

A conceptual image showing a hand holding a small plant with soil, symbolizing growth and development. In the background, a satellite is visible, representing ICT (Information and Communication Technology). The entire image is faded and serves as a background for the title.

***Rural Economies and ICT Policies
for Rural Development***

Role of ICT in the Agriculture Sector: A Study of Progressive Farmers, Malwa Region, Punjab India

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ABSTRACT

The present world scenario of agriculture is facing challenge to address the issue of higher food grain production which is only possible by adopting latest tools of Information and communication Technology (ICT). The role of ICT is important in agriculture sector in order to enhance its productivity. Agrarian state of Punjab famous for Green Revolution in 1970's in India was chosen as study area as it has one of the most fertile lands for agriculture in Asia drained by three rivers flowing across the entire state.

Study was conducted using sample survey method and farmers were interviewed to collect data. The data was input in excel program and statistical tools were applied. The study shows that 90% of famers were using basic information communication tools such as radio, television, telephone helplines and Mobile phones while only 2% use CcTV, GIS, Laser leveling techniques and internet. Mobile phones are the most powerful means of communication among farmers for exchanging agriculture information. Reason: Cost affordability, better network, easy availability and cheap tariff rates. Farmers are dependent on their large Social network and take advice from farm scientists, fellow farmers and friends. The factors inhibiting adoption of ICT were found out to be lack of training (average score 1.91) Inadequate infrastructure (average weighted score 1.67) and cost of equipment (average score 1.41 out of 0 to 2 scale).

Reasons for failure of private ICT projects in Punjab when compared to rest of India were found out to be better economic status of Punjab farmers, cropping system and strong social network of agricultural university, farmers, scientists and state government infrastructure.

Keywords: *ICT tools; mobile, farmers and agriculture.*

Introduction

Agriculture is one of the most important sectors in the economy of many Asian countries like India. It is the main source of employment to the people but till this sector is under immense pressure to grow more food for the growing population, consumer affluence and decreasing land resources. Food production in the past years has been increased mainly through improvement in yield by increasing area under cultivation, applying fertilizers for plant growth, using hybrid seeds and application of water resources. The role of information communication technology is very important in agriculture sector in order to enhance its productivity. The research study discusses about the progressive farmers of Malwa region of Punjab state in India who are employing latest tools related to information technology in their daily agricultural practices.

One of the best suitable solutions in order to increase the agriculture production seems to be the concept of KIM) knowledge-intensive management. It is a very effective tool to disseminate information to the farmers in Asia but it is plagued with many difficulties. The most effective way to deliver knowledge intensive management in agriculture is ICT. This is because it is information based and dynamic. Farmers in Asia and in country like India lack technical know how about ICT tools. For delivery of better ICT infrastructure and human resources development in developing Asia, there is need of role of Agricultural professionals to deliver knowledge-intensive management strategies directly to farmers. The most common problem in delivering proper and timely information to poor farmers in Asia is the lack of support from the government.

Although governments initiate many projects for development of agriculture sector but usually

these don't have any arrangement for transferring technology and implementing extension programs and lack the proper mechanism to connect the farmers. Poor planning, lack of adequate resources to implement ICT projects, illiteracy in rural areas are some of the additional problems among the farmers of Asia. But inspite of the various challenges which rural farmers in Asia face, there are successful stories where the role of information and communication technology has been very important in the rural community to disseminate proper information, keep the farmers update with latest tools of ICT and technology useful in agriculture practices. Some of the private sector companies have come forward to take the concept ICT to the poor farmers by providing them with the basic ICT infrastructure which governments lack or are slow to provide to farmers. This has helped to link the rural economies with the mainstream economies and thus facilitate commercial transactions in rural areas along with some technical knowledge to farmers.

Pressures on the Agricultural Sector in Developing Asia

Agriculture remains the important sector in Asian countries despite rapid industrialization taking place in Knowledge based Asian economies. Around 27 % of G P of South Asian developing countries come from agriculture sector while Developing countries in East Asian and pacific region accounted for 14% of GDP. (World Bank,2001). The 1999 farming statistics state that 63% of South Asian and 69% of East Asian and pacific, workforce in involved in agriculture. (Maxwell and Percy,2001). While in contrast, only 2.5 % of workforce in US is involved in agriculture and only 6 % of workforce is involved in agriculture in EMU countries (CIA Factbook, 2001; World Bank, 2001b). It means that the large rural population of Asia which is generally low income based is not only a driving force but also the backbone of these economies. But the increasing urban population and migration of people from rural areas to cities is creating problems in agricultural productivity. The number of farmers and size of their land holdings is decreasing day by day. So coming years will face the problem to feed the growing population

According to report by Rosegrant et al, (2001) "Asian Farmers have to meet the additional demand of food supply." But sadly the increase in agriculture production will depend on already depleting natural resources. Most of the fertile agriculture land is being converted to non-agriculture for the construction of buildings in urban areas and industrial cities. This has created problems such as land degradation because of

soil erosion, water logging in low lying areas, and in some places it has caused salination problems. There is acute shortage of fresh water resources for agriculture in some areas of Asia. In some places the ground water levels have gone down drastically, for example in The Punjab state in India, water level has gone down to 200- 300 feet in some places. Asian agriculture in some poor countries is dependent on Rainfall only. Farmers do not have enough resources and means to apply new scientific methods to address these problems. Thus increases in yield are difficult to accomplish. Cropping intensities in Asia are highest and it is difficult to increase yield because of "poor management of the agricultural resource practices which result in unsustainable farming systems" (Nath, 1999).

As a result of opening of global markets it has been observed that there is reduction in the number of marketing initiatives by governments, protecting the particular commodities and withdrawal of support prices. It has also resulted in less stress on research and training programs. As a result of trade liberalization farmers can earn more profits as the domestic commodity prices will rise. (Rosegrant et al., 2001) States that farmer in developing countries of Asia lack the skills which are required to take advantage of this situation, access market rates and latest trends in businesses opportunities". In order to meet these challenges farmers have to rely on usage of internet and other communication tools to be know about the latest information and trends on agriculture worldwide. Thus there is need of potential usage of Information communication tools in Indian agriculture, especially in the state of Punjab where farmers are rich in the experience of agriculture farming and their traditional knowledge.

Three Main Challenges to Asian Farmers

Economic. There is need to improve the economic performance of Asian farmers (i.e. maximise profits) in a largely unsubsidized and deregulated global market.

According to report by Malekar (2008), the state of Punjab has the highest Pesticide usage rate in India. The state uses 7100 MT of pesticides at 923 grams per hectare. It has been observed that in last three decades farmers in the state of Punjab have used lot of chemicals and pest resistant sprays in the farm fields. This has lead to extra usage of chemicals in farming and also extra burden on farmers financial resources. ICT can play important role in dealing with economic issues related to agriculture. Raju (2001) emphasized that economic development is about Information and knowledge, how to organize society to all productive activities to thrive and how

to create an economic environment. Timely access to information is a crucial ingredient for the success of any development effort. According to Pandey (2003), Information Technology can be used as a great facilitator in agriculture marketing by providing connectivity between marketers and exporters, through a wide area network of national and international linkages in order to provide day-to-day information with regard to commodity arrivals and prevailing market rates.

- *Production.* Production has to be increased by Asian farmers in order to meet their demands on food, fibre and other agricultural products. For Subsistence agriculture production should increase.

The "yield gap" is a commonly acknowledged phenomenon in agriculture and is defined in two ways. "The difference between the attainable yields that agricultural scientists at research stations achieve, and the actual yields obtained by farmers using the same seeds and inputs. Alternatively, yield gap may also refer to the difference between the mean yield of large plot demonstrations or the top 0% of farmers (using the presently available improved technologies and management practices in the best possible combination) in a given location and the average yield of all farmers for that location" (FAO, 2000).

In yield gap, a farmer who follows proper Knowledge intensive management principles is more likely to get higher crop value than farmer who does not follow. Factors such as differential access to information and the skills needed to apply, the same seeds, fertilizers, pesticides, irrigation access, and labour, affect the Yield gap. Yaragoppa (2005) stated that "information technology has a major role to play in all facets of Indian agriculture by facilitating farmers in improving the efficiency and productivity of agriculture and allied activities." Thus the potential of information technology lies in bringing about qualitative improvement by empowering farmers to take quality decisions which will have a positive impact on agriculture and allied activities.

- *Environmental.* Care should be taken while dealing with above said issues and natural resources should be wisely utilized.

While making farming decisions such as in case of Knowledge-intensive management strategies, for example Integrated Pest Management (IPM), take into account a variety of environmental, agronomic, and economic factors but ultimately make decisions that will make a farming operation profitable in a deregulated and largely unsubsidized global market.

This can be found out from the fact that Rice producers in Indonesia had excellent example of difference by adopting knowledge-intensive management strategies in agriculture in Asia.

During the period 1987-1990, IPM was adopted in rice production and it gave very positive results. It was found out that there was 50% decrease in use of pesticides, which resulted in 15 % increase in yields for farmer per season and an increased net profit of 18 US\$ per season. Government was also benefited with savings of US \$120 million a year in pesticide subsidies (Schillhornvan Veen et al, 1997).

According to Matson et al, (1997), "Integrated nutrientorganic matter management and pest management approaches are receiving increasing attention as pathways to sustainable high-production agriculture and reduction of offsite problems". For example, with Integrated Pest Management (IPM) profits can be maximized by balancing cost of pest control with economic damage cost pests can cause.

Objective

The main objective of this research study is to make a qualitative analysis on the status and potential of Information and communication Technologies used by farmers in agriculture sector of Malwa region of Punjab state, India. The specific objectives of the research are:

1. To study the status of usage of ICT in agriculture amongst progressive farmers of Punjab State in India.
2. To determine the benefits and constraints of various ICT tools used by the farmers for Agriculture and agri-business.
3. To identify the factors inhibiting the adoption of Information Communication Technology in agriculture sector.

The contribution of agricultural sector to Indian GDP is 23% and accounts for 21 % of the exports according Singh and Mangaraj (2006). It employs two third of India population and is source of raw material for the industry. Cost effective IT based system needs to build in order to improve the living standard of rural population. The National Agricultural Policy envisages application of new technologies through the national research system. The ICT related projects in India are mostly in the Southern part of country. These projects have been funded by local governments, private institutions, enterprises, international NGO's and National government. The main aim of all these projects is to empower the poor with better information system in order to help them to manage their supply chain.

They mostly include buying and selling of products through online kiosks, getting connected with vegetable market prices in cities and selling their farm produce directly to the companies. Following is list of some of these projects:

1. Bellandur Gram Panchayat, Karnataka
2. Boodikote Jagruthi Resource Center, Karnataka
3. eSeva APOne Centers, Andhra Pradesh
4. Gyandoot Government-to-Citizen Network, Madhya Pradesh
5. HP iCommunity in Kuppam, Andhra Pradesh
6. ITC eChoupals, Madhya Pradesh
7. M.S. Swaminathan Research Foundation InfoVillage Knowledge Centers, Pondicherry.

Overview of Punjab State

The word “PUNJAB” means, the land of five rivers. The five rivers namely Sutlej, Ravi, Beas, Chenab and Jhelum flow through the state of Punjab before India partition in 1947. Presently Punjab on the Indian side has three rivers flowing through it, which are Sutlej, Beas and Ravi, with Chenab partly flowing before going to Pakistan.

Punjab is also called the Grain Bowl of India. With just 1.53% of total geographical land area it produces 20 % of country wheat and 12 % of Rice. Punjab State which has earned a name “Food Basket of Country” & “Granary of India” has been contributing 40percent of Rice & 50-70 percent of Wheat for the last two decades (source: Punjabgovt.nic.in, 2010). Punjab State produces 1 percent of Rice, 2 percent Wheat & Cotton each of the World. Per hectare Consumption of Fertilizer is 225 Kg. As compared to 113 kg. at National Level. Punjab State Consumes 8 percent of total Fertilizer Consumption in India. Punjab State has been awarded National Productivity Award for Agricultural Extension service since 1991-92 to 2006-07 except 1999-2000.

When India stood on the brink of famine, the state of Punjab became cradle for a sweeping Green revolution in 1960’s. Since the period of green revolution farmers in this state have achieved high levels of modernization, mechanization and prosperity. This has been possible due to hardworking efforts and entrepreneur nature of Punjabi farmers, backed by significant contribution of farm scientists and researchers of the Punjab

Agricultural University. But presently the state farmers need to increase productivity by applying scientific methods in farming and utilizing their past experiences. Punjab farmers with their prosperous background need to use modern ICT tools in their agricultural practices. Farmers in other parts of India are getting benefits by use of ICT projects initiated in their states, but still they are behind in terms of Punjab’s progressive farmers.

Materials and Methods

A comprehensive review of relevant literature and expert opinion was sought for framing the research methodology of present study. In order to meet the objectives, a selfstructured questionnaire was prepared to elicit the information from the respondents on various aspects. Efforts were made to make the questionnaire free from ambiguities and making it relevant & purposeful.

Secondary data had also been collected from journals, magazines and relevant web sites to improve upon the understanding of the concepts of present study. A list of progressive farmers was prepared by getting information from the Department of Agriculture, Punjab and the farmer club. From this database, through purposive sampling technique, around 110 progressive farmers of Malwa region engaged in innovative farming practices were selected and a sample size of 86 was arrived by the following formula:

$$n = \frac{N}{1 + 20\sqrt{N}}$$

Yamane (1967) provides a simplified formula to calculate sample sizes. This formula was used to calculate the sample sizes. A 95% confidence level and Precision = 0.5 are assumed.

Data collection was done through scheduled interview of the respondents. Before recording the data, a good rapport was built with the subjects & they were explained about the purpose of the study. Every effort was made to clarify the question in local dialect to get the response from the subjects. A framework was designed for carrying out the research in a systematic manner for the fulfillment of the objectives. The questionnaire included questions on parameters like age, level of education, period of involvement, family type, operational holdings & occupation etc. Information sources were divided into (1) Print Media (2) Electronic Media and (3) ICT. Print media included newspaper, farm magazines / journals, books ad booklets. Electronic media covered Radio and Television, while Information Communication Technology (ICT) included computer internet, telephone, mobile phone, fax

machine, CCTVs and CDs. There is another important source of information i.e. gathering information through formal and informal means such as farmer fair, farm club meetings and social networking with fellow farmers and farm scientists. A comprehensive view of all these information sources was incorporated. Benefits & constraints of different type of information sources were also collected. Opinion of the respondents on this aspect & their suggestions & solution to improve upon was also collected.

Results and Discussion

It was found out through questionnaire survey that the maximum number of farmer (71%) was involved in this occupation for than 16 years and the 74% were below age of 49 years. Only 33% of the farmers attained education upto graduation level. These facts reveal that most of farmers rely on their rich experience and agriculture knowledge in the farming practices. It was found out that 50% of farmers cultivate wheat and rice only and only 2 % are involved in fisheries. Four ICT tools namely mobile, television, radio and telephone were possessed by 90 % farmers. Only 8.8% of respondents mostly involved in fisheries own CCTV. The usage of mobile was high among farmers with average weighted score of 3.33. This fact reveals that respondents use this ICT tool to get information from fellow farmers, scientists and check market rates. While on contrary mobile packages offered by Nokia and Reuters were not popular with average weighted score of only 0.71. The main reason for this low usage was unreliable and old information.

The most preferred source of information was found out to be the local farm fairs (average weighted score of 3.64). In print and electronic media the Newspaper was popular source of information (average weighted score 3.57), followed by television (average weighted score 3.55). Ease of reading and availability of information related to farming in local dialect was cited as the main reason of popularity. ICT tools such as use CD's, internet and helpline telephone numbers were found to be least preferred sources among the respondents. Internet usage had low score of 1.31 inspite of being the richest source of information. About 59 % of the respondents never used internet. This was due to lack training and education level of farmers. Respondents were not internet savvy and another major problem was the nonavailability of data and website information in local dialect. Thus 81% of the respondents preferred to read farm journals, magazines and farm booklets which are easily available in local dialect.

When asked about the importance of adoption of ICT in agriculture, the respondents feel that traditional agriculture practices have to shift towards knowledge intensive agriculture.(average weighted score 1.46 out of 0 to 2 scale). The factors inhibiting adoption of ICT were found out to be lack of training (average score 1.91) and cost of equipment (average score 1.41 out of 0 to 2 scale). Inadequate infrastructure (average weighted score 1.67) was cited as reason for inhibiting growth.

The research findings reveal that respondents desired the need of effective role of governments and private organizations. Respondents suggested the need of agriculture related dedicated television and radio broadcasting channels 24 X 7. Intensive training and frequent awareness of ICT tools such as internet and availability of fresh, real time data on help lines, mobile packages is required and adequate infrastructure in rural areas for enhancement of ICT.

Conclusion

1. Traditional sources of getting information on agriculture i.e. relying on fellow-farmers and farmscientists are popular and prevalent.
2. Mobile has been found the most interactive ICT tool, widely used by the respondents through their social networking with farm-fellows and farm scientists. The excellent mobile network and high density of ownership of mobiles by the progressive farmers of Punjab State is the reason for this popular tool.
3. Print media and mobile services benefit farmer in terms of cost-affordability, availability in local dialect and sufficient period to read it at any time at the disposal of farmer.
4. Role of internet: Quick accessibility, availability, content and quality of information were found to be attractive and useful features only if the user is internet savvy and knows the exact website to be visited for a particular piece of information.
5. As per suggestions of the farmers, the ICT-enabled initiatives in agriculture are required at massive level by the Government or the private players to improve the accessibility, content and timely information.
6. Dedicated TV channels and FM radio broadcasters exclusively on agriculture are required.

7. Lack of requisite skills among farmers and inadequate infrastructure emerged as the major factors inhibiting for adoption and growth ICT.
8. The usage of internet is not to the expected levels. ICTs are largely unknown and not applied in routine either for access of information or for routine management of agriculture.

Reasons for failure of private ICT projects in Punjab when compared to rest of India were found out to be better economic status of Punjab farmers, cropping system and strong social network of state agricultural university, farmers and scientists.

- Punjab state has the highest mobile density in India (16 million mobile subscribers). This fact can be linked to the purchasing power and social networking of farmers. Social networking is highly prevalent among the Punjabi society and this has contributed to farming sector tremendously. Farmers can contact farm scientists working at state Research centers and State agricultural departments any time.
- The State also has the highest vehicle density on roads of about 63.9 vehicles / km of road length (Bains,2007). This allows the farmers to have greater mobility anywhere and farmers can thus visit farm fairs organized by Punjab Agricultural University and its regional Kisan Vikas Kendras (Farmer centers) for seeking expert opinion from farm scientists and solving their problems. They can visit fellow farmers on their farms and take their advice and expert opinion also.
- Farmers of Punjab are also credited with the status of being highly mechanized when compared to farmers from other states of India. Punjab has the highest farm mechanization level in the country. Some of the rich farmers are already using advanced ICT tools like GPS and GIS in farming sector, use of Data recorders to note daily temperature and nutrient levels in soil, maintaining records on computer for future use and history of farming on field. Use of land laser levelers and other computer devices is slowly getting popular among rich farmers.
- Village farm centers set up by the State government provide daily weather updates and market information related to agriculture to the local farmers. Information such as crop rates, fertilizer, seeds rate information etc is available through these centers. Framers can know about

the prevalent market rate for selling their crops in the local grain market or buying agricultural inputs from the market.

- “Farmers own knowledge” is one of the important factors which overweighs the private ICT initiatives in Punjab. Rich farming experience of elder farmers has been passed on to the next generations who are involved in this profession for their livelihood. This family tradition and wealth of knowledge has been strengthened by the young educated farmer of the modern time who is very well aware of farming methods available in modern era. Farmers of Punjab are well educated to apply the new knowledge and techniques in their farming system.

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