Knowledge and Skill Development using Mobile Technology for Reducing Risks among Farmers

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INTRODUCTION

Agriculture in India contributes about 17% of the total GDP and provides employment to over 60% of its population. Significant strides have been achieved in technology, improved agricultural practices, and avenues for agro businesses. Enhancing the ability of smallholders to upgrade skills, meet their knowledge needs, connect with networks, and institutions, through effective extension, is the pathway to improve their lives and livelihoods.

ICT, in particular mobile technologies, are seen as a game changer in smallholder agriculture. Mobile phones exert a multi-dimensional positive impact on poverty reduction. Accessibility is the main challenge in harnessing the full potential (Silarszky et al., 2008). The potential benefits of use of ICT (McNamara, 2009) includes enhancing incomes of smallholders , linking poor farmers to markets, improving services and governance for the rural poor, promote small holder agricultural innovation, helping farmers manage a range of risks, helping poor farmers participate in higher-value agriculture, supporting decision making among rural families about their mix of productive activities.

M S Swaminathan Research Foundation (MSSRF), through Village Resource Centres (VRC) and Village Knowledge Centres (VKCs), disseminates locale specific, demand driven information, and knowledge, and builds the skills of farming communities in Tamil Nadu, Pudhucherry, Odisha, Kerala and Maharashtra, using a gamut of best-fit Information and Communication Technologies (ICTs) such as satellite and internet based conferencing facilities, laptops, public address systems, print media, and wireless phones using the hub and spokes model.

The hub is the VRC located at the district or block level, and the spokes are the VKCs managed by the rural community. The VRCs and VKCs are action platforms that empower rural communities with information and knowledge by providing access to and use of transformational ICTs.

Participatory rural appraisal techniques and exercises along with Focus Group discussions help assess needs of communities in areas of content, capacity building and convergence to be able to intervene accordingly. Daily audio and text messages, conferencing using video and audio, helpline service, and phone in programmes meet the needs of farmers' and bridge the land-to-lab gap in the areas of market and monsoon, pest and disease management, and government schemes. This minimises farmer vulnerabilities and maximises profits.

Relevant experts from different disciplines like entomology, soil science, water management, plant pathology drawn from public and private institutions, are empanelled and directly connected to farmers using best fit ICTs. The knowledge generated during this process is captured and reposited in the Knowledge Management System for further use.

A Mobile Soil and Water Testing Laboratory promote soil health in Tamil Nadu by reaching out to farmers' doorsteps and create awareness on the importance of soil testing, and build capacities on soil sampling.

Alongside a few programmes that have been implemented by MSSRF started showing positive leads towards empowering farming community with required knowledge and skills to address their issues. 'Plant doctors' introduced by Commonwealth Agricultural Bureau International (CABI), piloted through MSSRF, links extension and research by training farmers in the identification, diagnosis and management of pest and disease of crops. Second in this series fall Farm schools, envisioned by

Prof. Swaminathan to facilitate the processes of horizontal transfer of knowledge among farmers, implemented by MSSRF with assistance from the Indian Overseas Bank (IOB).

METHODOLOGY

Ninety respondents spread across 48 villages in 11 districts of Tamil Nadu receiving audio advisories were selected at random. Primary data on the extent of knowledge and skills built was collected from farmers using a pre-tested interview schedule that include qualitative and quantitative information. Data was collected through mobile. Secondary data from different sources such as project reports, papers were used. Focus Group Discussions were carried out with farmers to understand the knowledge and skills gained to address pest and disease related challenges. Simple frequency and cost benefit analysis was used to draw important conclusion.

Based on the broad classification of crops and cultivation pattern of farmers in the study area, the focus of the study was set on Agricultural and Horticultural crops.

RESULTS AND DISCUSSION

Access to Information among Farmers

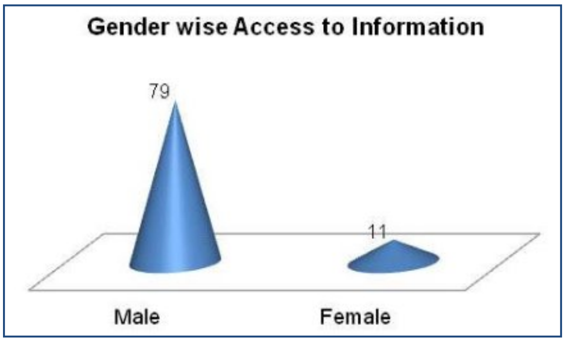

Figure 1 : Access to Information through mobile

Men had more access (88%) to information than women (12%), despite the fact that both are involved in agriculture (Fig.1). In majority of the instances, men hold mobile phones and hence would have received the information. Though several studies reveal positive leads about women development due to ICT in the areas of digital literacy, health and education, there are still gaps in primary occupation like agriculture and fisheries to get related information through ICT, especially mobile. The data shows that most of the women do not have control over mobile phones and are deprived of getting information and knowledge as required. This opined with Susanne Teltscher (2002) who also reported that despite the great potential for job creation and development, women are unable to benefit from this due to marginalization and particularly the gender digital– divide.

Knowledge Reach among Farming Community

Farmers in general depend upon various sources for information like progressive farmers (16%), input dealers (14%), radio (12%), television (10%) and extension workers (6%) (NSS report 2003). The study data projected in Fig.2 indicate that small farmers depend on mobile technology for accessing information and knowledge for solving their problems related to agriculture. All women farmers, who received information, belong to small farming category. In all 70% of farmers belong to the category of resource poor that encompass small (58%) and marginal farmers (12%). The data highlights that their existing source of information is not adequate hence leveraged the potential of technology. The low percentage of large farmer category indicates that their flow of information is from diversified sources. Qualitative data from the primary source unveils that the existing system of their information source is not timely and specific to address their issues.

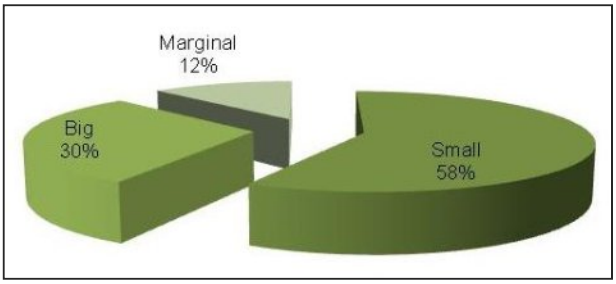

Figure 2: Category of Farmers accessed information

Knowledge Demand among Farmers

Farmers accessed and received information more frequently for the Agricultural crops (57%) compared to the Horticultural crops (43%).

Table 1: Classification of response based on crop cultivation

Sl. No	Name of crop	Big	Marginal	Small	Total
1.	Cereals	7	4	21	32
2.	Cash crops	9	2	12	23
3.	Vegetables	5	2	8	15
4.	Flowers	2	2	3	7
5.	Pulses	2	0	4	6
6.	Oilseeds	2	1	3	4
7.	Millets	0	0	1	1
	Total	**27**	**11**	**52**	**90**

The results obtained showed that a diversity of crops are grown by farmers namely cereals, pulses, oilseeds, and vegetables crops and accessed information for addressing related issues. It is observed through the data that small farmers relies more on information services and cultivate diversified crops. The voice messages or audio advisory received by farmers crop wise showed that farmers cultivating cereals have accessed more (32), followed by cash crops (23) and vegetables (15). The least access was for millets (1) (Table 1). It also signals that a shift has been taking place among farmers for cultivating cash crops, which will contribute to the stake of food security in future.

Choices of ICT and Information Seeking Behaviour among Farmer

Farmers were able to undertake scientific method of application in time due to the advice provided through text and voice messages and sought clarification through helpline. This enabled them to protect their crops from the devastating pest and disease as well gain considerable economic benefit.

Table 2: Type of interventions through which farmers benefitted

Sl.No	Type of intervention	No. of Farmers	Percentage
1	Audio advisory	55	62
2	Discussion with Experts	35	38
Total		**90**	**100**

Table 2 highlights that mobile based application has been extensively used for building knowledge and skills. Yet, the data indicates that farmers preferred to receive knowledge in their mobile through short advisories (62%) for addressing issues related to weather, market price and pest and disease management. However, they preferred to have discussions with experts using mobiles and audio conferences to gain knowledge on soil health, input management, good agricultural practices (38%). This highlights the choice of ICT tool and information seeking behavior to bridge the existing gap.

Categories of Challenges Addressed using ICT

Table 3 presents the context of vulnerability that persists with regard to abiotic and biotic stress. The overall scenario indicates the correct diagnosis and timely advice help farmers to save crops and curb yield loss from the devastating pest and diseases and climate variations.

Table 3: Details of Problems faced by the farmers

Farmers category wise problem faced in their crops					
Sl.No	**Nature of challenge**	**Big**	**Marginal**	**Small**	**Total**
I.	Abiotic	12	3	18	35
II.	Biotic				
	a. Pests	7	5	27	37
	b. Diseases	8	3	7	18
	Total	**27**	**11**	**52**	**90**

The data shows that farmers are challenged by biotic (insect, disease, weeds etc) constraints than abiotic (drought, flood, physiological disorder etc) and accessed information more frequently for biotic problems. The highest demand for information was for solving low yield under abiotic and brown plant hopper under biotic problems. Among the category of famers, 100% each category utilized the information. However, the nature of challenge for which they have used the information varies among the category. This result clearly proves that the marginal farmers normally do not access information and are in most of the cases involved in subsistence farming.

The shift in climatic conditions sometimes causes out break and expand particular pest population which adversely affects agricultural productivity, profitability and possibly even viability. It is examined that the effect of climate variation created sudden outbreak of pest and disease in agricultural field as well. The aforementioned date in Table 2 indicated that farmers face consequences due to abiotic and biotic stress, which demands timely and locale specific information and knowledge. It reiterates the role of ICT as potential tools to address the issue.

Differences in Similar Scenario

Fifteen respondents were selected for analysing the status from different districts of Tamil Nadu to compare issues related to water scarcity, epidemic outbreak of pest and diseases and water inundation due to unforeseen heavy downpour.

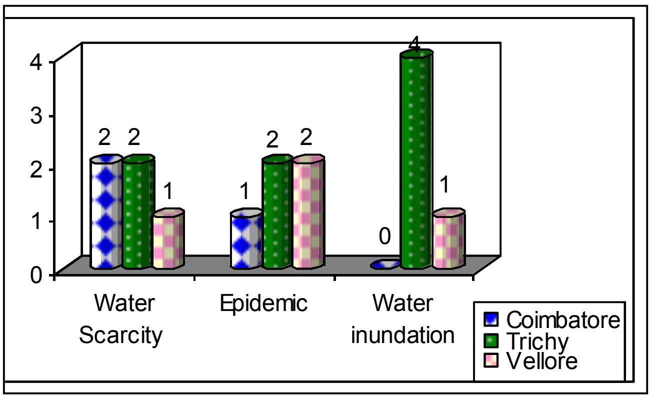

Figure 3 Variations in the Similar Context

Fig. 3 indicates that one part of the community is affected by the issue of water scarcity, while another section of the community is affected by water inundation due to heavy rain fall. These variations lead to the outbreak of pests and diseases in agriculture and horticulture crops and thus drastically affect the productivity.

Role of Mobile Technology in managing Water Scarcity

Over the last decade, there was no equal distribution of rainfall in Tamil Nadu and it has its effect upon ground water table (Reference). Among the respondents, 33% were unable to go for water intensive crops like sugarcane, paddy and turmeric as they did earlier. Among the 33%, 60% of the farmers have left their land fallow as there was no sufficient water for the next crop during second season (Feb – Mar) for paddy cultivation.

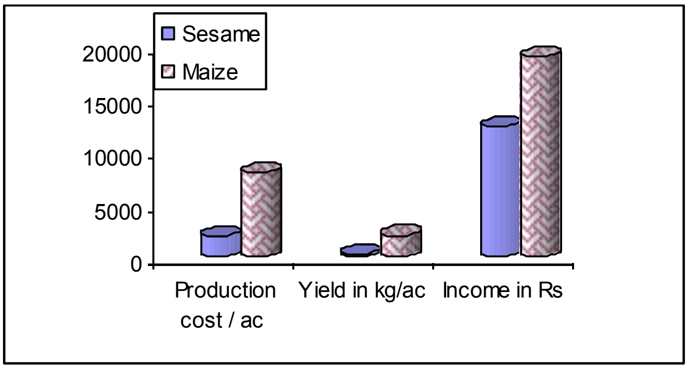

Figure 4 Benefits realized by Farmers

Normally, farmers cultivate paddy followed by paddy cropping system using well irrigation. But due to decline in the water table, farmers are compelled to grow paddy in the first season and leave the land fallow during the second season. Despite desiring to change cropping pattern, lack of awareness on alternate cropping pattern and technical know-how became constraint among farmers to adapt alternative practices. Factoring water availability and other parameters, sesame and maize were suggested through mobile based audio advisory as crop diversification measure and the remaining 40% of the farmers were advised to adopt system of rice intensification and drip irrigation as water management mechanisms. They immediately practiced in the second season *Masi pattam* (Feb –March) and benefited.

Fig. 4 highlights that the advisory provided on crop diversification has given 100% economic benefit. Farmers who adopted SRI and drip irrigation techniques witnessed economic benefits. Due to SRI cultivation, a sum of Rs. 3530/- was saved in the cost of cultivation. The yield has increased from 1940 to 2537 kg per acre and saving 11 cycles irrigation, generating an additional income of Rs. 6000/- per acre. Similarly, a person who installed drip irrigation for cotton crop increased yield from 700 to 900 kg /acre, thereby obtaining an additional income of Rs. 28,000/acre, in addition they saved 60% of water by reducing the number of irrigation.

Economic Benefit

The success of any intervention depends on the economic benefit realized by farmers. Table 5 revealed that more farmers were able to obtain an economical benefit by receiving the right information at the appropriate time. It facilitated them build their capacity of addressing the issues in time by applying recommended pesticides, good practices and marketing their produces in appropriate market trends. .

Table 5: Economic benefit realized by the farmers through ICT interventions

Farmers' Category								
Small	Frequency	%	Marginal	Frequency	%	Large	Frequency	%
500-1000	6	12	2500-5000	2	18	20000-40000	18	67
1000-2500	8	15	6000-8000	2	18	50000-100000	5	19
2500-5000	16	31	8000-10000	4	36	100000-200000	3	11
6000-8000	22	42	10000-20000	3	27	Above 200000	1	4
Total	**52**	**100**	**Total**	**11**	**100**	**Total**	**27**	**100**

Due to the variations in land holdings, the economic value differs from small, marginal and big farmers, evident from Table 5. Despite small farmers receiving lesser economic value when compared to big farmers, the data shows the power of information in enhancing the direct economic benefit while minimizing risk components.

Maintenance of Soil Health

During 2012-13, 52 awareness programmes have been conducted in Tamil Nadu involving 1120 men and 562 women from 52 villages. Since problems related to soil health cannot be changed overnight, care has been taken to analyse the soil samples from the same field every year since 2008. It is observed that the recommendations based on the soil testing, split application of nitrogenous fertilizers and application of suitable biofertilizers has increased the organic carbon, neutralized pH and a brought about a steady increase in the major nutrients. This consistent analysis and need based application to crops has led to improved soil health compared to soil that has not been analysed or which had adopted a blanket application. Qualitative data indicates that consistent effort and integrated nutrient management approach has instilled confidence among farmers.

Plant Clinic and Farm School

There were 14 Plant Clinics established by 17 Plant Doctors in Tamil Nadu, which tested a total of 12 different crops. Qualitative data highlights that empowering farmers at the community level has direct relevance and addresses pest and diseases in crops through appropriate recommendations. It evades them from banned pesticides attempting to protect ecology and reduce risks enhancing economic benefit. Alongside it gives significant leads for research and extension as huge data has been generated during the process. Similarly, Farm School engages farmers to interact with their fellow farmers to share their learning and best practices for mutual benefit. It plays a significant role to recognize the expertise of farmers and leverage it for gaining practical insights and knowledge for addressing the farm related issues. Further studies in this regard are likely to throw some interesting facts.

KEY LEARNING

- ICT can play a pivotal tool to empower farmers to bring about desired changes, if used appropriately and strategically and attribute to sustainable development to a greater extent through knowledge empowerment, if relevant content in all pursuit is disseminated to the last mile in right time.
- Despite women being involved in farming practices, information could not be provided to women due to lack of access and control over mobile technology. Exclusive approach/strategies as an alternate avenue to reach this critical mass are the need of the hour.
- In an era of intensive information and knowledge, identifying, encapsulating and disseminating pertinent content in time to facilitate informed farming among farmers across different agro climatic zones in the context of climate is challenging. However, if these are carried out on time through a demand driven approach, with due care to knowledge creation in the locale vernacular, the power of technology adds value in reaching last mile to reduce risks and maximize economic benefit.
- In the context of multiple technologies, connectivity is no longer an issue to build knowledge and skills among farmers, considering the fact that there is high mobile penetration is found in most cases. However, attention is required to ensure that technologies developed should support any applications that contribute for agricultural development and within the budgetary expectation of last mile.

CONCLUSION

Knowledge and skill empowerment is an essential part of sustainable development. ICT has demonstrated its immense potential to address the huge challenges faced by farmers due to climate change and other factors across the globe. It also bridged the divide between farmers and experts and extension requirements. Harnessing appropriate ICTs to link scientists and ensuring dissemination of pertinent contents to the changing knowledge and skill needs of farmers become underpinning to build resilience among farmers.

Ensuring scientific inputs and technical know-how among farmers build their capacity equipping them to adapt and respond to uncertainties, risks, market fluctuations and epidemic outbreaks. ICTs with human interface help to build relevant skills. The entire spectrum of knowledge empowerment interventions using ICT caters to effectiveness and efficiency ensuring ecological and livelihood development, if the information / knowledge provided is locale specific, demand driven, timely and provided in a user friendly manner using low cost technology.

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