Crop Nutrient Management Decision Support System: India

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Abstract

Rural poverty reduction is closely related to increase in agricultural growth and productivity. While, agriculture remains the main occupation in villages, agriculture sector growth has been showing a declining trend since 1991. One of the key reasons for this is poor crop and soil management practices, and imbalanced application of fertilizers historically over years by farmers due to lack of timely, accurate and reliable information on nutrient management and crop cultivation practices. Mobile phone growth over last few years have made it a ubiquitous device and can help reach out to large number of farmers. Through this action-research a system was designed, developed and implemented at the farm level to answer the question whether providing customized crop cultivation and nutrient management practices to farmers can improve livelihoods and if so what are the implications of such an effort. This study has shown that ICTs when appropriately harnessed can increase farmers’ access to information. Tailor-made information to individual farmers can improve farm productivity. Farmers still need to attain greater level of awareness on new crops and management practices and mobile phones can be the vehicle to support this. Farmers are interested in bundled services providing a variety of information related to crop production, processing and sale. This study also indicates the importance of socially embedding the technology with the help of local institutions to effectively address information needs of farmers

1.0 Introduction

Agriculture is the main occupation of the majority of rural household in India, a bulk of which comprise tiny land holdings. Though more than 50% of the population of India depends on agriculture, the contribution of agriculture to the GDP of India was only about 17.1 per cent in 2008-09 and the past several decades the sector has grown very slowly. Since 1949 agricultural productivity has grown at less than 2 percent (Reserve Bank of India 2008) and is currently in the range of 0.5 – 1.2 (Pullapre Balakrishnan 2007), while in other developing countries like China, agriculture, on the other hand grew at 6 per cent.

Poor agriculture performance has contributed to high rural poverty. Historically, in India rates of poverty reduction have been very closely related to agricultural performance – particularly to the rate of growth of agricultural productivity (Rao, Hanumantha 2005). Recent comparisons made across countries show that increases in agricultural productivity are closely related to poverty reduction (Hazell, et al. 2007). Countries that have increased their agricultural productivity the most have also achieved the greatest reductions in poverty (DFID 2004). At the macro-economic level, growth in agriculture (DFID 2004) has been consistently shown to be more beneficial to the poor than growth in other sectors.

There are many reasons for decline in the growth of agricultural productivity in India such as poor access to irrigation, soil nutrient (Carbon, Nitrogen, Zinc, Phosphorus) depletion, delays in planting, decrease in solar radiation (Ladha 2003). A number of studies have established that a marked decrease in soil nutrients has noticeably affected crop yield per hectare (Jagannathan 2010). Imbalanced fertilizer use is the root cause of poor crop yields and poor soil fertility status (Rao 2005). Micronutrient deficiencies in soils are also emerging as yield limiting factors. Unchecked nutrient depletion has major implications for the sustainability of agricultural systems and future food supplies.

A field specific approach to nutrient management will be required to improve factor productivity and yields (Dobermann A 1996). At present, however, most national agricultural research systems provide nutrient management recommendations on a regional or district basis, and this level of aggregation is far too large (Cassman K G 1997). The problems of farmers at the individual level vary based on varying management practices. Therefore each farm is a unique ecosystem and this uniqueness is hardly addressed by the present information provision system.
Even when relevant information is available at the national and international research institutions, it remains inaccessible to small and marginal farmers because of the missing last mile accessibility on the information highway. Farmers rarely have access to consistent, reliable, updated information that is tailored for their use. Further, no single source is able to provide the breadth of information required by the farmer through the demands of the farm cycle (Surabhi Mittal 2010).

ICTs can help smallholder farmers maximize the return on agricultural inputs, provided timely and relevant information is provided to them (Porcari 2010). In recent years, there has been a rapid increase in mobile phone subscription in India and is one of the fastest growing industries in the world (TRAI 2010). India has also developed its skill in Information Technology (IT) enabled services which could help in solving some of the problems Indian farmers are facing.

The Sustainable Livelihoods approach provides a useful framework for thinking about the potential contributions of ICT to enhancing rural livelihoods and combating rural poverty, since it serves as an important reminder of the complexity of rural poverty and of the equally complex strategies that the rural poor deploy to address their daily challenges (InfoDEV 2007).

1.1 Role of ICT

ICT could make the greatest contribution by telescoping distances and reducing cost of interaction between stakeholders (Bertloni 2004). The present ICT environment with reference to infrastructure and hardware facility in India is highly conducive to attain this objective. Indian Telecommunication Industry is one of the fastest growing telecommunications industry in the world (TRAI 2010). Growth of wireless subscription was a phenomenal 44.5 per cent between June 2009 – June 2010 (TRAI 2010). Overall tele-density has reached 56.83%. The number of telephone subscriber base in India as on June 2010 is 671.69 million. Out of this, mobile phone connections alone count for 635.71 million (95%). More and more people in rural India are using mobile phones. At present the rural subscriber base in India is 31% of the total existing subscription base. The rural mobile base subscription is expected to reach 320 million by 2012. This creates an an opportunity to provide useful information available more widely and to a large number of farmers in rural areas.

1.2 The research problem

Farming in India is being undertaken by a large section of population under extremely diverse conditions. As argued earlier, most of these farmers are small and marginal who do not have access to relevant and timely information that adversely affect agriculture growth and productivity. Therefore the research problem is:

- Poor soil health which is due to imbalanced application of nutrients leads to reduction in yield
- The reasons include the present information on nutrient management through conventional channels is too generalized and information does not reach individual farmers at the right time.

1.3 Objectives of the study

Given the above a system that can interact with individual farmers to provide, accurate, unique and timely information customized to his/her needs could improve farm productivity and through that farmer livelihood. Accordingly, the objectives are:

- To develop and provide simple, customized and effective last mile accessibility tool for nutrient inputs and management in paddy cultivation using ICT tools through Short Message Service (SMS) and Interactive Voice Response System (IVRS) by using mobile phones and providing detailed information through individual web pages (Figure 1).
- To test whether provision of such customized information helps in enhancing the livelihoods of farmers in rice cultivation.
1.4 Research question and hypothesis

Can and if so how, customized information on crop nutrient management for paddy farmers through convenient and cost effective ICT tools lead to an increase in their yield and/or reduce their cost of cultivation?. Based on this research question, the **hypothesis** states

*If site specific, timely, appropriate and customized information on nutrient management is provided to farmers through convenient and cost effective ICT tools, it may improve their yield and/or reduce their cost of cultivation.*

1.5 Description of the Project Area

(Figure 2)

Sirkali taluk is located at the northern most end of Nagapattinam district on the coastal, at the tail end of delta region of river Cauvery. It is bounded by the Bay of Bengal to east. The traditional cropping pattern of cultivation is *Kuruvai* as the first crop of paddy during the months of June – September followed by *Thaladi* (also known as Samba) during the months of (October – February) as the second crop. The farmers raise pulse crop (Blackgram) after *Samba/Thaladi* paddy using the residual moisture in the paddy field.

The actual villages involved in the pilot project are given in the following table.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of villages involved in the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perunthottam</td>
</tr>
<tr>
<td>2</td>
<td>Chinnaperunthottam</td>
</tr>
<tr>
<td>3</td>
<td>Mullayampattinam</td>
</tr>
<tr>
<td>4</td>
<td>Manigramam</td>
</tr>
<tr>
<td>5</td>
<td>Annapanpettai</td>
</tr>
</tbody>
</table>

Table 1: Name of villages in the project area

Vulnerability of the sample area

This district is one of the six backward districts of the state and ranks low on has low Human Development Index (HDI) (17th rank). The productivity of paddy of Nagapattinam district is only 1.65 tons per hectare, which is very low compared to the state average of 2.67 tons per hectare. This district ranks 25th in paddy productivity in the state (Chelliah RJ. n.d.)

Irrigation water for these delta villages in a normal year becomes available when it is released from Mettur reservoir which is located 330 kilometers upstream across Cauvery river,. For the past two decades, water in Mettur reservoir has frequently become insufficient to allow enough outflow to reach the tail end of the delta region. On the other hand, Nagapattinam also gets frequently flooded due to cyclones or depressions in the Bay of Bengal during the months of November-December leading to water logging. In both situations agriculture is affected (Sivanappan RK 2007). Proximity of agricultural lands to the sea makes them vulnerable and a high proportion of marginal farmers lands are prone to floods and cyclones. River water having become irregular, this proximity to the sea has led to ingestion of sea water in subsoil making it saline which is increasing over time..

Profile of the Sample Farmers

Sample farmers consisted of experimental and control farmers. 217 farmers in the selected villages who are members of KKFF formed the experimental group. Since no baseline study existed, another 236
farmers of similar socio-economic status were selected to be control farmers. The experimental and control farmers were from different villages. Experimental farmers were to use the information provided through their mobile phones and implement them. Control farmers were free to follow their own usual practices.

The following gives the details of the status of the farmers in terms of their landholding area.

Table 2: Landholding of farmers in acres

<table>
<thead>
<tr>
<th></th>
<th>Experimental farmers</th>
<th>Control Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average (ac)</td>
<td>Overall average of experimental farmers (ac)</td>
</tr>
<tr>
<td>Less than 1 acre</td>
<td>24</td>
<td>0.71</td>
</tr>
<tr>
<td>1 – 2 acres</td>
<td>174</td>
<td>1.42</td>
</tr>
<tr>
<td>&gt; 2 acres</td>
<td>18</td>
<td>2.75</td>
</tr>
<tr>
<td>All</td>
<td>216</td>
<td>236</td>
</tr>
</tbody>
</table>

Irrespective of the size of landholdings, all farmers had different sources of agricultural information. All the farmers were of age above 20, male and had different levels of formal education ranging from class III to undergraduate. All the farmers grew at least one crop of paddy during the *samba* / *thaaladi* season, that is between the months of September/October to January/February. After paddy crop a great majority of the farmers sow black gram by utilizing the residual moisture.

Sources of nutrient management information

Table 3: Sources of nutrient information

<table>
<thead>
<tr>
<th>Source</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local fertilizer and pesticide dealer</td>
<td>1</td>
</tr>
<tr>
<td>Other Progressive farmers</td>
<td>2</td>
</tr>
<tr>
<td>Department of Agriculture</td>
<td>3</td>
</tr>
<tr>
<td>Newspaper and Magazines</td>
<td>4</td>
</tr>
<tr>
<td>Radio and TV</td>
<td>5</td>
</tr>
</tbody>
</table>

While farmers get agricultural information from various sources, the primary source of information is the local fertilizers and pesticide dealer (see table above). All farmers selected for the study had at least one mobile phone.

All farmers are involved in cultivating irrigated paddy crop and their main source of irrigation is the water from Cauvery river. Some farmers also have bore wells which they use for supplementary irrigation in case water is not available from canals for a short period.

### 2.0 Methodology
This research study consists of the three major components, which includes, the complete system and information service design, implementing the system and evaluation the system. Design of the system took into consideration the local information needs of the farmers and deploying the system through a local farmer’s federation (KKFF) that enjoyed a high level of credibility and trust among farmers.

To test the hypothesis, the study was conducted among 450 paddy farmers from 5 villages of Sirkali Taluk in the district of Nagapattinam in the state of Tamilnadu in India. The plan was to choose 225 members of KKFF for the experimental group while another 225 farmers of the region but not members of KKFF to form the control group. After the service started it was decided to survey the first 216 farmers who started using the service and 236 farmers were identified for the control group.

Originally, it was planned to conduct this action research in two locations (one in Nagapattinam district – the present study) and in another location in Tirunelveli district among women Self Help Group (SHG) members. As the project progressed, it was noticed that it may not be possible to proceed with the same rigour as the SHGs in Tirunelveli district did not have the requisite staff like KKFF to work closely with farmers. Therefore it was decided to drop this location as this institutional arrangement with SHGs wasn’t effective in delivering the information service.

Data Collection: The project farmers were mobilized through Kazhi Kadamadai Farmers Federation (KKFF) a registered farmer federation. KKFF staffs were also involved in facilitating the project with the farmers as well as regular meetings with farmers. Data was collected through printed questionnaire comprising details of geographical, farm, economical, crop and nutrient management history and planned crop. Regular farm related data was collected through a number of meetings conducted with individual farmers by the field staff. It was also accompanied by a number of focused group discussions with farmers on specific issues relating to adoption of ICT for their information needs on nutrient management for paddy cultivation.

Every farmer was visited once in two weeks in order to verify whether they have implemented all the alerts received by them and at the same time, whether they had sent the implementation reports to the server. Confirmation by the farmer after the completion of each activity is automatically updated on the central database on a real time basis. The confirmation on field activity by the farmers has been facilitated through SMS and IVRS. A sample screen shot of the completed activities and also the dates are provided in (Figure 5).

Measurement of variables

For the purpose of this study, increased farm income and/or reduced cost of cultivation is taken as the measurable outcome. In this study, attempt is made to find out whether provision of agricultural information services helps in improving yields and/or reduces cost of cultivation.

For the purpose of analysis in the study, comparison of the income data of experimental farmers with those of control farmers using ANOVA was done. A detailed monitoring of all the inputs used by the experimental farmers as well as control farmers was done.
3.0 System Design

The system design primarily consisted of four components which include the users, interface, middleware and the core system.

**System Design**

**Users**

Users consists of farmers (all the registered farmers), partners (KKFF) and Project Administrator. Farmers are the end users of the system who interact through interfaces such as text message, Voice calls and internet. Partners played the role of facilitating the system with farmers by registering and help in interacting with the system. Project administrator was incharge of developing and managing the alert contents.

**Interface**

The interface layer is the tool for different users to communicate with the system. This includes text message (SMS), Voice calls (IVRS) and Internet.

**Middleware**

Middleware acts as an intermediary between the core system and the user interface. This includes SMS gateway, Voice gateway and Internet gateway. The SMS gateway enables receiving and sending of text messages to the registered farmers on their respective crop stages. This also initiates voice call facility to the farmers where it transforms the text message requests to automated voice call. The voice gateway acts as an interactive voice response system (IVRS) in helping farmers to listen expert ideas /
suggestions / clarifications on use of different methodologies and nutrients for the farm. The internet enables the partners and farmers (optional) to access their respective information on the convenient web platform.

Core system

This forms the key element in the entire design which includes data base server, application server and knowledge base. The data base server enables storage of individual farmer data including the complete activity of the farm cycle, scheduled SMS / IVRS / web content and configurable user and user roles. The application server runs the set of instructions on predefined triggers and user actions. Knowledge base consists of all information related to a crop, variety, pest and diseases, stage, nutrient requirements and geographical parameters.

Nutrient database including the tabulation of the details of various forms of nutrient inputs used by farmers as well as the nutrient content of individual nutrient form This tabulation was dovetailed to the software and was loaded to the server.

Developing SMS alert content and IVRS

In order to provide timely information on nutrient management the server sends automated alerts to individual farmers. The content of this alert was designed and programmed into the server. These alert contents are in the form of localized text messages (SMS) and Voice alerts were delivered to the registered mobile phones. These alerts were synchronized with the age and date of sowing of crop. Information on various crop management practices is also provided on demand over mobile phones through Interactive Voice Response systems (IVRS) (Figure 3) which are triggered through coded SMS by the farmer.

Through this system each farmer received approximately 106 - 110 SMS during the cropping season of 4 months. These SMS includes actual crop cultivation practices with nutrient management advice. A number of reminder SMS and other information on pest and diseases management were also sent. All text messages were sent from SMS gateway based on GSM/GPRS modem. A total of 20 different varieties of paddy were cultivated by farmers during the season in the 5 villages. Experimental farmers cultivated 7 different varieties which are included within the 20. Automated alerts were provided to all the experimental farmers on these 7 different varieties. A total of 760 IVRS calls were provided to farmers based on demand.

Soil Health User Guide

Soil Health User Guide (Figure 4) is a booklet that is distributed to each farmer in order to make them understand the Agro advisory system (crop management practices) for which he/she has been registered. This helps the farmer to utilize the system to its full potential. It contains the details on access to information, how to send reports and do self-updating of all operations as and when it is carried out. The guide had been prepared in Tamil, which is the local language in the state.
4.0 Results and Discussions

Introduction of ICT led to change in cultivation practices among the experimental farmers and some significant reduction in cost of cultivation. Experimental farmers had significant cost reductions than control farmers in all crop production operations as is evident in Table 6. Overall, net income of the experimental farmers was 15.2% higher than that for the control group. The experimental group was able to reduce costs by using appropriate quantities of seeds and inputs, and realizing better market prices as they had better information available on these.

Table 6: Comparison of experimental and control farmers with reference to inputs costs and income

<table>
<thead>
<tr>
<th>Inputs / activities</th>
<th>Experimental farmers (n=217)</th>
<th>Control farmers (n=236)</th>
<th>p value**</th>
<th>S/NS*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (Rs)</td>
<td>SD*</td>
<td>Mean (Rs)</td>
<td>SD</td>
</tr>
<tr>
<td>Seeds</td>
<td>895.47</td>
<td>360.5</td>
<td>985.5</td>
<td>390.66</td>
</tr>
<tr>
<td>Nursery preparation</td>
<td>1583</td>
<td>1073</td>
<td>1706</td>
<td>945</td>
</tr>
<tr>
<td>Main field preparation</td>
<td>800</td>
<td>225.6</td>
<td>763</td>
<td>136</td>
</tr>
<tr>
<td>Basal nutrient application</td>
<td>401</td>
<td>215</td>
<td>511</td>
<td>406</td>
</tr>
<tr>
<td>Transplanting</td>
<td>1242</td>
<td>261</td>
<td>1266</td>
<td>261</td>
</tr>
<tr>
<td>1st Top dressing</td>
<td>393</td>
<td>183</td>
<td>450</td>
<td>206</td>
</tr>
<tr>
<td>2nd Top dressing</td>
<td>314</td>
<td>140</td>
<td>393</td>
<td>160</td>
</tr>
<tr>
<td>1st Weeding</td>
<td>355</td>
<td>236</td>
<td>410</td>
<td>256</td>
</tr>
<tr>
<td>2nd Weeding</td>
<td>261</td>
<td>366</td>
<td>307</td>
<td>200</td>
</tr>
<tr>
<td>Harvesting</td>
<td>4268</td>
<td>1316</td>
<td>3956</td>
<td>1263</td>
</tr>
<tr>
<td>Gross Income</td>
<td>15944</td>
<td>3797</td>
<td>15469</td>
<td>4081</td>
</tr>
<tr>
<td>Net Income from paddy</td>
<td>3494</td>
<td>4472</td>
<td>2961</td>
<td>4058</td>
</tr>
</tbody>
</table>

* Standard Deviation
** p value is the probability value. Alternative (1 - p value) gives the level of confidence. (for example, if p value is 0.05 then 1 – 0.05 = 0.95 and it means that we could say with 95% confidence that there is a significant difference between the experiment and control group.
@ S – Significant / NS – Not significant

3.1.1 Seeds, nursery and field preparation

Experimental farmers spent Rs. 895, which was significantly less than Rs. 986 spent by control farmers. The main reason for the reduction in cost of seeds used by experimental farmers was because of the recommendation of correct quantity of seeds to be used per acre. Only 12 – 24 kg of seeds were recommended for one acre (Figure 6). While the quantity of seeds used by experimental farmers ranged from 20 kg per acre to 25 kg with an average seed rate of 24 kg per acre, the quantity of seeds used by control farmers ranged between 35 – 45 kg with a mean of 39 kg per acre. Apart from information on seeds, information on seed treatment and usage of bio fertilizers was also sent through SMS to experimental farmers (Figure 7). The cost of seeds was the same irrespective of the varieties used by farmers.

All the farmers in both the experimental and control categories raised nursery for sowing paddy seeds. Experimental farmers spent Rs.1583 which is Rs.123 less (but not significant) than control farmers who
spent Rs.1706. All farmers raised wet nurseries. Experimental farmers used more organic manures than control farmers. Organic manures included FYM\(^1\) @ 450 kg for 8 cents of nursery (Figure 8). Most of the organic manures used by experimental farmers was their own and they did not use Urea / DAP in their nurseries.

Main field preparation included activities like puddling, bund trimming etc. Data from the field shows that the cost of main field preparation is higher for experimental farmers compared to control farmers. The expenses incurred by experimental farmers were Rs. 800 per acre while the cost of main field preparation for control farmers was Rs.763. The difference was only Rs. 37 but significant.

All farmers in the project transplanted their seedlings. In this project, no significant difference was found in the cost for transplanting between experimental and control farmers. Experimental farmers spent Rs. 1242 per acre for transplanting while control farmers spent Rs.1266. The difference is Rs. 24 per acre but it not statistically significant.

3.1.2 Nutrient Management

The reduction in cost for experimental farmers was due to elimination of application of urea as basal fertilizers. Experimental farmers applied only DAP. The cost of urea is around Rs. 450 - Rs. 500 per quintal (100 kg). Half a bag of urea is 25 kg, which costs approximately Rs.112. Thus information about basal nutrient application to experimental farmers has reduced their application levels.

The normal farmers practice (control farmers) is to apply about 32 – 40 kg of urea during 1\(^{st}\) top dressing. The information system recommends 22kg of urea for first top dressing. This means only 10kg of nitrogen nutrient (as urea has only 46 per cent nitrogen) to be applied at this stage of the crop. This is a reduction of 10 – 18 kg of urea, which works out to a reduction in cost to a tune of Rs. 36 to Rs. 56 for the 1\(^{st}\) top dressing.

Model alert for 1\(^{st}\) top dressing is provided as in (Figure 9). The alert also provides information on mixing of urea with neem seed cake powder. Mixing of neem seed cake with urea reduces loss of nitrogen through nitrification. This leads to slow release of nitrogen from urea, thus saving cost of nutrients as well as increasing the efficiency of applied nitrogen nutrient.

Depending on the date of sowing and the date of transplanting and the variety used, the 2\(^{nd}\) top dressing coincided with panicle initiation stage. Accordingly experimental farmers spent Rs. 314 per acre, which is Rs.79 less than Rs.393 spent by control farmers. This difference is statistically significant. The normal practice of farmers is to use one full bag of urea with Muriate of Potash (MOP). The recommended dose of urea according to the information system is 22 kg while control farmers used about 50 kg urea. Experimental farmers used approximately 25 kg of urea compared to control farmers using around 45 – 50 kg of urea. According to farmers, this reduction in usage was due to information provided to them through their mobile phones.

3.1.3 Weeding

Experimental farmers spent Rs.355 per acre for weeding their plots, which is Rs.55 less than Rs.410 spent by control farmers. Weeds normally out compete paddy at least during the early stages especially when there is higher concentration of inorganic nitrogen. Intensity of weeds is higher in fields with higher applied inorganic nitrogen. It is possible that since experimental farmers did not apply basal nitrogen, they found fewer weeds in their fields than control farmers.

2\(^{nd}\) weeding is done normally at about 45 days after transplanting. Experimental farmers spent Rs.261 per acre for 2\(^{nd}\) weeding, which is Rs.46 less compared to control farmers who spent Rs.307 per acre. The difference was significant at 10 per cent but not significant at 5 per cent. Since 2\(^{nd}\) weeding is normally done at 45 days after transplanting, it is possible that the crop canopy would have covered the

\(^1\) Farm Yard Manure
land and therefore cost incurred in weeding is less than 1st weeding. Thus there is approximately Rs.90 spent less by both experimental and control farmers for 2nd weeding.

3.1.4 Gross income

Experimental farmers earned Rs.15944 per acre, which was Rs. 475, more than control farmers who earned Rs.15469 per acre. This difference was significant. Income is closely related to market prices and market prices for paddy vary on a day to day basis. Normally price of paddy is low during harvesting time and increases during off season. A small increase in sale price benefits the farmer especially if paddy is sold during off season. Therefore information on market price coupled with enhanced storage facility of farmers will definitely give better income.

3.2. Limitations of analysis

The alerts were developed for a normal season with a maximum rainfall variation of 20 per cent. Analysis of rainfall during the cropping period indicates a wide variation of rainfall distribution. Many of the nutrient management aspects could not provide the anticipated results due to low rainfall and excess rainfall during the months of September – December 2009.

Sowing dates varied from mid September to mid November. This can be one of the reasons for a high degree of variability in crop yield as well as input costs which are one of the limitations of this analysis. This analysis is based on the results obtained in one agricultural season.

4.0 Conclusions and Recommendations

The main conclusions and recommendations from this action research relate to the fact that an information delivery system was designed and tested with farmers groups using mobile phones as a mechanism to supply customized information on soil health. Factors affecting the success of this initiative are the need for customization of service to incorporate the dynamic needs of farmers and the need for awareness and capacity building of farmers to effectively use the service. With regard to this, leveraging trust and credibility of existing local institutions working with farmers groups is crucial to understand farmer demand for design and delivery of the service.

Because of the nature of agriculture, farmers need information suitable for their locations and agro-climatic zones. They also need information in time to make the best use in applying it to the various operations which are affected much by the vagaries of nature. This experience with Paddy farmers shows that they have benefitted from availability of customized and timely information; the same could be considered for other crops and other regions.

In the project location, the service has resulted in documentation of micro-level information which can serve the purpose of better insurance and credit products for farmers and there is a natural incentive for such institutions to facilitate this process. This would also be helpful for farmers who are generally excluded from these services. These are all factors that will determine a sustainable mechanism for continued delivery of information services and scale-up.

**Customised and timely information is a key factor in improving farmer incomes**

Customization of information is a key contributing factor to improvement in farmer incomes. Tailor-made and timely information services for to farmers resulted in an increase in net income by 15 per cent. This was made possible by incorporating the dynamic needs of farmers into a flexible delivery system, using an appropriate and convenient mode of access for farmers such as local language SMS and voice calls in the local language. Thus in a dynamic system such as agriculture with variable and changing information needs, customization of information is the key to better productivity and livelihoods.

**Local institutions help effectively embed technology in social processes**
For introduction and adoption of a technology or service the credibility of the local institution working with farmers is important. Having worked for several years in the area, KKFF, has established a high degree of trust among farmers. This helped evince farmers’ interest in the service. Working through KKFF also helped in understanding farmer needs to appropriately design the service and in its delivery. KKFF served as a valuable intermediary between the information providers and farmers. Local institutions can act as facilitators and would be necessary for the success of any future similar initiatives.

**Orienting users contributes to quick uptake and effectiveness of technology-based services**

On an average 3 reminder SMS were sent for each farm activity including assistance from the staff of KKFF. This was because farmers were not very familiar about interacting with the information system that was designed. Hence, some capacity building was needed to use mobile phones for receiving and posting information on agriculture. This was a crucial factor in farmers’ ability to not only use the information but interact with the system set-up to demand information when they needed. In using technology to design information systems for farmers building capacity of the users is important for effectiveness and quick up-take. This requires an assessment of users-capacity to use the technology early on and integrating elements to address this in the system design.

**A tested template can be replicated:**
The pilot system which can be taken as a template was designed and tested with farmers and has been found to be successful in increasing the profitability of farmers by improving soil health and through providing value-added information. This can be replicated elsewhere, taking into account the processes of customisation, capacity building and institutional linkages. Therefore the system is available for other crops and in other regions of the county.

**Micro-information on farmers and farming can be useful in accessing other services:**
The system developed through this research study has provisions by which the health status of crops could be monitored on an individual farmer basis. Such micro level information is extremely valuable to formal institutions like insurance, banks and other government as well as quasi government schemes which help in reducing the vulnerability of farmers. This can help in fine tuning the delivery of insurance product to individual farmers. This is expected to create a win – win situation for farmers as well as crop insurance agencies in the long term by providing reliable and correct information. The same information can be used for linking with banks for credit. Links can be established with institutions given the natural incentives of insurance providers and banks, in turn setting the stage for demand of more credible information availability.

**Sustainability will come from the value that users derive from information services**

It has been demonstrated that mobile phones can be utilized as last mile information delivery tool to reach a large number of farmers. Farmers using this system were able to increase their income by 15% than even in an unfavourable year. Those farmers who received agricultural information were able to get additional Rs.475 per acre in a 4 months duration of a season. In a favourable year this can even double up to Rs.1000 per acre. If the farmers are ready to pay a maximum of one tenth of this amount for one season (that is Rs.100) per season, then the return on investment is 1:10 for the farmer. This research study has shown a way by which extension can be localized and paid for by farmers. This is expected to pave the way by which payment by individual farmers for extension services rendered will be utilized for both individual profitability by improved livelihood of farmers and increase in agricultural productivity. The scale up process will bring down the cost of the delivery of service due to higher number of subscribers and use optimum technologies for such delivery. Funneling of various services through the local institution will provide a convergence model for bringing various services at the doorstep of farmers with an income generating possibility for the local institution on a sustainable basis.

References


Porcari, Enrica. 2010. Location - specific Intelligence, Smallholder farmers and ICT - KM. CGIAR.


