

Article

The Potential of Information Technology in Agriculture

Mayekar Sahil Sharad Smita¹, Krishnaratan Raju Mishra²

^{1,2}Research Scholar, MCA, Thakur Institute of Management Studies, Career Development & Research (TIMSCDR) Mumbai, Maharashtra, India.

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Corresponding Author:

Mayekar Sahil Sharad Smita, MCA, Thakur Institute of Management Studies, Career Development & Research (TIMSCDR) Mumbai, Maharashtra, India.

E-mail Id:

sahilmayekar212@gmail.com

Orcid Id:

<https://orcid.org/0000-0002-7552-5640>

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A B S T R A C T

This paper discusses, using the example of India, agriculture (policies, strategies, structure) and the role of information technology. The agro industrial sector in developing countries is faced with challenges, such as requirement for increase of food production, yield and creation of opportunity for employment of rural and poor population. In addition, the agricultural sector is influenced by global factors and fast change. However, the potential of IT is not fully utilizing in agriculture. Implementation of IT in agricultural sector and rural areas is relatively slow in comparison to the other sectors of the economy where contemporary IT has been implemented at high pace. These facts indicate that there is great need for information and information technologies, which can be used to cope with the challenges and changes and to improve agricultural production and marketing.

The aim of the paper is to analyze role, potential, and contribution of IT in agri-business and to explain opportunities for use of IT in many fields of agricultural sector. Our findings are based on economic theory and available literature, and they suggest that IT has great potential for supporting farmers and the other stakeholders in improvement of efficiency, and productivity of agriculture. However, the stakeholders must come up with many limitations and problems in IT implementation and use.

Keywords: Information and Communication Technologies, Agriculture Improvement, Agri-Business Electronic Commerce

Introduction

This paper discusses, using the example of India, agriculture (policies, strategies, structure) and the role of information technology. Agriculture plays an important role for economic and social development in most undeveloped countries. Reasons for this include issues of food security and health of people, requirement for increasing yields and food quality improvements. Challenges in agricultural development of every country are great, not only because of fulfillment of increasing demand for food, but because

of poverty and malnutrition reduction too. Issues are also made more complex as agricultural sector development should be gained on sustainable manner considering natural environment protection.

Currently farmers are faced with low profit margins – costs of many inputs like fertilizers and fuel have increased, while product prices have remained constant or even dropped. Increased globalization and market deregulation increases pressures on many smallholder farmers in developing countries. To get useful effect of these global changes,

politics of agricultural products pricing, marketing and trade must be revisited. At the same time, mechanisms for technology transfer must be revisited and revitalized under different conditions.

Agriculture as an Economic Sector

Agriculture was the mainstay of India's economy at the time of its independence 65 years ago and its largest economic sector. More than 90 per cent of the population was employed in it then. It is now the third largest sector after service and manufacturing with 55 per cent of the population depending directly or indirectly upon it. About 17 per cent of the national GDP is produced and shared by this population mainly in the rural area indicating its impoverishment and vast income and other inequities.

India, as a country, strives to reach about 4 per cent growth in its agriculture so that its overall annual growth reaches 7-8 per cent overall growth. However, it has managed just above 2 per cent overall annual growth in the last decade though certain parts of the country, e.g., State of Gujarat, have achieved nearly 10 per cent growth per annum for over a decade. The low 2 per cent growth is attributed to inappropriate policies and strategies that have led to a patchy but intensive, irrigation based, cereal producing agriculture, the "Green Revolution". In this Green Revolution agriculture higher yielding seeds, energy, water, fertilizer, and other inputs are subsidized. Farmers producing marketable surpluses are price protected through government-controlled markets and minimum support prices. This has led to an agriculture, which while producing large quantities of cereal grain, also contributes rapidly gaining damage to ecological foundation essential for sustainable farming – land, water, biodiversity, forests, and the atmosphere - whose effects are now evident. This has led to the rise of an emerging, exploitative agricultural community that is also politically strong to thwart any reform to current policies related to the agriculture they practice.

In parts of the country with large tracts of dry lands depending on rain fed agriculture and the vagaries of the monsoon as also where infrastructure has been poorly developed, the growth of agriculture has been erratic and weak. In parts of the country with large tracts of dry land where agricultural growth has been high, it is attributed to a combination of water conservation, irrigation and its efficient use, roads, availability of quality (voltage) electricity supply at regular times and fuel, shift to higher value crops and market infrastructure for these crops. This also points to successful policies and strategy shifts by local government.

The Spread of Food Production

Another, albeit less known facet of India's growth in food

production and resulting in significant surpluses is that it is concentrated around about 40 districts out of a total of more than 540 in the country. These districts mainly in Punjab, Haryana, Western Uttar Pradesh, Rajasthan, and the Kaveri Delta of Tamil Nadu are those that produce a surplus in wheat and rice. The rest of the country's food needs, in varying amounts, are satisfied by these surpluses largely through a public distribution system managed by the Government. The agricultural elite in the surplus states, who benefit from the subsidized "Green Revolution" model, have significant political clout to subvert policies and strategies that affect their dominant positions of practicing a protected agriculture.

India also must cope with very rapid urbanization with towns and cities growing at around 2.4 % fueled by rural migration as also growth in urban populations. This urban population of more than 350 million also needs to be fed. Food chains supplying urban needs have proved to be inefficient and wasteful due to infrastructural weakness. It is leading to high economic inflation and gain in food prices contributing to hunger in the urban poor. However, because of the political strengths of those who benefit from the current agricultural, food and trade policies, transforming food chains has been difficult.

Information Support to Agricultural Production and Marketing

Information of adequate quality is necessary condition for improvements of all areas of agriculture. The importance of information is particularly high in countries on the verge of entering bigger markets. This is for example the case for many Balkan and former communist countries in Eastern Europe where accession to the European Union is an issue. Agriculture in these countries is faced with deregulation that represents logical implication of process of integration to European Union which reinforces need for timely and relevant information, to make decision in agricultural sector and the other sectors related with it as suppliers of inputs for it or as buyers of agricultural products and raw materials. Improved communication and access to information's are related to the socioeconomic development of every country. Agribusiness is an economic area that has great potential for ICT use in aim of social and economic development of agricultural population (community) and rural regions. However, farmers still have problems to get important information in form that is understandable for them to make timely decisions for agricultural production improvements. With improved evidence of data, detailed analysis of costs and sophisticated marketing strategies, farmers will be able to make better decisions and greater profits. In addition, implementation and use of ICT can significantly support increase of competitiveness of their husbandries (Caching, Scott, 2003; Court right, 2004).

Agriculture and Agribusiness

It is interesting to note that policy makers and planners have only recently woken up to consider a shift from 'agriculture' to 'agribusiness' and to the view that it is an essential pathway to revitalize Indian agriculture. While the share of pure agriculture in GDP is on decline, the share of agri-business is not, and it is going up with the demand for value addition continuously increasing. The redefinition of India's agriculture to agribusiness now needs to be urgently done and considered in its entirety as an economic sector. This will provide the necessary structure agribusiness needs to bring institutional, structural and organizational change urgently needed to reduce endemic inflation, underemployment, and unemployment in rural and urban areas. Agribusiness (including agro- industries) in India needs to stabilize as contributing about 40 per cent to India's GDP as soon as possible.

The Generation, Adoption, and Adaptation of Technology

India may not be considered culturally as being "technology" centered, in the way the Western world is. India may be considered more "organic" depending on holistic beliefs of harmony between all elements of the environment and life in which "technology" as understood by the Western world is only a part of the bigger picture for development. This may appear to many as a barrier to rapid "technology" based progress. However, in recent years, the adoption of new information and communications technologies and those for personal transport have indicated that when making technological choices, Indians, even poor and in rural areas are judicious and quick to adopt, innovate and adapt those they find useful.

To improve agricultural production, farmers should have following information: Information on crops - Following information from field can be collected and transferred via net in database server: categories of seeded crops, size of land with specific crops, time of dropping seed, time of harvest, yields etc. The information is analyzed to create statistical reviews and tables that can be accessed by farmers through internet with ordinary browser. Farmers can make their own production plans based on the information Information on production techniques developed by experimental agricultural institutes and stations for agriculture improvements can be collected and integrated. The information is made available to farmers through internet and the other channels. Information on production equipment and agricultural inputs - The information is gathered from enterprises selling equipment's for soil processing and other production equipment, seed, and the other agricultural inputs. Information collected in such way is offered to farmers.

Market information - To support farmers in gaining the best prices for their products, information on markets of various agricultural products should be created. Aims of market information activities are to show review of prices on various markets and to facilitate reorientation of farmers' production to markets where better prices can get.

Farmers need overall reviews of food market information. The reviews present valuable information on some most important import and export markets. Information Technology can support to provide forecast information on main agricultural products in subsequent years. Such information helps farmers and traders to make decisions, when and how to sell their products (do they sell just after harvest or do they store products in expecting higher season prices). In combination with the other data (for example, available budget of the farm enterprise) such information can be used for decision making about crops which should be produced in next season.

The other information of interest for farmers and their families - Examples of such information includes weather forecast, availability of credit, and expert advice about maintaining crops in healthy state, etc.

There is no doubt that improved information flow has positive effect on the agricultural sector and individual producers but gathering and distribution of information is difficult and expensive activity. ICT offers capability for increase quantity of information that is available to all stakeholders in agricultural sector and for reduction of information distribution costs to all interested users. ICT can obtain the information to farmers even when they are in remote places.

Farmers need ICT applications supporting operative aspects of agricultural production for increase of productivity (applications for real-time decision making based on broadband wireless internet, e-mail and chat applications enriched with pictures, video clips and sounds, etc.). These applications are going to play great role in operative management of agricultural production in the future. A better example of ICT use for agriculture improvement is mobile communications. This ICT is used as a tool for access to market information's (prices), weather forecast, advice of agricultural experts, etc. Today, it is most accessible technology that is available to great number of people including marginalized people in remote and rural areas. All these technological changes give advantage to farmers in creation of effective and inexpensive agricultural production and marketing programs and give opportunity for reduction of poverty and improvement of their life quality (Gorla, 2009).

Producing Quality Food Sustainably

The current agricultural system in India forces large amounts

of food grain to be stored, transported, and distributed at long distances from where it has been produced. With inadequate infrastructure, bottlenecks in storage and transport and lack of transparency in distribution this system is increasingly being found wasteful and corrupt as also contributing to endemic hunger and malnutrition. An alternative is area specific production to satisfy specific consumption preferences. India is an exceptionally large country with many diverse communities each with their food preferences. This would entail reintroducing pre-green revolution farming systems, which were in no way less “productive” than those developed in the “Green revolution. These farming systems were based on mixed farming growing cereals, pulses, vegetables, fruits, fodder, livestock, and trees on the same farm. Albeit the return to pre- green revolution farming systems will be with enhancements brought about by new technologies for intensified sustainability through improved seed and animal varieties of local origins, precision agriculture at micro-levels using new irrigation methods linked to soil humidity and nutrition monitors for precise application of water and nutrients, integrated pest management, use of locally produced manures, bio fertilizers and bio pesticides etc. Virtual aggregation, using new ICTs, of small plots and farms at village and village cluster levels would enable better management of the farms to meet local food needs, farm inputs and of marketable surpluses.

Many technologies and processes needed to equitably distribute and sustainably use natural resources such as water and manage soil nutrients already exist and are available in India. Equitable water distribution use at community levels has been established in several parts of India (see the example of Ralegan Siddhi.

http://en.wikipedia.org/wiki/Ralegan_Siddhi). Vermiculture using manure and bio-fertilizers, bio-pesticides and integrated pest management are also available. The problem has been the neglect of the needs of resource poor farmers primarily because of their political weakness which cannot force policy decisions and investments in their favor.

Practice Livelihoods to Improve Quality of Life

The practice of livelihoods that improve quality of life of smallholder farmers and their communities require institutional and structural changes in systems that create and enable them to practice these livelihoods as also new infrastructure such as roads, electricity and communication and new capacities. India has witnessed economic growth without it creating commensurate employment which is gainful both within and outside agriculture.

Institutional change has been advocated by some of its leaders such as “Providing Urban Amenities in rural

areas” and the roll out of e-governance including the world’s largest unique identification system, Aadhar that is aimed to make access to public services and participation in governance related activities simpler and efficient. Structural changes in the economic sector, for example, enabling agribusiness and non-agricultural employment such as in infrastructure and rural services is needed. This can be achieved using new ICTs that can assist in opening the rural finance including banking, insurance, loans, and mortgage, bringing land records and locations to date and available online and provide knowledge services to farming, agribusiness and rural industries. ICTs can and have started to contribute to education and learning through open and distance education (ODE) at various formal and informal levels including vocational training. India today has one of the world’s largest ODE systems in the world.

Participate effectively in competitive markets Participating effectively in competitive markets forms a major and complex challenge for small holder farmers. There are three major avenues for smallholder participation in markets; through the “supermarket” route, where large corporate organizations intermediate the participation, through farmer aggregation such as cooperatives and “producer companies” and laissez faire, in which individuals’ farmers individually participate.

For each of the avenues for participating in the markets in an equitable manner, the use of new information and communications technologies (ICTs) including cellular telephony, Internet and use of computing devices as also the radio and television become important. These ICT tools can reduce asymmetry of information that defines the inequities that constraint these farmers especially when participating in markets. They can also, such as through use of social media, communicate information to aggregate and empower them to negotiate collectively in markets. There has been evidence of the use of new ICTs to empower urban populations. In India, as the use of new ICTs, especially cellular telephony, and “Smart” phones, already with more than 70 per cent of the population, grows the chances of rapid reduction in inequity and increase in empowerment also increases.

Lack of motivations to use computers and internet Despite internet accesses, users in rural areas have to be motivated for internet use. To use net, farmers and the other individuals in rural areas must have adequate level of competence and skills. Besides explained engagement of unemployed rural agricultural graduates as IT educators in rural areas, the other methods of computer literacy improvement of farmers could be used.

For e.g., a group of farmers can install a computer with internet connection and any educated young man from that group can experience training in using computer

and internet tools. He can help his colleagues to acquire computer knowledge and skill set and to increase motivation to use computers and internet (Phougat, 2006). Key challenge in adaptation of these methods of farmers' education is to motivate young and educated people to stay in rural areas. General suggestion (Kazlauskiene, Meyers) for governments in retaining and attracting people to rural areas is to make incentives and conditions for development of services of general interest, such as accessibility (roads, railways, waterways), ICT (broadband access, e-services, e-health, etc.), and public services (water, waste treatment, energy, health, education, etc.).

Lack of online government information Much of potentially vital government information is not available online. Governments in many developing countries do not focus on the poor population in rural areas and do not give them appropriate information and services through internet that could be used for improvement and development of agriculture.

Conclusion

Farmers and policymakers working on improvements of agriculture should be able for effective use of ICT, to react to new condition which are characterized by: complete and partial deregulation of agricultural market, reduction of protectionist measures of government, opening of agricultural markets, fluctuations in agricultural environment and use of chance to export. Quality of rural life also can be improved by quality information enabling better decision making. ICT can play a main role inside of transformation of rural areas and agriculture to respond to these challenges and reduce digital inequality and divide between rural and urban areas.

Fast changes in ICT domain enable development and dissemination of electronic services in agriculture. National strategies for implementation and use of ICT in agriculture should be formulated. National coordination agency with a consultative role can act as catalyst in this formulation process. No single institution can alone successfully implement ICT in agriculture and rural areas. Therefore, industries with great influence on agriculture, like the fertilizer or food industry, should jointly initiate and encourage implementation of ICT in agriculture.

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