CHAPTER 8

CONCLUSION, RECOMMENDATION, LIMITATION AND DIRECTIONS FOR FUTURE RESEARCH

This chapter draws together natural corollaries from the research study about the measurement of Information and Communication Technology acceptance in agriculture by farmers in Karnal and Sonipat districts of Haryana. The sample of 300 farmers was drawn from farmers directly engaged in agriculture. The perception of the farmers about the influence and importance of Information and communication technology and its role in enhancing agricultural income and consequently on consumption of consumer durables was measured. In this chapter conclusions of the research are discussed followed by limitations of the research study and recommendations for future research are made.

8.1 Conclusion

Information and Communication technology acceptance in various fields across the world has received a lot of attention. This thesis has explored the implementation of various technologies like internet, Mobile, Television and radio on farming activities which influences welfare of the farmers and the findings and recommendations draw heavily from the experience of developed countries which have some similarities with India despite their individual uniqueness of circumstances and priorities.

This study set out to measure the impact of Information and communication Technology on agricultural income by reduction of input costs such as fertilizers, pesticides, seeds, and better quality of seeds and thereby on consumption of consumer durables of farmers in Karnal and Sonipat districts of Haryana. The purpose of the study was not only to add to the existing body of research on Information and communication Technology and rural income and consumption, but also to learn what relationship exists in the variables under consideration.

The study proposes that accepting Information and communication Technology in farm operations would enable farmers to improve their agricultural performance and increase their agricultural incomes and thereby consumption. The study was carried out in Karnal and Sonipat districts in Haryana and reported on the engagement of Information and communication technology in enhancing their farm income. Specifically this thesis is an original contribution to the applied use of
Information and communication Technology components (Internet, Mobile, Television and Radio) in rural agriculture. Technology Acceptance Model has been used for classifying and interpreting technology acceptance in agriculture by farmers.

During the course of statistical data collection, it was observed that ICT applications by the farmers are creating both forward and backward linkages and positive externalities which are helping them to reap double advantages. ICT can boost small farmer’s incomes who have limited resources by assisting them in growing and marketing their output in an efficient manner. This is manifested in the following ways:-

1. The study found, from the results scored by technology acceptance model that farmers in both the districts had high Mean values of Internet, Mobile, Television and Radio with variables of ICT acceptance perceived usefulness, ease of use and Behavioral intention pattern in both Karnal and Sonipat districts and there was no substantive difference in the technology acceptance of farmers in both the districts. The thesis further proposed that the farmers who used ICT in their farm have benefited immensely in terms of reductions in costs, diversifying their crops and obtaining best rates for their produce in the market. This has resulted in reaping positive outcomes by them.

2. The study found that farmers increased their consumption of consumer durables except in Air conditioners in both districts of Haryana due to increase in their farm incomes. Farmers represent a major share of the rural consumer segment. Rural consumers have emerged as a big segment for various marketers as they generate volumes of business presently and in future.

3. It is significant to note that in tune with the opinion doing rounds in the international think tank on the role of ICT, Indian government is gradually accepting its importance and have undertaken various ICT initiatives for the development of rural society.

4. The farmers in the districts are getting SMS messages about the optimal quantity of manures and fertilizers to be used for different crops in the farm of standard size. This reduces the use of excess fertilizer and economizes the cost and results in savings for the farmers. This also leads to positive externality by not destroying the micro nutrients of the soil by excess use of fertilizers. Use of economical and optimum quantity of pesticide results in saving on account of inputs cost and indirectly increases the income of the farmers from the agricultural produce.

5. The farmers through SMS Messages receive information about the appropriate quantity of irrigation of crops as excess irrigation as well as inadequate irrigation leads to less agricultural crop production. Thus farmers are in a position to minimize the cost on account of optimal irrigation and obtain maximum agricultural production.

6. Through usage of ICT by the farmers, they receive valuable information about new varieties of high yielding varieties of agricultural seeds which help them to
increase farm productivity and income. They also receive information about best agricultural practices followed by the farmers in other states and regions which also creates positive externalities. There are many television programs which are featured on daily basis which provide agricultural information according to the ongoing season of cropping.

7. Not only there are inputs cost reductions by use of ICT technologies, the farmers also receive information about the prevailing rates of agricultural crops in the neighboring Mandis and on that basis they decide to sell their crops in the Mandi offering them the best rates. Thus the use of Radio, Mobile, Television and Internet help them to maximize their earnings from their agricultural produce. ICT technologies help farmers to get rid of middleman (Mandi agents) commission and exploitation. Problem of information asymmetry among farmers could be solved.

8. By the use of communication technology the farmers are getting information which crop they should grow depending on the rainfall situation. For instance, in the weather forecast, below normal rain was expected for the Rabi crops season in year 2014. Farmers were advised to go for cultivation of Maize Crop which required less water (irrigation). As the farmers have gone for sowing Maize this may lead to increased incomes because of higher yields of Maize. Use of ICT applications especially Mobiles are resulting into double benefits to the farmers both on account savings in total inputs cost as well as getting the best rates for their agricultural produce and by crops diversification depending on the weather forecast.

9. The Budget 2016-17 has called on the State Government’s to amend their agricultural Produce Marketing Committee Acts to form e-platforms which is based on the fact that ICT will be biggest facilitator for information sharing in the field of agriculture. Farmers can be guided on practices like micro irrigation and drip irrigation through mobile apps and SMS service. According to Economic Survey 2015-16, a Government study conducted in 64 districts of 13 states revealed that yield increased up to 45% in wheat, 20% in chana or chickpea and 40% in soya bean with micro irrigation.

10. India has not been able to reap the benefits of the impact of Information and communication technology on agriculture to the expected extent. Implemented ICT projects have yielded mixed results but the encouragement from the success stories is worth replicating with improvement in design and implementation.

**8.2 Recommendations**

Based on the findings of the study and previous empirical researches following recommendations are made to the agricultural community to improve further their farm productivity, income and consumption. In a developing country like India, the challenge is to integrate new technologies in the management and planning of agriculture in a more effective manner. Four components of technology: access, affordability, innovation and application needs to be strengthened to diffuse the
technology on a large scale. These recommendations are heavily interdependent and cannot be considered as standalone suggestions but be viewed as an interwoven bundle-

1. The cost of information dissemination through ICT technologies is miniscule as compared to the accrued benefits derived from it. Farmers derive economic benefits by reducing the cost of farming, increasing farm productivity and thereby increasing their agricultural incomes. Farmers need to be educated about the benefits they can derive by using new ICT components like Internet and Mobiles. ICT benefits could be demonstrated to farmers by local panchayats or government nodal bodies. ICT platforms could be created for villages to launch series of agricultural services which could lead to economies of scope for farmers.

2. Accessibility and affordability are the key drivers of ICT acceptance in socially and economically backward communities. Private Service providers offering ICT services should work on creating adequate and cost effective technological infrastructure to improve service delivery. They should try to enhance connectivity in rural areas as it a major hurdle in most of the rural backward areas.

3. Information dissemination services could be provided through community centers or information kiosks with a view of keeping people informed about the agricultural information and its economic impact on their agricultural performance. The test lies in improving the services of these platforms to make the platform cost-effective and benefiting the rural poor without worsening the ‘digital divide’.

4. Mobile penetration is already very high in rural markets and it can be used as an opportunity in designing agricultural applications. Mobile phones companies need to establish wider, affordable and effective product offerings to rural consumers to bridge their informational gaps. Mobile APPs providing Localized content available on-demand can make the informational messages more relevant and understandable for the people. The nature of local content should vary from district to district as per the different requirements of farmers in different districts. Feedback channels can also be created to respond to user requests, by understanding their specific needs.

5. To increase the ICT use among rural consumers, initiatives can be taken to develop regional portals. A regional portal can make it easier for rural communities to access content in regional languages and negotiate better deals with local buyers and financial institutions by aggregating their demand. These portals can also be used by marketers to promote product categories like consumer durables along with other products and services.

6. Create a learning infrastructure to satisfy then huge unmet demand for skill development and IT education among the rural population. Creation of learning infrastructure which may evoke sufficient response for using it for ecommerce and other ICT applications. Training should be given to farmers on how they can use the ICT tools like internet and Mobile phones to get access to latest information on agricultural production. Farmers should also form associations to facilitate such training programs. New technologies cannot be adopted without
sufficient training and education to the farmers. Training can drive the development and diffusion of ICT among rural masses. Agricultural information technology courses can be initiated in the curriculum of degree programs offered in Agricultural Universities. Training can be provided to farmers, and extension personnel for the use of ICTs to promote agricultural productivity.

7. It is now time to build experiments and programs which can leverage ICT technologies and scale them higher in agriculture. For a qualitative change the rural areas require reliable and continuous power supply. It is imperative that round the clock power supply is provided in rural areas so that farmers can make use of Television and internet to learn about the latest innovative and new practices in agriculture.

8. There is a vital need to develop modern integrators and logistics providers to procure fruits and vegetables grown by farmers in countryside and supply these directly to e retailers in urban centers using temperature controlled transport for which Agri Apps can be developed. Modernizing and development of agriculture calls for greater usage and application of ICT in this sector of the economy. Innovations like wireless broadband connections and solar technology can facilitate better information exchange and control on agriculture supply chains.

9. Policy designing comes about after taking inputs from extensive primary and secondary research of the ICT application in rural areas. Superior outcomes analyzing the impact of ICT on rural market has been observed so policies regarding investments in ICT technology need to be designed and implemented to obtain visible results focused on overall rural development. Robust investments for promoting ICT in rural sector should be made by the Government and private sector both. More private sectors projects need to be initiated for enhancing the rural livelihoods and improving the present status of agriculture in the country. Larger Budgets should be provided for ICT research and development for the benefit of rural sector.

10. Agriculture is a multifaceted system, comprising of varied activities and challenges: fragmented land, Family agriculture versus large-scale farming, Traditional crops versus commercial crops, relying on government subsidy or become self-competitive, challenges faced due to weather, land degradation or market uncertainty. Agriculture is cross-linked, pervasive and multi-disciplinary in nature which is linked to various agro industries. So Agro-ICTs, as an area of knowledge and field of action should be developed which requires an in-depth analysis to create a systemic understanding of the current state of Agriculture, its future scope and continuous innovation.

11. The rural areas of Karnal and Sonipat are widely diverse and thus require different solutions. It is important to take into account the idiosyncrasies and opinions of the people. People in Karnal are more aware and developed in terms of agricultural development. So more customized agricultural information services should be provided to farmers through ICT’s as per their requirement. Information should be relevant, updated and provided in real time. E-development projects should encompass all the information of entire resources in the supply chain to have a developmental impact.
12. The challenge of bringing connectivity to rural areas must be comprehensively addressed. All ICT can enable dissemination of information but government should try to boost the spread of new modern ICT (Mobile and internet) as they are more interactive, provides timely information at the click of a button and cheaper as compared to the traditional ICT (Television and Radio). Deployment of modern ICT requires focus on two components: cost and distribution. Hardware and software cost across the world are declining whereas distribution of modern ICT should be intensified. All Village Knowledge Centres, agri-clinics and e Platforms should provide single window solutions (hardware and software) to farmers’ problems and unemployed youth in villages should be trained and involved in this activity.

13. Indian agriculture faces many challenges like weak infrastructure, lack of credit, availability of right inputs, market inefficiencies, etc. and information is only considered as only of the challenge by the farmer to make his agricultural efforts profitable. Farmers require models like ITC e choupal which takes care of the needs of entire agri supply chains. Organizations should try and develop Agri models which help the farmers from sowing to selling the crops in the market supporting them and enhancing value at each stage of supply chain.

14. Indian agriculture thrives on trust, cooperation, and mutually beneficial relationships. Farmers in the village discuss their problems and opportunities amongst themselves, share their farm equipment’s and labour expenses and help each other in their financial decisions. So there should be more community awareness programs to make the entire village aware about the benefits of accepting ICT technologies in their farming activities. Farmers have low ICT literacy and are not able to understand the benefits of using emerging technologies for knowledge and information acquisition. Therefore, it is essential that central, regional and local governments should work in cooperation to take initiatives for the adoption of modern technology for information dissemination.

15. It is very essential to share the experiences of ICT applications in diverse fields as they can be a source of understanding the benefits and challenges of ICT use. It will help the policy makers to design the strategic initiatives focused on the holistic development of rural people by usage of ICT platforms.

8.3 Limitations of the Study

There are a number of ICT pilot projects being implemented by Government, NGOs and private enterprises but reaching out to farmers with the relevant information at the right time is a very big challenge.

1. A practical limitation of the study concerned the method of administration. Respondents who completed the questionnaire were contacted personally yet the conditions under which the test was completed were not controlled, so it is not known if conditions were always optimal for test taking of this nature, that includes the time of day, sincerity, setting with limited distractions and free from source of bias and the test was completed in one sitting without interruptions.
2. Only 4 different ICTs; Mobile, Internet, Television and Radio are considered in
the study. Impact of these ICTs have only been analysed on agricultural income
and agricultural performance thereby leading to increased consumption.

3. The sample was limited to farmers of only two districts of Haryana; karnal and
sonipat, it can be extended to other districts of Haryana in order to find out the
application of the construct of Information and communication technology.

4. The rural consumers in this study only included only farmers. The study can be
extended to people living in rural areas not practicing farming as their
occupation.

5. Since the study is limited to only two districts of Haryana, due caution must be
taken while interpreting the results or extending the study in other parts of India
and globe.

6. The methodology design included a convenience sample due to descriptive
nature of the study and time constraint. However, with additional planning and
time, the inclusion of random sampling would have been able to provide
strengthened regression and/or causal models.

7. Only consumer durables including five products; Television, Air conditioner,
Refrigerator, Mixer/grinder and washing machine are selected for the study due
to time and cost constraints.

8. The thesis is an exposition on the micro level analysis conducted in two districts of
Haryana. Though the issues and solutions for measuring the impact of ICT
application on consumption may not be very different from macro issues but the
same has been largely ignored in this study. The recommendations are of aggregate
nature, pronouncing broad changes at the level of policy decision making.

The future of India lies in its rural markets. It needs to be nurtured properly so
that it could generate optimistic results to the marketers who would explore its
treasures with gratifying expectations.

Note:
Gaging the influence of modern technologies, such as the internet and mobile
telephony, on agriculture is crucial in the pursuit for sustainable development in the
rural market of a developing economy. Mobile phones have the potential to assist
farmers on sharing relevant agricultural information that will boost their productivity
and incomes. This study will provide economic and social planners, decision makers,
and implementers for implementing effective policies on sustainable agricultural
development. The study will also guide policy-makers, researchers, and practitioners
on methods and approaches that can be used to promote the development of the use of
ICT in agricultural operation.

Adoption and Appropriation of ICTs in rural market is a long and gradual
process which will enable consumers in rural market to explore new dimensions and
benefits of ICT use in their lives. Even if new ICTs like Internet and mobile is quite beneficial but it has to be customer centric. Target customers need to integrate these technologies in their lifestyle. Presently there are innovators and early adopters of these technologies in rural market. But with innovation in Telecom and Broadband Industry very soon diffusion of these technologies is going to reach greater heights.

8.4 Directions for Future Research

The evolution of ICT in developing countries offers a new platform for accessing information. It could be complementary to agricultural extension, which has long suffered with challenges related to scale, sustainability, relevance and responsiveness. There are various ICT projects in India, Bangladesh and sub-Saharan implemented in the agriculture sector. But like traditional agricultural extension, ICT-based agricultural extension risks becoming unsustainable, a “fad” and with limited impact on knowledge, application of technology and prosperity of poor households. For this reason, projects need to be evaluated and monitored rigorously. It is important to assess their potential sustainability as well as cost effectiveness in the long run. ICT is an instrument and not a resolution to the socioeconomic problems of India. The information services must be tailored according to the requirements of rural consumers and be development focused.

There have been more than hundreds of ICT projects implemented in the last few years in India. Social inclusion has been the mantra for various government ICT projects implemented so far. ICT intervention in the field of agriculture is still at a very nascent stage but it has gained momentum in the last few years. However, significant outcomes in increase of agricultural output due to implementation of ICT technology has been recorded in very few of them. Most of them are pilot projects covering small geographical areas and are yet to be generalised as a model applicable for whole agriculture sector. Therefore many projects need to be restructured and reframed to incorporate the learning’s from the successes and failures of the past.

In tune with the ideology of inclusive development, government attempts to provide a holistic solution for increasing agricultural productivity and incomes by running ICT projects and schemes to facilitate this on a sustainable basis. National and State level e-Agriculture policy need to be formulated, focussing on strengthening ICT infrastructure and providing localised content. Government should increase their investment in productive agricultural research and technology innovation rather than spending their budgets on giving farm subsidy to rural farmers.

In the rural areas access to 3G and 4G service operators can encourage more use of internet and Mobile internet for searching about product categories and expand marketers reach. It can aim to promote e-commerce in rural markets which is worth exploring as a marketing agenda in today’s information age. ICT adoption in rural market should not be restricted to only agriculture. Its contribution to the rural community in different forefronts like e governance and E-selling should also be considered. The “agent of change” may not be the “innovative farmer” and the target function may not be to maximize agricultural output but the development of entire rural community.