plants, diseases, drought insects and other threats.

This success also depends on access to efficient, effective irrigation to supplement rainfall in many climates; on advanced harvesting, handling and storage equipment and techniques to prevent losses and to market commodities efficiently. It depends, in turn, on both public and private investment to provide access to technology, equipment, information and physical facilities throughout the production-marketing system. And, it depends on well supported commercial and financial systems and broad public policies that support effective commercial markets at all levels that generate economic returns throughout the system.

Importance of ICT Interventions in Agriculture

There is really little mystery about why agriculture is important. It is the physical foundation of human energy, health, and physical wellbeing all key components of every important human activity. To the degree these components are missing, the human existence is defined primarily by the effort necessary to provide them. Making them more widely available at lower costs increases the capacity of any population to invest in more productive work, education, economic development and cultural activities.

The basic facts are clear

- More people the world over eat more and better because of modern agriculture. Increased production continues to enable steadily improving diets, reflecting increased availability of all foods, dietary diversity and access to high-protein food products;
- The additional food modern systems provide has enabled hundreds of millions of people to realize more of their potential and better lives—thus enhancing the achievements of all, from students to retirees. It increases workforce productivity and generally supports human development and growth;
- The current hunger and malnutrition that extends to some one billion people reflects poor policies, low productivity and low incomes. Failure to continue to apply new technologies to advance productivity on the farm and across the food system simply worsens every aspect of these problems, especially those forced on individuals and families who live in poverty. To a very large extent, current food insecurity problems reflect bad policies, poor infrastructure and low economic productivity in the nations where these conditions occur, rather than a physical lack of food or food production capacity.
- The significant hunger and malnutrition that persist in many parts of the world would have been far worse had agricultural systems not grown and developed as they did;

Applications of ICT in Agriculture Sector

- The physical pressures on the environment that have become increasingly prominent public concerns have been greatly ameliorated by modern agriculture, which has reduced the need to expand land area, and thereby reduced pressure to cultivate fragile lands and forested areas. Modern agriculture includes successful new technologies, including biotechnology to enable both higher yields and reduced environmental impacts. These reduce the land, fertilizer and pesticide use per unit of output;
- Pressure on grassland, forestland and cropland thus increasing wildlife habitat as a result;
- While the unintended negative environmental consequences of modern agriculture are frequently noted, little mention is ever made of the negative environmental impacts that frequently arise from smallholder farming, especially from slash and burn primitive systems in wide use in developing countries where vertical rows are often planted up steep hillsides, resulting in some of the world's heaviest soil erosion, badly polluted watercourses and many other problems of both efficiency and sustainability. The lack of sustainability of these practices can be seen in the fact that they typically lead to abandonment of successive plots year after year;
- Processing technology and handling advancements contribute enormously to improved food safety through pathogen reductions and large reductions in post-harvest losses that further increase food supplies. Pasteurization of milk, canning, freezing, and other processing technologies significantly reduce health risks associated with food. Threats from bacteria and other contaminants are still important, but the risks of illness and death are far less than in the past, a fact that is widely underappreciated;
- Modern agriculture brings enormous economic and social benefits to consumers including: Improved quality of life and living standards as food costs decline. This effectively raises consumer incomes since it leaves greater purchasing power for other consumer goods, for education, health care, leisure, etc., a trend that has been a major driver of economic growth in developed countries, and in some developing countries, as well. Today, consumers in the United States spend less than 10% of their disposable income for food while many in the developing world spend from half or more of their income on food, a huge drag on quality of life. It is now widely recognized that the development of modern food system has been a major factor in improving the standard of living enjoyed in much of the world today;
- When consumers spend the major share of their income and virtually all of their daily efforts simply to find food, little money or time is left for human investments. This survival treadmill characterizes the lives of most smallholder farmers, especially in developing countries;
- Modern agriculture increases global political stability by making more food available, improving its quality and making it accessible to more people. Without the advances that characterize modern agriculture, the world arguably would be a much more dangerous and volatile place because more people would be food insecure as the food price spikes of mid-2008 clearly illustrated.
- Development of a robust, rules-based trading system has been extremely important in improving food distribution and increasing accessibility in food-deficit areas.

Benefits of the Modern Agricultural System

While the phrase, industrial farming is frequently intended to deride modern farm organization, it is impossible to ignore the fact that agriculture, like other sectors, has become much more productive as machines and computers have eliminated the most laborious (and, dangerous) parts

of the job, and farming communities have educated their children to choose, in many cases, other careers and the number of people who want to work on farms in the old, labor-intensive way is very small. The result is that hand-labor-intensive crops (e.g., coffee, strawberries...), or high labor cropping systems (e.g., organic) appear to be on a collision course with demographic trends, since the pool of unskilled, low cost farm labor upon which those crops and systems have depended appears likely to continue to decline and increasingly to make non-mechanization an increasingly non-viable option.

At the same time, modern agriculture has become much more productive. Pre-industrial yields were low and stagnant before introduction of better machines, synthetic fertilizers, improved plant and animal breeding, pesticides and, most recently, biotechnology and the huge changes these new techniques brought. At the same time, it is true that environmental issues that led to the Dust Bowl calamity of the 1930s also led to the establishment of the Soil Conservation Service and other important steps that continue to improve farming practices through public and private programs until they have all but eliminated wind and water erosion hazards. For example, the pioneers of no-till agriculture actually began in the early 1960s in efforts to save fuel and stop erosion. And, the environmental movement of the late 1960s led to the creation of the Environmental Protection Agency in 1969, and to major changes in pesticides and pesticide regulation since that time.

A few relatively simple practices have had great success in protecting both soil and water quality and are being widely adopted now.

These include

- Continuous no-till, which saves fuel, stores soil moisture better, eliminates erosion and off-site movement of pollutants, increases biodiversity;
- Cover-cropping, which when combined with no-till leads to net carbon sequestration, and can be used either to produce biologically fixed nitrogen or to scavenge excess nitrate as needed;
- Controlled wheel traffic, which saves fuel, stops compaction, reduces nitrous oxide emissions; and
- Precision, variable-rate fertilization which increases the efficiency of fertilizers and reduces their needs and reduces emissions of nitrous oxide.

Today, agriculture uses strong links to public and private input providers and others to maintain and increase efficiency and productivity, and to do a lot on a sustainable basis. ICT has helped agricultural sector to a great extent that further making livelihood of rural people better; finally the services of ICTs are of big importance for the nation since GDP of the country is controlled by agriculture.

The major outcomes are

- Increase productivity due to growth and penetration of mobile ICTs in rural areas.
- Innovation in agriculture through electronic media that supports education and training.
- Creation of new opportunities increasing the development of human and social capital.
- Achieving improved process control, transparency in market information.
- Reduction of transaction cost in tracking of consumer needs.
- Enhanced food security and support rural livelihood.
- Poverty alleviation of rural farmers through modern agriculture.

Applications of ICT in Agriculture Sector

- Expansion of perspective of local communities in terms of national or global developments.
- Creation of new business opportunities for rural farmers.

Conclusion

Agriculture information resources should be significantly organized and processed and disseminate right information to the right user at the right time. Dissemination of information like marketing information, package of practices through mobile and the television could create positive impact of the production system of the country. The major challenges inhibiting the use of ICT in disseminating agricultural knowledge and information at the low level of access to ICT infrastructure and services which need to be addressed. The existing potential for extending the current ICT infrastructure to reach rural farmers, coupled by presence of wide area radio service coverage across the country, should be exploited to implement ICT-based knowledge and information dissemination in the short term. Government and its partners should consider policy and investment priorities in order to promote cost-effective knowledge management in agriculture in a view to reach the goals of “make in India”.

References

- Agarwal P.K (1999), Building India's national internet backbone, communication of ACM, Vol. 42, No. 6, June 1999.
- Bell, P., Reddy, P. and Rainies, L. (2004), “Rural Areas and the Internet. Rural Americans Internet use has grown, but they continue to lag behind others, “Pew Internet & American Life Project, Retrieved http://www.pewtrusts.org/news_room_detail.aspx/id=17062.
- Bhatnagar, S. and Vyas, N., (2001), Gyandoot: community-owned rural internet kiosk, E-Governance Case Studies, World Bank, Washington, DC. Retrieved from www.worldbank.org/publicsector/egov/gyandootcs.htm.
- Devraj and Chaturvedi, K.K. (2003). Internet for Transfer of Agriculture Technology, Agriculture Extension Review., pp. 3-6.
- Ghosh, S. (2002), Cyber Extension, A New Era in Agricultural Extension in India, Agriculture Extension Review, pp. 3-5 .
- Lex, J., (1995), Virtual Agriculture in the Information Society Zeitschrift-fur grarininformatik, 3:6 pp:125-130.
- Nidhi Dwivedy, (2011), ‘Challenges faced by the Agriculture Sector in Developing Countries with special reference to India’, International Journal of Rural Studies (IJRS), vol. 18 no. 2 Oct 2011.
- William C. Motes, (2010), ‘Modern Agriculture and Its Benefits- Trends, Implications and Outlook’.