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

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ABSTRACT

Among modern information and communication technology (ICT), 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. 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. 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 is very cheap and affordable by farmers. After the early success in the promotion 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.

Keywords: ICT, mKRISHI®, Mobile phone

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 land and water resource base for an average farm holding has declined over the last few decades. There are wide gaps in yield potential and national average yields of most commodities. "In addition to stressed natural resources and very inadequate rural infrastructure, there are 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). Access to adequate information is very essential to increase agricultural productivity (Sharma *et al.*, 2012).

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 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. Traditional public-sector extension services use a variety of extension programmes to overcome barriers to technological adoption without much success (Aker, 2010). Typically poor and illiterate, rural Indian farmers generally have very limited access

to information regarding improved farm techniques (Jain, 2011).

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 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). 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 *et al.*, 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 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. 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).

MATERIALS AND METHODS

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. Besides the farmers, 20 staff person 10 from each state, associated with mKRISHI® were 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. The beneficiary farmers, local mediators and the extension personnel who are involved in this were also interviewed to collect relevant information.

RESULTS AND DISCUSSION

Genesis of mKRISHI®: 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. 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. As is obvious, an expert cannot go to every farm to visit and inspect the context of the query, so it was 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.

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. 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. 2 presented the staff pattern of mKRISHI®. At the apex level mKRISHI® with a 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

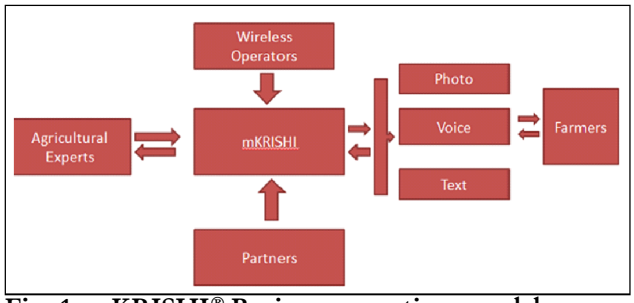

Fig. 1: mKRISHI® Business operations model

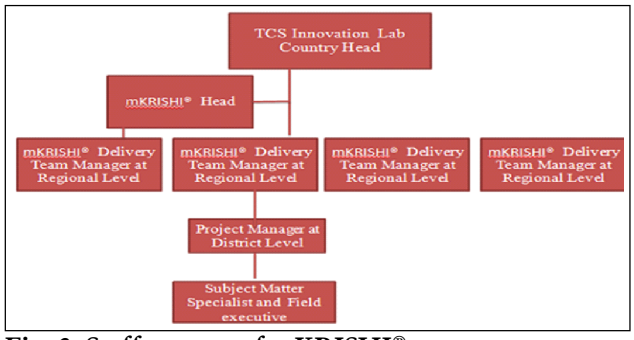

Fig. 2: Staff pattern of mKRISHI®

managers are supported by Subject Matter Specialist and Field Executive. In each *Taluka* generally 2-3 Field Executives are posted.

Approach of mKRISHI®: Farmer looks for specific, actionable information. Farmers are not just interested in remotely sent SMS, market information or agro advisory. 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.

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™ model.

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 online system. In farmer registration process around 250 data points are captured as per the project stage. It starts with 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.

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.

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.

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 1: Distribution of mKRISHI® staff according to their age (n=20)

Age category	Frequency	Percentage
Young (Below 35 years)	12	60
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.

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.

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.

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.

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.

Table 2: Functional mechanism of mKRISHI®

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

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 2 represented 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.

Table 3: Distribution of the farmers according to age (n=60)

Age	Beneficiary group	
	Frequency	Percentage
Young (35 years and below)	30	50.0
Middle aged (36-58 years)	26	43.3
Old (59 years and above	4	6.7
Total	**60**	**100**

Socio-personal variables of member farmers

Age: Table 3 showed the distribution of the farmers according to their age. Most of the farmers (50 %) were of young age.

Education: The educational levels of the respondents are reported in Table 4. It was observed that majority of the respondents (36.7%) had secondary level education.

Table 4: Distribution of farmers according to education level (n=60)

Education level	Beneficiary group	
	Frequency	Percentage
Illiterate	3	5.0
Functionally literate	1	1.7
Primary school	14	23.3
Secondary school	22	36.7
Higher secondary school	11	18.3
College and above	9	15.0
Total	**60**	**100**

Gender: The sex of the respondents is reported in Table 5. It was observed that majority of the respondents (86.7%) were male farmer.

Table 5: Distribution of farmers as per sex (n=60)

Gender	Beneficiary group	
	Frequency	Percentage
Male	52	86.7
Female	8	13.3
Total	**60**	**100**

Family Size: Table 6 showed the distribution of the farmers according to size of family. Most of the respondents (75%) belonged to medium sized family.

Table 6: Distribution of farmers as per size of family (n=60)

Size of Family	Beneficiary group	
	Frequency	Percentage
Small family size (Up to 3 members)	6	10.0
Medium family size (between 4 to 6 members)	45	75.0
Large family size (between 7 to 9 members)	5	8.3
Very large (More than nine members)	4	6.7
Total	60	100

Occupation: Table 7 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 7: Distribution of farmers as per their occupation (n=60)

Occupation	Beneficiary group	
	Frequency	Percentage
Farming	38	63.3
Farming and Business	22	36.7
Total	60	100

Land holding: It was evident from the Table 8 that most of the farmers (30%) were small farmers and (26.7%) semi-medium farmers.

Table 8: Distribution of farmers based on land holding (n=60)

Land holding	Beneficiary group	
	Frequency	Percentage
0-1 ha (marginal farmer)	11	18.3
1-2 ha (small farmer)	18	30.0
2-4 ha (semi-medium farmer)	16	26.7
4-10 ha (medium farmer)	8	13.3
10 ha (large farmer)	7	11.7
Total	60	100

Farming experience: Table 9 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 9: Distribution of farmers based on farming experience (n=60)

Farming experience	Beneficiary group	
	Frequency	Percentage
(Upto 5 years)	1	1.7
(between 6-10 years)	5	8.3
(between 11-15 years)	21	35.0
(16 -20 years)	21	35.0
(More than 20 years)	12	20.0
Total	60	100

Annual household income: Table 10 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 10: Distribution of farmers based on annual household income (n=60)

Annual household income	Beneficiary group	
	Frequency	Percentage
(Below one lakh) –low	2	3.3
(1-3 lakh) medium	12	20
(3 to 6 lakh) high medium	34	56.66
(6 lakh and above) high	12	20.0
Total	60	100

Share of agriculture in total household income: Table 11 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 11: Distribution of farmers according to share of agriculture in total household income (n=60)

Per cent share of agriculture in total household income	Beneficiary group	
	Frequency	Percentage
Agriculture	34	56.7
Non agriculture	26	43.3
Total	60	100

Social participation: It is clear from the Table 12 that 61.7 per cent member farmers were member of cooperative society and 28.3 per cent member farmers also had *gram panchayat* membership.

Mass media utilization: Table 13 showed the mass

Table 12: Distribution of farmers according to social participation (n=60)

Social participation	Beneficiary group*f* (%)		
	No membership	Membership	Official post
Gram Panchyat	43(71.7)	17(28.3)	3(5)
PanchyatSamiti	60(100.0)	0(0)	0(0)
Cooperative Society	21(35.0)	37(61.7)	2(3.3)
Mahilamandal	51(85.0)	6(10.0)	3(5.0)
KisanSangh	45(75.0)	14(23.3)	1(1.7)
Youth club	60(100.0)	0(0)	0(0)
Zilaparishad	60(100.0)	0(0)	0(0)
Block Development committee	60(100.0)	0(0)	0(0)
Self Help Group	60(100.0)	0(0)	0(0)

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.

Extension agency contact: The communication of the respondents with the extension agency is shown in the Table 14. Most of member farmers go to KVK for obtaining information regarding farm practices.

CONCLUSION

Presently, there are a lot of ICT based projects are running in India and trying to eradicate the digital divide in India. But the methodology adopted by mKRISHI®is quite different from all others ICT based projects and expected to meet the demand of farmers. In this context, mKRISHI® is more appropriate, very cheap and affordable by farmer and provide information to members in their local dialects. 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. In contrast to Meera *et al.* (2004) 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, mKRISHI® overcomes all such types of barriers and results in better adoption of technology by the farmers.

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Table 13: Distribution of famers as per mass media utilization (n=60)

Mass media utilization	Beneficiary group *f* (%)				
	Never	Sometime	Often	Most often	Always
TV	0(0)	0(0)	5(8.3)	30(50.0)	25(41.7)
Radio	3(5)	11(18.3)	32(53.7)	7(11.7)	7(11.7)
News Paper	19(31.7)	5(8.3)	8(13.3)	1(1.7)	27(45)
Movies	33(55)	0(0)	9(15)	6(10)	12(20)
Farm Magazines	1(1.7)	3(5)	2(3.3)	18(30)	36(60)
Mobile	0(0)	1(1.7)	9(15)	5(8.3)	45(75)
Internet	38(63.3)	6(10)	8(13.3)	2(3.3)	6(10)

Table 14: Distribution of famers as per extension agency contact (n=60)

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

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