एम–कृषि द्वारा मोबाइल आधारित कृषि सलाह सेवाओं का विवेचनात्मक विश्लेषण

Critical Analysis of Mobile Based Agro - Advisory Services: A Case of mKRISHI®

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DIVISION OF AGRICULTURAL EXTENSION
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Critical Analysis of Mobile Based Agro -Advisory Services: A Case of mKRISHI®

By

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A Thesis Submitted to the Faculty of Post Graduate School,
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CERTIFICATE

This is to certify that the thesis entitled **"Critical Analysis of Mobile Based Agro - Advisory Services: A Case of mKRISHI®."** submitted to the Faculty of the Post-Graduate School, Indian Agricultural Research Institute, New Delhi, in partial fulfilment of the requirements for the award of **Master of Science (Agriculture)** degree in **Agricultural Extension,** embodies the results of bona fide research work carried out by **Mr. Madan Singh, Roll No.-20257,** under my guidance and supervision, and that no part of this thesis has been submitted for any other degree or diploma.

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DEDICATED TO

The

Loving

Memory Of My Brother

Ajay Singh

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CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

Chapter-I

Introduction

Agriculture is the heart of the Indian economy because of its high share in employment and livelihood establishment. The share of agriculture and allied sectors in India's GDP is 13.7 per cent (2012-13); providing livelihood to nearly 600 million Indians. Despite a decline in the sector's contribution to GDP, food grain production has increased from 230.8 million tonnes in 2007-08 to 255.4 million tonnes in 2013-14(Economic Survey, 2013).

Indian agricultural growth is hindered by low productivity, shrinking agricultural land base, urbanization, diversification in production and consumption bases, poor market linkages and other factors. Two major developments have affected the growth of the agricultural sector in India since the1990s.One has been the stagnation in public investment, and the other has been the breakdown of extension services that has led to large gaps between the yield from experimental farms and the yield from farmer’s fields (Mittal, 2012).

Insufficient extension services and poor access to information have impeded the transfer of technology at the farm level in India. Extension services in India have primarily been the responsibility of the public sector. The government has huge research and development infrastructure in the form of institutions such as the Indian Council of Agricultural Research (ICAR), State Agricultural Universities (SAUs) and Krishi Vigyan Kendras (KVKs). Extension services help to fill the yield gaps by disseminating information regarding the technology relevant for the farmer’s geographical area and cropping system, and by recommending the appropriate quantity and quality of inputs and their timely use. They also educate farmers about good agricultural and crop management practices, and help in providing coping strategies to farmers in times of disastrous climatic conditions.

Agricultural Extension System in India

Raabe (2008) reviewed agricultural extension approaches in India by considering supply-side and demand-side reform aspects. Demand-side aspects explored were governance structures, capacity development, and affirmative action. Supply-side aspects addressed included administrative and fiscal decentralization,

private- and third-sector involvement, capacity development, and information and communication technology (ICT) use. Demand-driven approaches may improve accountability and incentives, but if organizations suffer from low staffing and low morale and are under resourced, organizational performance and the implementation of such reforms may continue to be poor. The different approaches to agricultural extension in India and worldwide continue to evolve. Since the Green Revolution in late 1960s and the accredited unsustainability of the Training and Visit (T&V) programme (Anderson, Feder, and Ganguly, 2006; Moore, 1984), agricultural extension, with its focus on escalating production via technology transfer, has adopted decentralized, participatory and demand-driven approaches in which accountability is geared toward the users (Birner *et al.*, 2006; Birner and Anderson, 2007; Davis, 2008; Hall *et al.*,2000; Kokate *et al.*,2009; Sulaiman and Hall, 2008; Swanson, 2009).

While the call for demand-driven agricultural extension has existed for several decades now, new modes of reaching out to farmers could have significant impact in India, as they might better reflect the local information needs of farmers. The diverse nature of the Indian subcontinent, with its wide variety of agro-climatic regions and broad range of socioeconomic conditions calls for agricultural extension approaches that are context and situation-specific. With more than 81 percent of Indian farmers cultivating an area of 2 hectares or less (DES, 2009; NSSO, 2006), there is an increasing need for stronger intermediaries that can facilitate information access for diverse smallholder farmers. Further progress in poverty and hunger reduction crucially depends on the increased productivity and profitability of these farmers, which, in turn, depends on the successful delivery of agricultural extension services.

Farmers require a varied range of information to support their farm enterprises. Information is needed not only on the best practices and technologies used for crop production, which the traditional public-sector extension system provided during the Green Revolution, but also information about postharvest aspects including processing, marketing, storage, and handling etc.

However, despite the renewed interest and investment in agricultural extension in India, the coverage of such services is insufficient. Government extension programs, extension services of the national agricultural research system, cooperatives, and non-governmental extension programs have a very limited outreach (NSSO, 2005). The NSSO (2003) survey showed that 60 percent of farmers had not accessed any source of information on modern technology to assist in their farming

practices in the past year. Of those who had sourced information, 16 percent received it from other progressive farmers, followed by input dealers. Of those farmers who had accessed information, the major problem of extension services was found to be the practical relevance of the advice (NSSO, 2005). The coverage and relevance of information provided to farmers through the agricultural extension system is therefore questionable. While this may be partly due to inadequate contact by the services, which need to reach a large and complex farming community, inappropriate or poor-quality information could also be a key hindrance to farmers' use of extension services. In other words, the content of the information provided by agricultural extension approaches, and the information farmers actually need, may not be aligned. Therefore, there is a need to reconsider the current agricultural extension approaches in India to understand where information gaps exist and determine why farmers are not accessing information through the large, well-established public-sector extension system in addition to emerging private and third-sector actors. Hence, comes the role of information and communication technologies in agriculture.

ICT in Indian agriculture

Information and communication have always mattered in agriculture. Ever since people have grown crops, raised livestock, and caught fish, they have sought information from one another. Agriculture is facing new and severe challenges in its own right. Given the challenges, the arrival of information communication technology (ICT) is well timed. With the booming mobile, wireless, and Internet industries, ICT has found a foothold even in poor smallholder farms and in their activities. The ability of ICTs to bring refreshed momentum to agriculture appears even more compelling in light of rising investments in agricultural research, the private sector's strong interest in the development and spread of ICTs, and the enhancement of organizations committed to the agricultural development agenda.

The generation and application of agricultural knowledge is increasingly important, especially for small and marginal farmers, who need relevant information in order to improve, sustain, and diversify their farm enterprises. In India, information and communication technology (ICT) projects that support such information flows are rapidly growing, with many initiatives are being implemented. ICTs can directly support farmer's access to timely and relevant information, as well as empower the farming community through creation and sharing of knowledge. ICTs in agriculture have the potential to facilitate greater access to information that drive or support

knowledge sharing. ICTs essentially facilitate the creation, management, storage, retrieval, and dissemination of any relevant data, knowledge, and information that may have been already been processed and adapted (Batchelor, 2002; Chapman and Slaymaker, 2002; Rao, 2007; Heeks, 2002). In the past, television and radio were the main electronic broadcast technologies used to reach rural communities; however, in the past two decades, Internet and mobile-based channels have emerged. ICTs now include computer-based applications and such communication tools as social media, digital information repositories (online or offline), and digital photography and video, as well as mobile phones (Balaji, Meera, and Dixit, 2007).

However, in agriculture, despite the rapid spread and potential of ICTs to facilitate farmer's access to information, many of the initiatives face common challenges, such as issues of sustainability, affordability, ease of use, accessibility, scalability, and availability of relevant and localized content in an appropriate language (Keniston, 2002; Dossani, Misra, and Jhaveri, 2005; Saravanan, 2010). The way in which ICT projects access, assess, apply, and deliver content may increase the likelihood of ICT use by farmers and thus may become an important factor in a project's success. To address the information needs of farmers, relevant content is a key component of ICT projects. The extent to which content is customized and localized to a farmer's condition influences its relevance. Local content has been defined as content that is intended for a specific local audience, as defined by geographic location, culture, or language or as content that is socially, culturally, economically, and politically relevant to a given society (Ballantyne, 2002). Thus, local content is the expression of a community‘s knowledge. Local content includes external or global content that has been transformed, adapted, and assimilated into a knowledge base.

Among the ICT tools, the rise of the mobile phone has been one of the most spectacular changes in the developing world over the past decade. Mobile phone, because of its affordability, accessibility, minimum skill requirement, widespread network etc., has emerged as important tools for the smallholder farmers. The increase in use of mobile phones across the globe and India has impinged on agriculture in various ways. Mobiles are being used to help raise farmers' incomes, making agricultural marketing more efficient, lowering information costs, reducing transport costs, and providing a platform to deliver services and innovate. Whether the potential of these trends can be realized more widely, especially in rural areas and in

an equitable way, is uncertain. Every aspect of the technology is changing rapidly; the public sector, private sector, and private citizens are constantly experimenting with new applications for it.

Indian Telecom market is one of the fastest growing markets in the world. With its 926.55 million telephone connections, it is the second largest network in the world after China. It is also the second largest wireless network in the world. The country is poised to achieve 1 billion telephone connections. Wireless telephones are increasing at a faster rate. The share of wireless telephones is 96.47per cent of the total phones. The share of private sector in total telephones is 86.09per cent. Overall tele-density has reached 73.32per cent. Urban tele-density is 146.96 per cent, whereas rural tele-density is 41.02percent which is also steadily increasing. Broadband connections increased to 13.30 million. The penetration of internet and broadband has also improved with 20.99 million internet subscribers and 13.30 million broadband subscribers across the country. The rural telephone connections increased from 282.29 million in March, 2011 to 343.76 million in June, 2012 and further to 349.22 million in March 2013 Annual Report 2012-13, Dept .of Tele-communication, GOI). The share of rural phones in the total telephones has constantly increased, from 34.04 per cent in December 2011-12 to 39.47 per cent in December 2012-13 (Annual Report 2011-12, Dept. of Tele-communication, GOI).

Mobile phone penetration in rural India is expanding rapidly (from 1.4 units per 100 people in 1995 to 51 units, or one phone per two persons, currently). There are a number of initiatives using mobiles to communicate information directly to farmers; these include IKSL (IFFCO Kisan Sanchar Ltd. in collaboration with Airtel), Mandi on Mobile (BSNL and Uttar Pradesh Marketing Board), Reuters Market Light, and Nokia Life Tools and mKRISHI®. Most of these approaches provide market information through SMS or voice messages, or question-and-answer capabilities. To date, there has been little evaluation of the impact of these services on farm production. Tata consultancy service (TCS) initiative mobile KRISHI (mKRISHI®) is one of the successful models. The mKRISHI® is innovative because it enables farmers to transform information into risk-mitigating actions.

Mobile based agro-advisory - mKRISHI®

mKRISHI® is a research project that seeks to disseminate targeted agricultural information to small and marginal farmers in India through mobile phone. The mKRISHI® (m = mobile; *krishi* = agriculture) platform, developed by Tata

Consultancy Services in 2006, enables farmers to access best-practice information and agricultural experts through low-cost mobile phones using SMS. The mKRISHI® disseminates a wide range of personalized information; the critical difference from others is that experts can respond to farmers' queries. It was visualized to increase income, improve the efficiency of markets, reduce transaction costs, and offer a great opportunity for innovative interventions, especially in service delivery.

The mKRISHI® project was started with the goal to develop a Mobile Agro Advisory System to provide the benefits of the information and communication technology (ICT) to the rural farmers by enhancing their agricultural productivity, farming efficiency and improving their earnings. This would help the farmers to generate wealth and improve their standard of living. The long term goal of mKRISHI is to bridge the barrier between the farmers and other stake- holders in their socio-economic ecosystem like agricultural experts, agri-business units, financial institutions, hospitals and many more utility providers.

mKRISHI® is a patented mobile based personalized services delivery platform that enables two-way data and information exchange between the end-users such as farmers and field agents and repositories of knowledge such as virtual knowledge banks, agriculture experts &procurement officers (PO). Currently, mKRISHI® offers a bouquet of agricultural services such as agro advisory, best practices, alert services, check weather forecast, agrisupply chain management services (like farm produce procurement), etc. among many others. It is not merely a technological platform, but a business solution which encompasses technology and enterprise management.

With the mKRISHI® platform, the intelligent management of the collective entity becomes possible due to the instantaneous digitization of the available field data through the mKRISHI® mobile component. The data are transmitted over the GPRS or any other equivalent network, and the ready availability of this data for analysis by the experts and operational planners through the mKRISHI® web component. The analyzed data is again transmitted back to the field for implementation. The introduction of this powerful technology to the conventional concept of a rural enterprise leads to its subsequent transformation into a "well-oiled" economically vibrant PRIDE™. This enables farmers to collectively procure, sell, and perform various transactions. The 'digital' feature of the PRIDE™ is the core critical

component to the success of this model and enables the rapid growth and its self-sustenance.TCS mKRISHI® platform combines multiple technologies such as cellular network, camera phone, automatic weather station, soil and crop sensor technologies to bring vital information regarding local weather, fertilizer requirement based on soil conditions, pest control, and current grain prices in local markets in a rich content format to the farmer's handset. mKRISHI® is connecting various eco partners (farmer's stakeholders) to farmers directly or through village entrepreneur. It connects farmers with a variety of stakeholders packaging multiple services through communication devices like mobile phones. It can also integrate wireless sensors and script technology with communication devices to provide an enhanced solution.

mKRISHI® serves to achieve the following:

- Reach farmers individually to understand their needs
- Enable farmers to receive important information about pesticides, fertilizers and soil and water conservation
- Provide critical micro-climate, weather information in order to plan farming operations
- Facilitate better production and cultivation practices
- Improve access to markets, refining the associated economy

Farmer looks for specific, actionable information. Farmers are not just interested in remotely sent SMS, market information or agro advisory. Farmer wants an end-to-end service and expects personal attention and occasional visit by experts once in a while. Most of the services do not stand up to his expectations. Though there has been initial enthusiasm to such services there is no repeat buying. TCS experience was no different. To tackle this problem, they designed a model that integrates agro-advisory services via calls and SMS with personal visits from field executives. Customers value personalised human interaction. Feedback gathered from farmers indicates that they greatly valued the personalised and face-to-face interaction with mKRISHI® field officers, providing the inclusive business with a sharp competitive edge.

Statement of the problem:

There is a muddle up of ICT initiatives in India by the governmental, cooperative agencies, non-governmental organization and private players. Most of them are site specific or crop specific, isolated and are confined to a small area.mKRISHI® is one among the numerous private ICT initiatives in India that need

to be premeditated in detail owing to its success. Today mKRISHI® network is spreadin 13 major Indian states namely Maharashtra, Andhra Pradesh, Gujarat, Orissa, Tamil Nadu, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Bihar through 70 projects.

With the promising role of ICT in agriculture development and poverty reduction, modest has been done to realize the full potential of the ICT in this field. Several attempts made so far in India and other parts of the world about describing the project in software and hardware aspects. Very little investigation has been done concerning the effectiveness and impact study of the ICT project.

Keeping above points in view a study of "Critical Analysis Of Mobile-Based Agro advisory-Services: A Case Of mKRISHI®" was formulated with following researchable issues.

Researchable issues:

In this present situation a number of researchable issues are drawn which need serious and sincere investigation. These researchable issues are-

1) What is the structural and functional mechanism of mKRISHI®?
2) How effective is mKRISHI® in addressing the information need of the farmers?
3) What are the socio economic impacts of mKRISHI®?
4) What are the constraints experienced by the stakeholders?
5) What are the suggestions for improvement and scaling up of the advisory services?

Specific Objectives:

1. To analyze the socio-economic profile of member farmers and to study the structural and functional mechanism of mobile based agro-advisory services.
2. To find out the effectiveness of mobile based agro-advisory services in addressing the information needs of the stakeholders.
3. To measure the socio-economic impact of mKRISHI® model.
4. To delineate the constraints faced in mobile based agro-advisory services and suggest a strategy for enhancing the effectiveness of mKRISHI®.

Scope of Study:

The findings of the study will have immense practical utility. The findings will be helpful to policy makers, cooperatives, governmental and non-governmental agencies, development professional and other agencies which are working for the agriculture and rural development through the use of ICT.

The study can contribute to the existing body of research on effectiveness and integration of information communication technology (ICT) and rural development. The findings of this study may serve as a guide for future researcher who may examine ICT in similar context. The farmer's perception of problem, solution and ICT role in solving those problems, their information needs, priorities and preference will be of huge practical utility.

Limitations of the study:

Utmost care has been taken to make the study as perfect as possible. However the limitations experienced during the study are as follows:

- Single student investigation has the inherent limitations of time and resources.
- The study was conducted in the regions of Maharashtra and Tamil Nadu states and the results were discussed in the specific context of the region and as such it is very difficult to generalize the findings to other areas.
- Also, the study is based on the expressed information and opinion of the respondents, which may not be free from individual biases and prejudices. In spite of the above limitations, considerable care and thought was exercised in making the study as scientific, systematic and as objective as possible

Chapter - II

Background

Research in any field invariably requires a sound theoretical understanding of the problem under study. Mobile based agro-advisory services are relatively new and emerging research areas in agricultural extension. Tata Consultancy Service (TCS) initiative mobile KRISHI (mKRISHI®) is one of them like these research areas. Even though research literatures of direct relevance to the topic were limited an attempt is made in this chapter to review the available related literature on theory and research in these and related areas and the same is presented appropriately in this chapter under the following heads:

2.1. Structural and functional mechanism of ICT based models in farm technology transfer

2.2. Effectiveness of ICT based models in agro-advisory services in addressing the information needs of the stakeholders

2.3. Socio-economic impact of ICT based models

2.4. Constraints in the functioning of ICT based models in agriculture

2.1. Structural and Functional Mechanism of ICT based Models and ICT in Farm Technology Transfer

Technical Centre for Agriculture and Rural Development (CTA) (1998) reported that for a promising agricultural development, the agricultural extension system that handles the rudder of the information dissemination system needs to be revitalized by perceiving the timely information needs of farmers. Synchronization in time and space between knowledge and input delivery systems is essential to impart credibility to the extension message. But, accessing information coming from physically remote rural locations in the developing world is quite difficult and costly; and it is equally difficult to deliver information to the farmers, extension workers and researchers who live and work in different places.

Alex et al. (2002) opined that communication is the essence of extension, which seeks to provide knowledge and information for rural people to modify behaviour in ways that provide sustainable benefits to them and society in general. New information and communications technologies (ICTs) provide alternative sources of information to rural people and open new vistas of possibilities for extension in development

communications, rural telecommunications and application of information technologies.

Dhaka and Mann (2002) stated as ICT as a comprehensive term which describe the whole range of process for generation, storage, transmission, retrieval and processing of information in desirable manner.

Chattopadyay (2003) explained that ICT projects around empowerment of rural women in Self Employed Women in Agriculture, Info-village of Pondicherry, Akshya, Malappuram, Kerala project showed that even the poor, neo-literate rural women can take full advantages of ICTs in changing their lives. Projects like Warna Wired village of Maharashtra motivated sugarcane farmers to overcome the hurdles of cultivation and marketing whereas e-choupal project of ICT established an excellent marketing network to avoid the pressure of middlemen on farmers and attain higher return to sale of produce.

Meera *et al.* (2004) opined that ICTs can help in enabling extension workers to gather, store and retrieve information needed by farmers, thus transforming them from extension workers into knowledge workers. The emergence of such knowledge workers will result in the realization of the much talked about bottom-up, demand driven technology generation, assessment ,refinement and transfer. She also reported that the overall development of rural areas is expanding in new direction and old ways of delivering information services are being challenged and traditional societies are being transformed to knowledge societies all over the world.

Davison *et al.*(2005) concluded that ICTs can be seen as useful in improving linkages between the research and the extension sub systems. The experience of rural tele-centres in the developing world shows that ICT can help in enabling rural development workers to gather, store, retrieve, adapt, localize and disseminate a broad range of information needed by rural families.

Mittal *et al*. (2010) reported that the new ICT initiatives are transforming the traditional agricultural extension system, but the mobile and internet-based information delivery models have to be complementary to conventional extension services.

2.2. Effectiveness of ICT based Models in Agro-advisory Services in Addressing the Information Needs of Stakeholders

Richardson (1997) opined that it is increasingly recognised that ICT is necessary for accessing required information and knowledge.

Meera (2002) reported that the functionaries of i-Kisanwere found to be highly effective compared to other two projects viz., Gyandoot and Warna Wired Village project. He also reported that the frequency distribution based on personal effectiveness score was found to follow normal distribution in case of Gyandoot with 73 per cent at medium level of personal effectiveness and the projected functionaries working in all the three project had medium to high level of personal effectiveness, which was a good indication for agricultural performance of ICT project and majority of the farmers in these project were found to be IT illiterate but their frequency of use of ICT services was very high.

Kaushik and Singh (2004) found that ICT allows efficient and transparent storage, processing and communication of information and that entrepreneurial innovation in this field may affect economic and social change.

Meera *et al*. (2004) reported that ICT would enable extension workers to gather, store, retrieve and disseminate a broad range of information needed by small producers such as information on best practices, new technology, better prices of inputs and outputs, better storage facilities, improved transportation links, collective negotiations with buyers, information on weather. They found that in Gyandoot, education and professional qualifications together enhance the professional competence of the staff, which may in turn improve their personal effectiveness. Their faith in people and their orientation towards IT extension were also found to be logically associated with their personal effectiveness.

De Silva and Ratnadiwakara (2008) reported that mobiles were used for timely interventions through SMS and up to 40 percent of wastage could be prevented, a service for which farmers were willing to pay. Mobile phone usage by farmers can reduce the information search costs, thereby dramatically lowering transaction costs and enabling greater farmer participation in commercial agriculture.

Silarszky *et al*. (2008) found that mobile phones do have a multi-dimensional positive impact on sustainable poverty reduction and accessibility was the main challenge in harnessing the full potential.

Fischer *et al*. (2009) emphasized that ICT had great potential and should be given the same importance as biotechnology revolution. In the context of India, the impact of mobiles as a mode of providing information for farming will depend on the how mobile networks are able to link the farmers to the market information in a timely and accurate manner.

Sugahara (2009) found that greater efficiencies in farm equipment and agricultural processes, and traceability in agricultural products' transport and marketing through mobile technologies such as RFID, wireless Internet, and cellular telephony for labelling, traceability and identity preservation.

Mittal and Tripathi (2009) also noted that the potential benefits of the flow of information had been obtained mainly by large farmers in the various states of India. This was because small farmers, despite access to information, had not succeeded in overcoming constraints resulting from poor access to capital, poor infrastructure and lack of access to markets.

Mittal *et al*. (2010) also stated that mobiles allow fishermen, particularly the more prosperous ones, to get timely price information and decide on the best place to land and sell their daily catch.

2.3. Socio-Economic Impact of ICT Based Models

Cecchini and Scott (2003) described the impact of information and communication technology in rural areas of India. Their study indicates that ICT can reduce poverty by improving poor people's access to education, health, government and financial services. Further, ICT can help small farmers and artisans by connecting them to markets. They also argued that in rural India, as well as in much of the developing world, realization of this potential was not guaranteed.

Annor-Frempong *et al*. (2006) opined that ICTs are increasingly being seen as cost-effective and practical tools to facilitate information delivery and knowledge sharing among farmers, extension agents and other stakeholders.

A study by Abraham (2007), on Kerala fishermen, found that the widespread use of mobile phones increased the efficiency of markets by decreasing risk and

uncertainty, although it noted that realising potential efficiencies depended on easy access to capital. Using mobile phones at sea, fishermen were able to respond quickly to market demand and prevent wastage from the catch – a common occurrence before the adoption of phones. Mobile phones helped co-ordinate supply and demand, enabling traders and transporters to take advantage of the free flow of price information by catering to demand in undersupplied markets.

Best and Maiyer (2007) studied the relationship between the use of ICT with personal characterises of the users and reported that the average age of the ICT user was 20 and of non-subscriber was 31.There was no significant relationship in educational level of both the groups.

Ilahiane (2007) stated that farmers who purchased mobile phones in Morocco found that that the average income increased by nearly 21 percent.

Jensen (2007) while examining the impact of mobile phone used by Kerala fishermen found that the introduction of mobile phones decreased price dispersion and wastage by facilitating the spread of information, which made markets more efficient and enhanced both consumer and producer welfare. Mobiles allow fishermen, particularly the more prosperous ones, to get timely price information and decide on the best place to land and sell their daily catch.

De Silva and Ratnadiwakara (2008) foundthat in Sri Lanka the cost of information from planting decision to selling at the wholesale market can make up to 11% of total production costs. The study also found that information asymmetry is an important contributor to overall transaction costs.

Aker (2008) reported that reduction in price dispersion with increased cell phone use is also seen in the grain markets in the sub-Saharan African country, Niger. Cell phones have a greater impact on price dispersion where travel costs were high.

Heeks and Molla (2009) found in their ICT evaluation compendium that ICT was not fully utilized in agriculture.

Labonne and Chase (2009) found strong evidence in Philippines that purchasing a mobile phone was associated with higher growth rates of incomes, in the range of 11–17 percent, as measured through consumption behaviour.

Ali and Kumar (2010) examined the impact of India Tobacco Company (ITC's) e-choupal on decision making by farmers and did a comparative analysis of users and non-users. They found that education, social categories, income and landholding size were important factors that influenced the use of ICTs in decision making.

Wankhade*et al*. (2011) studied the impact of Kisan Mobile Sandesh in 10 dimensions and reported Kisan Mobile Sandesh was playing effective and positive role for technology transfer in terms of cost effectiveness and addressing need based solution

Chahal*et al*. (2012) revealed that 6.03 per cent of the respondents of Reuter Market Light (RML) subscriber had less than two hectares of operational land holding. The average size of holding was 1.16 ha, 2.65 ha and 6.09 ha for small, medium and large farmers, respectively. Majority of the respondent subscribers (94 per cent) belonged to large or medium category farm holdings. The study also reported that 94 per cent RML subscribers were literate through the varying schooling years, 15 per cent respondent had obtained graduate degree and more than 78 per cent respondents were at least matriculate.

2.4. Constraints in the Functioning of ICT Based Models in Agriculture

Mansell and When (1998) reported that illiteracy is a fundamental barrier to participation in knowledge societies. A large proportion of the rural population of developing nations, particularly majority women of these nations are illiterates. It means that these individuals are disadvantaged and lack the basic skills required for the benefits of ICTs. The assistance of intermediaries may there be required.

According to Nath (2000), the barriers to adopt information technology in the developing countries include:

- Inabilities to recognize the knowledge they possess, put a value to it and use the power of knowledge to their growth.
- Who gets to access the information superhighway is the most prominent question. Knowledge sharing will continue to be impeded by the digital barrier unless there is a universal access to ICT in all parts of the world particularly the last mile delivery.
- Lack of relevant and locally specific content constitutes the most critical element impeding the growth of knowledge societies after connectivity.
- Handling ICT, hosting of information and retrieving useful information from the net does require a fair amount of technical skills and net-literacy. In developing countries, the level of skills about computer use and internet navigation is extremely low which impedes their transformation to knowledge societies even when other factors are favorable.

- Language is one of the major barriers to the formation of perfect knowledge societies in developing countries. Each day over two million pages are added on the Internet but there is very small content representation on the net in the vernacular languages.

Munyua (2007) reported that the greater use of ICT in agriculture is the scattered nature of ICT initiatives. This leads to low adoption and usage of support tools developed for small-scale agriculture because extension services do not reach the targeted population on time.

Bhavnani*et al. (*2008) pointed out that despite the increasing availability of mobile phones and supply of agricultural information the benefits are not reaching the poor.

Mittal and Tripathi (2009) opined that the messages delivered should be based on the information needs of farmers so that it can be used by them for daily agricultural activities.

Mittal, S. (2012) also reported that although farmers are getting information through mobile sources, they realise only little add-on gain from this information vis-a-vis the information received through traditional information sources. He also reported that though mobile phones promise new opportunities for reaching farmers with agricultural information, its potential remains unutilised due to several institutional and infrastructural constraints. The main beneficiaries of the ICT revolution have been population segments in areas with a developed infrastructure. Apparently, the poor and those living in distant areas have been excluded.

Chapter -III

Research Methodology

This chapter relates to the description of methods and procedures used to conduct the study. The procedure adopted for research is presented under the following sub headings:

3.1. Research Design

3.2. Selection and description of the study area

3.3. Selection of the respondents

3.4. Selection of the variables and their measurement

3.5. Methods and tools of data collection

3.6. Statistical tools applied

3.1. Research Design:

A research design is the overall plan or program in any research. According to Tripathi (1987), it is the general blueprint for the collection, measurement and analysis of data. It includes an outline of what the investigator will do from writing the hypotheses and their operational implications to the final analysis of the data. Research designs are developed to enable the researchers to answer research questions with validity, objectivity and accuracy. In the present study, where the main aim is to analyse the effectiveness of mKRISHI® an *ex post facto* research design was used.

According to Kerlinger (1964), an *ex-post facto* research is a systematic empirical enquiry in which the researcher does not have direct control over the variables because their manifestations have already occurred or because they are inherently not manipulable. The *ex-post facto* research design was used in the present study, as the manifestations of the variables presumably had already occurred and there was no scope for manipulation of any variable.

3.2. Selection and description of the study area:

The two states, Maharashtra and Tamil Nadu were selected purposively for the study location. mKRISHI® was working in these states for the last six years and these were the states where mKRISHI® was started. To study the effectiveness of

mKRISHI® approach, a period of action intervention was essential to record the impact.

The two districts were purposively selected which had been adopted by mKRISHI®, Nasik of Maharashtra and Kanchipuram of Tamil Nadu. Further, two blocks were selected by simple random sampling technique from each of the districts. Thus total four blocks were selected for the study. Two villages of Nasik and Dindori block (Maharashtra), Girnari and Permori, were selected by random sampling and two control villages Matori and Palkhed respectively, were also selected for the comparative study. Similarly, two villages of Chitamur and Acharapakkam block (Tamil Nadu), Thenpakkam and Velliyampakkam, were selected by random sampling and two control villages Ammanampakkam and Karasangal respectively, were also selected for the comparative study.

Nasik District

The district lies between 18° 00' to 20° 53' N latitude and between 73° 16' to 75° 16’ E longitude. The district is completely landlocked, being surrounded by Thane district on the west and south west, Ahmednagar district on the south, Aurangabad district on the south east and east, Jalgaon district on the east and north east, Dhulia on the north and Surat and Dang districts of Gujarat on the west.

Table: 3.2.1. Demographic profile of Nasik district

Area	15,530 sq. Km
Population(2011)	61,07,187
Sex Ratio	934
Number of Block	15
Number of Villages	1931
Literacy Rate	82.31%

Kanchipuram District

It lies between 11° 00' to 12° 00' N latitudes and 77° 28' to 78° 50' E longitudes. The district lies in the north east of the state of Tamil Nadu in India. It is bounded in the west by Vellore district and Thiruvannamalai district, in the north by Tiruvallur district and Chennai district, in the south by Viluppuram district and in the east by the Bay of Bengal.

Table: 3.2.2. Demographic profile of Kanchipuram district

Area	4,432 sq. Km
Population(2011)	39,98,252
Sex Ratio	986
Number of Block	13
Number of Villages	648
Literacy Rate	84.49%

3.3. Selection of the respondents:

Fifty villages in Nasik and eighteen villages in Kanchipuram district are adopted by mKRISHI®, respectively. From these 68 villages, four villages, two each from respective states were chosen for the study by random sampling. Besides these, two each from the respective blocks of two states was selected as the control villages. Thus a total of eight villages, (4 mKRISHI® villages and 4 control villages) were selected. Fifteen farmers from each of the identified villages were selected by simple random sampling technique. Thus, a total 120 respondents (60 members and 60 non-members) were selected. Besides, 10 extension personnel, KVK scientist and mKRISHI® staff were also selected from each of the two districts (20) for the study. Thus, there were a total of 140 respondents.

3.4 Variables and their measurement:

The appropriate variables for the present study were prepared based on the objectives of the study, review of literature, discussion with experts and also the observations made by the researcher.

3.4.1: Independent variables

The following socio-economical and communication variables were chosen as independent variables for the study:

Table 3.4.1. Variables and Their Measurements

Socio-economic Variables	**Tools used for measurements**
Age	Chronological age in years (direct questioning)
Education	Level of formal Education (direct questioning)
Farming experience	Scheduled developed
Land holding	GOI classification
Occupation	Scheduled developed

Family size	Scheduled developed
Annual household income	Direct questioning
Share of total household	Scheduled developed
Social participation	Modified scale of Murali(1997)
Communication variables	**Tools used for measurements**
Extension agency contact	Modified scale of Somasundaram(1976)
Mass media utilization	Modified scale of Kumar(2008)

Operational definitions of the variables

According to Kerlinger (1964) an operational definition is a specification of the activities of the researcher in measuring a variable or in manipulating it. The operational definitions of the variables taken under study are given below.

1. Age: It is quantified as the number of chronological years completed by the respondents at the time of survey. The age was classified as below:

Category	Score
Young(35 years and below)	1
Middle aged(36-58 years)	2
Old(59 years and above)	3

2. Educational Status: Educational status was operationalized as the level of literacy. Based on the level of literacy possessed by the respondents, their educational status was classified into six categories as developed by Man Singh (1993) with slight modifications for the study purpose. The scoring procedure adopted as given below:

Level of Education	Score
Illiterate	1
Functionally literate	2
Primary	3
Middle	4
Higher secondary	5
Collegiate	6

3. Size of Family: Size of family is an important variable affecting the labour availability in processing enterprise. It was measured as the total number of family members residing together in one household at the time of investigation. It was further categorized and scored as follows.

Category	Score
Small family size(up to 3 members)	1
Medium family size(between 4 to members)	2
Large family size(between 7 to 9 members)	3
Very large(more than nine members)	4

4. **Farming experience:** Farming experience refers to the actual completed years of experience of the respondents in farming at the time of interaction. Each year of experience was given a unit score.
5. **Land holding:** The extent of land an individual possessed and cultivated was termed as land holding. The procedure followed to convert the total extent of land possessed into score as follows:

Extent of land	Score
No land (landless)	1
0-1 ha (marginal farmer)	2
1-2 ha (small farmer)	3
2-4 ha (semi-medium farmer)	4
4-10 ha (medium farmer)	5
> 10 ha (large farmer)	6

6. **Occupation status:** Occupational status refers to the major activity of the respondent in which he or she was involved for most part of the day, and which generates the major part of family income. The categorization is as follows:

Sources	Score
Farming	1
Farming + Labour	2
Farming + Business	3
Farming + Independent profession	4
Farming + Service	5

7. **Annual household income:** This refers to the income generated by the respondent through various sources in rupees.
8. **Share of agriculture in total household income:** This refers to the contribution of agriculture and non-agriculture sector towards the respondent's family income. For this, an arbitrary scoring system was developed as follows:

Category	Score
Partially from agriculture	1
Agriculture alone	2

9. Social participation: Social participation was operationalized as the extent of involvement of an individual in any formal organization in his/ her community. The scale used by Trivedi (1963) was followed in this study with slight modification. The social participation was measured in terms whether he/she is member of the organization or any office post holder in the organization. The score '0' is given for no membership, '1' is given for membership and '2' is given for office post holder in the organization.

10. Mass media utilization: It refers to the degree of utilization of the mass media sources by the respondent. To measure this variable a four point scale (Kumar, 2008) was used which indicates how often the respondents got information about improved farm practices from each of the sources. The scoring procedure for the responses was Most often (3), Often (2), Sometimes (1) and Never (0). The score of the individual respondent was obtained by adding the scores over different sources. The range of score was from 0 to 15. Total score of the respondents were classified as frequency of farmers.

11. Extension agency contact: This is referred to the degree to which an individual contacted extension agencies to get information on agriculture and other aspects. The responses were scored on a 6- point scale developed by Somasundaram (1976). The scoring system followed was 6 for "weekly", 5 for "fortnightly", 4 for "monthly", 3 for "once in two months", 2 for "once in three months", 1 for "once in six months". The total score of the respondents were classified as on frequency distribution.

3.4.2. Assessment of the effectiveness of mKRISHI® services

Effectiveness of mKRISHI® is the degree to which farmer was satisfied with the services which were available timely in terms of appropriate technology that increases their production as well as their income. The effectiveness was measured through an "effectiveness index" developed for the study, which consisted of following five dimensions.

1. Timeliness of information
2. Quality of information
3. Utility of information

4. Satisfaction of farmer

5. Ease of understanding

3.4.2.1. Measurement of timeliness of information

It refers to the availability of the technology and the services provided by the mKRISHI® at the appropriate time to the farmers in terms of seasonality of the crops grown in that particular area. It was measured by using schedule and the scoring pattern used was as follows:

Timeliness of information	score
Not at timely	1
Timely	2
Very timely	3

3.4.2.2. Measurement of quality of information

It was operationally defined as the degree or level of excellence of the information provided by mKRISHI® expert perceived by farmer according to their farming conditions and climate in particular region. It was measured by using schedule and the scoring pattern was as follows:

Quality of information	Score
Not at all good	1
Moderate	2
Good	3
Very good	4
Excellent	5

3.4.2.3. Measurement of utility of information

It refers to the degree to which information is useful in resolving a problem. It was measured by using schedule and the scoring pattern used was as follows:

Utility of information	score
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly disagree	5

3.4.2.4. Measurement of Satisfaction of farmer

It referred to the degree to which information was able to meet the information need of the users. The farmer's satisfaction was operationally defined as the perceived need satisfaction with the use of services provided by mKRISHI®. It was measured by

using schedule and the scoring pattern used was as follows:

Need Satisfaction	Score
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

3.4.2.5. Measurement of ease of understanding

It referred to the degree to which the message conveyed is clear and understandable. It was measured by using schedule and the scoring pattern used was as follows:

Ease of understanding	Score
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

3.4.2.6 Effectiveness index

After calculating all the five dimensions of effectiveness, the effectiveness index was calculated for each respond based on the following formula:

$$Effectiveness\ Index = \frac{TI\ X\ W_1 + QI\ X\ W_2 + UI\ X\ W_3 + SF\ X\ W_4 + EU\ X\ W_5}{W_1 + W_2 + W_3 + W_4 + W_5} X100$$

Where TI=Timeliness of information

QI=Quality of information

UI=Utility of information

SF = Satisfaction of farmers

EU = Ease of understanding

W_1= Weightage for the timeliness of information as given by the judges

W_2= Weightage for quality of information as given by the judges

W_3= Weightage for utility of information as given by the judges

W_4= Weightage for satisfaction of farmers as given by the judges

W_5= Weightage for ease of understanding as given by the judges

The respondents were classified into five categories from very low effectiveness to very high effectiveness based upon five equal class intervals as given below:

Effectiveness level	**Effectiveness index score**
Very low	
Low	
Medium	
High	
Very high	

3.4.3. Assessing the socio-economic impact of mKRISHI®

Decision Quality: A set of five statements were made related to decision making and respondents including members and non-members were asked to score these statements on basis of decision they would have taken. The scoring system is given as below.

Category	**Score**
Change	0
No Change	1

Change in Knowledge: A set of six statements were made related to knowledge and respondents including members and non-members were asked to score these statements on basis of whether they knew this information. The scoring system is given as below.

Category	**Score**
Yes	0
No	1

Information Networking: The information networking patterns of the mKRISHI® were analyzed using a rating scale that contains a set of eight questions. Responses were scored on a 3-point continuum ranging from 0 = 'Never' to 2= 'Often' for all statements.

3.4.3.4. Change in yield

Change in yield was calculated by subtracting the yield per acre per crop for non-members from the production per acre per crop of the members. The change in yield was converted into percentage change in yield, using the following formula:

Change in yield=

$$\frac{\text{Yield per acre (member farmers) - Yield per acre (non-members)}}{\text{Yield per acre non members}} \times 100$$

3.4.3.5. Change in income

Change in income was calculated by subtracting the income per acre per crop for non-members from the income per acre per crop of the member farmers. The change in income was converted into percentage change in income, using the following formula:

Change in income =

$$\frac{\text{Income per acre (member farmers) -Income per acre (non-members)}}{\text{Income per acre non members}} \times 100$$

3.4.3.6. Change in market price

Change in market price was calculated by subtracting the market price per quintal per crop received by member farmers from the market price per quintal per crop received by the non-members. The change in price was converted into percentage change in income, using the following formula:

Change in market price =

$$\frac{\text{Market price per quintal member farmers-Market price per quintal non members}}{\text{Market price per quintal non members}} \times 100$$

3.4.3.7. Expenditure pattern

Expenditure pattern for members and non-members were taken on different items and compare the both group expenses through with without design with the help of mean value.

3.4.4. Constraints in mKRISHI® services

For the measurement of constraints for the mKRISHI® system, four dimensions of constraints were analyzed through a rating scale developed for the purpose, that contains a set of statements in four dimensions viz.,(i) Technological constraints, (ii) Economic constraints, (iii) Social constraints, and (iv) Psychological constraints. Responses were obtained on a 3-point continuum with scores ranging from 1 to 3 for all statements.

Severity of constraints	Score
Not severe	1
Severe	2
Most severe	3

The constraints of mKRISHI® in dissemination of technology have been studied through open-ended questions. As all items were not ranked by all the respondents, the responses are arranged by using Garret's ranking formula i.e. the method of combining of incomplete order of merit ratings as suggested by Garrett(1979) was followed. Garret's ranking technique provides the change of orders of constraints and advantages into numerical scores. The prime advantage of this technique is that constraints are arranged based on their importance from the point of view of respondents. Garret's formula for converting ranks into per cent was given by:

$$\text{Percent position} = \frac{(R_{ij} - 0.5)}{N_j} X100$$

Where,

R_{ij}= Rank given for i^{th}factor by j^{th}individual

N_j= Number of factors ranked by j^{th}individual

The per cent position of each rank was transmuted to order of merit into scores referring to the table given by Garret and Woodworth (1969). For each factors, the scores of individual respondents were added together and divided by the total number of the respondents for whom scores were added. These mean scores for all the factors were arranged in descending order, ranks were given and most important factors were identified.

3.5. Method and tools of data collection

Both primary and secondary data had been of concern. The primary data were collected by survey with a well-structured schedule developed for the purpose. The major tools used for data collection were personal interviews utilizing structured schedules and conducting group discussions. The secondary data were collected from the home page of mKRISHI® website, the annual reports of mKRISHI® and also from the functionaries of mKRISHI®.

3.6. Statistical tools used

The quantification of qualitative data was done by descriptive and analytical statistics. The data was further analyzed for testing their significance. Data were analyzed by calculating frequency, percentages, mean, standard deviation, coefficient of variation, independent sample t-test, Friedman test and Mann-Whitney U test.

SPSS: It is a software package used for statistical analysis. It was used for calculation of independent sample t-test to find the significant difference among the means of different samples.

Percent: Percent were used in descriptive analysis for making comparisons. For calculating per cent the frequency of a particular cell was multiplied by 100 and divided by the total number of respondents in that particular cell.

Arithmetic mean: The mean is the value arrived at by dividing the sum of observations by the total number of observations.

Standard deviation: The standard deviation is defined as the square root of the mean of the squared deviations of individual values from their mean. The formula used for standard deviation was as under

$$S.D. = \sqrt{\frac{\sum (Xi - \overline{X})}{N}}$$

Where,

Xi = Values of every cell entries

X = Mean of overall cell entries

N = Number of observations

Coefficient of variation (CV): CV is calculated to observe the variation in data is calculated by (S.D/Mean *100)

Independent sample t-test: It was calculated to find the significance difference between the mean of two independent samples.

Friedman test: It was used to find the most severe constraints among the given number of constraints by measuring the mean score of all the constraints.

Mann–Whitney U test: It was used for two independent samples. This test is used to compare the means of two independent samples.

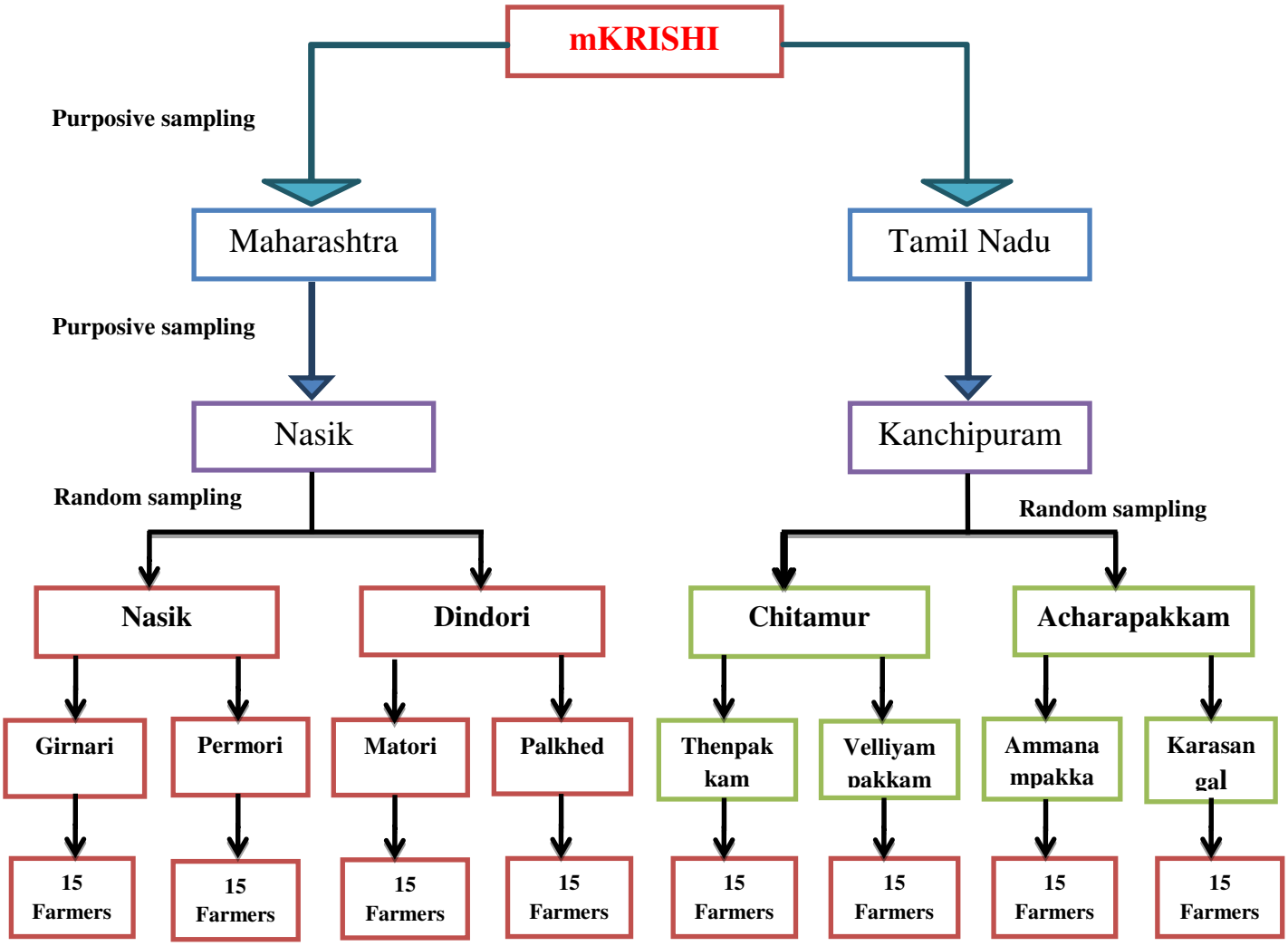


Plate No. 3.1 Sampling procedure in two districts of Maharashtra and Tamil Nadu

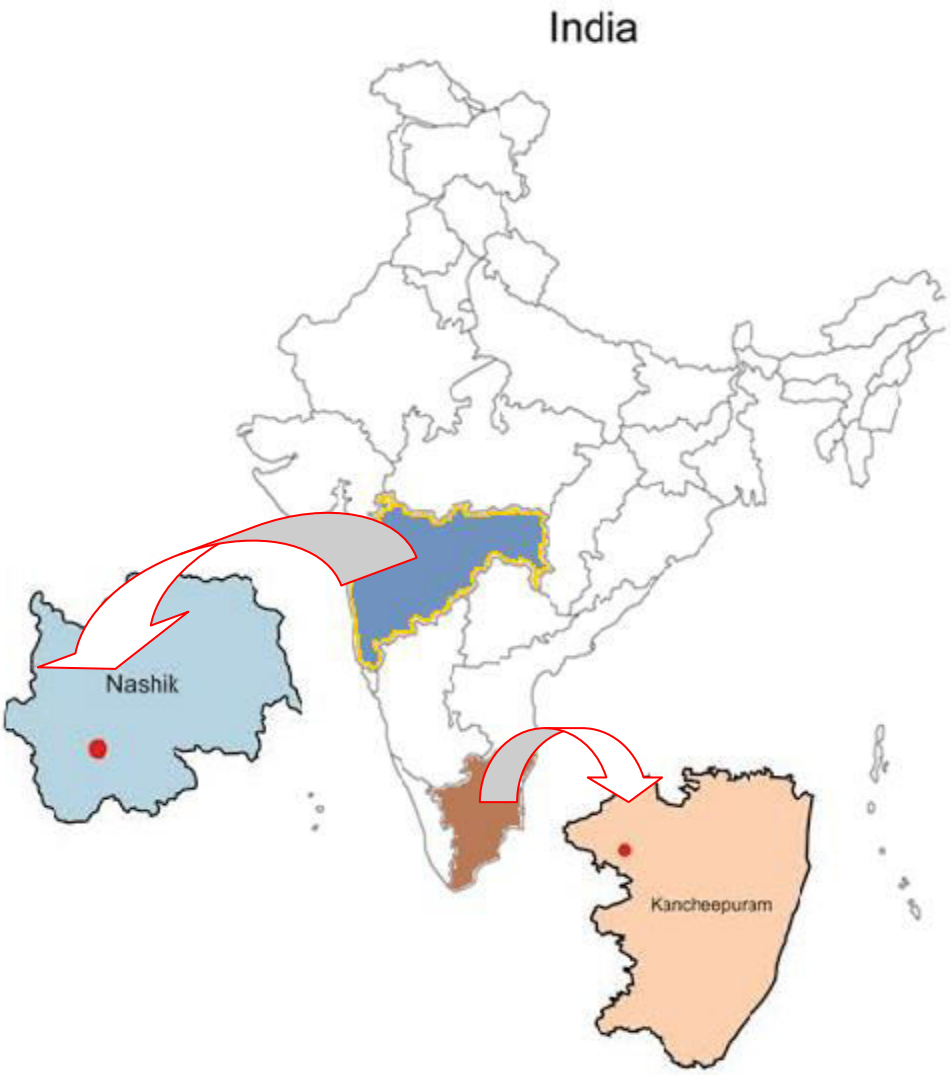


Plate No 3.2. Study location in Maharashtra and Tamil Nadu

Researcher collecting data from farmers in Maharashtra

Researcher collecting data from farmers in Tamil Nadu

Plate No 3.3. Student interacting with the farmer during data collection

Research Paper I **Chapter-IV**

Socio-Economic Profile of the Member Farmers and Structural and Functional Mechanism of Mobile Based Agro-advisory Services

Abstract

Among modern information and communication technology (ICT) modes, mobile phone has been most recent and widely accepted mode of delivering information in most of the developing country including India. Increasing mobile phone and its services enhance the availability to access information and to increase awareness, education, better adoption of technology, better health and efficiency, reduced transaction costs, better market efficiencies, etc. These in turn will catalyze the rural sector development and economic growth. As an information platform to receive messages – SMS or voice-message information provide the ability to get connected to new knowledge and information sources not previously available with the possibility of real-time, highly tailored information delivery. The overall goal of using the mobile phone-enabled information delivery mechanism is to have inclusive growth by reducing the knowledge gap between large and small farmers and by creating awareness among the farming community. Most of Indian farmers are small and marginal so they cannot afford costly ICT based services. In this context, mKRISHI® which was started in 2006 is more appropriate as compared to all other ICT based projects in India because mKRISHI® operated through mobile phone which is very cheap and affordable by farmers. After the early success in the popularization of sustainable farming practices through the use of localized message in local language in the Maharashtra state, it had been deployed to thirteen other states of the country. There were totally 11 languages in which message had produced in 13 states of the country. This unique approach is popular among farmers which resulted in better adoption of improved farm practices. Most of member farmers belong to young aged group, small farmer, high social participation and high contact with extension agency.

Key words: ICT, mKRISHI®, Mobile.

Introduction

Indian agriculture is essentially small farm agriculture with the majority of farmers owning less than 1 hectare land. Small and marginal farmers now constitute over 80 per cent of farming households in India. The average farm size has been declining. “The slow growth of opportunities in the non-farm employment sector has led to the proliferation of tiny and economically non-viable holdings” (NCF, 2006). The land and water resource base for an average farm holding has declined over the last few decades and this essentially means producing more food from less land and water resources. There are wide gaps in yield potential and national average yields of most commodities are low. “In addition to stressed natural resources and very inadequate rural infrastructure, there was clear evidence of technology fatigue, run-down delivery systems in credit, extension and marketing services and of insufficient agricultural planning at district and lower levels” (Planning Commission, 2011).

Agricultural extension services can play an important role in addressing many of these challenges. Perhaps, there is no agency at the ground level, other than agricultural extension services that can provide knowledge support to farmers and other intermediaries who are supporting farmers and at the same time support programme implementation. Considering the changing nature of agriculture and the evolving challenges, producers currently need a wider range of support, including organisational, marketing, technological, financial and entrepreneurial. To be successful, farmers require a wide range of knowledge from different sources and support to integrate these different bits of knowledge in their production context. Agricultural extension services include transferring knowledge to farmers, advising and educating farmers in their decision making, enabling farmers to clarify their own goals and possibilities, and stimulating desirable agricultural developments. Traditional public-sector extension services use a variety of extension programmes to overcome barriers to technological adoption without much success (Anderson and Feder, 2004; Anandajayasekeram et al., 2008; Aker, 2010).

The extension workers and farmers ratio is very wide in India .This clearly indicates about the inadequate manpower of extension worker in India. All these things have made to think beyond the traditional agriculture extension and subsequently led to

the increase application of ICT in agriculture. ICTs in agriculture have the potential to facilitate greater access to information that drive or support knowledge sharing. ICTs essentially facilitate the creation, management, storage, retrieval, and dissemination of any relevant data, knowledge, and information that may have been already been processed and adapted (Batchelor, 2002; Chapman and Slaymaker, 2002; Rao, 2007; Heeks, 2002). In the past, television and radio were the main electronic broadcast technologies used to reach rural communities; however, in the past two decades, internet- and mobile-based channels have emerged. ICTs now include computer-based applications and such communication tools as social media, digital information repositories (online or offline), and digital photography and video, as well as mobile phones (Balaji, Meera, and Dixit, 2007). However, in agriculture, despite the rapid spread and potential of ICTs to facilitate farmers‘ access to information, many of the initiatives face common challenges, such as issues of sustainability, affordability, ease of use, accessibility, scalability, and availability of relevant and localized content in an appropriate language (Keniston, 2002; Dossani, Misra, and Jhaveri, 2005; Saravanan, 2010). At present in India a number of ICTinitiatives in agriculture. The modes for providing information vary in different ICT projects. The approach adopted by mKRISHI® is different from all other projects. The present study attempts to study the socio-economic profile of member farmers and conduct in depth documentation of organizational and functional mechanism of the well establishing mKRISHI® system i.e. Tata Consultancy Service (TCS).

Methodology

Two districts, one from each of the states of Maharashtra and Tamil Nadu were selected for the study purposively as mKRISHI® was started in these district in 2006.The districts were Nasik in Maharashtra and Kanchipuram in Tamil Nadu. The data was collected from 60 respondents from the mKRISHI® subscriber farmers. Beside it, 20 staff person 10 from each state, associated with mKRISHI® was also interviewed. The genesis, growth and approach of mKRISHI® extension system were studied by using secondary sources, i.e. annual reports and the research papers. The website of mKRISHI® was also extensively used for this purpose. Besides this, the beneficiary

farmers, local mediators and the extension personnel who are involved in this was interviewed to collect relevant information.

Results and Discussion

4.1. Socio-personal variables of member farmers

4.1.1. Age

Table 4.1.1showed the distribution of the farmers according to their age. Most of the farmers (50 %) were of young age.

Table: 4.1.1. Distribution of the farmers according to age

(n=60)

S.N.	Age	Beneficiary Group	
		f	%
1.	Young (35 years and below)	30	50.0
2.	Middle aged (36-58 years)	26	43.3
3.	Old (59 years and above	4	6.7
Total		60	100

f=frequency, %=percentage

4.1.2. Education

The educational levels of the respondents are reported in Table 4.1.2. It was observed that majority of the respondents (36.7%) had secondary level education.

Table: 4.1.2. Distribution of farmers according to education level (n=60)

S.N.	Education Level	Beneficiary Group	
		f	%
1.	Illiterate	3	5.0
2.	Functionally literate	1	1.7
3.	Primary school	14	23.3
4.	Secondary school	22	36.7
5.	Higher secondary school	11	18.3
6.	College and above	9	15.0
Total		60	100

f=frequency, %= per cent

4.1.3. Gender

The sex of the respondents is reported in Table 4.1.3. It was observed that majority of the respondents (86.7%) were male farmer.

Table: 4.1.3. Distribution of farmers as per sex

(n=60)

S.N.	Gender	Beneficiary Group	
		f	%
1.	Male	52	86.7
2.	Female	8	13.3
Total		60	100

f=frequency, %= per cent

4.1.4. Family Size

Table 4.1.4 shows the distribution of the farmers according to size of family. Most of the respondents (75 %) belonged to medium sized family.

Table: 4.1.4. Distribution of farmers as per size of family (n=60)

S.N.	Size of Family	Beneficiary Group	
		f	%
1.	Small family size (Up to 3 members)	6	10.0
2.	Medium family size (between 4 to 6 members)	45	75.0
3.	Large family size (between 7 to 9 members)	5	8.3
4.	Very large (More than nine members)	4	6.7
Total		60	100

f=frequency, %= per cent

4.1.5. Occupation

Table 4.1.5 illustrated the occupation of respondents to which they depend for their livelihood. It was apparent from the table that the occupation of most of the beneficiary farmers (63.3%) was farming and farming and business (36.7%).

Table: 4.1.5. Distribution of farmers as per their occupation

(n=60)

S.N.	Occupation	Beneficiary Group	
		f	%
1.	Farming	38	63.3
2.	Farming and Business	22	36.7
Total		60	100

f=frequency, %= per cent

4.1.6 Land holding

It was evident from the Table 4.1.6that most of the farmers (30%) were small farmers and (26.7%) semi-medium farmers.

Table: 4.1.6. Distribution of farmers based on land holding

(n=60)

S.N	Land holding	Beneficiary Group	
		f	%
1.	0-1 ha (marginal farmer)	11	18.3
2.	1-2 ha (small farmer)	18	30.0
3.	2-4 ha (semi-medium farmer)	16	26.7
4.	4-10 ha (medium farmer)	8	13.3
5.	10 ha (large farmer)	7	11.7
Total		60	100

f=frequency, %= per cent

4.1.7 Farming experience

Table 4.1.7 showed the distribution of the farmers according to their farming experience. Most of the farmers (35%) were having farming experience between 11-15 years of and 16-20 years.

Table: 4.1.6. Distribution of farmers based on farming experience

(n=60)

S.N	Farming experience	Beneficiary Group	
		f	%
1.	(Up to 5 years)	1	1.7
2.	(between 6-10 years)	5	8.3
3.	(between 11-15 yeras)	21	35.0
4.	(16 -20 yeras)	21	35.0
5.	(More than 20 yeras)	12	20.0
Total		60	100

f=frequency, %= per cent

4.1.8 Annual household income

Table 4.1.8 showed the distribution of the farmers according to their annual household income. Most of the farmers (56.66%) were having high medium annual household income.

Table: 4.1.8. Distribution of farmers based on annual household income

(n=60)

S.N	Annual Household Income	Beneficiary Group	
		f	%
1.	(below one lakh) –low	2	3.3
2.	(1-3 lakh) medium	12	20
3.	(3 to 6 lakh) high medium	34	56.66
4.	(6 lakh and above) high	12	20.0
Total		60	100

f=frequency, %= per cent

4.1.9 Share of agriculture in total household income

Table 4.1.9 showed the distribution of the farmers according to their share of agriculture in total household income. Most of farmers (56.7%) were earn their household income from agriculture.

Table: 4.1.9. Distribution of farmers according to share of agriculture in total household income (n=60)

S.N.	Per cent share of agriculture in total household income	Beneficiary Group	
		f	%
1.	Agriculture	34	56.7
2.	Non agriculture	26	43.3
Total		60	100

f=frequency, %= per cent

4.1.10 Social participation

It is clear from the Table4.1.10 that 61.7 per cent member farmers were member of cooperative society and 28.3 per cent member farmers also had *gram panchayat* membership.

Table: 4.1.10 Distribution of farmers according to social participation

(n=60)

S.N.	Social participation	Beneficiary Group *f (%)*		
		No membership	*membership*	Official post
1.	*Gram Panchyat*	43 (71.7)	17 (28.3)	3 (5)

2.	*Panchyat Samiti*	60 (100.0)	0 (0)	0 (0)
3.	Cooperative Society	21 (35.0)	37 (61.7)	2 (3.3)
4.	*Mahila mandal*	51 (85.0)	6 (10.0)	3 (5.0)
5.	*Kisan Sangh*	45 (75.0)	14 (23.3)	1 (1.7)
6.	Youth club	60 (100.0)	0 (0)	0 (0)
7.	*Zila parishad*	60 (100.0)	0 (0)	0 (0)
8.	Block Development committee	60 (100.0)	0 (0)	0 (0)
9.	Self Help Group	60 (100.0)	0 (0)	0 (0)

4.1.11 Mass media utilization

Table 4.1.11 showed the mass media utilization by the farmers. It depicted that farmers (50%) most often obtained the information from television and most of beneficiary farmers (60%) always read farm magazine for obtaining farm information.

Table: 4.1.11 Distribution of famers as per mass media utilization

(n=60)

S.N.	**Mass media utilization**	**Beneficiary group(N=60)** *f (%)*				
		Never	**sometime**	***often***	***Most often***	**always**
1.	TV	0 (0)	0 (0)	5 (8.3)	30 (50.0)	25 (41.7)
2.	Radio	3 (5)	11 (18.3)	32 (53.7)	7 (11.7)	7 (11.7)
3.	News Paper	19 (31.7)	5 (8.3)	8 (13.3)	1 (1.7)	27 (45)
4.	Movies	33 (55)	0 (0)	9 (15)	6 (10)	12 (20)
5.	Farm Magazines	1 (1.7)	3 (5)	2 (3.3)	18 (30)	36 (60)

6	Mobile	0 (0)	1 (1.7)	9 (15)	5 (8.3)	45 (75)
7	Internet	38 (63.3)	6 (10)	8 (13.3)	2 (3.3)	6 (10)

4.1.12Extension agency contact:

The communication of the respondents with the extension agency is shown in the Table 4.1.12. Most of member farmers go to KVK for obtaining information regarding farm practices.

Table: 4.1.12 Distribution of famers as per extension agency contact

(n=60)

S. N.	**Extension agency contact**	**Beneficiary group** *f (%)*						
		Never	**Once in six month**	**Once in three month**	**Once in two month**	**Monthly**	**fortnightly**	**weekly**
1.	Govt. official	55 (91.7)	0 (0)	1 (1.7)	2 (3.3)	2 (3.3)	0 (0)	0 (0)
2.	Private extension staff	60 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3.	Non Governmental organization	56 (93.3)	0 (0)	0 (0)	4 (6.6)	0 (0)	0 (0)	0 (0)
4.	Krishi Vigyan Kendra	0 (0)	1 (1.7)	10 (16.7)	16 (26.7)	18 (30)	7 (11.7)	8 (13.3)

4.2 Genesis of mKRISHI®

Food production has become stagnant over the past 20 years while there has been an exponential jump in the population. Productivity is extremely low due to unscientific farming practices, fragmented land holdings, lack of agro-climatic focus for crops selection, lack of access to the right farming advice at the right time. Farmers are plagued by myriad issues all around like timely and reliable access to farm inputs, access to markets, access to reliable information at the right time and cheap access to credit. Thus,

farming is becoming a “dead” profession with many marginal farmers opting to leave their lands barren and migrating into the cities in the hope of a better life. This is leading to unprecedented choking of the cities' infrastructure and the situation has become worse.

This situation has led to serious introspection within TCS and various initiatives leveraging technology to alleviate the issues in the agricultural sector have gathered momentum. The Progressive Rural Information & Digital Enterprise (PRIDE™) powered by the TCS mKRISHI® platform is one such initiative. The mKRISHI® platform, developed by Tata Consultancy Services(TCS) in 2006, enables farmers to access best-practice information and agricultural experts through low-cost mobile phones using SMS. The mKRISHI® project was started with the goal to develop a mobile agro advisory system to provide the benefits of the information and communication technology (ICT) to the rural farmers by enhancing their agricultural productivity, farming efficiency and improving their earnings. This helps the farmers to generate wealth and improve their standard of living. The long term goal of mKRISHI® is to bridge the barrier between the farmers and other stakeholders in their socio-economic ecosystem like agricultural experts, agri-business units, financial institutions, hospitals and many more utility providers. Multimedia technology was used at different stages in a rural farmer’s ecosystem to assist them in many different ways.

mKRISHI® developed approaches that allowed a farmer to use audio-visual facilities that mKRISHI® provided on a mobile phone to articulate their queries to experts with minimal use of text. An expert can only effectively advise a farmer if he has all information related to the farm available. As is obvious, an expert cannot go to every farm to visit and inspect the context of the query, so we decided to ‘take the farm to the expert’ using all current and historical multimodal, including visual, sensory measurements. The main contextual data elements of the mKRISHI® includes many different types of sensors, such as temperature, humidity, soil moisture, canopy temperature, canopy humidity and wind velocity, placed on the field with data loggers to communicate the observations to the mKRISHI® server. This information includes climatic conditions and events, soil conditions, rain and fertilization history, and the pesticide and insecticide history. By presenting all this information in the context of the farmer query, experts diagnose the problem and promptly provide advice to the farmer in

his native language. One of the challenges for mKRISHI® was to provide a scalable backbone to map fewer experts to large number of queries by the farmers.

4.3 Structural mechanism of mKRISHI®

Tata Consultancy Services (TCS) is an IT services, business solutions and outsourcing organization that delivers real results to global businesses, ensuring a level of certainty no other firm can match. TCS offers a consulting-led, integrated portfolio of IT and IT- enabled services delivered through its unique Global Network Delivery Model ™ recognized as the benchmark of excellence in software development. A part of the Tata Group, TCS has successfully employed innovative technology to add value to agriculture. One such initiative that it has introduced is mKRISHI®, which uses mobile phones and the sensor technology to give personalised advice to farmers. Conceived in October 2006, it was felt that mKRISHI® had the potential to create new markets and offer its services at a low cost. It was, therefore, positioned as 'disruptive innovation'. The concept of mKRISHI® grew out of a need for understanding and resolving the problems of farmers, especially issues that were voiced in meetings with several small and progressive farmers, government officials, agriculture university faculty, NGOs, experts from agro product companies and agriculture scientists from research labs to understand the problems faced by the farmers. It was clear from these meetings that there was no integrated system in place that addressed the farmer's locale-specific queries. In the absence of such a system, farmers were left unsupported, as they struggled to make sense of varied, often unpredictable, issues such as weather, quality of the crops, condition of the market, etc. mKRISHI® was planned as a mobile agro-advisory system that would allow farmers to send queries to agricultural experts in their local language through a mobile phone and receive personalised advice or relevant information in their local language. The service eliminates the hindrance that prevents illiterate farmers from accessing good technology.

Fig 4.3.1: mKRISHI® Business operations model

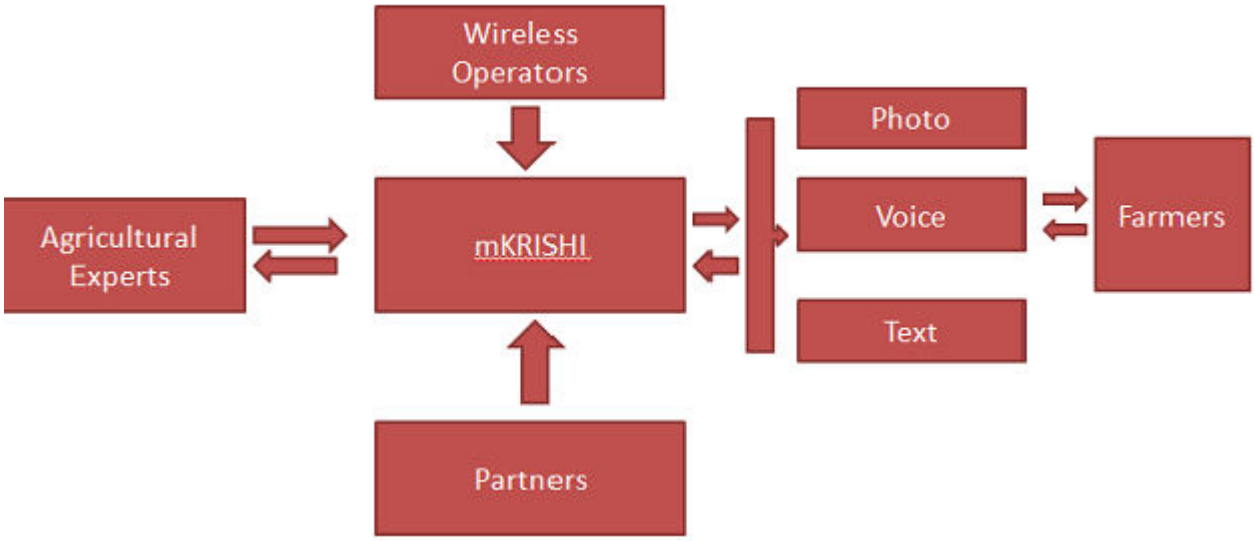


Fig 4.3.2: Staff pattern of mKRISHI®

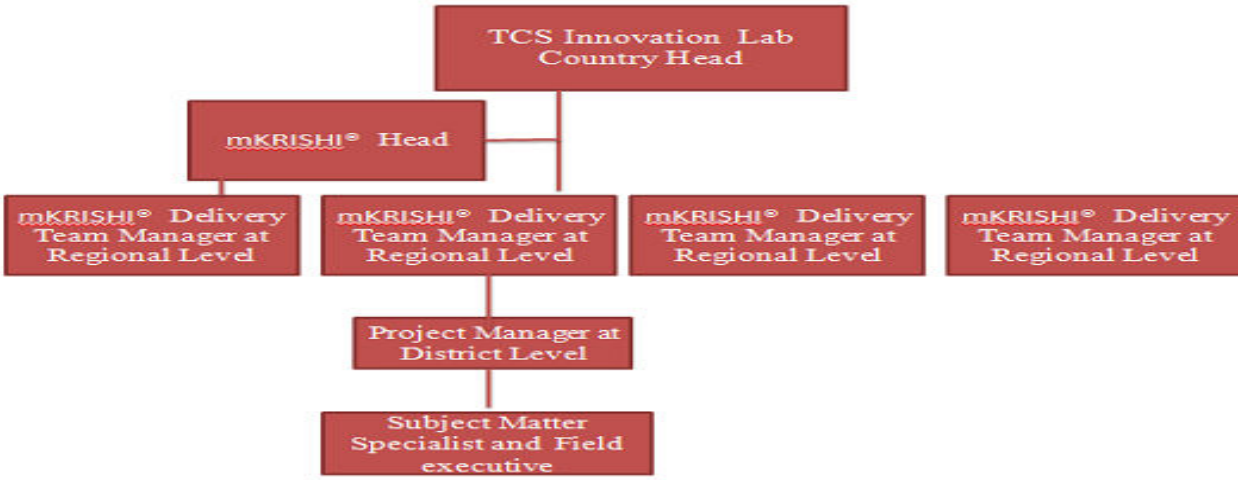


Fig 4.3.2 presented the staff pattern of mKRISHI®. At the apex level mKRISHI® has country Head TCS and Head mKRISHI®. Under them Delivery Team manager operates at regional level. Under each region mKRISHI® has a set of project being implemented in selected districts. In each district, Project Managers are responsible to implement the project. The project managers are supported by Subject Matter Specialist and Field Executive. In each *Taluka* generally 2-3 Field Executives are posted.

4.4 Approach of mKRISHI®

Farmer looks for specific, actionable information. Farmers are not just interested in remotely sent SMS, market information or agro advisory. Farmer wants an end-to-end service and expects personal attention and occasional visit by expert once in a while. Most of the services in vogue do not stand up to his expectations. Though there has been initial enthusiasm to such services there is no repeat buying. Our experience has been no different. To tackle this problem, mKRISHI® integrates agro-advisory services via calls and SMS with personal visits from field executives. Customers value personalisation and human interaction: Anecdotal feedback gathered from farmers indicates that they greatly valued the personalisation and face-to-face interaction with mKRISHI® field officers, providing the inclusive business with a sharp competitive edge. Hence mKRISHI® has a high-touch model for the rural market.

4.5 Role and responsibility of mKRISHI® and its linkage mechanism (Govt., NGO or Private):

TCS is responsible for the creation of a tailor-made mKRISHI® platform as per the needs of the client. TCS provides the IT services and infrastructure for the agro-advisory service. mKRISHI® is currently being deployed for horticulture, pulses, fishery, dairy and sugarcane farmers in the 13 Indian states. In Maharashtra, Tamil Nadu, Haryana, Madhya Pradesh, Odisha, Uttar Pradesh, Gujarat, and Kerala, the mKRISHI® field partners are FPOs(Farmer Producer Organizations) with anywhere between1,500 to 5,000 members registered on mKRISHI® powered PRIDE^{TM} model.

4.6 Process of member registration, membership fee:

TCS works in collaboration with NGOs, cooperatives, state governments or other agriculture related agencies to deploy the mKRISHI® - PRIDE™ model to a large group of farmers. Farmers are charged for the services in different ways. This include charging a transaction fee to input providers, retailers, advisory charges through membership, and other services such as animal husbandry and crop consultancy. mKRISHI® is focusing on establishing operating model and building an ecosystem.

The farmers are registered in our online system. In farmer registration process around 250 data points are captured as per the project stage. It starts with his personal

details, farm details, family details, financial details, other proof of identity and residence details, buying and spending habits, etc. Membership fee was Rs 4000 for one year.

4.7 Geographical distribution of mKRISHI®

The service has been deployed in 13 major Indian states through 70 projects; namely Maharashtra, Andhra Pradesh, Gujarat, Orissa, Tamil Nadu, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Bihar.

4.8 Languages in which message produced

Hindi, Marathi, Gujarati, Telugu, Kannada, Oriya, Malayalam, Bengali, Tamil, Punjabi and English are the main language in which mKRISHI® produce message.

4.9 Personnel involved in Functioning of mKRISHI®

There were four main personnel who conduct the smooth functioning of mKRISHI®. TCS head Hyderabad (Country level), mKRISHI® Head (Mumbai), Delivery Team Manager (Regional level) and Project Manager (District level). Under Project Manager there were number of Subject Matter Specialist and Field Executive in every block for carrying out effective function of mKRISHI®.

Table: 4.9.1.Distribution of mKRISHI® staff according to their age

(n=20)

S.N.	Age Category	Frequency	%age
1.	Young (Below 35 years)	12	60
2.	Middle (35-59 years)	8	40

Most of the staff (60%) belonged to young aged group while only 40 per cent were belonging to middle aged group.

4.9.2 Level of Education

It was observed that the personnel involved with the mKRISHI® have agricultural education to understand the situation and need of the farmers. All of mKRISHI® staff belong to agriculture background among them 12 person have ABM/M.sc background in their respective subjects while 8 person completed B.Sc in Agriculture.

4.9.3. Personal effectiveness of the staff

Personal effectiveness referred to the competence of the staff to meet with the need of the job. Out of 20, 95 per cent staff found themselves as competent enough to do

their job. They have capability to do their job without any supervision. After entering the mKRISHI®, they involved themselves with the village people to understand their need. In their job they found themselves free with their work and which contributed to the success of the organization.

4.9.4 Orientation of staff towards mKRISHI®

Orientation towards mKRISHI® referred to how the staff perceived about the working condition within the organization. Most of the staff had the positive attitude with the organizational environment of mKRISHI®. They perceived that this could really contribute for the betterment of agriculture in India. It provided them the opportunity to interact with the villagers and make them able to learn about the rural situation.

4.10 Functional mechanism of mKRISHI®

Farmers need information on weather, soil, fertilizer and pesticide that are specific to their plot of land. They also need information and clarification about new types of seeds and crops that are available in the market. Further, local market price information for various agricultural produce is valuable to them. However, media broadcasts do not provide highly localized information. Culturally too, farmers only rely on their personal network for making crucial decisions related to fertilizer, irrigation, disease control, finance and so on. mKRISHI® uses advances in information and communication technology (ICT) to address such issues. Farmers can now receive information on microclimate, local *mandi* (market) price, expert's advice, and other information relevant to them, on a mobile phone.

The mKRISHI® application enable farmers to send queries, comprising of text, voice and pictures, specific to their land and crop to agricultural experts using their mobile phones. The mKRISHI® ecosystem provides an integrated view of the farmers profile, farming history, and the required farm parameters on a console at a remote location to an expert. Farmers can also send pictures of their crops and pests captured with mobile phone cameras; sensors provide farm specific soil and crop data, weather stations provide microclimate details and voice based querying system gives freedom to the farmers to ask any query in their local (natural) language. After analysis of the available information, the expert's advice on the farmer's query is provided on the farmer's mobile phone.

Table: 4.10.1Functional mechanism of mKRISHI®

S.N	Item	Nasik	Kanchipuram
1	Number of registered farmers	3000	2500
2	Membership fee	Rs 4000/yr	Rs 4000/yr
3	Method of communications with member farmers	5-6 voice message/week	5-6 voice message/week
4	Method of farmer query	Through phone of field executive(android application)	Through phone of field executive(android application)

Table: 4.10.1 represents that mKRISHI® communicates with farmer through IVR (Interactive Voice Record), Voice call and messages. The number of message send by mKRISHI® was 5-6 messages per week to member farmer. The mKRISHI® field executive meets the farmer to solve their field problem. In case of the farmers want to generate query they contact the subject matter specialist and field executive who visits the member farmers at regular interval. The project manager, subject matter specialist and project executive have mobile handset with android application through which queries can be generated.

Conclusion:

Presently, there are a lot of ICT based projects are running in India and trying to eradicate the digital divide in India. Most of the ICT based projects use the internet technology to decrease the information gaps. But the methodology adopted by mKRISHI®is quite different from all others ICT based projects and expected to meet the demand of farmers. Among modern information and communication technology (ICT)modes, mobile phone has been most recent and widely accepted mode of delivering information in most of the developing country including India.

In this context, mKRISHI® is more appropriate because mKRISHI® operated through mobile phone which is very cheap and affordable by farmer and provide information to members in their local dialects. It is more suitable to small and marginal farmer of India. The findings are contrast to study of Chahal et al.(2012) which revealed that majority of RML subscriber belong to large or medium category of farm holding. mKRISHI® disseminated the information through by the use of mobile. Local dialects

were used in the message, which helped better understanding and convicting among the farmer. It also helped to reduce heterophily between scientists and farmers because of involvement of local people. It also resulted to develop faith for the extension workers among the farmers. Meera *et. al.* (2004) reported that staff for agricultural extension projects has inadequate training and farmers have very little faith in the ICT project personnel and their commitment to achieve the goals of the projects. Thus mKRISHI® overcomes all such types of barriers and results in better adoption of technology by the farmers.

Research Paper II **Chapter-V**

Effectiveness of Mobile Based Agro-Advisory Services in Addressing the Information Need of the Stakeholders

Abstract

Many information and communication technology (ICT) projects in Indian agriculture have emerged, either substituting or supporting extension services by providing farmers with access to agricultural information, but accessing it by farmers in remote villages is restricted due to the lack of infrastructure. Telecommunication, especially mobile phones have the potential to provide solution to the existing information asymmetry in various lagging sectors like agriculture. In such a situation, mKRISHI® made significant contribution in information spreading in some parts of India. So the study was undertaken for assessing its effectiveness in information dissemination to farmers. The study was conducted in two districts, one from both Maharashtra and Tamil Nadu states where mKRISHI® was working for the last six years. The data were collected from 60 respondents from the mKRISHI® member farmers. The effectiveness was measured by effectiveness index developed for the purpose. The study revealed that the extension services rendered by mKRISHI® were found to be high in effectiveness by majority of the farmers (46.66 %). About 21.66 per cent of farmers rated extension service of mKRISHI® to be very highly effective.

Key words: Effectiveness, Information need, mKRISHI®

Introduction

The contribution of information and knowledge in bringing about social and economic development has been well recognized globally. However, communicating this relevant knowledge and information to rural communities continues to remain as a major challenge even today, though the world has been better connected than ever before. The advent of new age Information and Communication Technologies (ICTs), especially, personal computers, the internet and mobile telephone during the last two decades has provided a much wider choice in collection, storage, processing, transmission and

presentation of information in multiple formats to meet the diverse requirement and skills of people. While discussing ICTs, one along with also needs to look at the traditional ICTs such as radio, television and print media, and the emerging convergence of many of these with the new ICTs. We are currently witnessing a revolution in both the media as well as the ICTs. There is a vast literature on the potential and benefits of using these technologies for wider rural development. However, the contradiction between the potential for ICTs to address the challenges faced by rural development and the current failure to harness them for this purpose is striking (Chapman and Slaymaker, 2002). There is an increasing realization that the digital divide the gap between those who have access to technology and those who do not access technology. Besides a digital gap between women and men in society, there is a social divide among the information rich and poor in societies (Huyer and Mitter, 2003). ICT is one of these solutions, and has recently unleashed incredible potential to improve agriculture in developing countries specifically.

Hence, the policy framework for agricultural extension (Ministry of Agriculture, Govt. of India, 2000) highlights the opportunity for information and communication technology (ICT) to improve the quality and accelerate the transfer and exchange of information to farmers, and ICT is consequently given a high priority, particularly as a tool for improving the marketing aspects of farm enterprises. At present, in India, there are a number of ICT initiatives in agriculture. The modes for providing information vary in different ICT projects. The approach adopted by mKRISHI® is different from all other projects. Keeping these points in view, the present study was conducted to assess the effectiveness of mKRISHI® in information and technology dissemination to the farmers.

Methodology:

Two districts, one from each of the states of Maharashtra and Tamil Nadu were selected purposively since these were states where mKRISHI® was started in 2006. The districts were Nasik in Maharashtra and Kanchipuuram in Tamil Nadu. An *ex-post facto* research design was used for the study. The data were collected from 60 respondents from the mKRISHI® subscriber farmers. The information was obtained with the help of structured interview schedule. The effectiveness was measured by effectiveness index

developed for this purpose. To measure the effectiveness of mKRISHI®, an index was developed, which contains five dimensions, i.e. timeliness of information, quality of information, utility of information, satisfaction of farmers and ease of understanding.

Results

5.1. Effectiveness of mKRISHI®

The perceptions of the farmers were taken on all the dimensions of the effectiveness index. The parameters of the effectiveness index are timeliness of information (TI), quality of information (QI), utility of information (UI), satisfaction of farmers (SF), and ease of understanding (EU).

5.1.1. Timeliness of the information

It referred to the availability of the technology and the services provided by mKRISHI® at the appropriate time to the farmers in terms of seasonality of the crops grown in that particular area. The perceptions of the farmers were collected through the schedule. The data obtained are presented in the following table.

Table: 5.1.1.1 Distribution of respondents on effectiveness: Timeliness of the information (n=60)

S.N	Type of services	VT		T		NAT	
		f	%	*f*	%	*f*	%
1.	Agronomic information	7	11.7	51	85.0	2	3.3
2.	Varietal information	12	20.0	43	71.7	5	8.3
3.	Pest and disease Management Information	7	11.7	49	81.7	4	6.7
4.	Weather related information	6	10.0	48	80.0	6	10.0
5.	Post-Harvest Technology related information.	8	13.3	42	70.0	10	16.7
6.	Information related to soil and water conservation	6	10.0	50	83.3	4	6.7

7	Information about credit	12	20.0	46	76.7	2	3.3
8.	Marketing Information	13	21.7	39	65.0	8	13.3
9.	Information about Govt. schemes and policies	7	11.7	29	48.3	24	40.0

VT=Very Timely, T=Timely, NAT=Not at all timely

Table 5.1.1.1 represents the response of the farmers to the timeliness of the services of the mKRISHI®. It showed that eighty five per cent farmers perceived that information regarding the agronomic information was provided timely while, 11.7 per cent farmers perceived that it was provided very timely and 3.3 per cent farmers perceived that it was not at timely. Almost 72 per cent farmers assumed that varietal information of crop was provided timely while 20 per cent farmers felt that it was provided very timely. In case of pest and disease management information 81.7 per cent farmers perceived that it was provided timely while, 11.7 per cent farmers said that it was very timely. Eighty per cent farmers assumed that information regarding the weather was provided in time while 10 per cent farmers felt that it was provided very timely. In case of post harvest technology related information 70 per cent farmers said that it was timely provided while 13.3 per cent farmer felt that it were very timely. Regarding the soil and water conservation information 83.3 per cent farmers felt that the information was provided timely and 10 per cent farmers felt that it was provided very timely. Regarding credit 76.7 per cent farmers assumed that information was provided in time while twenty per cent farmers felt that it was very timely. In case of marketing Information 65.0 per cent farmers perceived that it was timely while 21.7 per cent farmers said that it was very timely. Regarding information about Govt. schemes and policies 48.3 per cent farmers felt that the information was timely while 11.7 per cent farmers said that it was very timely.

Table 5.1.1.2: Descriptive statistics of timeliness of the information provided by mKRISHI®

Sl.No.	Statistics	AI	VI	MPI	WR	PHT	SW	CRE	MI	IGS
1.	Mean	2.08	2.11	2.05	2.0	1.96	2.03	2.16	2.08	1.7

2.	Standard deviation	0.38	0.52	0.42	0.45	0.55	0.41	0.45	0.59	0.66
3.	C. V (%)	18.31	24.74	20.91	22.5	28.03	20.18	21.10	28.35	38.8

AI= Agronomic information, VI = Varietal information, MPI = Management practices Information, WR = Weather related information, PHT = Post-Harvest Technology related information, SW = Information related to soil and water conservation, CRE = Information about credit, MI = Marketing Information about price, quantity demand, IGS = Information about Govt. Schemes and policies.

Table 5.1.1.2 depicts the mean, standard deviation and coefficient of variation with regard to the timeliness of the information provided by the mKRISHI®. The mean score for the varietal information was 2.11, which denotes that farmers were getting the advisory information regarding the cultivation at the time of cropping season followed by agronomic information, 2.083, which signifies that the information was available on time. The coefficient of variation for information about Government schemes and policies was high (38.80%) which signifies that it was high inconsistent among the farmers. But the other parameters were consistent because of low coefficient of variation.

5.1.2. Quality of information

It was operationally defined as the degree or level of excellence of the information provided by mKRISHI® expert as perceived by the farmers according to their farming conditions and climate in particular region. The perceptions of the farmers were collected through the schedule. The data obtained were presented in the following table.

Table 5.1.2.1: Distribution of respondents on effectiveness: Quality of information

(n=60)

S.N.	Type of services	Excellent		Very good		Good		Moderate		Not at all good	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%
1.	Advisories issued for mKRISHI® on the following aspects										
i	Crop protection	0	0.0	25	41.7	29	48.3	6	10.0	0	0.0

ii	Weather related information	8	13.3	21	35.0	27	45.0	4	6.7	0	0.0
iii	Soil and water conservation	5	8.3	25	41.7	25	41.7	5	8.3	0	0.0
iv	Marketing information	4	6.7	21	35.0	28	46.7	7	11.7	0	0.0
v	Post-harvest technology	2	3.3	20	33.3	29	48.3	9	15.0	0	0.0
vi	Varietal information	0	0.0	21	35.0	31	51.7	8	13.3	0	0.0
vii	Information about Govt. schemes and polices	0	0.0	22	36.7	27	45.0	11	18.3	0	0.0

Table 5.1.2 .1 represents the response of the farmers to the quality of information provided by mKRISHI®. It showed that 48.3 per cent farmers perceived that quality of information regarding crop protection was good while 41.7 per cent farmers perceived that it was very good followed by weather related information, 45 per cent farmer said that quality of information was good, 35 per cent farmers said it was very good while 13.3 per cent farmers felt that it was excellent.

Table: 5.1.2.2. Descriptive statistics of quality of information provided by mKRISHI®

S.No.	Statistics	CP	WR	SWC	MI	PHT	VI	IGP
1.	Mean	3.33	3.51	3.50	3.36	3.23	3.21	3.11
2.	Standard deviation	0.68	0.77	0.77	0.78	0.69	0.66	0.69
3.	C. V (per cent)	20.43	21.93	22.05	21.66	21.60	20.70	22.22

CP = Crop protection, WR = Weather related information, SWC = Information related to soil and water conservation, MI = Marketing Information, PHT = Post-Harvest Technology related information, VI = Varietal information, IGS = Information about Govt. Schemes and policies

Table 5.1.2.2 depicts the mean, standard deviation and coefficient of variation in the quality of the information provided by mKRISHI®. The mean score for weather related information was the 3.51 which signifies that the quality information was excellent followed by soil and water conservation related information for which mean score was the 3.50 which signifies that the quality information was very good. The mean

score about Govt. schemes and policies had 3.11 which indicate that quality of information is not at all good. The coefficient of variation for Govt. schemes and policies was high (22.22 %) which signifies that it were high inconsistent among the farmers. But the other parameters were consistent because of low coefficient of variation.

5.1.3. Utility of the information

It was operationally defined as the degree to which the information provided by mKRISHI® expert is useful in resolving farmer problem according to their farming needs. The perceptions of the farmers were collected through the schedule. The data obtained were presented in the following table.

Table: 5.1.3.1. Distribution of respondents on effectiveness: Utility of information (n=60)

S.N.	Type of services	SA		A		U		D		SD	
		f	%	*f*	%	*f*	%	*f*	%	*F*	%
1.	Technological information provided by mKRISHI® is highly relevant to your farming system.	11	18.3	42	70.0	7	11.7	0	0.0	0	0.0
2.	Technological information provided by mKRISHI® is suited for both big and small farmer.	8	13.3	41	68.3	5	8.3	6	10.0	0	0.0
3.	Technological information provided by mKRISHI® has increased yield.	9	15	37	61.7	12	20.0	2	3.3	0	0.0
4.	Soil testing facilities provided by mKRISHI® increased soil fertility	10	16.7	31	51.7	16	26.7	3	5.0	0	0.0
5.	Marketing information provided by mKRISHI® has increased price of your produce	7	11.7	39	65.0	10	16.7	4	6.7	0	0.0
6.	Technological information provided by mKRISHI® reduced pest incidence	16	26.7	37	61.7	4	6.7	3	5.0	0	0.0
7.	Technological information provided by mKRISHI® reduced disease incidence	20	33.3	36	60.0	2	3.3	2	3.3	0	0.0

SA-Strongly Agree, A-Agree, U- Undecided, D- Disagree, SD-Strongly Disagree

Table 5.1.3 .1 represents the response of the farmers to the utility of information provided by the mKRISHI®. It showed that 70 per cent farmers agreed with the statement that technological information provided by mKRISHI® is highly relevant to farming system, 18.3 per cent farmers strongly agreed with it and 11.7 per cent were undecided about it. Regarding information being suitable for both big and small farmer that 68.3 per cent farmers agreed with it, 13.3 per cent farmers strongly agreed with it and 8.3 per cent farmers were undecided while 10 per cent farmers disagreed with it.

Table: 5.1.3.2. Descriptive statistics of utility of information provided by mKRISHI®

S.No.	Statistics	TFS	TBS	TY	STF	MI	TIP	TID
1.	Mean	4.06	3.85	3.88	3.80	3.81	4.10	4.31
2.	Standard deviation	0.54	0.77	0.69	0.77	0.72	0.72	0.53
3.	C. V (per cent)	13.48	20.19	17.81	20.43	18.98	17.80	12.45

TFS= technological information provided by mKRISHI® is highly relevant to your farming system, TBS= technological information provided by mKRISHI® is suited for both big and small farmer, TY= technological information provided by mKRISHI® has increased your yield, STF= soil testing facilities provided by mKRISHI® is increased soil fertility, MI= marketing information provided by mKRISHI® has increased price of your produce, TIP= technological information provided by mKRISHI® reduced pest incidence, TID= technological information provided by mKRISHI® reduced disease incidence

Table 5.1.3.2 depicts the mean, standard deviation and coefficient of variation for the responses of the farmers regarding the utility of the technology provided by mKRISHI®. The mean score for the disease management information was 4.31, followed by pest management information and relevant information which signifies that this information was highly useful to the farmer. The coefficient of variation for soil testing facilities was high (20.43%) which signifies that it were highly inconsistent among the farmers. But the other parameters were consistent because of low coefficient of variation.

5.1.4. Satisfaction of farmers

The farmer's satisfaction was operationally defined as the degree to which information is able to meet the information need of the users. The data obtained is presented in the following table.

Table: 5.1.4.1. Distribution of respondents on effectiveness: Satisfaction level (n=60)

S.N.	Statements	SA		A		U		D		SD	
		f	%	*f*	%	*f*	%	*f*	%	*F*	%
1	Technology provided by mKRISHI® is cost effective.	12	20.0	48	80.0	0.0	0.0	0.0	0.0	0.0	0.0
2	mKRISHI® platform provides all the needed inputs through its partners.	3	5.0	38	63.3	12	20.0	7	11.7	0.0	0.0
3	Advisory services are specific to your field.	5	8.3	34	56.7	15	25.0	6	10.0	0.0	0.0
4	mKRISHI® provides proper marketing linkage.	6	10.0	36	60.0	14	23.3	4	6.7	0.0	0.0
5	mKRISHI® personnel have enough knowledge to solve farmers field problems	5	8.3	28	46.7	12	20.0	15	25.0	0.0	0.0
6	Services provided by mKRISHI® are helpful in increase in yield, reduction in cost.	7	11.7	42	70.0	11	18.3	0.0	0.0	0.0	0.0
7	Field personnel are fair and do not show any favours to specific farmers during their field visit while solving farmer problem.	3	5.0	29	48.3	18	30.0	10	16.7	0.0	0.0

SA-Strongly Agree, A-Agree, U- Undecided, D- Disagree, SD-Strongly Disagree

Table 5.1.4 .1 represents the satisfaction of the farmers toward information provided by the mKRISHI®. It revealed that 80 per cent farmers agreed with the technological information provided by mKRISHI® is cost effective while 20 per cent

farmers strongly agreed with it. Regarding mKRISHI® platform provides all the needed inputs through its partners showed that 63.3 per cent farmers agreed with it, 5 per cent farmers strongly agreed with it, 20 per cent farmers undecided about it and11.7 per cent farmers disagreed with it.

Table: 5.1.4.2. Descriptive statistics of satisfaction level of farmers provided by mKRISHI®

S.No.	Statistics	Cost	Inp	Advi	ML	Know	Help	FP
1.	Mean	4.20	3.61	3.63	3.73	3.38	3.93	3.41
2.	Standard deviation	0.40	0.76	0.78	0.73	0.95	0.548	0.82
3.	C. V (per cent)	9.60	21.04	21.49	19.65	28.35	13.94	24.31

Cost= Technology provided by mKRISHI® is cost effective, Inp= mKRISHI® platform provides all the needed inputs through its partners, Advi= The advisory services are specific to your field, ML= mKRISHI® provides proper marketing linkage, Know= mKRISHI® personnel have enough knowledge to solve farmers field problems, Help= Services provided by mKRISHI® are helpful in increase in yield, reduction in cost, FP= Field personnel are fair and do not show any favours to specific farmers during their field visit while solving farmer problem.

Table 5.1.4.2 depicts the mean, standard deviation and coefficient of variation for the responses of the farmers regarding the satisfaction toward technology provided by mKRISHI®. The mean score for the technology provided by mKRISHI® was cost effective was 4.2, followed by the services provided by mKRISHI® were helpful in increasing in yield (3.93) and marketing linkage which signified that most of farmers strongly with it. The coefficient of variation for mKRISHI® personnel have enough knowledge to solve farmers field problems was high (28.35%) which signified that it were high inconsistent among the farmers. But the other parameters were consistent because of low coefficient of variation.

5.1.5. Ease of understanding of information

The ease of understanding was operationally defined as the degree to which the message conveyed by mKRISHI® system is clear and understandable by farmers. The data obtained is presented in the following table.

Table 5.1.5.1: Distribution of respondents on effectiveness: Ease of understanding of information (n=60)

S.N.	Statements	SA		A		U		D		SD	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%
1	Language of text message is very clear and understandable.	9	15.0	49	81.7	2	3.3	0	0	0	0
2	Technical term used in text message easy to understand.	6	10.0	30	50.0	11	18.3	13	21.7	0	0
3	Content of text message provided by mKRISHI® is clear and understandable	8	13.3	41	68.3	5	8.3	6	10.0	0	0
4	Information about weather and market is easy to understand, adopt and helps in taking decision.	7	11.7	34	56.7	9	15.0	10	16.7	0	0
5	Voice message delivered by mKRISHI® are clear	5	8.3	49	81.7	6	10.0	0	0	0	0

SA-Strongly Agree, A-Agree, U- Undecided, D- Disagree, SD-Strongly Disagree

Table 5.1.5.1 represents the response of the farmers to the ease of understanding information provided by the mKRISHI®. The language of text message is very clear and understandable showed that 81.7 per cent farmers agreed with it 15 per cent farmers strongly agreed with it and 3.3 per cent farmers undecided about it. Regarding technical term used in text message easy to understand showed that 50 per cent farmers agreed with it, 10 per cent farmers strongly agreed with it, 18.3 per cent farmers were undecided about it and 21.7 per cent farmers disagreed with it.

Table: 5.1.5.2. Descriptive statistics of ease of understanding of information provided by mKRISHI®

S.No.	Statistics	Lan	Tech	Cont	Inf	Voice
1.	Mean	4.12	3.48	3.85	3.630	3.98
2.	Standard deviation	0.41	0.94	0.77	0.90	0.43
3.	C. V (per cent)	10.09	27.20	20.18	24.81	10.83

Lan= language of text message is easily clear and understandable, Tech= Technical term used in text message easy to understand, Cont= Content of text message provided by mKRISHI® is clear and understandable, Inf= Information about weather, market, is easy to understand, adopt and helps in taking decision, Voice= Voice message delivered by mKRISHI®clear.

Table 5.1.5.2 depicts the mean, standard deviation and coefficient of variation for the responses of the farmers regarding the ease of understanding of information provided by mKRISHI®. The mean score for the language of text message is very clear and understandable was 4.12 which signified that most of farmers strongly agreed with it followed by followed by voice message delivered by mKRISHI® are clear (3.98). The coefficient of variation for technical term used in text message easy to understand were high (27.20%) which signified that it were high inconsistent among the farmers. But the other parameters were consistent because of low coefficient of variation.

5.2 Effectiveness of the mKRISHI® services

Effectiveness of the services of mKRISHI® referred to its ability to meet the farmer needs in providing the new technology which suits to their conditions and results in better production. It were operationalized in term of five components, i.e. a) timeliness of information, b) quality of information, c) utility of information, d) satisfaction of farmers and e) ease of understanding.

5.2.1 Categorization of farmers based on timeliness of the information provided by mKRISHI®

Table 5.2.1 shows that the 55 per cent of the total farmers believed that they got timely information about the crop followed by 43.33 per cent of the farmers who believed that they received information very timely in case of the crops.

Table 5.2.1: Distribution of farmers based on timeliness of the information (n=60)

S.N.	Category of Timeliness	Class Score	*f*	%
1.	Not at timely	9-15	1	1.66
2.	Timely	15-21	33	55
3.	Very Timely	21-27	26	43.33
Mean		18.21		
Standard Deviation		3.41		

5.2.2. Categorization of respondents based on quality of the information provided by mKRISHI®

Table 5.2.1 shows that the 70 per cent of the total farmers believed that quality of information was very good followed by 23.33 per cent of the total farmers who believed that quality of information was excellent.

Table 5.2.2: Distribution of respondents based on quality of the information (n=60)

S.N.	Category of Quality	Class Score	Frequency	(%)
1.	Good	17-23	4	6.66
2.	Very good	23-29	42	70
3.	Excellent	29-35	14	23.33
Mean		23.28		
Standard Deviation		4.14		

5.2.3. Categorization of farmers based on utility of the information provided by mKRISHI®

Table 5.2.3 shows that the 75 per cent farmers perceive that information provided by mKRISHI® was useful to their field situation followed by 20 per cent farmers who perceive that information provided by mKRISHI® was highly useful to their field situation.

Table 5.2.3: Distribution of farmers based on utility of the information (n=60)

S.N.	Category of Utility	Class Score	*f*	%
1.	Moderately useful	17-23	3	5
2.	Useful	23-29	45	75
3.	Highly useful	29-35	12	20
Mean		27.75		
Standard Deviation		4.98		

5.2.4. Categorization of farmers based on satisfaction of the information provided by mKRISHI®

Table 5.2.4 shows that 66.66 per cent of the total farmers had high level of satisfaction whereas 33.66 per cent of farmers had very high level of satisfaction towards mKRISHI® extension services.

Table: 5.2.4. Distribution of farmers based on satisfaction of the information (n=60)

S.No.	Category of Satisfaction	Class Score	*f*	%
1.	Medium	17-23	0	0.0
2.	High	23-29	40	66.66
3.	Very high	29-35	20	33.66
Mean		29.3		
Standard Deviation		3.03		

5.2.5. Categorization of farmers based on ease of understanding of the information provided by mKRISHI®

Table 5.2.5 shows that 83.33 per cent farmers had easily understood the information provided by mKRISHI® whereas 15 per cent farmers had moderately understood the information provided by mKRISHI®.

Table 5.2.5: Distribution of farmers based on ease of understanding of the information (n=60)

S.No.	Category of Satisfaction	Class Score	*f*	%
1.	Moderately understood	13-17	9	15
2.	Easily understood	17-21	50	83.33
3.	Very easily understood	21-25	1	1.66
	Mean		19.78	
	Standard Deviation		2.23	

5.2.6. Overall effectiveness of mKRISHI®:

The overall effectiveness of mKRISHI® was obtained by developing the effectiveness index based on the above all five components. The formula used for this index was as follows:

$$\textit{Effectiveness Index} = \frac{\text{TI} \times \text{W1} + \text{QI} \times \text{W2} + \text{UI} \times \text{W3} + \text{SF} \times \text{W4} + \text{EU} \times \text{W5}}{\text{W1} + \text{W2} + \text{W3} + \text{W4} + \text{W5}} \times 100$$

Where TI= Timeliness of information

QI= Quality of information

UI= Utility of information

SF= Satisfaction of farmers

EU= Ease of understanding

W_1= Weightage for the timeliness of information as given by the judges

W_2= Weightage for quality of information as given by the judges

W_3= Weightage for utility of information as given by the judges

W_4= Weightage for satisfaction of farmers as given by the judges

W_5= Weightage for ease of understanding as given by the judges

The respondents were classified into five categories from very low to very high effectiveness based on five equal class intervals as given below:

The obtained scores were divided into five equal groups ranging from very low effectiveness to very highly effectiveness of the mKRISHI® services. Table 5.2.6 revealed that 46.66 per cent of the total farmers perceived that the mKRISHI® was highly effective as a means of getting information followed by 21.66 per cent farmers who perceived it very highly effective in obtaining the information regarding their farming needs.

Table 5.2.6: Distribution of farmers based on effectiveness index scores (n=60)

S.N.	Category of Effectiveness	Class Score	*f*	%
1.	Very Low	63.06-66.62	2	3.33
2.	Low	66.62-70.16	5	8.33
3.	Medium	70.16-73.72	12	20
4.	High	73.72-77.27	28	46.66
5.	Very High	77.27-80.82	13	21.66
	Mean		73.97	
	Standard Deviation		3.47	

5.2.7. Comparison of mKRISHI® services in Maharashtra and Tamil Nadu

To assess the effectiveness of mKRISHI® services in Maharashtra and Tamil Nadu Independent Samples‘t’ test was done. The calculated t-value (3.89) was greater than the tabulated t-value (1.645) at 0.05% level of significance. So it can be inferred that mKRISHI® services are more effective in Maharashtra compared to Tamil Nadu.

Table 5.2.7: Group Statistics of independent Samples t test

Group	N	Mean	Std. Deviation
Maharashtra	30	75.5814	2.79314
Tamil Nadu	30	72.3734	3.53606
Total	60		

Table 5.2.8: Computed value of independent Samples‘t’ test

S.N.	Category	Value
1.	Calculated t value	3.89
2.	Degree of freedom	58
3.	Sig. (2-tailed)	.000

***** t-value 1.645(58,.005)

Discussion:

Among modern ICT modes, mobile phone has been most recent and widely accepted mode of delivering information (Mittal and Mehar, 2012). Increasing mobile phone based services enhances the availability to knowledge and information in agriculture and meets the increasing information demand of farmer’s. It further also help in improving awareness, education, better adoption of technology, better health and efficiency, reduced transaction costs, better market efficiencies, etc.

mKRISHI® is a highly effective in the farming situation in both Maharashtra and Tamil Nadu. According to (Mittal, 2012) effectiveness of ICT in passing on information to farmers, particularly small landholders, holds the key to its successful utilization as a complementary information dissemination mechanism for extension services. ICT would enable extension workers to gather, store, retrieve and disseminate a broad range of information needed by small producers such as information on best practices, new technologies, better prices of inputs and outputs, better storage facilities, improved transportation links, collective negotiations with buyers, information on weather *etc*. There were 88.33 per cent famers who perceived that the services of mKRISHI® could be easily applied in their field situation because of local involvement. Hence, the adoption rate is faster as compared to the other traditional methods. It showed that

mKRISHI® is highly effective in comparison to other information delivery mechanisms to the farmers. It had the high effectiveness of 60-80 per cent for the farmers in their situation. It is in similar with the findings of Afroz and Singh (2013), who reported that effectiveness of the Digital Green as 60-80 per cent. It is in contrast with the findings of Mukherjee and Bahal (2011), who reported effectiveness of the services of Tata Kisan Sansar is 40-60 per cent. Similar report were also made by Hanumankar (2005) who concluded that nearly 84 per cent of respondent have expressed their satisfaction from the advice provided through *Kissan Call Centre*. The result are contrast with study made by Meera (2002) who found that nearly three fourth of respondent (73%) expressed medium level of personal effectiveness of *Gyandoot*.

Conclusion:

The mKRISHI® playing a vital role in availing different information and services need of the farmers. This provide timely information which help in solving many problem of farmers. The mKRISHI® is quite efficient in delivering advisory service, weather service, market support and diagnostic services. Due to intervention of mKRISHI® in both the districts of Maharashtra and Tamil Nadu has changed the scenario of farming by providing appropriate technology, market, input and information support which resulted in yields and income of the farmers has increased to a great extent. This leads to high farmer's satisfaction. The effectiveness of mKRISHI® can be further increased by making partnership with govt. and other local agencies.

Research Paper – III **Chapter-VI**

Socio-Economic Impact of mKRISHI® model

Abstract

Rapid increase in mobile phone users among the farming community paved the way to improve information dissemination to the knowledge intensive agriculture sector and also help to overcome information asymmetry existing among the group of farmers. It also helps, at least partially, to bridge the gap between the availability and delivery of agricultural inputs and agriculture infrastructure. The use of mobile phones has been found to encourage poor farmers towards greater market participation and diversification to high-value crops. This change has helped increase farm earnings through higher price realization and reduction in wastages. Eventually, it is expected that mobile-based information services will influence the behavior pattern of farmers and this will facilitate adoption of improved technologies leading to better yield. India's agricultural sector suffers from low growth rates and low productivity. As mobile penetration continues to increase among farming communities and information services and to adapt and proliferate, the scope exists to increase agricultural production and productivity. Today in access to information is the major issues at every stage of agrisupply chain. For small farmer-based economy like India, access to information can possibly enable better incomes and productivity to the farmers. In such a situation mKRISHI® had made significant contribution in information dissemination in some parts of India. Hence the present study was undertaken for assessing different socio-economic impact of mKRISHI® model. The location of the study was selected in two districts, one each from both Maharashtra and Tamil Nadu states where mKRISHI® was working for the last six years. An ex-post facto research design was used for the study. The data was collected from 60 respondents from the mKRISHI® subscriber farmers and 60 farmers (control group) from non-adopted villages of the same district. The study revealed that majority of mKRISHI® farmers perceived that there was considerable change in their decision making quality and gain in knowledge, and increase in yield and income.

Key words: Impact, Mobile phone, mKRISHI®.

Introduction

Smallholder agriculture dominates the landscape of the developing world. Increasing their productivity and incomes can make a major contribution to reducing hunger and poverty (Zhou, 2010). Indian agriculture is the home of 80 per cent small and marginal farmer's (K. D. Kokate, 2012). Small holdings also face new challenges on integration of value chains, liberalization and globalization effects, market volatility and vulnerability to climate change etc. (Thapa and Gaiha, 2011). Despite the improved interest and investment in agricultural extension in India, the coverage of such services is derisory to meet all these challenges. Given the challenges, the arrival of information communication technology (ICT) is well timed. Over the year the use of ICT are being used in all spheres of life with no exception to the agriculture. The unprecedented adoption of various ICT based gadget has raised the general expectation about its potential contribution to the dissemination of innovative farming technology as well as enhancing farmer knowledge, thereby creating an environment for social and economic benefit to the end users. Public and private sector actors have long been on the search for effective solutions to address both the long- and short-term challenges in agriculture, including how to answer the abundant information needs of farmers.

Overall, the use of mobile phones has been found to encourage poor farmers towards greater market participation and diversification into high-value crops. This change has helped to increase farm earnings through higher price realization and reduction in wastage. According to Bhatnagar (2008), the contribution of ICT can be felt at all stages of the agricultural cycle; the impact has been in terms of both quantifiable gains (increase in income, improved yield etc.), and non-quantifiable gains (social benefits of improved communications, information about education and health decision making ability and change in knowledge etc). According to Anderson and Feder (2007), information is one of the key inputs to productivity growth. The farmer's demand for information is seen as a productive input, and thus depending on how productive or useful the information is, the farmer is willing to purchase that input. Therefore, different delivery systems will have different values depending on the kind of information being delivered i.e. availability of inputs, new seed varieties, input prices, weather information, future prices, ways of using inputs etc. There are many ICT based extension models existing in India at present which focus on farming community.

The assessment of socio economic impact of such models could provide inputs for the sustainable use of such ICT based extension projects and further improvement. The present study was an attempt to study the socioeconomic impact of mKRISHI® extension model.

Methodology:

Two districts Maharashtra and Tamil Nadu were selected purposively for the study purpose as mKRISHI® was selected first in these two districts in 2006. The districts were Nasik in Maharashtra and Kanchipuram in Tamil Nadu. An ex-post facto research design was used for the study. The data were collected from 60 respondents from the mKRISHI® subscriber farmers and 60 farmers (control group) from non-adopted villages of the same district. With –without method was followed to study change in decision making quality and knowledge gain as a result of mKRISHI® services provided to subscriber farmer and non member farmers. The impact on the production and incomes of beneficiary and control farmers were assessed with independent sample t-test.

Results and Discussion

6.1. Change in decision making quality

To evaluate change in decision making quality, a set of five statements were rated by the respondents. The total sum of each statement for all the individuals was calculated through with –without design for subscriber farmer and control farmer. The result was represented in the graph (Fig.6.1) given below.

Fig.6.1 Change in Decision Making Quality

* 1-- I think I am confident enough to take decisions regarding selection of crops and its management practices, 2-- I always analyze the demand and market value of any crop before adopting it in my farmland to avoid possible losses, 3-- I used to be late to take decision regarding farm activities because of lack of timely information regarding various cultivation aspects, 4-- I always get new crop information in time and that helps me to plan various agricultural activities to get a good profit, 5--Timely market information helps me to identify the right market for the produce and thus to avoid distress sale.

From the result in Fig 6.1 it was clear that there was substantial change in decision making quality of the mKRISHI® subscriber after mKRISHI® information given to its member compared to that of nonmember. Most of them agreed that their decision making quality has improved due to the timely availability of various information.

Here, the change in the decision making quality might be due to the superiority of the information that they get or due to the timely availability of the information so that they will be able to make informed decision compared to non member farmer of same locality.

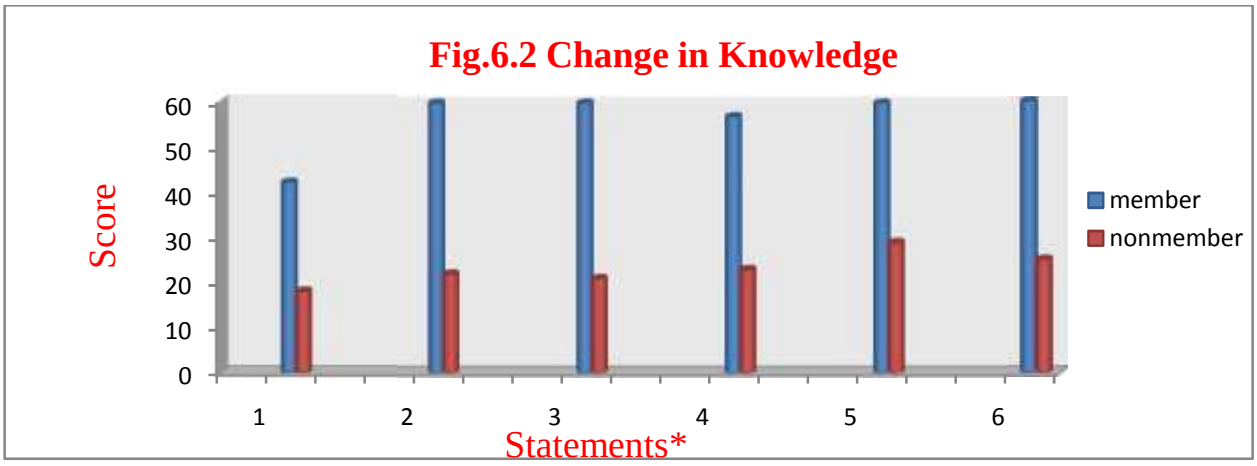
To confirm this further, Mann-Whitney U Test for two independent samples was done. This test is used to compare the means of two independent populations. The Table 6.1.1 given below shows the calculated value of Mann-Whitney U Test statistic and its level of significance.

Table 6.1.1: Computed value for decision making quality

Group	n	Mean Rank	Sum of Ranks
Member	60	79.98	4799.00
Nonmember	60	41.02	2461.00
Mann-Whitney U		631.000	
Z		-6.241	
Asymp. Sig. (2-tailed)		.000	

6.2. Level of change in knowledge

Change in the knowledge gain was estimated using a set of six statements. The total sum of each statement for all the individuals was calculated through with –without design for subscriber farmer and control farmer. The result was presented in Fig 6.2



* 1-- Knowledge about fertilizers, pesticides, water such as how much and when to given crop, 2-- Knowledge about harvesting of crop in relation to weather to limit crop damage, 3-- Knowledge about new improved varieties of crops, 4-- Knowledge about chemical weed management in crop, 5-- Knowledge about current market prices available so we can choose where and when to sell, 6-- Knowledge about new government policies and schemes for farmers.

From the result in Fig 6.2 it was clear that there was substantial change in knowledge achieved by the mKRISHI® member when compared to the non member.

To confirm this further, Mann-Whitney U Test for two independent samples was done. This test is used to compare the means of two independent populations. Table 6.2.1 given below shows the calculated value of Mann-Whitney U Test statistic and its level of significance.

Table 6.2.1: Computed value for level of change in knowledge

Group	n	Mean Rank	Sum of Ranks
Member	60	74.78	4486.50
Nonmember	60	46.22	2773.50
Mann-Whitney U		943.500	
Z		-4.558	
Asymp. Sig. (2-tailed)		.000	

6.3. Information Networking

Information networking consists of interconnected individual who are linked by patterned flows of information. Networks have a certain degree of structure or stability. This patterned aspect of network provides predictability to human behavior.

Table: 6.3.1. **Distribution of mKRISHI farmers based on information networking** (n=60)

S.N	Information networking	Often		Rarely		Never	
		f	%	*f*	%	*f*	%
1	I receive information from my mKRISHI® user fellow farmers.	3	5.0	34	56.7	23	38.3
2	I verbally share the information sought from mKRISHI® with my fellow farmers	11	18.3	34	56.7	15	25.0
3	I message the information sought from mKRISHI® to my fellow farmers through mobile	0	0	48	80.0	12	20.0
4	Farmers approach me to ask what new information/ technology I have learnt from mKRISHI®	50	83.3	10	16.7	0	0
5	We discuss and experiment the new technologies learnt from mKRISHI®	1	1.7	55	91.7	4	6.7
6	We have modified the technologies learnt from mKRISHI® to make them compatible to our situation	6	10.0	47	78.3	7	11.7

Table: 6.3.1**.**represents the response of the farmers to the information networking. Regarding I receive information from my mKRISHI® user fellow farmers showed that 56.7 per cent farmers were rarely receive information from their fellow farmer and 38.3per cent never receive information from their fellow farmers and 5 per cent farmers were often receive information from their fellow farmer. In case of I verbally share the information sought from mKRISHI® with my fellow farmers 56.7 per cent farmer was rarely share the verbally information to their fellow farmer and 25per cent farmer was never verbally share information to their fellow farmer and 18.3 per cent farmers were often verbally share information to their fellow farmer.

6.4. Categorization of farmers based on information networking

Table 6.4.1 depicted that majority of farmer 66.66 per cent rarely exchange information received from mKRISHI® while 20 per cent farmer often exchange information received from

mKRISHI® and 13.3 per cent farmer often exchange information received from mKRISHI®.

Table 6.4.1: Categorization of farmers based on information networking

S.N.	Category of Timeliness	Class Score	Frequency	%
1.	Never	16.66-41.66	8	13.33
2.	Rarely	41.66-66.66	40	66.66
3.	Often	66.66-91.66	12	20
	Mean		65.46	
	Standard Deviation		5.41	

6.5 Comparison of market price of different crop in Maharashtra and Tamil Nadu

Table 6.5.1**:** depicts the comparison of different market price for different crop in both states between beneficiary and control group. After the intervention of mKRISHI® there was significant difference in the price of beneficiary and control farmers. The calculated t-value was greater than the tabulated t-value (1.645) at 0.05 per cent level of significance.

Table 6.5.1: Comparison of market Price of different crop

Tomato in Maharashtra (Rs/q)	Number of farmer	**Mean**	**t-cal**
Member	26	1513.7	3.69*
Non member	26	1389.6	
Onion in Maharashtra (Rs/q)			
Member	25	3856.6	3.02*
Non member	15	3450.6	
Grape in Maharashtra (Rs/q)			
Member	23	1508.69	2.55*
Non member	23	1371.95	
Paddy in Tamil Nadu (Rs/q)			
Member	29	1505.17	1.89*
Non member	29	1377.93	
Groundnut in Tamil Nadu (Rs/q)			
Member	29	4537.93	2.11*
Non member	29	4263.73	
Okra in Tamil Nadu (Rs/q)			
Member	24	843.75	3.47*
Non member	24	718.12	

***** Significant at 5 level of significance

6.6 Comparison of yield of different crops in Maharashtra and Tamil Nadu

Table 6.6.1 depicts the comparison of different crop yield in both states between beneficiary and control group. After the intervention of mKRISHI there was significant difference in the yield of beneficiary and control farmers. The calculated t-value was greater than the tabulated t-value (1.645) at 0.05per cent level of significance.

Table 6.6.1: Comparison of yield of different crop

Tomato in Maharashtra (qtl per acre)	Number of farmer	**Mean**	**t-cal**
Member	26	76.73	1.99*
Non member	26	63.88	
Onion in Maharashtra (qtl per acre)			
Member	25	55.44	2.59*
Non member	15	43.06	
Grape in Maharashtra (qtl per acre)			
Member	23	66.08	1.81*
Non member	23	57.60	
Paddy in Tamil Nadu (qtl per acre)			
Member	29	26.89	2.32*
Non member	29	22.17	
Groundnut in Tamil Nadu (qtl per acre)			
Member	29	14.36	3.2*
Non member	29	9	
Okra in Tamil Nadu (qtl per acre)			
Member	24	27.50	3.4*
Non member	24	22.66	

***** Significant at 5 level of significance

6.7 Comparison of increase in income of member and non members in Maharashtra and Tamil Nadu

Table 6.5.1**:** depicts the comparison of different crop income in both states between beneficiary and control group. After the intervention of mKRISHI® there was significant difference in the income of beneficiary and control farmers. The calculated t-value was greater than the tabulated t-value (1.645) at 0.05 per cent level of significance.

Table 6.7.1: Comparison of income of different crop

Tomato in Maharashtra (Rs/acre)	Number of farmer	**Mean**	**t-cal**
Member	26	95240.15	3.12*
Non member	26	64807.70	
Onion in Maharashtra (Rs/acre)			
Member	25	79240	1.82*
Non member	15	47066	
Grape in Maharashtra (Rs/acre)			
Member	23	99173.91	1.85*
Non member	23	67652.17	
Paddy in Tamil Nadu (Rs/acre)			
Member	29	37793.10	3.93*
Non member	29	30068.97	
Groundnut in Tamil Nadu (Rs/acre)			
Member	29	58772	4.06*
Non member	29	42558	
Okra in Tamil Nadu (Rs/acre)			
Member	24	39958	3.35*
Non member	24	23217	

***** Significant at 5 level of significance

6.8 Extent of adoption

The mKRISHI® was providing technological information for different region specific crops. In the study area maximum farmers were cultivating grapes, tomato and onion in Nasik district while in Kanchipuram maximum farmers were cultivating paddy, groundnut and okra. These different crops were selected to study the extent of adoption. There were several recommended in these crops cultivation prescribed by the agronomist of mKRISHI®. Among them five practices, regarding, improved variety, fertilizer, plant protection, herbicide and irrigation were selected. The results are given bellow.

Table 6.8.1 Adoption of Recommended Practices in Onion and Rice (n=60)

S.N	Recommend Practices	Frequency	%
1	Variety(Agrifound dark red, ADT36,37,IR 50 IR64)	52	86.66
2	Fertilizer for Onion and Rice	50	83.33
3	Plant Protection Chemicals (Thiram, Carbendazim, Chlorpyriphos etc)	53	88.33

4	Herbicides (Oxyfluorfen, Pendimethalin)	48	80
5	Irrigation at the recommended stages of crop growth.	46	76.60

The table 6.8.1 depicted maximum numbers of farmers 88.33 per cent adopted the plant protection chemicals recommendation followed by 86.66 per cent of farmers adopted recommended high yielding varieties of crops. On an average 88.66 per cent of farmers adopted the recommended practices.

6.9 Total Expenditure Pattern

Expenses on household item

Table 6.9.1 depicts that after the intervention of mKRISHI®, there was high increase in the income of member farmer facilitating more spending on household item compare to control farmer of same locality. The mean value of member farmer, after intervention of mKRISHI® was greater than the control farmer. So there is significant increase in expenditure on household items.

Expenses on child education

Table 6.9.1 depicts that after the intervention of mKRISHI®, there was huge increase in the income of member farmer, enabling them to spend more on their children education compare to control farmer of same locality. The mean value of member farmer, after intervention of mKRISHI® was greater than the control farmer. So there is significant increase in expenditure on children education.

Personal expenses

Table 6.9.1 depicts that after the intervention of mKRISHI®, there was increase in the income of member farmer so they spend more money on themselves compare to control farmer of same locality. The mean value of member farmer, after intervention of mKRISHI® was greater than the control farmer. So there is significant increase in personal expenses of member farmer

Table 6.9.1 Expenses on Different items

Expenses on household item(Rs/year)	**Number of farmer**	**Mean**	**Standard Deviation**
Beneficiary	60	21358.33	3.23
Control	60	12333.33	1.85

Expenses on child education ((Rs/year)			
Beneficiary	60	16725	2.23
Control	60	11825	1.25
Personal expenses(Rs/year)			
Beneficiary	60	5708.33	1.20
Control	60	4728.33	1.45
Expenses on food items(Rs/year)			
Beneficiary	60	27833.33	4.09
Control	60	35466.67	2.70
Expenses on agricultural inputs(Rs/year)			
Beneficiary	60	40925.00	8.07
Control	60	53266.67	8.52

Expenses on food items

Table 6.9.1 signifies depicted that after the intervention of mKRISHI®, there was increase in the income of member farmer so they spend more on food items compare to control farmer of same locality. The mean value of member farmer after intervention of mKRISHI® was greater than the control farmer. So there is significant increase in expenditure on food items.

Expenses on agricultural input

Table 6.9.1 depicts that after the intervention mKRISHI®, the member farmer get accurate timely information, appropriate advice and improved varieties of different crops and proper dose of pesticide and fertilizer according to demand of crops which helped them in reduction of agricultural inputs compare to non member farmers of same village. The mean value of member farmers after intervention of mKRISHI® was less than the non-member farmers. So there was significant decrease in expenditure on agricultural inputs.

Discussion:

mKRISHI® had a very high impact on the farming conditions in both the districts of Maharashtra and Tamil Nadu. One of the perceived benefits of mobile was greater access to information on markets and prices. Price information had an impact in improving the

bargaining capability of farmers with traders, better price realization and reduction in arbitrage, wastage or spoilage. Fafchamps and Minten's (2011) in their case study on Reuters Market Light (RML) in Maharashtra found that farmers used this information for decision- making, but found no statistically significant effect of the intervention on the price received by farmers or reduction in crop wastage due to climatic factors. These results are contrary to present studies which reveal that there is significant effect of the price received by farmer after mKRISHI® intervention. A considerable change in decision making, quality and gain in knowledge was observed as a result of mKRISHI®. This result was similar to the finding of Balakrishnan (2012). After mKRISHI® intervention there was significant increase in yield and income of farmer. This result is similar to the findings of Afroz and Singh (2013). The findings are in contrast to study of (Ilahiane, 2007) who found that farmers who purchased mobile phones in Morocco found that average income increased by nearly 21 per cent.

Conclusion:

The above study conclusively shows the differential impact of mobile based extension service on agricultural activities of member's farmers. A considerable change in decision making quality and gain in knowledge was observed as a result of mKRISHI® intervention. The economic impact due to the mobile based intervention was significant as it resulted in the higher yield and higher income due to continuous adoption of mobile based extension services. As a general conclusion to this study, differences were found between mKRISHI® farmers and non mKRISHI® farmers in terms of increased yield, price and income and adoption of improved technologies.

Research Paper-IV **Chapter-VII**

Constraints faced in mobile based agro-advisory services and strategy for enhancing the effectiveness of mKRISHI®

Abstract

Risk and uncertainty are ubiquitous in agriculture and have numerous sources: the vagaries of weather, the unpredictable nature of biological processes, the pronounced seasonality of production and market cycles, the geographical separation of producers and end users of agricultural products, and the unique and uncertain political economy of food and agriculture within and among nations. The farmer's exposure to risk and uncertainty is often provoked by lack of information about inputs, farm management practices or market prices, and this lack of information has an adverse impact on crop production and income. The evidences suggested that a farmer who received quality, up-to-date information, and who has the ability to use that information, was able to lessen the effect of these risks. To minimize all types of risks of farmers, there are number of ICT initiatives working in the country. However escalating large number of ICT projects in country, are unable to fill the information gap. mKRISHI® system of disseminating messages in agriculture technology is an important extension methodology in this ICT era. Beside its wide adaptability among the farmers, it has few limitations to meet the information needs of all the farmers. Hence the present study was conducted in the Nasik and Kanchipuram districts of Maharashtra and Tamil Nadu where mKRISHI® is working with the objective to analyze the various constraints in providing the extension services through the use of message. A sample of 60 beneficiary farmers from both the districts was selected. An open-ended questionnaire was used to obtain the perception of the farmers about the constraints. Garrette ranking technique was used to rank the constraints. Later a structured schedule was also used to collect information related to the constraints. Friedman test was used to identify the most severe constraints. It was found that the most severe constraint in the functioning of mKRISHI® was Lack of update information followed by High cost for service provided. low IT literacy and low literacy.

Key words: Constraints, mobile based agro-advisory, Garrette ranking technique,.

Introduction

Agriculture is the main occupation of farming community of India. Transfer of technology plays a major role in disseminating the research outcome to the farming community. In recent year agriculture facing severe challenge and coupled with limited man power of extension personnel due to which information need of farmers are not met. In this the context arrival of ICTs in agriculture is well time. The use of ICTs is more prevalent now a day in agriculture. ICT has reduced the costs of gathering, processing, and disseminating information that helps farmers mitigate risk. Applications of ICTs to transfer agricultural risk through instruments such as insurance and futures contracts are still quite limited. The widespread use of these instruments seems to be hampered by low levels of institutional development, high costs, inability to customize products to meet smallholders' requirements, and poor financial literacy rather than by the information constraints that ICTs can address. A lot of ICT initiatives are working in the country to meet the information needs of the farmer. According to (Saravanan, 2010) that many ICTs were on pilot basis, operational at small scale, had difficulty in localization of the content and constrained with limited infrastructure. Gelb et al., (2004) in their study found that connectivity is the constraint for low use of ICTs especially among extension workers and farmers is the differing levels of consensus among these actors. Another constraint in the use of ICT in agriculture was the scattered nature of ICT initiatives which led to low adoption and usage of support tools developed for small-scale agriculture because extension services did not reach the targeted population on time (Munyua, 2007). Hence, in this study an attempt was made delineate the constraints faced in mobile based agro-advisory services and suggest a strategy for enhancing the effectiveness of mKRISHI®.

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Methodology

The two districts Nasik of Maharashtra and Kanchipuram of Tamil Nadu were selected purposively for the study as mKRISHI® was started in these districts in 2006. Based on the available information on mKRISHI®, different constraints in dissemination of agricultural technologies through mKRISHI® were enlisted from farmers. The enlisted constraints were categorized into four categories, i.e. technological constraints, social constraints, economic constraints and psychological constraints. Responses to these

constraints were recorded on a three point-continuum of most severe, severe and not severe. The perceptions of the farmers were obtained on these continuum and descriptive statistics were used to interpret the information available from the farmers. All the constraints were ranked by the respondents, then method of combining of incomplete order of merit ranking as suggested by *Garrett (1979)* was followed. The Friedman test was also used to identify the most severe constraints among the four constraints.

Results

The major constraints faced by the farmers were enlisted and ranked by them based on the extent of severity as perceived by them, which were analyzed by Garrette ranking technique. The results are presented in Table 7.1.

Table: 7.1. Constraints in Functioning of mKRISHI® as perceived by the farmers

(n=60)

S.N.	Constraints faced by Farmers	Mean Score	Ranks
1.	Lack of updated information	35.27	I
2.	High cost for service providing	31.94	II
3.	Low IT literacy	31.38	III
4.	Low literacy	30.00	IV
5.	Poor connectivity of network	29.32	V
6.	Lack of skill to use modern IT gadgets	26.33	VI
7.	Lack of self confidence in handling mobile based information system	23.00	VII
8.	High cost for establishment	18.26	VIII

Table 7.1 signified that the most severe constraint in effective functioning of mKRISHI® was the lack of updated information as perceived by farmers with Garrett's score 35.27. They consider that the information for the cropping system was not completely new due to which could not properly manage their field resulted in reduced yield followed by high cost for service provided with Garrett's score 31.94. The farmer perceived that cost received by mKRISHI® for their service provided was more compare to their service delivered to

farmer. Low IT literacy was listed as the third most severe constraint by the farmers with Garrett's score 31.38. They felt that they could better interpret the message if they had good knowledge of IT. They were able to understand the message because of the local coordinator who was available at that time explained the content. Low literacy among the farmers was considered as fourth most significant constraint with Garrett's score 30. They had argued that because of the poor knowledge level, they are unable to understand and remember the name of variety, chemicals, pesticide formulation etc. They perceived that better literacy could make them understand message better. Poor connectivity of network was ranked fifth.

An interview schedule was also used to collect the information related to the constraints faced by the farmers on a three point continuum. The constraints were divided in four major dimensions, i.e. technological constraints, economic constraints, social constraints and psychological constraints. The results obtained are presented in Table 7.2. The mean score of each of the sub-dimensions is also calculated.

Table: 7.2. Response of the farmers on different constraints

(n=60) `

S.N.	Constraints	Responses of the farmers (*f* & %)						Mean	Rank
		Most Severe		Severe		Not severe			
A.	**Technological Constraints**	f	%	F	%	f	%		
1	Poor connectivity of network	28	46.7	27	45.0	5	8.3	2.30	V
2	Lack of updated information	38	63.3	21	35.0	1	1.7	2.61	I
b	**Economic Constraints**	f	%	F	%	f	%		
1	High cost for service provided.	0	0	13	21.7	47	78.3	2.41	II
2	High cost for establishment.	0	0	0	0	60	100.0	1.56	VIII
c	**Social Constraints**	f	%	F	%	f	%		
1	Low literacy	18	30.0	10	16.7	32	53.3	2.38	III
2	Low IT literacy	7	11.7	43	71.7	10	16.7	2.33	IV

3	Lack of skill to use modern IT gadgets	0	0	30	50.0	30	50.0	1.95	VI
d	**Psychological Constraints**	f	%	F	%	f	%		
1	Lack of self confidence in handling mobile based information system	0	0	34	56.7	26	43.3	1.40	VII

In Table 7.2 the constraints were worked out by calculating the mean score for each of the sub dimensions. It also revealed the same result as obtained by the Garrett's ranking technique.

To find out which one constraint is most severe among the four the dimensions, Friedman test was used. The results obtained by the use of this test were presented below.

Table: 7.3. Test Statistics of Friedman test

S.N.	Statistics	Value
1.	N	60
3.	Df	3
3.	Asymp. Sig	.000

Table: 7.4. Mean Rank by Friedman test

S.N.	Constraints	Mean Ranks
1.	Technological	3.94
2.	Economic	2.73
3.	Social	2.32
4.	Psychological	1.72

Table 7.3 showed that asymptotic significance obtained from the Friedman test was 0.000 (<5). Hence it can be interpreted that there was significant difference in between the different constraints faced by the farmers while taking the services of mKRISHI®.

Table 7.4 further revealed that the mean ranks obtained by the use of Friedman test was highest for technological constraints (3.94) which means that it was most severe constraint among all the four constraints. This result was same as the result obtained from Table 7.1 and Table 7.2. The mean rank of psychological constraints was 1.72 which implied that it was the least severe constraints.

Strategies for enhancing the effectiveness of mKRISHI®

Some of the suggestions for improving mKRISHI® functioning as perceived by farmers and other stakeholders given below

1. Technical expert should have more focus on practical knowledge of field crops
2. Daily visit to each subscriber farmer with improved technology
3. Latest information about crop varieties, pesticide and other related practices
4. Interface in every fortnight to ensure face to face interaction with mKRISHI® expert.

Strategy for enhancing the effectiveness of mKRISHI®

Based on the findings of the study and the suggestions of farmers and other stakeholders the following strategy is formulated.

1. Create awareness among farming community about the potential of mKRISHI®
2. Training must be given to extension officers as well as the officials in agricultural department and other line departments to promote mKRISHI®
3. Training may be provided to farmers about how to utilize the information available in mobile
4. Regular updating of information
5. Location specific and problem specific information must be provided
6. There should be more linkage of mKRISHI® centre with State Agricultural University, Krishi Vigyan Kendra's, ICAR Institutes, State Department of Agriculture and other development departments

7. Experts should provide prompt reply to the queries and information asked by the farmers
8. Demonstrations with experts on farmer's field help to build rapport between mKRISHI® staff and farmers.

Discussion

There are several advantages of mobile based ICTs tools in agriculture delivering the information needs of the farmers. It is not being utilized to its full potential. Mittal and Tripathi, (2009) found in their study that although it was evidenced that mobile phones were being used in ways which contributed to farm productivity, to leverage the full potential of greater access to information enabled by a mobile phone, particularly for small producers, will require significant improvements in the supporting infrastructure and also in capacity-building amongst farmers to enable them to use the information they access more effectively. Heeks and Molla (2009) found in their study that ICT based tool is under utilized in agriculture. Scaling up of delivery still remains at experimental stage. In this context, mKRISHI® is an excellent alternative for the transfer of information through the use of message. But some constraints made it unable to work at its full potential in technology disseminations to the farmers. The results obtained can be use to understand the major gap in the services of mKRISHI®. Most of the farmers perceived that the updated information was main constraints in technology dissemination among the farmers. The low IT literacy and low literacy were the other major barriers in such type ICT tool in dissemination of information. The result are similar to the finding of Vishwatej (2012) who reported that lack of adequate skill to use ICT was a constraint in effective utilization of ICT based project by farmers. This result was similar to the finding of Balakrishnan (2012) and Afroz (2013). Hence there is a need to develop some of the strategy to cope up such barriers in disseminations of technology. Some of the suggestions provided by the famers can be used to enhance the effectiveness of mKRISHI services for efficient transfer of information to farmers, thereby improving their prosperity and quality of life.

Conclusion

Realization of full potential of mobile based agro advisory is constrained by shortcoming in areas like technological, economic, social and psychological factor in agriculture. In spite of these few constraints mKRISHI® showed promising option for the

dissemination of information among farmers and extension workers due to its unique technology adopted for dissemination of information. So it can be replicated in other parts of country also to disseminate the technologies and information of practices to the vast numbers of small and marginal farmers in the country.

Chapter -VIII

General Discussion

Information and communication have always mattered in agriculture. Ever since people have grown crops and raised livestock, they have sought information from one another. Agriculture is facing new and severe challenges in its own right. Given the challenges, the arrival of information communication technology (ICT) is well timed. With the booming mobile, wireless, and internet industries, ICT has found a foothold even in poor smallholder farms and in their activities. The ability of ICTs to bring refreshed momentum to agriculture appears even more compelling in light of rising investments in agricultural research, the private sector's strong interest in the development and spread of ICTs, and the enhancement of organizations committed to the agricultural development agenda.

The generation and application of agricultural knowledge is increasingly important, especially for small and marginal farmers, who need relevant information in order to improve, sustain, and diversify their farm enterprises. In India, information and communication technology (ICT) projects that support such information flows are rapidly growing, with many initiatives in operation today. ICTs can directly support farmer's access to timely and relevant information, as well as empower the creation and sharing of knowledge of the farming community itself. ICTs in agriculture have the potential to facilitate greater access to information that drive or support knowledge sharing. ICTs essentially facilitate the creation, management, storage, retrieval, and dissemination of any relevant data, knowledge, and information that may have been already been processed and adapted (Batchelor, 2002; Chapman and Slaymaker, 2002; Rao, 2007; Heeks, 2002). In the past, television and radio were the main electronic broadcast technologies used to reach rural communities; however, in the past two decades, internet- and mobile-based channels have emerged. ICTs now include computer-based applications and such communication tools as social media, digital information

repositories (online or offline), and digital photography and video, as well as mobile phones (Balaji, Meera, and Dixit, 2007).

Indian agriculture is the home of 80 per cent small and marginal farmer's (Kokate, 2012). Small holdings also face new challenges on integration of value chains, liberalization and globalization effects, market volatility and vulnerability to climate change etc. (Thapa and Gaiha, 2011). Despite the improved interest and investment in agricultural extension in India such services is fail to meet all these challenges. Given the challenges, the arrival of information communication technology (ICT) is well timed. Over the year the use of ICT has been witness in all spheres of life without no exception to the agriculture. The unprecedented adoption of various ICT based gadget has raised the general expectation about its potential contribution to the dissemination of innovative farming technology as well as enhancing farmer knowledge, thereby creating an environment for social and economic benefit to the end users. Public and private sector actors have long been on the search for effective solutions to address both the long- and short-term challenges in agriculture, including how to answer the abundant information needs of farmers.

Overall, the use of mobile phones has been found to encourage poor farmers towards greater market participation and diversification into high-value crops. This change has helped to increase farm earnings through higher price realization and reduction in wastage. According to Bhatnagar (2008), the contribution of ICT can be felt at all stages of the agricultural cycle; the impact has been in terms of both quantifiable gains (increase in income, improved yield etc.), and non-quantifiable gains (social benefits of improved communications, information about education and health decision making ability and change in knowledge etc). According to Anderson and Feder (2007), information is one of the key inputs to productivity growth. The farmer's demand for information is seen as a productive input, and thus depending on how productive or useful the information is, the farmer is willing to purchase that input. Therefore, different delivery systems will have different values depending on the kind of information being delivered i.e. availability of inputs, new seed varieties, input prices, weather information, future prices, ways of using inputs etc. There are many ICT based extension model

existing in India at present which focused towards farming community. The approach adopted by mKRISHI® is different from all the ongoing ICT based projects. This study entitled as *"CRITICAL ANALYSIS OF MOBILE-BASED AGRO ADVISORY-SERVICES: A CASE OF mKRISHI®"* was an attempt to analyze the structural and functional mechanism of mKRISHI and its effectiveness in information dissemination to the farmers. The results of the study are discussed under the following sub headings.

1. Socio-economic profile of member farmers and structural and functional mechanism of mobile based agro-advisory services.
2. Effectiveness of mobile based agro-advisory services in addressing the information need of the Stakeholders.
3. Socio-economic impact of mKRISHI® model.
4. Delineate the constraints faced in mobile based agro-advisory services and suggest a strategy for enhancing the effectiveness of mKRISHI. ®

8.1. Socio-economic profile of member farmers and structural and functional mechanism of mobile based agro-advisory services

Presently there are a lot of ICT based projects are running in India and trying to eradicate the digital divide in India. Most of the ICT based projects use the internet technology to decrease the information gaps. But the methodology adopted by mKRISHI® is quite different from all others ICT based projects and expected to meet the demand of farmers. Among modern ICT modes, mobile phone has been most recent and widely accepted mode of delivering information among developing country including India.

In this context, mKRISHI® is more appropriate as compared to all other ICT based projects in India because mKRISHI® operates through mobile phone which is very cheap and affordable by the farmers. Hence it is also suitable to small and marginal farmer of India. Local dialects were used in the message, which helped better understanding and conviction among the farmers. It also helped to reduce heterophily between scientists and farmers because of involvement of local people. It resulted in developing faith for the

extension workers among the farmers. Meera *et. al.*, (2004) reported that staff for agricultural extension projects have inadequate training and farmers have very little faith in the ICT project personnel and their commitment to achieve the goals of the projects. Thus mKRISHI® overcomes all such types of barriers and results in better adoption of technology by the farmers.

The mKRISHI® platform, developed by Tata Consultancy Services (TCS) in 2006, enables farmers to access best-practice information and agricultural experts through low-cost mobile phones using SMS. The mKRISHI® was started with the goal to develop a mobile agro advisory system to provide the benefits of the information and communication technology (ICT) to the rural farmers by enhancing their agricultural productivity, farming efficiency and improving their earnings. Farmers require information on weather, soil, fertilizer and pesticide that are specific to their plot of land. They also need information and clarification about seed of improved varieties that are available in the market. Further, local market price information for various agricultural produce is valuable to them. However, media broadcast do not provide highly localized information. Culturally too, farmers only rely on their personal network for making crucial decisions related to fertilizer, irrigation, disease control, finance and so on. mKRISHI® used advanced in information and communication technology (ICT) to address such issues. Farmers are receiving information on microclimate, local mandi (market) price, expert's advice, and other information relevant to them, on their mobile phone.

8.2. Effectiveness of mobile based agro-advisory services in addressing the information need of the stakeholders.

Among modern ICT modes, mobile phone has been most recent and widely accepted mode of delivering information (Mittal and Mehar, 2012). Increasing mobile phone based services enhances availability of knowledge and information in agriculture and meet the increasing information demand of farmers .It further also help in improving awareness, education, better adoption of technology, better health and efficiency, reduced transaction costs, better market efficiencies, etc.

mKRISHI® is a highly effective in the farming situation in both Maharashtra and Tamil Nadu. According to Mittal (2012), effectiveness of ICT in passing on information to farmers, particularly small landholders, holds the key to its successful utilization as a complementary information dissemination mechanism for extension services. ICT would enable extension workers to gather, store, retrieve and disseminate a broad range of information needed by small producers such as information on best practices, new technologies, better prices of inputs and outputs, better storage facilities, improved transportation links, collective negotiations with buyers, information on weather *etc*. There were 88.33 per cent famers who perceived that the information disseminated by mKRISHI® could be easily applied in their field situation because the information in locally relevant Hence the adoption rate is faster as compared to the other traditional methods. It showed that mKRISHI® is highly effective in comparison to other information delivery mechanisms to the farmers. It had the high effectiveness of 60-80 per cent for the farmers in their situation. Similalrly the findings of Afroz and Singh (2013), reported that effectiveness of the digital green. It is in contrast with the findings of Mukherjee and Bahal (2011), who reported less effectiveness of the services of Tata Kisan Sansar. Similar report were also made by Hanumankar (2005) who concluded that nearly 84 per cent of respondent have expressed their satisfaction from the advice provided through kissan call centre. The result are contrast with study made by Meera (2002) who found that nearly three fourth of respondent (73%) expressed medium level of personal effectiveness of *gyandoot*.

8.3. Socio-economic impact of mKRISHI® model.

mKRISHI® had a very high impact on the farming condition in both the districts of Maharashtra and Tamil Nadu. One of the perceived benefits of mobile was greater access to information on markets and prices. Price information had an impact in improving the bargaining capability of farmers with traders and better price realization. Fafchamps and Minten's (2011) in their case study on Reuters Market Light (RML) in Maharashtra found that farmers used this information for decision- making, but found no statistically significant effect of the increased market price received by farmers for their produce after reduction in crop wastage due to climatic factors. These results are contrary to present studies which reveal that there is significant effect of the increased market price

received by farmers for their produce after mKRISHI® intervention. A considerable change in decision making quality and gain in knowledge was observed as a result of mKRISHI®. This result was similar to the finding of Balakrishnan (2012). After mKRISHI® intervention there was significant increase in yield and income of farmer. This result is similar to the findings of Afroz and Singh (2013).

8.4. Delineate the constraints faced in mobile based agro-advisory services and suggest a strategy for enhancing the effectiveness of mKRISHI®

There are several advantages of mobile based ICTs tools in agriculture delivering the information needs of the farmers. It is not being utilized to its total potential. Mittal and Tripathi (2009) found in their study that although it was evidenced that mobile phones were being used in ways which contributed to farm productivity, to leverage the full potential of greater access to information enabled by a mobile phone, particularly for small producers, will require significant improvements in the supporting infrastructure and also in capacity-building amongst farmers to enable them to use the information they access more effectively. Heeks and Molla (2009) found in their study that ICT based tool are under utilized in agriculture. Scaling up of delivery still remains at experimental stage. In this context, mKRISHI® is excellent alternative for the transfer of information through the use of message. But some constraints made it unable to work at its full potential in technology disseminations to the farmers. The results obtained can be use to understand the major gap in the services of mKRISHI®. Most of the farmers perceived that the updated information was main constraints in technology dissemination among the farmers. The low IT literacy and low literacy were the other major barriers in such type ICT tool in dissemination of information. The result are similar to the finding of Vishwatej (2012) who reported that lack of adequate skill to use ICT was a constraint in effective utilization of ICT based project by farmers. This result was similar to the finding of Balakrishnan (2012) and Afroz (2013). Hence there is a need to develop some of the strategy to cope up such barriers in disseminations of technology. Some of the suggestion provided by the famers can be used to enable the services efficient in transfer of information, change the behavior of the farmers and to make competent in the commercial agriculture.

Strategy for Enhancing the Effectiveness of mKRISHI®

1. Create awareness among farming community about the potential of mKRISHI®
2. Training must be given to extension officers as well as the officials in agricultural department and other line departments to promote mKRISHI®
3. Training may be provided to farmers about how to utilize the information available in mobile
4. Regular updating of information
5. Location specific and problem specific information may be provided
6. There should be more linking of mKRISHI® centre with State Agricultural University, Krishi Vigyan Kendra's, ICAR Institutes, State Department of Agriculture and other development departments
7. Experts should provide prompt reply to the queries and information asked by the farmers
8. Demonstrations with experts on farmer's field help to build rapport between mKRISHI® staff and farmers.

Chapter- IX

Summary and Conclusion

Information and communication have always mattered in agriculture. Ever since people have grown crops and raised livestock they have sought information from one another. Agriculture is facing new and severe challenges in its own right. Given the challenges, the arrival of information and communication technology (ICT) is well timed. With the booming mobile, wireless, and internet industries, ICT has found a foothold even in poor smallholder farms and in their activities. The ability of ICTs to bring refreshed momentum to agriculture appears even more compelling in light of rising investments in agricultural research, the private sector's strong interest in the development and spread of ICTs, and the enhancement of organizations committed to the agricultural development agenda.

Among the ICT tools, the rise of the mobile phone has been one of the most spectacular changes in the developing world including India. Mobile phone, because of its affordability, accessibility, minimum skill requirement, widespread network etc. has emerged as important tools for the smallholder and marginal farmers. The use of mobile phones has been found to encourage poor farmers towards greater market participation and diversification to high-value crops. This change has helped increase farm earnings through higher price realization and reduction in wastages. Eventually, it is expected that mobile-based information services will influence the behavior pattern of farmers and this will facilitate adoption of improved techniques leading to better yields. Mobile phones confer distinct advantages as a communication link in isolated circumstances because of its distinct feature of mobility. Mobile phones serve as a two-way communication mode and provide access to the information service even in the fields. This included the ability to describe plant diseases from the field to the experts and to coordinate better with the hired labor.

Information and Communication Technology (ICT) is the key enabler and a vital component of the new knowledge based economy and information revolution. It is a

major factor in economic growth and increasing productivity. India is increasingly integrating ICT into its national development plans and adopting strategies for its widespread promotion in all the spheres of economic activities. There is a need to ensure that the benefit of the ICT percolates to all the different socio-economic strata and to the grass roots of the rural India.

mKRISHI® is one of the ICT initiatives taken to meet the location specific needs of the farmers. It is regularly deploying to number of states of the country and has wide adaptability by the farmers. Recognizing the importance of it, a study was undertaken entitled as "Critical Analysis of Mobile-Based Agro Advisory-Services: A Case of mKRISHI®" with the following objectives:

Specific Objectives:

1. To analyze the socio-economic profile of member farmers and to study the structural and functional mechanism of mobile based agro-advisory services.
2. To find out the effectiveness of mobile based agro-advisory services in addressing the information needs of the stakeholders.
3. To measure the socio-economic impact of mKRISHI® model.
4. To delineate the constraints faced in mobile based agro-advisory services and suggest a strategy for enhancing the effectiveness of mKRISHI®.

Research Methodology:

The two states, Maharashtra and Tamil Nadu were selected purposively for the study location. mKRISHI® was working in these states for the last six years and these were states where mKRISHI® was started. To study the effectiveness of mKRISHI® approach, a period of action intervention was essential to record the impact.

The two districts were purposively selected which had been adopted by mKRISHI®, Nasik of Maharashtra and Kanchipuram of Tamil Nadu. Further, Two blocks were selected by random sampling from each of the two districts. Thus total four blocks were selected for the study. Two villages of Nasik and Dindori block (Maharashtra), Girnari and Permori, were selected by random sampling and two control villages Matori and Palkhed respectively, were also selected for the comparative study. Similarly, two villages of Chitamur and Acharapakkam block (Tamil Nadu), Thenpakkam and

Velliyampakkam, were selected by random sampling and two control villages Ammanampakkam and Karasangal respectively, were also selected for the comparative study.

Fifty villages in Nasik and eighteen villages in Kanchipuram district are adopted by mKRISHI® respectively. From these 68 villages, four villages, two each from respective states were chosen for the study by random sampling. Besides these, two each from the respective blocks of two states was selected as the control villages. Thus a total of eight villages, (4 mKRISHI® villages and 4 control villages) were selected. Fifteen farmers from each of the identified villages were selected by simple random sampling technique. Thus, a total 120 respondents (60 members and 60 non-members) were selected. Besides, 10 extension personnel, KVK scientist and mKRISHI® staff were also selected from each of the two districts (20) for the study. Thus, there were a total of 140 respondents.

Major findings

9.1. Socio-economic profile of member farmers and structural and functional mechanism of mobile based agro-advisory services.

mKRISHI® was launched in 2006 and started functioning in Maharashtra state. Right now the service has been deployed in 13 major Indian states through 70 projects; namely Maharashtra, Andhra Pradesh, Gujarat, Orissa, Tamil Nadu, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Bihar. Since Originally, it was purely an agro-advisory platform focused on providing farmers with access to information and expert recommendations on their mobile phones. In the past, the mKRISHI® platform only offered expert agro-advisory services to individual farmers' on their mobile phones. Using voice, SMS and photo, farmers can send their queries to agro-experts sitting in a remote location. These experts reviewed the messages and provided recommendations using the same mobile platform. The advisory service has so far helped individual farmers significantly reduce costs associated with inputs, increase yield and improve quality of produce, thereby positively impacting their profit margins.

At the apex level country Head TCS, Head mKRISHI® under them. Delivery Team manager operates at regional level .Under each region mKRISHI® has a set of

project being implemented in selected districts. In each district, Project Managers are responsible to implement the project. The project managers are supported by Subject Matter Specialist and Field Executive. In each Taluka generally 2-3 Field Executive are posted.

There were different approaches used for information dissemination. Farmer looks for specific, actionable information. Farmers are not just interested in remotely sent SMS, market information or agro advisory. Farmer wants an end-to-end service and expects personal attention and occasional visit by expert once in a while. Most of the services in vogue do not stand up to his expectations. Though there has been initial enthusiasm to such services there is no repeat buying. Our experience has been no different. To tackle this problem, we have designed a model that integrates agro-advisory services via calls and SMS with personal visits from field executives. Customers value personalisation and human interaction: Anecdotal feedback gathered from farmers indicates that they greatly valued the personalisation and face-to-face interaction with mKRISHI® field officers, providing the inclusive business with a sharp competitive edge. The mKRISHI® communicates with farmer through IVR (Interactive Voice Record), Voice call and messages. The number of message send by mKRISHI® was 5-6 messages per week to member farmer. The mKRISHI® field executive meets the farmer to solve their field problem.

The result of the findings shows that majority (50 %) of the respondents belonged to the age group below 35, and majority of the respondents (36.7%) had secondary level education. The main occupation of most of the beneficiary farmers (63.3%) was farming and that most of the farmers (30%) were small farmers and semi-medium farmers (26.7%). Most of the farmers (56.66 %) had high medium (3-6 lakh) annual household income. Majority of the respondents (61.7 %) were members of social organization. Most of the beneficiary farmers (50%) most often obtained the information from television as source of information. Among the member (30%) farmers go to KVK monthly for obtaining information regarding farm practices.

9.2. Effectiveness of mobile based agro-advisory services in addressing the information need of the stakeholders.

Based on perceptions of the farmers and visit of field executive of mKRISHI in the farmer field it was found that 55 per cent of the total farmers believed that they got timely information about the crop followed by 43.3 3per cent of the farmers who believed that they received information very timely in case of the crops.

Majority (70%) of the farmers perceived that quality of information provided by mKRISHI® on various advisories issues was very good followed by 23.33 per cent of the total farmers who believed that quality of information was excellent.

Majority (75%) of the farmers perceived that information provided by mKRISHI® was useful to their field situation followed by 20 per cent farmers who perceived that information provided by mKRISHI® was highly useful to their field situation.

Based on perceptions of the farmers it was found that 66.66 per cent farmers had high level of satisfaction with the services of mKRISHI® whereas 33.66 per cent of farmers had very high level of satisfaction towards mKRISHI® services. They perceived that services of mKRISHI® fulfilled their information needs.

Based on perceptions of the farmers it was found that 83.33 per cent farmers had easily understood the information provided by mKRISHI® whereas 15 per cent farmers had moderately understood the information provided by mKRISHI®.

Based on the five dimensions and with the effectiveness index it was found that the 46.66 per cent farmers perceived that the mKRISHI® was highly effective as a means of getting information followed by 21.66 per cent farmers who perceived it was very highly effective in obtaining the information regarding to their information needs.

9.3 Socio-economic impact of mKRISHI®model

The result of the findings showed that there was substantial change in decision making quality and change in level of knowledge of member farmers regarding farming practices compared to non member farmers of same locality.

The findings also showed that there was significant increase in market price of crop, yield and income. The study reveal that most of the farmers had significant increase in their crop price, increase in their production and increase in their income compared to non member farmers of the same locality. In case of member farmers there was decrease in expenditure on agricultural inputs. It implies that mKRISHI® had significant socio-economic impact on member farmers life.

9.4 Constraints faced in mobile based agro-advisory services

Technological constraint was found to be in the first position among the four groups of constraints. Among the technological constraints, lack of updated information was found to be having the top rank. In the economic constraints, high cost for service provided was found to be the most important. Among the social constraints, low IT literacy and low literacy were also listed as major constraints.

9.5 Strategy for Enhancing the Effectiveness of mKRISHI®

1. Create awareness among farming community about the potential of mKRISHI®
2. Training must be given to extension officers as well as the officials in agricultural department and other line departments to promote mKRISHI®
3. Training may be provided to farmers about how to utilize the information available in mobile
4. Regular updating of information
5. Location specific and problem specific information must be provided

6. There should be more linkage of mKRISHI® centre with State Agricultural University, Krishi Vigyan Kendra's, ICAR Institutes, State Department of Agriculture and other development departments
7. Experts should provide prompt reply to the queries and information asked by the farmers
8. Demonstrations with experts on farmer's field help to build rapport between mKRISHI® staff and farmers.

CRITICAL ANALYSIS OF MOBILE-BASED AGROADVISORY-SERVICES: A CASE OF mKRISHI®

Abstract

Agriculture is the main occupation of farming community of India. Indian agriculture is the home of 80 per cent small and marginal farmers. Small holdings also face new challenges on integration of value chains, liberalization and globalization effects, market volatility and vulnerability to climate change etc. Despite the improved interest and investment in agricultural extension in India, such services fail to meet diverse information need of the stakeholders. Given the challenges, the arrival of information communication technology (ICT) is well timed. ICT in agriculture is an emerging field focusing on the improvement of agricultural and rural development in India. It can provide timely accurate and quality information to the farmers which facilitate increased agricultural output.Many information and communication technology (ICT) projects in Indian agriculture have emerged, either substituting or supporting extension services by providing farmers with access to agricultural information. But the content that the ICTs deliver has more relevance if it is localized and context specific, as this improves the value and action ability of the information, which can have greater impact on farm management.Among modern ICT modes, mobile phone has been most recent and widely accepted mode of delivering information to the farmers in developing country including India.Increasing mobile phone and mobile phone based services enhances the availability to knowledge and information and will further help in improving awareness, education, better adoption of technology, better health and efficiency, reduced transaction costs, better market. The present study was conducted on mKRISHI® in Nasik in Maharashtra and Kanchipuram in Tamil Nadu. An *ex-post facto* research design was used for the study. The data was collected from 60 beneficiary farmers and 60 control farmers. Besides, 10 extension personnel, KVK scientist and mKRISHI® staff were also selected from each of the two districts for the study. Thus, there were a total of 140 respondents. A structured interview schedule was developed to collect the data from respondents. Most of the farmers perceived that it was highly effective in terms of timeliness of information, quality of information, utility of information, satisfaction of farmers and ease of understanding of the information. Information provided by mKRISHI® helpedin increase in yield, market price and increasedfarm income. Despite of high level satisfaction, there were some constraints which cause hindrance in the smooth running of mKRISHI®. Technological constraints were the most severe in mKRISHI® information delivering and followed by economical constraints. Hence, mKRISHI® had wider impact on the farmers among the sampled respondents. It can be replicated to remaining part of country for effective dissemination of farm technology information.

एम-कृषि द्वारा मोबाइल आधारित कृषि सलाह सेवाओं का बिवेचनात्मक विश्लेषण

सार

कृषि भारत मे किसान समुदाय का मुख्य व्यवसाय है | भारतीय कृषि 80% छोटे अवाम माध्यम परिवारों का घर है | छोटे जोत हमेशा नई चुनौतियों जैसे एकिक्रत वैल्यू चैन, उदरवाद अवाम विश्वव्यापी प्रभाव, बदलता बाज़ार एवं असामान्य जलवायु का भी सामना कर रहा है | बेहतर इच्छा एवं निवेश के होते हुये भी भारत मे कृषि विस्तार से संबन्धित सेवाएँ जरूरतमन्द हितधारको को प्राप्त नहीं हो प रही है | सूचना संचार तकनीकी को ध्यान मे रखते हुये आने वाली चुनौतियों का सामना सही समय मे करना है | कृषि मे सुधार एवं ग्रामीण विकास के लिए सूचना संचार तकनीकी द्वारा आकस्मिक संकट से बचा जा सकता है | यह समय से सटीक जानकारी किसानो को सरलता से उपलब्ध करवाकर कृषि उत्पादन बढ़ाने मे सहायक है | कई सूचना एवं संचार तकनीकी परियोजना भारतीय कृषि मे द्रष्टिगोचर हो रही है, जो विस्तार सेवा के द्वारा किसानो को आसानी से सुचना दे रही है | लेकिन सूचना संचार तकनीकी द्वारा ज्यादा स्थानीय एवं संदर्भित विशिस्ट जानकारी दी जा सकती है | जिससे सूचना की कीमत एवं सूचना की क्षमता बढ़ जाती है जिससे फार्म मेनेजमेंट, सूचना संचार तकनीकी मोड्स, मोबाइल फोन बढ़ाकर उपलब्ध ज्ञान एवं सूचना आगे के लिए ज्यादा जागरूक, शिक्षा, अच्छी तकनीकी का अंगीकरण, अच्छा स्वास्थय एवं कार्यकुशलता, कम व्यापार खर्च एवं बहुत अच्छा बाज़ार उपलब्ध कार्वा सकते है | वर्तमान अध्ययन एम-कृषि पर महाराष्ट्र के नासिक एवं तमिलनाडू के काँचीपुरम मे किया गया था | इस अध्ययन के लिए एक्स पोस्ट फेकटों रिसर्च डिजाइन का प्रयोग किया गया था | यह डाटा 60 सदस्य किसान, 60 गैर सदस्य किसान, 10 विस्तार कार्यकर्ता एवं एम कृषि स्टाफ के साथ दो जिलो मे की गई | ज़्यादातर किसानो मे देखने मे आया था कि वे सूचना कम समय, गुणवत्तापूर्ण सूचना, सूचना की उपयोगिता, किसानो की संतुष्टि एवं विवेकपूर्ण सूचना एम-कृषि द्वारा दी गई सूचना की सहायता से उपज, बाज़ार कीमत एवं फार्म इन्कम मे बढ़ोतरी हुई है | उच्च संतुष्टि स्तरहोते हुये भी एम-कृषि के संचालन मे अडचने आती है | इस कारण से एम-कृषि का असर सदस्य किसानो मे मध्य अच्छा रहा | यह फार्म तकनीकी सूचना के प्रचार प्रसार मे शेष देश के हिस्से मे भी असरदायक रहेगा |

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CRITICAL ANALYSIS OF MOBILE-BASED AGROADVISORY-SERVICES: A CASE OF 'mKRISHI'

INTERVIEW SCHEDULE FOR FARMERS

Socio-economic profile

Respondent No.:

1. **Name of the respondent:**
2. **Member of mKRISHI: Yes: ……. No**: ……
3. **Age: _____**
4. **Gender :- Male/Female**
5. **Village:**
6. **Block**
7. **District: _____**
8. **Education : _____**

S.N.	Category	Score
1.	Illiterate	
2.	Functionally literate	
3.	Primary school	
4.	Secondary school	
5.	Higher secondary school	
6.	College & above	

8. Family Size (No. of family members): _____

9. Occupational Status

Sources	**Score**
Farming	
Farming + Labour	
Farming + Business	
Farming + Independent profession	
Farming + Service	
If any other ,(Please Mention)	

10. Land holding:

Extent of land	**Score**
landless	
0-1 ha (marginal farmer)	
1-2 ha (small farmer)	
2-4 ha (semi-medium farmer)	
4-10 ha (medium farmer)	
> 10 ha (large farmer)	

11. Farming experience (in years): _____

12. Annual Household Income:

13. Share of Total Household Income:

S.N.	**Category**	**Score**
1.	Agriculture	
2.	Non agriculture	

14. Social Participation: Are you member/holding post in any social organization other than mKRISHI?

S.N.	Social organization	Member	Official post
a.	Gram Panchayat		
b.	Panchayat Samithi		
c.	Cooperative society		
d.	Mahila Mandal		
e.	Kisan Sangh		
f.	Youth Club		
g.	Zila Parishad		
h.	Block Development Committee		
i.	Self Help Group		
j	If any other ,(Please Mention)		

15. Mass media utilization: How often do you get information about improved farm practices from each of the following sources?

S.N.	Source	Frequency of obtaining information				
		Always	Most often	often	sometime	Never
1.	T.V					
2.	Radio					
3.	News Paper					
4.	Movies					
5.	Farm Magazines					
6.	Mobile					
7.	Internet					
6.	Any other					

16. Extension agency contact: How often do you meet the followings?

S.N	Source	Frequency of obtaining information						
		Weekly	**Fortnightly**	**monthly**	**Once in two months**	**Once in three months**	**Once in six months**	**Never**
1	Govt.officials							
2	Private extension staff							
3	NGOs							
4	KVK							
5	Others							

Schedule for Effectiveness of mobile-based agro-advisory services

a) Timeliness of information

S.N.	Type of services	Very Timely	Timely	Not at all Timely
1.	Agronomic information			
2.	Varietal information			
3.	Pest and disease Management Information			
4.	Weather related information			
5.	Post-Harvest Technology related information.			
6.	Information related to soil and water conservation			
7	Information about credit			
8.	Marketing Information			
9.	Information about Govt. schemes and policies			

b) Quality of information (In terms of accuracy)

S.N.	Type of services	Excellent	Very good	Good	Moderate	Not at all good
Advisories issued for mKRISHI® on the following aspects						
i	Crop protection					
ii	Weather related information					
iii	Soil and water conservation					
iv	Marketing information					
v	Post-Harvest Technology					
vi	Varietal information					
vii	Information about Govt. schemes and polices					

c) Utility of information

S.N.	Type of services	SA	A	U	D	SD
1.	Technological information provided by mKRISHI® is highly relevant to your farming system.					
2.	Technological information provided by mKRISHI® is suited for both big and small farmer.					
3.	Technological information provided by mKRISHI® has increased your yield.					
4.	Soil testing facilities provided by mKRISHI® increased soil fertility					
5.	Marketing information provided by mKRISHI® has increased price of your produce					
6.	Technological information provided by mKRISHI® reduced pest incidence					
7.	Technological information provided by mKRISHI® reduced disease incidence					

SA-Strongly Agree, A-Agree, U- Undecided, D- Disagree, SD-Strongly Disagree

d) Satisfaction of farmer

S.N.	Statements	SA	A	U	D	SD
1	Technology provided by mKRISHI® is cost effective.					
2	mKRISHI® platform provides all the needed inputs through its partners.					
3	Advisory services are specific to your field.					
4	mKRISHI® provides proper marketing linkage.					
5	mKRISHI® personnel have enough knowledge to solve farmers field problems					
6	Services provided by mKRISHI® are helpful in increase in yield, reduction in cost.					
7	Field personnel are fair and do not show any favours to specific farmers during their field visit while solving farmer problem.					

SA-Strongly Agree, A-Agree, U- Undecided, D- Disagree, SD-Strongly Disagree

e) Ease of understanding

S.N.	Statements	SA	A	U	D	SD
1	Language of text message is very clear and understandable.					
2	Technical term used in text message easy to understand.					
3	Content of text message provided by mKRISHI® is clear and understandable					
4	Information about weather and market is easy to understand, adopt and helps in					

	taking decision.					
5	Voice message delivered by mKRISHI® are clear					

SA-Strongly Agree, A-Agree, U- Undecided, D- Disagree, SD-Strongly Disagree

Schedule for socio-economic impacts of mKRISHI®

Decision quality

S. N.	Statement	Members	Non members
1.	I think I am confident enough to take decisions regarding selection of crops and its management practices		
2.	I always analyze the demand and market value of any crop before adopting it in my farmland to avoid possible losses		
3.	I used to be late to take decision regarding farm activities because of lack of timely information regarding various cultivation aspects		
4.	I always get new crop information in time and that helps me to plan various agricultural activities to get a good profit		
5.	Timely market information helps me to identify the right market for the produce and thus to avoid distress sale		

Level of change in knowledge

S.N.	Statements	Members	Non members
1.	Knowledge about fertilizers , pesticides, water such as how much and when to given crop		
2.	Knowledge about harvesting of crop in relation to weather to limit crop damage		
3.	Knowledge about new improved varieties of crops		
4.	Knowledge about chemical weed management in crop		
5.	Knowledge about current market prices available so we can choose where and when to sell.		
6	Knowledge about new government policies and schemes for farmers		

Information Networking

S .N.	Statement	Often	Rarely	Never
1.	I receive information from my mKRISHI user fellow farmers.			
2.	I verbally share the information sought from mKRISHI with my fellow farmers			
3.	I message the information sought from mKRISHI to my fellow farmers through mobile			
4.	Farmers approach me to ask what new information/ technology I have learnt from mKRISHI			

5.	We discuss and experiment the new technologies learnt from mKRISHI			
6.	We have modified the technologies learnt from mKRISHI to make them compatible to our situation			

Change in yield

S.N.	Name of the	Member Yield	Non member Yield	Change in yield
1				
2				
3				

Reason For increase in yield …….....

Change in market price

S.N	Name of crop	Member market price	Non member market price	Change in market price
1				
2				
3				

Reason For increase in market price …….....

Change in income

S.N	Name of crop	Member income	Non member income	Change in income
1				
2				
3				

Total Expenditure Pattern

S.N	Particular	Member expenditure	Non member expenditure
1	Expenses on household items		
2	Expenses on child education		
3	Personal expenses		
4	Expenses on food items		
5	Expenses on agricultural inputs		
6	If any other		

Extent of adoption of technology recommended by mKRISHI®

S.N	Recommended Practices	Practice Adopted
1		
2		
3		

Major constraints to the promotion of mobile based-agro advisory services

What are the constraints you feel as important? Please rank it.

_____

_____

_____

_____

Particular			Rating		
			Most Severe	**Severe**	**Not Severe**
a	**Technological Constraints**				
	1	Poor connectivity of network.			
	2	Lack of update information.			
b	**Economic Constraints**				
	1	High cost for service provided.			
	2	High cost for establishment.			
c	**Social Constraints**				
	1	Low literacy			
	2	Low IT literacy			
	3	Lack of skill to use modern IT gadgets			
d		**Psychological Constraints**			
	1	Lack of self confidence in handling mobile based information system			

Suggestions for improving mKRISHI®

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Interview Schedule for 'mKRISHI' Staff

1) Name
2) Place of working:
3) Age:
4) Gender: Male/Female
5) Educational Qualification: B.Sc…..…/M.Sc……./P.hD……
6) Discipline/Division/Department:
7) Position in the organization:
8) Experience (in Years):
9) **Provision of training:**

Training agencies	**Weekly**	**Fortnightly**	**monthly**	**Once in two months**	**Once in three months**	**Once in six months**	**Never**
m KRISHI							
OTHERS							

10) Extension agency contact: How often do you meet/ contact?

	Weekly	Fortnightly	monthly	Once in two months	Once in three months	Once in six months	Never

mKRISHI							
Agronomist							

11. This is a general opinion questionnaire. Give answer by tick mark appropriate column against each item. You will agree with some statement and disagreement with other statements. It is a matter of your opinion and not or right or wrong answers. (SA- Strongly Agree; A- Agree; UD- Undecided; DA- Disagree; SDA- Strongly Disagree).

Personnel Effectiveness:

S.N	Statement	SA	A	UD	DA	SDA
1	I always involve myself in the work.					
2	I set success in my work due to my own abilities.					
3	I have the capability to my own job properly.					
4	I have the capability to do my work without supervisors.					
5	I have the ability to initiate any work.					
6	Generally my speed of work is fast.					
7	Social cooperation helps me getting success.					
8	I succeeded when I get opportunity to increase efficiency					
9	Monotony and lack of freedom are responsible for my failure at work.					

10	Knowledge about the subject and goal of mKRISHI helps in getting success.					

Orientation towards mKRISHI profession:

S.N	**Statement**	**SA**	**A**	**UD**	**DA**	**SDA**
1	I think by doing this job/work I can do something for agricultural development in the area.					
2	I dislike this profession as it working in rural areas.					
3	This job gives me an opportunity to mingle with rural people and share their problems.					
4	I dislike this job as it doesn't have adequate social status compared to other profession.					
5	This job gives sufficient opportunity to develop leadership qualities of a person.					
6	Close interaction with poor and farmers reduces my status in the society.					
7	I like this job because through this job I can help people to help themselves.					
8	I joined mKRISHI as I did not get in any other organization.					

What are the constraints you feel as important? Please rank it.

……
……
……
……
……
……
……

Suggestions for improving mKRISHI