

A model for ICT based services for agriculture extension in Pakistan

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List of Acronyms

1G	First Generation of Wireless Telephone
2G	Second Generation of Wireless Telephone
3G	Third Generation of Wireless Telephone
4G	Fourth Generation of Wireless Telephone
AMPS	Advanced Mobile Phone System
ARPU	Average Revenue Per User
ATM	Automated Teller Machine
BBR	Branchless Banking Regulation
BBS	Branchless Banking Solution
CKW	Community Knowledge Worker
CKWs	Community Knowledge Workers
CMP	Cellular Mobile Policy
COP	Community of Practice
DAP	Di Ammonium Phosphate
DFID	UK Department for International Development DoA Department of Agriculture
EDGE	Enhanced Data for GSM Evolution
EXT.	Extension
FA	Field Assistant
FAB	Frequency Allocation Board
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FFC	Fauji Fertilizer Company
FGD	Focus Group Discussion
FYM	Farm Yard Manure
GDP	Gross Domestic Product
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
ICC	Information and Communication Centre
ICM	Information Communication Management
ICT	Information and Communication Technology
IGO	Intergovernmental Organization
IFAD	International Fund for Agricultural Development
IFFCO	Indian Farmers Fertiliser Cooperative
IPM	Integrated Pest Management
IRDP	Integrated Rural Development Program
IT	Information Technology
ITC	Imperial Tobacco Company of India Limited
KAP	knowledge, Attitude, Practise
MINFA	Ministry of Food and Agriculture
MoITT	Ministry of Information Telecommunication and Telecommunications
MoST	Ministry of Science and Technology Pakistan
MTN	Mobile Telecommunication Network
N	Nitrogen
NGO	Non-Government Organizations
NRSP	National Rural Support Program
P	Phosphorus
PPMs	Plant Protection Measures
PTCL	Pakistan Telecommunications Ltd.
PTA	Pakistan Telecommunication Authority
PTV	Pakistan Television
SME	Small Medium Enterprise
SMP	Significant Market Power

SMS	Short Message Service
SOP	Standard Operating Procedure
T&V	Training & Visit
UBL	United Bank Limited Pakistan
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USF	Universal Service Fund
USSD	Unstructured Supplementary Service Data
VAS	Value Added Services
WCDMA	Wideband Code Division Multiple Address
WiMAX	Worldwide Interoperability for Microwave Access

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Executive Summary

Agriculture is referred to as the backbone of Pakistan's economy; it is the single largest sector employing almost half of the country's total workforce and contributing one-fourth to the GDP. Pakistan's current and potential agricultural land is under enormous pressure to grow more from existing land areas from three specific drivers of change. The first driver is population growth rate which was 2.1% in 2009 (in the equivalent period UK population grew at 0.7%). The second is available arable land. It has been estimated that throughout Pakistan, each day approximately 500 acres of farmland is taken out of agriculture by the expansion of settlements, roads, factories and other non-agricultural activities. It is predicted that if this trend continues in Pakistan, approximately a million acres or more of arable land would be taken out of agriculture. Finally the size of land holdings per family is getting smaller as the land is divided in accordance with inheritance law among the children. Of the 6.6 million farm households in Pakistan, 86% are classified as small farmers with one third of the rural population represented by farmers with less than 2 ha or are landless.

Out of the total land area (80 million hectares), 21 million hectares is cultivable. Though considerable development and expansion of output has taken place since the early 1960s, the country is far from realizing the yield that can be obtained from this. The best area for agriculture is Punjab as its soil is very fertile and its irrigation system is relatively well developed. Its total area is equal to quarter of the total area for Pakistan, and 57% of the total cultivated land of the country is in this province.

For this reason this project is based in Punjab with the aim of supporting the extension services (public and private) in their quest to improve productivity and increase harvests by harnessing the power of communication, knowledge sharing and networking offered by emerging telecommunications technologies, specifically mobile phones.

Working with the local communities, farmers' groups, public and private sector extension service providers, as well as local government departments, a series of focus groups were planned. Forty focus group discussions with the farming community in twenty villages of Punjab were carried out, following a standard format and reporting methodology. The focus group discussions aimed to understand the problems facing farmers, what information they needed and their view of the barriers to the uptake of new technologies. In depth interviews were carried out with farmers and public extension workers in three districts of Punjab to pinpoint specific needs of the farmers. A separate series of interviews were conducted with public and private extension service providers to gauge their use of ICTs for extension purposes. Three cellular phone operators were also interviewed to assess their interest in providing agriculture based services to the rural areas.

Results from the farmer focus group discussions show that they consider themselves as 'information poor', and that news about new agricultural technologies to help them improve productivity is not reaching them and lack of information was cited as the single largest barrier to the uptake of technology. Farmers wanted area/crop specific information according to land types and needed solutions tailored to their budgets. There was a clear need for advice on a yearly cropping plan to improve return on investment. The advice of field assistants/agriculture officers was considered more reliable than that of input suppliers, but farmers also depended on the experience of fellow farmers who had 'early adopted' the advice. This is interesting as it demonstrates the power of networks and supports the building of larger mobile-based communities where farmers could benefit from the experience of farmers in their own or other villages. The farmers expressed mainly negative views on the use of TV, newspapers, and radio, as channels for agricultural information. Their main concerns were about scheduling of TV programmes and accessibility and knowledge of the existence of newspapers and other print delivery channels.

Cell phone usage is quite prevalent in the rural areas of Punjab, as evidenced by the telecom indicators (PTA, 2011b) and survey results. Therefore mobile applications are extremely well suited for communication between farmers and extension service providers and in the dissemination and

collection of information to and from the field. The surveyed villages were found to be completely covered by mobile phone operators and one third of the villages covered had access to internet.

Extension workers cited the main barriers for technology uptake and job performance as lack of appropriate incentives, low level of recognition, high transportation cost and inadequate budgets, inadequate technology training, lack of affordable system of communication with the farmers, and lack of training in communication skills and social mobilization techniques. Reward/recognition of their profession/efforts was found to be a sore point with farmers and public extension workers.

Despite considering public extension workers as more reliable, a wide disparity in the quality of service of the public extension staff was reported in the surveyed villages. Field assistants were accused of serving the more affluent farmers only.

Information about weather, seeds, trusted pesticide and fertilizer suppliers, pesticide sprays, crop diseases and their solutions, soil and water analysis, specific land treatments, comparative pricing of crops and inputs, balanced fertilizers, marketing techniques, food storage to minimising post-harvest losses and agriculture economics was cited as most needed by the farmers.

The concept of using mobile phones as a major tool for reaching out to farmers and transmitting timely and low cost information was highly appreciated in all the villages. The idea was overwhelmingly approved by the respondents. Most of the respondents had cell phones in the price range GBP 15-25; however a few had really good quality sets. Moreover, the average monthly spending on mobile phones ranged from a minimum of GBP 3 to around GBP 11.

After demonstrating some features on smart phones farmers agreed that voice-based messages or calls were best for disseminating information. Most farmers were comfortable with Urdu (the national language of Pakistan) as the language of preference for audio as well as text messages. Video messaging was also appreciated because of its clarity and visual impact, however, farmers did not have access to compatible mobile sets with large screens and they perceived that these would not be affordable for them.

Real differences in extension service management between public and private sector agencies were apparent. In the private sector farmer profiles are maintained centrally and 'solutions packages' targeted to them according to their profile. In government funded extension, the advisory services are less personalized and farmer profiles are not maintained in a central or formal way.

The private sector extension service providers maintain records of the activities on standardized forms and the aggregation and digitization of this data is therefore quite easy. In the public sector services such practices do not exist and reports are produced by hand in non-standard formats which are difficult to aggregate. In the private sector tele-calls are routinely used to engage farmers, and to provide advice related to crops and their product at the beginning of the season and at different pre-defined crop control points in the season. The advice provided is logged and recorded for each contact farmer. This is similar to the concept of patient history in human health and has similar benefits when extension staff next visits the farmer to diagnose and solve their problems. Such records are not maintained in public extension due to the large number of farmers to be serviced. Building trust was an important factor in ensuring that farmers are converted to active customers. It was evident that private service providers already rely on ICTs for monitoring and tracking activities.

Within the government system there was weak linkage between the Directorate of Agriculture Extension and Adaptive Research, the Directorate of Agriculture Information and district governments. As there are no formal linkages, or because they are weak, farmers' problems, questions and possible solutions do not flow freely through the system. Representatives of extension staff reported that inadequate training hinders the growth of the field staff. Under the government's devolution plan it will become more difficult for the Directorate of Agriculture Extension to provide such training as the field staff will no longer be under their administrative control.

Reaching the farmers incurs high transportation costs, and budgets do not support sufficient visits by field extension staff to the farmers in their area. To address this, the Directorate of Agriculture Information introduced a 'help line'. This service is hopefully in its evolutionary phase as the current model does not profile its clients; keep client query history; classify queries by crop or by area; or maintain FAQs. All queries are managed by one agricultural expert and there is no built-in mechanism to gauge customer satisfaction. The help line is advertised in the bi-monthly 'Zarat Naama' and in the newspapers, but these channels were not used by the surveyed farmers. The outcome was that most of the farmers had not heard of this toll-free facility and the majority who had did not find it reliable.

A survey of the telecommunications coverage and services offered revealed that four of the five cellular operators operating within the Punjab have launched interactive voice response (IVR) based agriculture services, but that none are generating revenues; a lack of content/information is identified as the root cause of the failure to generate revenue. The operators surveyed expressed keen interest in developing their businesses through generating micro-revenue from developing knowledge services targeted at the rural population, as it is recognized this is potentially a huge un-tapped market.

Fourteen mobile-based solutions currently in operation in different parts of the world were reviewed. The services provided ranged from agriculture advisory services, business management, linking farmer to traders, monitoring extension worker activities, surveys, scout polling, live market feeds, linking small holder farmer to exporters/buyers, voice blogging and online training. A review of mobile applications in agriculture and interviews with the cellular operators indicates that subscription-based models provide the most predictable revenue-generating model for services to the masses.

The Focus Group Discussions and the surveys carried out with extension service providers and telecommunications providers confirm the potential to use ICTs to backstop and support extension service providers. The aim would be to provide a communication and knowledge sharing platform supported by verifiable actionable information that responds the demands for information from the farmers.

Informed by the research study, a model is proposed which is compatible with the current telecom infrastructure within Pakistan. It uses mobile phones as the user interface for field use by farmers and extension workers. A web-based interface is proposed for institutional users. The model focuses on providing customized information to the users, and is intended to be self-sustaining in about three years.

1. Introduction

DFID's research strategy 2008-2013 includes elements that focus on finding ways to utilise new technologies for poverty alleviation. The use of new technology in alleviating poverty will only be achieved if people are convinced of its value and if it is easily accessible, easy to use and affordable. The aim of this project is to identify factors inhibiting or constraining the adoption of new technologies and to identify mechanisms of overcoming these constraints. This present research was done to test the use of Information and Communication Technologies (ICTs), specifically mobile phones, in providing actionable information to poor farmers, as part of the extension infrastructure in Pakistan.

1.1 Agriculture in General, Growth, Poverty and Its relation with Agriculture

It is common belief among development economists that industrialization is not the only recipe to achieve growth and poverty alleviation; it is in fact intertwined with agricultural growth which involves populations that usually have low education and income levels (Johnston, 1967).

Agriculture has been referred to as the backbone of Pakistan's economy; it is the single largest sector employing almost half of the country's total workforce and contributing one-fourth to the GDP (Admin, 2010).

A small farm is complex, it is a family affair



There are three major factors affecting agricultural production in Pakistan:

- The total land area of Pakistan is nearly 197 million acres, while the population growth rate was 3.1 per cent annually reported by Alam, 1999, more recently the World Bank Development Indicators (2011) report growth rates at 2.1% in 2009. With a growing population, there is growing pressure on cultivated land. As a result, Pakistan's current and potential agricultural land is under enormous pressure to grow more from existing land areas.
- It has been estimated that throughout Pakistan, each day approximately 500 acres of farmland is taken out of agriculture by the expansion of settlements, roads, factories and other non-

agricultural activities (in the USA, in comparison, nearly 3,200 acres of farmland is lost each day due to non-agricultural uses). It is predicted that if this trend continues in Pakistan, approximately a million acres or more of arable land would be taken out of agriculture (Alam, 1999).

- The third factor is the fact that the size of land holdings per family is getting smaller as the land is divided in accordance with inheritance law among the children. The land which used to feed only one family has now been divided among many families and is unable to meet their requirements. Pakistan's agriculture economy is characterized by an extremely skewed ownership of productive assets, particularly land and water. Of the 6.6 million farm households in Pakistan, 86% are classified as small farmers with the 14% of large farmers having the best access to land and water. (Amjad, 2010). One third of the rural population represents farmers with less than 2 ha or are landless, and their earnings are generated from livestock or services rendered to other farmers.

Arable land is a basic and major resource for the production of human food. However growth of the human population and human activities are reducing the availability of land suitable for food production at an alarming rate. An expanding population demands more food whilst also devouring agricultural land.

Pakistan has a well-established irrigation system which stretches from the upper parts of the country, down to the mouth of the Indus in the south. Out of the total land area (80 million hectares), 21 million hectares is cultivable. Irrigated areas (nearly 16.0 million hectares, 77%) are generally limited to the Indus plain: the River Indus and its tributaries are the main source of irrigation water. Of this, 12.09 million hectares are canal irrigated; 3.35 million hectares supplied by tube-wells; and another 0.6 million hectares by other sources. Of the total area under irrigated agriculture, about 9.6 million hectares is arid, 3.8 million semi-arid and the remainder sub-humid. Despite a number of interventions, salinity and water-logging problems continue to persist, resulting in an annual loss of 40,000 hectares of irrigated land (Alam, 1999).

To sum up, although the stability of Pakistan's agricultural sector is questionable, its potential is not. Though considerable development and expansion of output has taken place in Pakistan since the early 1960s, the country is far from realizing the yield that can be obtained from this.

In Pakistan, the best area for agriculture is Punjab. Its soil is very fertile and its irrigation system is relatively well developed. Its total area is equal to quarter of the total area for Pakistan, and 57% of the total cultivated land of the country is in this province (Alam, 1999).

In Punjab, the Provincial Agriculture Extension Department is the main source of productivity information for farmers. Despite being a huge enterprise, the Government's extension services do not reach poor small farmers because of the geographical spread and low motivation of the extension staff serving them.

These challenges have severely affected the growth of this sector. Besides the elaborate government extension setup, there are various private and multi-national companies, as well as non-governmental organizations, contributing towards the goal of "*changing the fate of the farmer*" by equipping farmers with the required tools and inputs. However, the factor affecting the farmer most is the lack of relevant information required for taking appropriate and timely action. Most of the organizations involved in this type of service delivery face real practical difficulties: two-way communication is difficult; farmers don't have access to context specific and localized information; and linkages between research institutions, extension workers and farmers are weak. As a result, the farmer does not get hold of accurate, timely and actionable information as discussed in chapter 6. Farmers therefore remain poor and unable to take advantage of the wealth of agricultural knowledge that exists.

Recent econometric studies have started to recognize telecommunication development as a basic ingredient of economic growth. The contribution of ICTs is now being fully realized. ICTs can play a vital role in poverty alleviation by empowering the rural poor to access markets, health care and other

services provided by the government. The role of ICT in agriculture is increasingly being recognized in Pakistan. It offers the double benefit of increasing access to information for the rural poor, whilst also helping the government to determine the current state of affairs at a lower cost. As discussed in the telecommunication review section, there has been enormous growth in telecommunication infrastructures. Total tele-density has reached 64.08%, and as Pakistan is largely a pre-paid market (i.e. poor people can easily afford it) this represents a unique opportunity for wide diffusion of ICT services. However, the use of ICT in agriculture is not a new endeavour in Pakistan; almost every mobile operator has launched agriculture-related services.

1.2 Rationale

The evidence from development projects suggests that the success of agricultural research projects is multi-factorial: new technologies and methods are important, but their adoption and impact depend also on other factors such as end user acceptance of the technology, and positive sustainability indicators and scalability conditions prevailing in the area (Khang and Moe, 2008). Various top down efforts in ICT for development (ICT4D) have resulted in failure (Cecchini and Scott, 2003). The literature is rich in describing the benefits of participatory approaches, but improvements in livelihood cannot be achieved by the poor in isolation (Green, 2000); grassroots efforts need to be complemented by assistance from government institutions and aid organizations. A crucial factor is that these development agencies should delegate responsibilities, nurture skills and capacities of local stakeholders to an extent that the project can be sustained

Sustainability means that the project must remain viable beyond its initial phase. It can be looked at from four different angles i.e. social, technological, financial and political sustainability. Social sustainability can be measured by the degree of positive impacts a project has on human development, willingness of communities to participate, development of local capabilities, how much a service is valued by its customers etc. Technological sustainability means the degree of suitability of the selected technology to its end users' requirements and capabilities; it also requires the presence of solid infrastructure to support its use. Financial sustainability implies that the project earns revenues equal to or greater than the amount invested, and can continue without external support. Political sustainability requires a conducive policy environment which will encourage the private sector into further investment.

Sustainability is a crucial factor, due to the complex associations between development partners. Partners may find it difficult to support and nurture such complex projects for a long period of time. The challenge can be addressed by an intelligent use of ICT, and careful design and implementation can yield positive results. The notion of "appropriate technology" is of utmost importance here. Many western ICT efforts have failed because they were top down in nature and did not perceive what was desired and demanded by the community. Technology is often biased to be pro-rich, so ICT tool selection shouldn't only be on technological grounds; it must also be culturally acceptable (Diga, 2007).

This research therefore aims to complement the existing extension services by determining:

- Specific knowledge requirements of the farmers
- Technologies that can be used to process and deliver this knowledge

The research design is based on the assumption that mobile phones and mobile applications are emerging as technologies that can reach the poorest of the poor. A major factor contributing to this is the extremely competitive air time pricing structure in Pakistan which makes mobile phone air time charges comparable to land line charges. The availability of second hand phones and low cost phones from China has made them even more affordable. Almost the entire country is covered by at least one operator. The combined tele-density of cellular phone, fixed land line and wireless local loop is 65.4%, of which the contribution of cell phone is 61.7% (PTA, 2011b). The local IT industry is providing world class solutions to the export industry and to the local government and private sector. Thus human resources required for such operations are fairly developed and cost effective.

Based on this background, the rationale of this research was to test the concept of utilising ICTs, specifically mobile phones, to provide low cost, timely and actionable information to the farmers to increase their ability to improve yields and eventually enhance their earning capacity. The research will evaluate the extension environment, user needs and the telecom environment, with the aim of proposing a sustainable ICT-based model that would help in information provision and knowledge management of the extension services required by the farmers.

2. Research Methods

2.1 Research Objectives:

The research objectives were twofold:

To identify technologies that can be used to process and deliver agriculture extension information

- Review the state of use of ICTs in agriculture by public and private extension service providers.
- Review the existing ICT-based solutions in use for agriculture extension
- Identify appropriate ICTs, specifically the use of mobile phones, to deliver agriculture extension information to the rural masses.

To determine the specific knowledge requirements of the farmers and to get an insight into their behaviours and attitudes, specifically:

- To gauge the existing patterns of the farmers; a KAP (Knowledge, Attitude and Practice) study through qualitative approach
- To assess their level of awareness about new technologies and how they are accessed
- To find out the level of TV reception and number of channels available
- To assess the prevalence and uptake of mobile phones
- To identify primary usage of mobile phones and preferences for use
- To get an insight into their level of reliance on particular source/s of information and the amount they spend on these, in terms of time, money and contact development.
- To evaluate the impact of such information and influencing factors affecting their decisions to adhere to these sources; any contribution of “role models”, peer influence, networking etc.
- To look for case studies through “Most Significant Change” technique.
- Concept testing of different communication strategies; their preference for various options including mobile phones, TV, DVDs and further preference for graphics, voice or text.

The other angle of the research was more concentrated and involved interviews with extension workers as well as farmers. These in-depth interviews had the following precise objectives:

- To assess the reliability and dependence on various sources of information
- To determine the un-met information needs of the farmers
- To evaluate the impact of lack of information

The extension service providers were asked about their approach, issues and barriers to the delivery of such services. The agenda for discussion with these service providers was:

- To find out the area-specific problems and issues of the farmers
- To determine the most frequently requested information and knowledge needs of the farmers

- To determine the calibre and professional expertise of the extension staff
- To evaluate the information and training needs of extension providers required for service delivery
- To get an insight into the barriers to provision of timely and actionable information to the farmers

2.2 Research Methods

A systems approach was used for the research. The extension environment for which the services are to be designed and the telecom environment which will provide the platform for the provision of these services were studied.

The research was carried out with the support of the Directorate of Agriculture Extension and Adoptive Research. On the directive of the Director General, Directorate of Agriculture Extension and Adoptive Research, the field extension staff identified a local influential farmer who gave support to the forward team in pre-screening of the farmers for the focus group discussion. The Executive District officers (EDOs) provided access to the field extension staff for in-depth interviews

It is the social reality in Pakistan that women are mostly involved in providing labour for agriculture as well as looking after the household and raising children. Women rarely travel to the main markets to buy inputs or negotiate rates (Jamali, 2009) and consequently they are not directly involved farm related decision making.

Attitudes about women's interaction with technology are barriers to their involvement with new technologies. Conservative opinions believe that the vulgarity on television shows would negatively influence women, and that mobile phones would give women secret access to nefarious influences (such as males). For all these reasons, women face a digital divide in Pakistan, especially in rural areas (Society, 2010).

As the surveys in this study were focussed on assessing the knowledge needs of the farmers and the uptake of technologies, women were not identified from the local communities as participants in the focus group discussions.

However things are changing, in some places the local landline exchange is no longer functional (see Chapter 6) so wireless phone is the only option and it is increasingly available. Consequently cell phones have begun to replace the household landline. It is anticipated that in the near future rural women will have more access to cell phones, and will be able to use the services offered, thus increasing their access to communication and networking tools as well as information.

The collection of such detailed information required substantial and sensitive discussions with the stakeholders, so focus group discussions were used to gather information. This qualitative technique allowed participants to freely discuss issues, ideas, and experiences among themselves. Guidelines (Annex-XXI) were developed to introduce the main objectives of the research and to delineate the parameters of the hypothesis.

Two focus group discussions were held with farmers in each village, giving a total of forty discussion groups. The focus of the discussion groups was to evaluate the concept of the use of mobile phones for dissemination of information and to identify exact knowledge requirements for integrating production, marketing and value addition activities.

The following steps were taken to conduct the focus group discussions:

- A small advance team familiarized with the recruitment criteria visited the villages to recruit farmers for the focus group discussions.
- A focal person from each village was identified to facilitate the process. The recruiter approached the focal person who introduced him to various farmers.
- Farmers were selected on the basis of the selection criteria (Annex-XX), availability and their consent to participate in the discussion.
- A brief questionnaire for profiling the farmers (Annex-XX) was filled for each farmer and they were informed about the details, date and venue of the discussion.
- The field staff made the arrangements for carrying out the discussion on the set date and ensured the availability of the recruited farmers.
- The discussions based on the broad guidelines were moderated by the researcher (see Annex XXII for researcher profile).
- Two different mobile phone sets were used to show the audio and video messages to the respondents.
- The participants were shown examples of audio and video messages using two different mobile sets to gauge their level of expertise on various functions of the cell phone. The messages were tested for their clarity, comprehension and conception. Their acceptability and farmers' immediate reaction to the concept were also recorded.
- The farmers' body language and expression were recorded in the post-meeting moderator notes to gauge their acceptability to the concept of using ICT's for information dissemination
- The discussions were audio recorded for the purpose of transcription and report writing.

To complement the results gathered through FGD's, interviews were carried out with farmers and government extension workers. In line with the behavioural approach of the research, this data was also collected through another qualitative technique: in-depth interviews.

The research required a multi-pronged strategy, so another dimension was built into the research design which aimed at field visits with private and government extension service providers to document the models being used for service delivery. The private companies were the primary input suppliers for the farmers, having a strong vested interest in keeping a direct rapport with their clients. However, they were operating with different approaches and the purpose of the study was to quantify the strength of each model; to put forth the weaknesses as well as strengths of each system to form the basis of a more effective proposed model. Field visits to three major cell phone service providers were also incorporated in the research to get their views on their current services for the agriculture sector and to assess their willingness to collaborate for any agriculture based service.

The in-depth interviews were conducted in three districts of Central Punjab. Two villages from each district were identified for the research. The government extension workers from the selected villages were also approached to get feedback about their experience, issues and approach towards delivery of services.

The interviews/visits were carried out at the respondents' workplaces. Similarly, key personnel from cell phone operators were also contacted at their offices.

2.3 Geographical Coverage

Ten districts were chosen in Northern, Central and Southern Punjab: see Table 1. The villages were selected to represent different farming environments, including arid areas, and different crops, e.g., citrus, mango, rice and cotton.

Table 1. Geographical Coverage for FGDs

District	Village Name	Cropping Zone	Region
Khanewal	152/R	Cotton Zone	Southern Punjab
	159/R		
Vehari	160 WB	Cotton Zone	Southern Punjab
	330 WB		
Shujabad	Gardezipur	Mango farms / Cotton Zone	Southern Punjab
	Moaza Wahi Rikki		
Bhalwal	26 N	Citrus	Central Punjab
	Puraana Bhalwal		
Daska	Bharoke Khurd	Wheat-Rice	Central Punjab
	Galotian Kalan		
Hafizabad	Waddaray	Wheat-Rice	Central Punjab
	Punj Hathar		
Kalar Kahar	Dhalwal	Rain Fed	Northern Punjab
	Khairpur		
Toba Tek Singh	247 GB	Mixed Zone	Central Punjab
	183 GB		
Jhang	181 GB	Mixed Zone	Central Punjab
	Wakeel Wala		
Jehlum	Dharyala	Rain Fed	Northern Punjab
	Kot Baseera		

A total of forty focus group discussions were carried out in these twenty villages. Ideally, the FGDs are conducted with a panel of 6-10 people. However, to get maximum output from the discussions the aim was to keep the group on a higher side, so a total of 412 farmers participated in the discussions.

The villages for in-depth interviews, Sialkot, Hafizabad and Sargodha, are concentrated in the central belt of the province. Hafizabad and Sialkot represent the rice-wheat farming area, whereas Sargodha reflects the most promising citrus growing region. A total of 89 farmers, 58 from the rice-wheat area and 31 from citrus belt, and 60 extension workers from the same vicinity, were interviewed during the process. The extension workers included 54 Field Assistants and 6 Agriculture Officers.

3. Agriculture Extension Environment in Pakistan

Agricultural extension is a service or system which assists farmers through educational procedures in improving farming methods and techniques, increasing production efficiency and income, bettering their levels of living and lifting the social and educational standards of rural life (Mauder, 1973)

The agriculture management model in Pakistan is quite similar to other developing countries. The Ministry of Food and Agriculture (MINFA) through its provincial departments carries out most of the agricultural extension (Umali and Schwartz, 1994). The role of the agricultural extension service is to introduce new technologies, advise farmers on various aspects of crop production, supply inputs such as chemicals, fertilizer and seed, and provide services like crop and orchard sprays against pests and diseases. Pakistan has tried several extension models including the Village Agricultural and Industrial Development Programme (Village-AID Programme), Basic Democracies System (BDS), Integrated Rural Development Programme (IRDP), and Inputs at Farmers' Doorsteps Approach (Axinn and Thorat, 1972). In 2001 the Government of Pakistan instituted reforms of Agricultural Extension with the name 'Devolution of Power Plan', which is the more advanced form of Decentralization. The decentralization of agricultural extension reforms is being implemented in many developing countries in Asia. (Lodhi, 2003). Under this system all extension activities are transferred at District level. All District Govt. are now responsible about all functioning & funding of this service.

The system is, however, undergoing transformation due to an increasing trend towards privatization of services. The inclusion of the private sector to ensure competition is gaining credence as one solution, especially with regard to agricultural input-supply firms. It is assumed that a market-driven extension service will provide the most rational and efficient mechanism to 'get agriculture moving' and usher in a second Green Revolution. The active engagement of private sector in agricultural extension began after 1988, when the National Commission on Agriculture recommended to the government that "...the traditional role of the private corporate sector in providing material agricultural inputs and services needs to be strengthened and expanded to cover newly emerging needs such as specialized cultivation operations, spraying, and harvesting and to provide total package services rather than single inputs..." (1988). The interest of private sector in providing extension services comes mainly from their aggressive "marketing strategy" of selling the product and extension services as one package.

Notwithstanding, the opening up of agricultural extension has had major impacts in Pakistan, not the least of which is the dismantling of the Government monopoly on delivering services and extension to farmers. Public extension is now one among many extension service providers, although it remains the largest.

Access to information and improved communication is a crucial requirement for sustainable agricultural development. Modern communication technologies when applied to conditions in rural areas can help improve communication, increase participation, and disseminate information and share knowledge and skills (Sharma, 2006).

3.1 Profile of the organizations:

The following organizations were interviewed to gain an insight to their extension methods and the model for providing extension services.

- Directorate of Agriculture Extension and Adoptive Research Punjab
Type: Public (Government of Punjab)
Main Function: To provide extension services to the entire province of Punjab.
Method of Extension: Modified T&V and Farmer field Schools
- Organization Name: The Directorate of Agriculture Information Punjab
Type: Public (Government of Punjab)
Main Function: Produce Agriculture related technology packages in print, radio, video (TV) form.
- Organization Name: Syngenta Pakistan Ltd
Type: MNC
Major Products: pesticides, seeds
- Company name: FMC United (Pvt) Ltd
Type: MNC

Major Products: pesticides, seeds

- Company name: Ali Akhbar & Dada jee group of companies
Type: National Company
Major Products for Agri. Sector: Agro chemicals, seeds, fertilizers
- Company name: Auriga Group.
Type: National Company
Major Products: pesticides, new breed of seeds etc.
- Company name: Fauji Fertilizer Company (FFC), Ltd
Type: National Company
Major Products: Fertilizer

3.2 Area Distribution

The area distribution in the private sector organizations and the extension department was compared.

Table 2: Area distribution for extension services for private and public sector organisations

Organization	Type	Zone Managers	Territories	Radius of Territory (KM)
Punjab Exten	Public	36 District Officers	126	30-45
Syngenta	MNC	4	113	40-45
FMC	MNC	8	150	35-40
Ali Akbar Group	National	5	108	30-35
Auriga	National	5	96	25-30
FFC	National	9	9 technical officers	100-150

The data in the above table can only be considered representative, as the private sector organizations change the size of the territory and the number of the zones depending upon their marketing plans. Though the size of the territory in public sector is comparable to the private sector, however public extension is expected to cover all the villages in the territory (min = 200, max = 300) the private extension reported targetting between 30-40 villages per territory.

In the private sector advice record for each contact farmer is maintained. This is similar to the concept of patient history in human health and has similar benefits when extension staff visits the farmer next to diagnose and solve their problems. Due to the large area to be covered by the public extension services such records are not maintained.

3.3 Minimum Area of Focus

Table 3: Minimum land holding size for farmer selection for extension services

Organization	Type	Ha
Punjab Exten	Public	All size farmers
Syngenta	MNC	10
FMC	MNC	4
Ali Akbar Group	National	4
Auriga	National	4
FFC	National	4

Farmer selection was found to be an important aspect for all extension service providers. The private sector organizations select farmers on the basis of their own surveys and government district extension office statistics. Farmer referral was also found to be a factor for farmer selection. Syngenta being one of the oldest operators in the country already has a strong customer base therefore it has a very strong referral system. In the case of private companies, regardless of how the farmers are selected, only farmers who have the potential to buy their products are targeted for their extension services.

In the case of Punjab extension, all farmers are expected to be targeted however it was reported that farmers with comparatively large landholding and educated/progressive farmers even with smaller landholdings are mostly served by the extension staff. Budget constraints were cited as big reasons for this.

3.4 Use of ICTs for Agriculture Extension in Pakistan

- **Directorate of Agriculture Information- Government of Punjab**

The Punjab government has a separate dedicated Directorate for Agriculture information. The Directorate is very well equipped and has a Publications section, Audio/Visual Production section equipped with a studio and a high quality recording and editing facilities, Research Information unit with in-house documentation unit, media liaison/audio production unit, computer section and composing/graphic designing unit. It also has a Media Liaison/Research Section.

The directorate has a huge library of video and audio content. However, as the field surveys indicated (chapter 6) the telecast/broadcast timings of this content does not suite the farmer. However there is a need for crop/area specific content as was echoed by 'We need good video clips to use in our field staff trainings' (Uman Shoaib, Assistant Manager Technical Training, Syngenta (Feb 2011)).

- **Toll Free Help Line**

Directorate of Agriculture Information was a pioneer in providing a toll free help line service in the public sector. This can be called toll free only from a land line. Approximately 8000 plus calls are received at the help line per year. To use this service the caller makes the call; the query is recorded on a voice recorder. The messages are transcribed and the query and caller number and name are recorded. The help line technical support is provided by one Agriculture officer. The Agriculture officer after analysing the queries answers the same by calling back the callers in the afternoon, usually at their mobile numbers as by then the farmers are not available at home. If required the Agriculture officer consults experts from Agriculture research for advice. The directorate spends quite a lot of money on providing this service

The limitations are:

- The helpline software is IVR based but is established on a single machine
 - No customer history is maintained, something that can help in farmer categorization and prediction
 - Problems are transcribed on paper by hand and hence are of little use for any analysis
 - There is no satisfaction analysis performed on the process, the efficiency of the help line is being monitored by frequency and count of calls being maintained by the department
 - The help line is manned by one qualified person and an assistant. It is difficult for one person to be an expert on all crops and on all crop related issues
 - There is no formal process for expert advice backstopping support to the help line staff
- **Call Centre/Tele Marketing in Private Sector Extension:**
The main function of the Tele Marketing department is to support the sales and marketing function. These also provide support to the extension services provided by the field staff

of the companies. The following table summarizes the main function of the Tele marketing department.

Table 4: Main functions of the telemarketing department - private sector

Company	Main focus of the Call Centre/Tele Marketing
Syngenta	Very focussed on Tracking information. Track Franchisee Sales, Track field Activities, Maintain Farmer (Bigger and Medium Size customers) Contact to track satisfaction with field activities. Farmer Relationship management, specified number of contacts must be made with a farmer in year. Customers can call back for solution to problems. Customer DB is maintained. Agriculture Graduates work as CSAs
FMC	No call centre. Customer DB is maintained.
Auriga	Separate Tele-Centres for seed and Pesticide business. Farmer Relationship management. Advise customers on use of products on per season and area basis. Advise on farming technology. Customers can call back. Very good visual aids available to the Call centre agents. Customer DB is maintained
Ali Akbar Group of Companies	Tele marketing centres in the field to cater to weather and crop advisory alerts to a contact DB of 1000 farmers.

The private extension service providers depend on tele-calls to monitor the field activities through customer feedback. In the government sector such monitoring does not exist.

All these companies maintain a customer profile database. Therefore, these try to match the extension solutions provided to the pockets of their customer. *"We just need a database of all the farmers who grow a certain crop say wheat and the rest is our job"* (Farooq Shahid, CEO, FMC, December 2010)

In the government sector such monitoring does not exist. The provision of extension service under the 'Devolution Plan 2001' at the district level is under the district government. Due to the weak linkage between the Directorate of Agriculture Extension and Adoptive Research, the Directorate of Agriculture Information and the District government, the field activity monitoring has suffered.

- **Directorate of Agriculture Extension and Adoptive research.**

A lot of data is collected by the field staff of the directorate for different reports (Annex-II) that are required by the management. However no formal format or method was observed for this data collection. Field Assistants send handwritten reports in local language (Urdu). This is then consolidated by the Agriculture officers as a handwritten report. These reports are then consolidated at the district level by using self-designed excel sheets. These are further consolidated at each higher level. The final formal format is given to the report only by the last producer of that report.

Farmer contact lists were available in self-designed excel sheets at some districts. At others these were in manual registers. There is no formal process for update of these lists nor was a standard format observed which could help in consolidation of this data.

The above portrays a rather poor picture of ICT use in agriculture extension in Pakistan. The area under coverage of public extension is wide and difficult to manage with the current resources. The farmers and extension workers due to the nature of their work are mobile workers. The cell phones usage is quite prevalent in the rural areas. This is supported by the telecom indicators (PTA, 2011b) and supported by the survey results (chapter 6) as well. Therefore mobile applications seem best

suitable for dissemination and collection of information from the field. This could enhance the service delivery to small farmers and improve the service levels.

4. ICTs Environment in Pakistan

ICT is an umbrella term that generally covers computers, the internet, telecommunications infrastructure, cell phone, radio television, newspapers and digital libraries. The internet revolution on one side has proliferated information access to its users, on the other hand it has played a role in increase of information. Information processing and knowledge synthesis has become a very crucial economic activity itself. The role of ICT is of primary importance, it not only provides infrastructure but also provides necessary toolset to process and disseminate knowledge.

In the recent years, Pakistan has made enormous strides in improving ICT infrastructure, promoting its education and making it affordable for masses. The government policies have promoted innovation and further enhanced the business model of already offered services. The most noticeable efforts in this regard are favourable IT and Telecommunication policies. IT policies resulted in introducing and reducing internet access charges whereas telecommunication policy made cell phones commodity for the poor (for more detailed discussion please see 'State of Telecommunications in Pakistan' section).

ICT is regarded as the most important component of modern knowledge economy, in order to understand the use of ICT in socio-economic development and poverty alleviation; we must recognize roles of ICT in shaping the country's economy. ICT can be summarized as:

- ICT as Economic Sector: it means commercial significance of ICT industry for country's economy. Economic activities encompass hardware manufacturing and software development.
- ICT for Socio-Economic Development: The benefits of ICT are manifold as it contributes heavily in increasing productivity, increasing work efficiencies achieving economies of scale in every sector whether it is manufacturing, communication, education, rural development, etc.

However simple provision of ICT as a production sector will not aid the development agenda of a country, it is the provisioning of services on the available technologies that will affect the masses and create powerful social and economic networks by drastically improving the communication and knowledge exchange.

4.1 State of telecommunications in Pakistan

For the past two decades, an exponential growth in mobile telecommunication industry at the global level is being witnessed. The continued growth rate and its impact on human life have thus strengthened it as an important economic development indicator (Kenny and Keremane, 2007). The true potential of mobile telecommunication is yet to be realized in developing countries. Pakistan is one such country; it is the third fastest growing telecommunication market in the world. Pakistan telecommunication industry exhibited triple digit growth till 2007-2008, the growth seemed to have slowed down after that but it has again picked up in 2010 (PTA, 2010a). A study (King et al., 1994) suggests diffusion of a particular technology in a market is mainly attributed to three reasons, a) consumer's pull and b) provider's push and c) the above two are influenced by regulator's rules of the game. Pakistan Telecommunication Authority (PTA) role as a regulator has been pivotal in sustaining this growth and with the upcoming sale of 3G licenses, it is perceived to regain increased growth rate in coming years. It is now clear to telecommunication operators that only way forward is by furnishing niche mobile value added services (VAS).

4.2 Technology, Standards and Services

Mobile technologies standards are continuously evolving to provide new and innovative services and improved air and network interface standards. Introduced in early 1980s, Advanced Mobile Phone System (AMPS), commonly regarded as (1G) first generation mobile technologies became the first

enablers of mobile communication. 1G technology was based on analogue formatting and hence provided poor performance for communication over digital counterparts. Moreover, AMPS was expensive to build, difficult to mould and hence only useful to support business processes. Advancements in digital signal processing soon led to 2G mobile technologies in mid 1980s. Global system for Mobile Communications (GSM) became a popular 2G technology due to its roaming facility and has proved to be most successful telecommunication technology, a study in 2006 revealed that there were more than 2 billion GSM subscribers that represented 84% of total mobile population. Nowadays, various upgrades enabling larger data volumes such as General Packet Radio Service (GPRS) (2.5G) and standard Enhanced Data Rates for GSM (EDGE) so called 2.75 are also available especially in metropolitan regions where higher data rates are demanded by customers.

3G systems portray further improvement in the same direction, mostly deployed as Wideband Code Division Multiple Address (WCDMA) and (WCDMA2000). 4G systems are currently under development and at the moment it seems a far cry as Pakistani market has yet to see 3G implementations. Mostly operators are opposing the adoption of 3G technologies as they have yet to recover their return on investment. The trend in technology improvement is actually towards enabling internet access on mobile devices enabling complex applications to be developed. We are witnessing revenue saturation for voice services, a phenomenon now observable in Pakistan and is the same as the trend that occurred in Europe some time ago. Nowadays, European Telecommunication Industry's major revenue generator is data hungry, Value Added Services. The need is slowly and surely being realized by Pakistan's telecommunication industry. The PTA has completed its plans for the auction of 3G licenses, however these seem to have been delayed for some unforeseen reasons.

4.3 Regulatory frameworks and policy review

Pakistan's telecommunication industry has witnessed some tough times over the years. The triple digit growth is a result of favorable and clear government policies, safeguarding consumer's and country's interests, establishing an atmosphere of security and competition and projecting telecommunications as profitable venture attracting foreign direct investment (FDI). Government's foremost responsibility is to formulate a national policy that takes a holistic view of the industry and constitutes rules and regulations that safe guard each stakeholder's interest. Regulator can promote or constrain technology innovation influenced by its national policy it can either create monopolized or liberal market composition(Gruber, 2005). The other aspects can be licensing, service quality, and network coverage in rural and under developed areas(Tilson and Lyytinen, 2006).

Mobile phones were introduced in Pakistan in 1990 on AMPs network by Instaphone and Paktel (Looney, 1998). Mobilink a third operator entered the market in 1994 on a GSM based network. However during this period the mobile phones remained a commodity for the rich only.

It was the period from 1996 to 2003 when most of the institutional reforms and focus on public policy was witnessed. The slow growth, lack of public policy and absence of autonomous institution regulating a fair competition was recognized by the Government and appropriate measures were taken. The most significant step was promulgation of "Telecommunication Act 1996". The act not only created an atmosphere of justice and freedom but also resulted in formation of two autonomous bodies i.e., Frequency Allocation Board (FAB) and Pakistan Telecommunication Authority (PTA). FAB was made responsible was frequency allocation and management of the country's spectrum whereas PTA's role was to protect consumer's rights, regulate fair competition among the operators, issue new licenses and oversee tariff rates. Ministry of Telecommunication and Telecommunications (MoITT) further, promoted telecommunication sector by making policy development open and transparent by involving operators and public at large.

Ministry of Science and Technology (MoST) paved the way of establishing new Universities and IT institutes in the country and also played a crucial role in laying infrastructure for internet connectivity throughout the country.

The period also exhibited complete digitization of Pakistan's cellular market with GSM being the de facto standard for all operators thus enabling SMS, Web browsing, Email and other Value Added Services (VAS).

The era from 2004 to 2008 was most substantial in terms to telecommunication expansion. The subscriber base increased from 63 million in 2004 and became 94.3 million till 2008. Two more players Al-Warid and Telenor entered Pakistan's mobile arena following Government's move of introducing Cellular Mobile Policy (CMP). CMP reaffirmed Government's commitment of national policy and restricted operators with Significant Market power (SMP) to indulge in Anti-Competitive conducts such as cross-subsidization and price manipulation exhibiting the characteristic of strongly regulated market. Al-Warid also launched Pakistan's of first WiMAX solution, providing voice and data services in 17 major cities. Summer of 2007 resulted in fruition of all above discussed efforts as China Mobile, the world's largest mobile operator acquired Paktel by a US\$460 million deal and further planned to invest US\$400 million in improving its infrastructure and services, the move reaffirmed confidence and profit depth in Pakistan's Telecommunication market.

Mobile phone initially remained a rich man's commodity, measures taken by the government and regulator has made it affordable for the masses. Voice calls within the same network range from £0.018/h to £0.037/h depending upon the time of the day. The maximum charge for off net calls is £0.0185/min. There are special and innovative subscription packages targeted to housewives, teenagers, business people etc. (PTA, 2011a).

PTA further made it mandatory for all operators to expand their network coverage to rural areas a crucial step to achieve universal access to mobile communications. Pakistan's Universal Service Fund (USF) was established in 2006 by PTA to provide subsidy to extend basic telephony and data related infrastructure to rural areas. It was an important initiative that guaranteed growth even against slow down experience in 2008-2009.

Operators started to launch VAS that would accommodate the population at large. The move by both operators and PTA is actually in response to saturation of urban markets. *The national survey conducted in 2008 revealed that 59% of the rural respondents said they have house-hold access to mobile phone versus 89% of the urban area respondents.*

As the voice market has saturated operators are facing difficulty in maintaining decent ARPUs (average revenue per user), the trend has moved towards finding suitable Value Added Services with high expectation of adoption by masses. Services like mobile music, culture or religious services like Quranic recitation and mobile banking are now taken seriously by the operators (Annex-I) Mobile banking also pitched as Branchless Banking Services (BBS) has been taken up seriously by both Govt. Institutions and mobile operators. State Bank of Pakistan (SBP) has taken lead by devising Branchless Banking Regulations (BBR) in 2008. BBR provides clear guidelines on market entry and participation, thus coherently regulates Branchless Banking in Pakistan. Through BBR, SBP has restricted BBS to bank-led strategies only, which means that all the customer relationship (transaction details) is handled at the Bank's end and mobile operators or agents can facilitate banking operations on behalf of concerned bank. At the moment, most of the BBS are to pay utility bills and money transfer within the country to friends and family that may not have bank account in the same bank but have an active mobile account subscription. BBS can be provisioned by following any of the three models specified by BBR and are described below:

- One to Many: Here a Bank allows any customer to avail BBS who has a mobile connection by any of the five mobile operators, provided the operator or the bank provisions SMS pipeline for processing transactions. United Bank Limited (UBL) through its Omni banking have started offering such services by making its customer pay upfront by purchasing prepaid mobile cards for utility and money transfer to friends and family.
- Many to Many: The models suggests a transaction processing entity "the switch" that provides total interoperability between different banks who may employ different agents to fulfill BBS activities. Customer of any bank (direct or through agent) can execute transaction to other

banks and all the processing is done at the central switch. The model greatly resembles ATM model and which has proved (its regulation easy and customer friendly) banking significance over the years. The framework is yet to be developed and deployed.

- One to One: This model suggests that one bank may provide BBS to its customers through a single mobile operator. Easy Paisa is one such service that is provided by Telenor in Pakistan. Telenor now the second largest Telecom Operator bought controlling shares in Tameer Bank complying to BBR by SBP. In early 2010, Telenor finally launched EasyPaisa Mobile Wallet, expanding its services from money transfer and utility bill payment to savings account, insurance and loans.

Telenor's Easy Paisa service has recorded 9.3 billion transactions till December 28, 2010, it was estimated that there are 30 million economically active people in Pakistan who do not have access to banking services and can become potential customer of such service (Zeeshan, 2010). Branchless banking is touted to be the "future of country's financial sector as it open up opportunities for bringing unbanked segments of the society into the financial system" (Reporter, 2001).

4.4 Potential of cellular phone operators to launch agriculture related services

0700 an Interactive Voice Response service (IVR), providing agriculture related information, was launched by Mobilink, Telenor, Ufone and Zong to target rural customers

Interviews with Mobilink, Ufone and Zong indicated that:

1. This Value Added Service (VAS) was launched in response to the fact that the farming community is a huge customer base which the telecom operators would like to target as a sector.
2. This service is not generating any sizeable revenue for any of the telecom operators interviewed. Therefore the service though still available is not advertised/marketed anymore. This is supported by the FGD survey where the respondents were not aware of the existence of this service.
3. Access to proper content was cited as the major handicap in making this service successful. *"We lack in content and hence are in need of good content providers to make these services profitable"* (Mustafa Wasif, Director VAS, Mobilink. Jan 2011). A review of the content indicated this to be true, very basic level information is being provided via this service (see Annex III).
4. The operators showed a keen interest in partnering with a good content provider. *"If we can capture farming community through this service, then revenues will be generated for us not only through the Agriculture service, but additional revenue will be generated for us as the subscribers will use voice and other services offered by us"* (Sobia Nazir, Manager VAS, ZONG Jan 2011). Mobilink already is in the process of branding wholesale markets (Mandis) and has plans to provide up-to-date price information to farmers for their commodities.

This draws a very healthy sketch of Pakistan's Telecommunication environment and portrays its readiness for launching niche mobile services in Agriculture.

5. Mobile services for agriculture in the World:

Notable ICT efforts that aim to facilitate agriculture sector and try to bridge the digital divide between rural poor and new agriculture research findings are reviewed here.

1. ICT Service Name: Application Laboratory (AppLab) (Grameen-Foundation, 2011)
Country/Region: Uganda/Africa.
Technology used: Mobile Phone, Internet
Model: Subscription (Google Scholar)

Involved Institutions: MTN Uganda, Google Uganda, Bill and Melinda Gates Foundation, Grameen Foundation, USA.

Service Description: The service is destined to solve various day to problems of local villagers. Community Knowledge Workers (CKW) are local trusted intermediaries trained to use available mobile and assist villagers in solving their problems. The service comprises of suite of five mobile services explained below:

Farmers Friend: service interfaces a CKW with an information system that stores agriculture advice, weather forecasts.

Health Tips: Reproductive health is a big problem in Africa. On demand health tips are provisioned by this service.

Clinic Directory: provides information of closes clinic in the vicinity.

Google Trader: interfaces buyers and seller through a information system.

Search: provides Google search facility on mobile phones.

AppLab was augmented to CKW initiative and the project started in Jan, 2009. CKWs as said earlier are trusted local intermediaries who are trained to use AppLab suite of applications and solve problems of farmers at their door steps. Another interesting use of CKW Applab combination is to conduct surveys for various crops. CKWs were offered an additional incentive to conduct surveys, to which they responded well, the 38 CKWs conducted 6000 surveys and successfully mapped the spread of banana bacterial wilt till September, 2009. An additional benefit of using mobile applications was that CKWs used GPS positioning to note their location and pictures were also recorded to further enrich survey data.

Limitations: Human motivation and language barriers

2. ICT Service Name: Question Box (Mind, 2011)

Country/Region: Uganda/Africa.

Technology used: Fixed Line phone/ Internet enabled call centre setup

Involved Institutions: MTN Uganda, Goolge Uganda, Bill and Melinda Gates Foundation, Grameen Foundation, USA, Open Mind, California, U.S.A.

Service Description: Villagers can ask questions to CKW workers on a range of topics.

Limitations: Requires the use of specialized hardware and internet connectivity.

3. ICT Service Name: Sustainable Livelihood Development (Simanto, 2010)

Country/Region: Kenya/Africa

Technology used: Mobile Phones, Internet Website

Model: experimental study to monitor extension workers' performance in realtime

Involved Institutions: FAO

Service Description: This project is aimed at conserving ecological integrity of the complex by implementing effective natural resource management of the watershed. As part of the project, mobile applications are development that record performance of extension workers in the fields. Mobile application presents a form to be filled with important information about workers efficiency and satisfaction level by the farmers, when posted it is processed automatically at the project server and presented in real-time through a user friendly website. The website provides actionable information to the manager who can assesses that whether the desired goals are achieved.

Limitations: not yet launched commercially

4. ICT Service Name: Esoko (Esoko, 2011)
 Country/Region: Afghanistan, Tanzania, Mozambique, Madagascar, Uganda, Nigeria, Cameroon, Ghana, Ivory Coast, Mali, Burkina Faso, Benin, and Togo.
 Technology used: Mobile Phones, Internet, Information Systems
 Involved Institutions: IFDC, FAO, IFAD, Technoserve, USAID, MTN, ZAIN, Sudani.

Service Description: The solution constitutes four key services:

- Live market Feeds: Real-time SMS alerts on market prices of agriculture commodities.
- Direct SMS marketing: Target specific groups of users to send procurement or extension messages and reduce travel and communication costs.
- Scout polling: facility to set up automatic SMS polling for field activities to track inventories, crop activities etc. to monitor and report on crop cycles and yields.
- Online profiling and marketing: Customizable Web space that can advertise goods and services.

Limitations: Not used for extension aims

5. ICT Service Name: SAPA Mobile (Rosmansyah, 2010)
 Country/Region: Sukabumi, West Java, and Serdang Bedagai, and North Sumatera regions
 Technology used: Mobile Phone, Personal Computer, Satellite phones, Internet
 Model: public to private transfer
 Involved Institutions: Institut Teknologi Bandung , Ministry of Social Welfare, Ministry of Cooperative and SME, Ministry of ICT, Ministry of Maritime and Fishery, Nokia Indonesia, Nokia APAC, Grameen Foundation USA, Korean International Agency, Markany Corporation.

Service Description: SAPA Mobile is a mobile-based full supply chain and information management system. It integrates large numbers of smallholder farmers into commercial supply chains facilitating mutually beneficial partnerships between smallholder farmers and exporters/buyers. It also provides technical information, and recommends best practices to smallholder farmers at real time.

Limitations: not a commercial solution yet

6. ICT Service Name: Nokia Life Tools (Nokia, 2009)
 Country/Region: India, Indonesia
 Technology used: Nokia Mobile Phones
 Model: Subscription based
 Involved Institutions: IDEA Cellular

Service Description: Nokia life tools are operator agnostic bundled agriculture, education and entertainment services furnished in local languages.

Limitations: only available on Nokia Phones

7. ICT Service Name: Reuters Market Light (RML) (Reuters, 2011)
 Country/Region: India
 Technology used: phones, Internet, Operator agnostic
 Model: subscription based
 Involved Institutions: Proprietary

Service Description: Provisions customized commodity pricing information, local news and weather updates. RML provides information relevant to 54 commodities in 270 crop wholesale markets (mandis).

Limitations: not used for extension services

8. ICT Service Name: IFFCO Kisan Sanchar (IKSL) (IKSL, 2011)

Country/Region: India

Technology used: Mobile Phone, Bharti Airtel

Model: subscription based

Involved Institutions: Proprietary

Service Description: IKSL bundled services' connections are called Green SIMS. Consumers can also call to a designated number to receive farm advisory service at a fixed price. Subscribers are also entitled to receive five 1-minute voice-based messages free of cost every day. Content is developed by experts (CABI) in the fields of agronomy, pathology, animal husbandry and entomology.

Limitations: Limited to one mobile operator

9. ICT Service Name: AgriFone 1-2-3 (VaudioFone, 2010)

Country/Region: Maharashtra/India

Technology used: Mobile Phone, Internet Application & Operator Agnostic

Model: Subscription based

Involved Institutions: Third Party, Proprietary

Service Description: AgriFone is a focused application developed for agriculture sector by third party. It addresses the needs of farmers, agricultural workers, agribusinesses and input suppliers. It provides convenient and easy-to-use tools for farmers on cheap mobile phones. A unique feature of AgriFone is one-to-one, one-to-many and peer-to-peer exchange of text, voice and images among mobile subscribers. The exchange enables setting up communities of practices.

Limitations: not yet used commercially

10. ICT Service Name: Bubbly™ (Meghawat, 2010)

Country/Region: Maharashtra/India

Technology used: Mobile Phone, Bharti Airtel

Model: Subscription based

Involved Institutions: Third Party, Proprietary

Service Description: It is a voice-blogging service for mobile phones. It maintains individual records of voice updates which can also be played back. It is marketed as "Twitter with a voice" with similar 'follow' and 'unfollow' options but lacks option of searching similar interest users.

Limitations: Limited to one mobile operator

11. ICT Service Name: mKrishi (Services, 2011)

Country/Region: India

Technology used: Mobile Phone, Bharti Airtel

Model: Subscription based

Involved Institutions: Third Party, Proprietary owned by Tata Consultancy

Service Description: mKrishi is a collaborative platform integrating different stakeholders in provisioning agriculture services in local language. Farmers can send queries to agriculture experts and receive replies in personalized or relevant information.

Limitations: Proprietary solution

12. ICT Service Name: SME Toolkit (IFC, 2011)

Country/Region: India

Technology used: Mobile Phone, Bharti Airtel

Model: Subscription based

Involved Institutions: Third Party, Proprietary owned by Tata Consultancy

Service Description: SME Toolkit is a project of the International Finance Corporation, the SME Toolkit offers free business management information and training for small businesses/small and medium enterprises (SMEs) on accounting and finance, business planning, human resources (HR), marketing and sales, operations. SME offers a wide range of how-to articles, business forms, free business software, online training, self-assessment exercises, quizzes, and resources to help entrepreneurs, business owners, and managers in emerging markets and developing countries. SME Toolkit consists of four components: Web/CD-ROM Interface, Global Content, Content Management System, and Training Curriculum.

Limitations: Not accessible on mobiles

13. ICT Service Name: eChoupal 3.0 (C.K. Prahalad, 2010)

Country/Region: India

Technology used: Mobile Phone, Personal Computer, information systems

Model: Subscription based

Involved Institutions: ITC Limited, Nokia life Tools

Service Description: eChoupal 3.0 is the newest version which is destined to be released in 2012. the new version is planned to integrate mobile devices into the eChoupal's management information system. eChoupal is a success story which allows farmers to get up-to-date knowledge of market prices for their commodities. eChoupal 3.0 plans to offer personalized crop management advisory services to individual farmers.

Limitations: to be launched commercially and not yet for extension services

14. ICT Service Name: Sustainable Livelihood Development Project

Country/Region: Kenya/Africa

Technology used: Mobile Phone, Personal Computer, Internet Website

Model: Research Study

Involved Institutions: FAO- TCI

Service Description: The project aims at monitoring ecological integrity of the FAO complex. It's a study that augments ICT to agricultural tools such as FFS and Rural-Invest. The application is web based and also uses mobile devices for information collection and dissemination for monitoring purposes. The information sent by the mobile phones are automatically inserted into a database for further processing thus provides real-time actionable information to its managers who can take decisions to meet its expectations.

Limitations: not yet launched commercially.

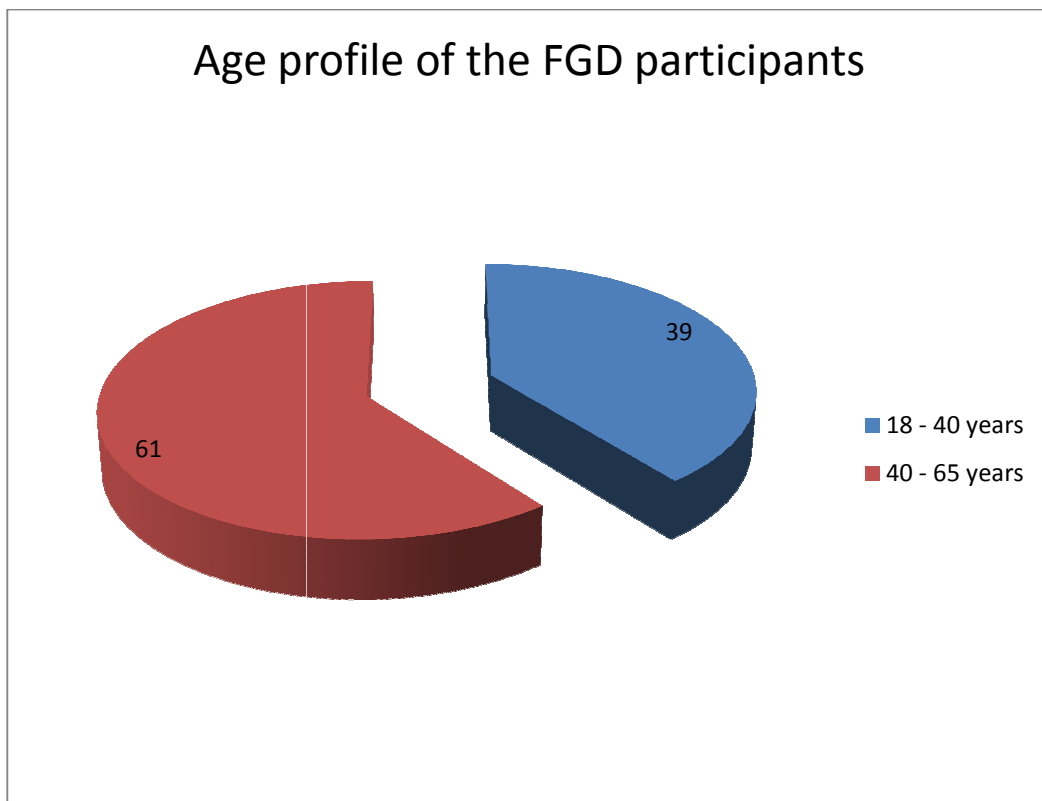
6. Barriers to uptake of technology & knowledge needs

6.1 Farmers Profile

There were 412 farmers in all who participated in forty Focus Group Discussions. Various angles of their profile have been discussed here.

6.1.1 Age Profile

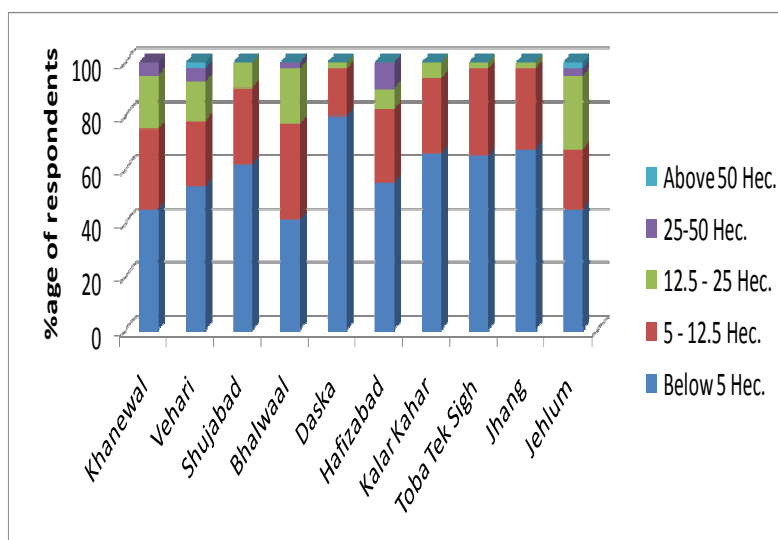
The age profile here is not indicative of the natural age distribution in the farmer category. A reasonable percentage of relatively young farmers were persuaded to participate in the discussion to get representation of their age group as well. Youth can act as an agent of change, therefore, gauging their behaviour and approach towards utilising new technologies was of utmost importance. However, the purpose was not to get away from the ground realities which reflect a major influence of elderly farmers involved in established and potentially outdated technologies for farming. The greater proportion of farmers, 61%, was between 40 -60 years with 39% falling between 18 – 40 years.



6.1.2 Size of Landholding

- Size of land holdings differed in various regions, however, the data shows smaller land holdings in Daska, where 80% respondents had below 5 ha of land.
- Daska was followed by Jhang, Kalar Kahar and Toba Tek Singh, with 67.5%, 66% and 65% farmers having smaller than 5 ha of land.
- In Bhalwal, there were only 41% farmers in this land category, followed by Jehlum and Khanewal with 45% having less than 5 ha of land.
- The respondents with the biggest land holdings were in Vehari, Jehlum and Hafizabad.
- An important point to mention here is that there is a tendency among the farmers to under-report their land holdings due to a debate in top echelons of government to impose agriculture tax. The land sizes documented here are those reported by the respondents. Moreover, in certain areas, there are farmers who do not own the land but are involved in contract/tenant farming and was more common in fruit farms. There were disparities within the same district, for instance, taking the case of Jehlum, farmers had big land holdings in Kot Baseera but these were usually being managed through tenants. Whereas farmers in Dharyala had smaller land areas but were managing these themselves.

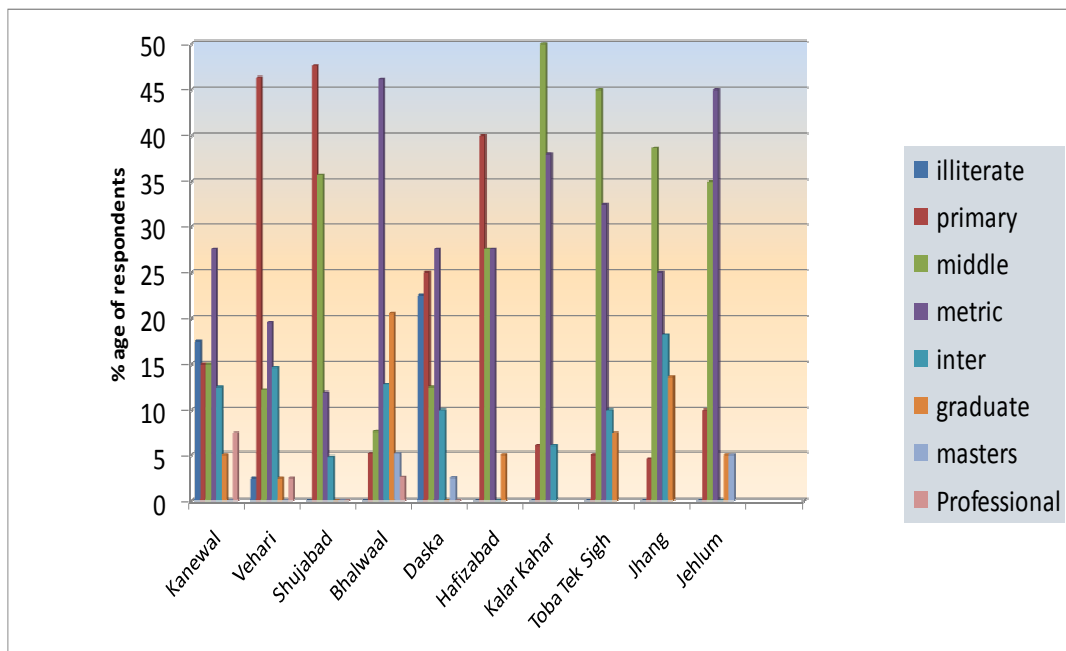
Size of landholding of the FGD participants



6.1.3 Education of the respondents

- The most educated sample of respondents was from Bhalwal, where there were a fair number of farmers who had completed graduation (two years of university education) and even post-graduation.
- Farmers in Khanewal also depicted a healthy trend; almost half of the respondents had completed at least intermediate level.
- There were only 17 respondents who had low levels of literacy. Overall a quarter of the total sample had education levels of primary or below. The remaining respondents had completed middle school and therefore could easily comprehend at-least Urdu language texts.
- It was encouraging to note that there is a growing tendency among the farmers to educate their children, even the females. The families under interaction had very healthy education trends; the younger generation of farmers was engaged in all kinds of formal education.

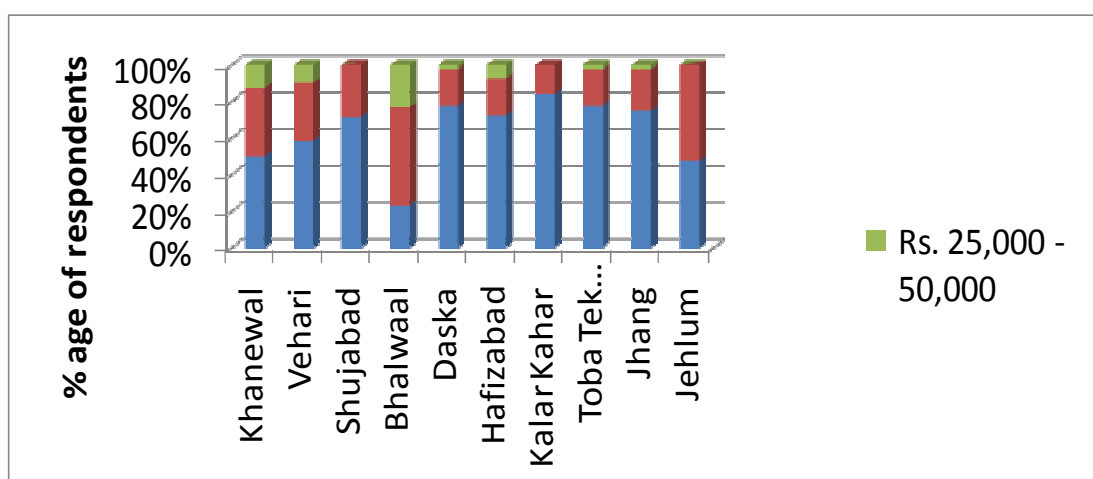
Education of the FGD participants



6.1.4 Income level of respondents

- The income levels mentioned by the respondents do not match with their observed life styles and spending habits. However, they are indicative of their income class within their own framework.
- Almost two-third of the respondents reported them in the income bracket below GBP 75 per month, another 30% had a household income between GBP 75 - 185, and none was earning more than GBP 375 a month.
- This includes farmers with land holdings more than 50 ha. Moreover, most of the farmers were involved in cattle breeding for additional income. There were certain districts where reliance on jobs was a major source of income. This phenomenon was more prominent in Kalar Kahar and Jehlum. These are arid lands, especially Kalar Kahar area and farmers cannot rely on their crops for their subsistence. Farmers in Jehlum reported that every household had at least one member working out of the country. They were quite affluent but they clearly mentioned that this cannot be attributed to farm income.

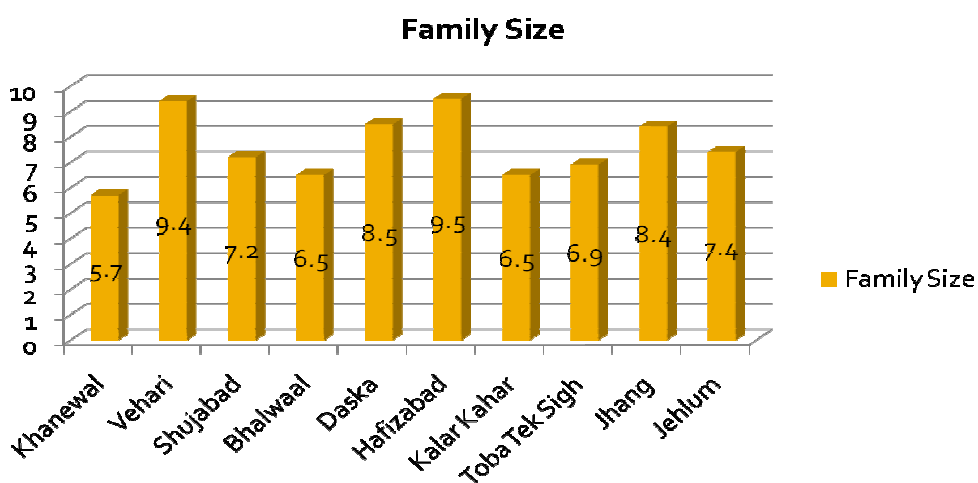
Monthly Household income of FGD participants



6.1.5 Average Family size

- The overall average family size was calculated as 7.5 persons per family. The national figure for family size is 6.5 and the trend of bigger families is more entrenched in rural areas.
- The smallest family size was observed in Khanewal at 5.7 members, followed equally by Toba Tek Singh and Bhalwal standing at 6.5 persons per family.
- The largest family size was noticed in Hafizabad and Vehari with very close figures of 9.5 and 9.4, respectively.

Average size of the family of the FGD participants



6.2 Barriers to Uptake of Technology

6.2.1 Infrastructure and availability of basic facilities

The overall infrastructural facilities and basic amenities differed in the various villages covered during the study. A brief summary of these infrastructure facilities is presented:

- Out of the twenty villages approached during the research, there was only one which did not have access to electricity. This particular village was “Kot Baseera” in Jehlum district; however because of being located on the river bed, this was split in two different regions. The main village had electricity but the major portion of the land where the agricultural activity was being undertaken was totally uncared for. Due to non-accessibility to electricity, they had severe constraints for using tube wells. Moreover, there was no proper road to link them to the major towns lying a few miles away.
- Farmers in all the villages watched television, however, only 25% had access to various international and national satellite channels. The rest could only watch three terrestrial network channels i.e. PTV, PTV Home and ATV. However, some affluent farmers in these villages had installed dish antennas and could access satellite channels. Some villages bordering India had access to Indian channels, as well. There were very few households who did not have television sets; this trend was more commonly found in the less affluent arid village of Khairpur, Kalar Kahar.
- Farmers in one-third of the villages have access to the internet, access depended on whether fixed PTCL lines were in place. There were a few villages where the telephone exchange had become non-operative due to low volume of clientele. Voice call rates of landlines and mobiles phones are comparable and there has been a shift towards the use of mobile phones which brought the usage of landlines to a negligible level.
- Use of radios was observed to be not very common. The young generation listen to FM radio and its usage is for entertainment purposes rather than for getting any information. This medium, therefore, has lost its strength in villages.
- The surveyed area was found to be completely covered by mobile phone networks; the most popular operators were found to be Telenor and Mobilink. Both these networks were rated very high in terms of popularity and signal strength. The next to follow was Ufone. There was little response for Warid and Zong. There was an interesting fact brought forth by the farmers; the signal strength is affected due to frequent power failures. The cellular companies provide generators as alternate energy solutions to keep the system running; however, the diesel is mostly misappropriated and not used for the purpose.
- There was very modest presence of newspapers; most of the farmers reported that they watch television for news instead of newspapers. In most of the villages, just a couple of newspapers are available and these are shared amongst the farmers. The most popular newspapers were “Khabrain”, followed by “Nawa-e-Waqt” and “Jang”.

6.2.2 Media habits

The villages in Punjab have access to most of the print and electronic media. The attitude towards these mediums has been discussed below:

- Farmers watch television, but most of them can only access three channels. Despite this restricted access, they do watch television especially for weather reports and news. They also entertain themselves with dramas. The peak time for watching television was between 19:00 to 22:00 which is in line with the trend in major cities.
- The usual span of watching television was reported as two to three hours a day. However, time was affected by requirements in the fields because at times they have to go out even at night for watering.

- There was hardly any response towards watching agricultural programs on television. The farmers were very critical about the timings in terms of length and placement. They were of the view that these programs are broadcasted at a time when they are in the fields and hence, cannot watch the same. Moreover, the time given to agricultural programs does not match its importance in the rural economy; it is about half an hour, whereas the rest is all granted to entertainment, religious, political and sports programs. There was a very sarcastic comment by a farmer: *“Agriculture is referred to as the bedrock of the economy; but it is not reflected through media there is just half an hour allocated to us and the rest all goes to urban life”*
- There is not a lot of choice of channels available to the farmers generally, however, where the farmers had access to satellite channels, they liked Geo news, Geo entertainment, sports channels, National Geographics, Sohni Dharti (agriculture channel), Dunya, Express and Punjabi channels. The villages bordering India e.g. in Kalar Kahar and Daska, farmers have the opportunity to view Indian channels as well. A few farmers especially mentioned the agriculture related programs from India which they consider better than those broadcasted through Pakistan’s national network.
- There was very limited audience for radio. There were very few examples cited where it is used for listening to agricultural programs and weather forecasts.
- Newspapers are also not a popular medium any more. The few newspapers that reach the villages are, however, kept at prominent get together spots in every village, referred to as “Deras”, where people accumulate and readership is shared among groups of people. The general behaviour towards newspapers was quite indifferent as the farmers think they are better equipped on news through electronic media.
- Magazines have not made inroads in to villages so far; there was absolutely no response on this medium. The printed information brochures distributed by the Government extension program are read with interest; unfortunately these reach the farmer only sporadically. *“Zaraat Naama”*, a bi-monthly magazine by the Directorate of Agriculture information Punjab had limited reach. There were around one-third villages where farmers had ever seen or had knowledge about this magazine. Moreover, even the farmers who were aware of this magazine were not aware of its subscription details. During the Focus Group Discussion in Toba Tek Singh, farmers were inquired about *“Zaraat Naama”*. They mentioned that it used to be delivered to their village but for some reason it has been discontinued. They had not been told that they need to pay for subscription. When they were explained about the details each farmer paid for the subscription during the discussion. This magazine is not properly promoted otherwise it can act as a very strong tool for communicating with the farmers.

6.2.3 Barriers to uptake of new technologies

Contrary to a popular belief that farmers usually are stuck with the old fashioned mindset and prone to a rigid behaviour as far as technology adoption is concerned, the results of the research were different. Tenacity to their belief system and “tricks of the trade” exists, however, they were very eager to learn new techniques. Most of the farmers showed immense interest in getting latest information and learn techniques which could transform their age-old farming methods.

Public sector agricultural extension is characterized by poorly motivated staff, a preponderance of non-extension duties, inadequate operational funds, lack of relevant technology, top-down planning, centralized management, and a general absence of accountability (Antholt, 1994). The public as well as the private extension efforts have not been very productive in reaping the results. While looking at the barriers to adoption of new technology one can safely presume that the problem does not lie with farmers approach and attitude, rather there is a need to address their economic and social issues besides equipping them with the necessary knowledge inputs. The ground is all set to adapt to new changes; all what is required is a change in the set of conditions provided to the farmer. There is a need to restore their credibility of the efforts meant for them, equip them with their required knowledge

needs, assist them in translating this knowledge in to action by proposing need based solutions, and help them gain maximum advantage out of their yields.

6.2.4 Lack of adaptable information

Despite the efforts of government and private extension services, lack of information has been the single largest barrier towards uptake of technology.

- The principal aim of any information disseminated to the farmer has to be its ability to be translated into productive action for establishing better farming practices. However, such information has to be accessible, available and affordable (Fiona Smith, 2009). The farmers clearly expressed their dissatisfaction with the information provided by the extension service providers which appear to lack relevance to the needs of the farmers. Farmers were of the view that the information provided to them is generalised for the province not taking account of specific requirements of each region and each socio-economic category. They stressed upon the need to address the requirements of the farmers by providing them localised information for their specific regions and land types. Moreover, it needs to be tailored in accordance to varied resource budgets. There are all kinds of solutions available and the need is to provide the farmer with multiple technological options to choose from depending upon his resources.
- Another major observation of the research was that there is a huge disconnect between the flow of latest information from the research institutes and the farmers: the missing link is the extension program. The extension workers do not adhere to latest training sessions and their information is not regularly updated. Where the farmers complain about their unmet information needs, researchers have perceived thinking of their research not being taken up.
- The farmers regarded extension workers as unbiased; however, they expressed their mistrust on them for their minimal qualifications and lack of updated knowledge. On the other hand, private extension workers are better qualified and undergo extensive training but farmers perceive their advice as biased. Farmers were of the view that the private extension workers have their vested interest in selling their products and solutions suggested by them are usually not affordable for them.

6.2.5 Economic barriers

- The farmers have stricken in the poverty cycle in a way which is squeezing their resources with every yield. They don't have enough resources to heed to the needs of the crop, thereby, reducing the yield. Moreover, they get further demoralised as they are not able to fetch reasonable prices for their crops. They mentioned that with increased yields prices fall down and resultantly the fate of the farmer remains the same. Moreover, achieving better yield is only possible with higher spending on inputs, thereby, bringing a loss for the farmer in the longer run. There is a clear need that smaller farmers be advised on a yearly cropping plan to improve their lot.
- The farmers reported that inputs are hoarded and black marketed when farmer needs these for their crops.
- Farmers had severe issues with cash flow; they have constraints with proper planning and they are in dire need of cash for inputs. They have to resort to informal loaning mechanisms which costs them loads at one hand and at the same time, they are forced to buy inputs from exploitative traders, most of them selling inferior quality or counterfeit products.
- Farmers acknowledged the misuse of formal loans by themselves; they often utilize the loans for addressing their household spending. This is also an offshoot of the cash flow problem of the farmers especially the ones with agriculture being the major source of income.
- Farmers of Punjab are at a disadvantage due to a relatively warmer climate in the province of Sindh. The farmers in Sindh harvest the crop earlier and get financial advantage due to

limited supply and early crop. Tunnel farming is being adopted by more and more farmers but that is also limited due to farmers' affordability.

6.2.6 Social and motivational issues

- There is a growing resentment among the farmers that they are not granted due respect in the society. This was a common comment heard from all kinds of farmers, small as well as big. The ramifications of this attitude are reflected in the demoralization of our farmers who have accepted their status as the given set of conditions.
- The farmers suggested that they should be granted some kind of special "kissan cards" or any other stimulus to acknowledge their contribution to the country. They should be granted respectful treatment at government offices as against the disregard they have to face at the moment.

6.2.7 Barriers for extension workers

The government extension workers also face various challenges in delivering their job responsibilities and upgrading their skill set. Observations of the in-depth interviews with government extension workers have been recorded below:

- Lack of appropriate incentives and limited monitoring capacity result in low levels of extension agent accountability to the farmers they serve. There are no laid down parameters for performance appraisal to link with career development.
- High transportation cost in the wake of inadequate budgets incapacitates the extension workers to meet the needs of a growing number of farmers spread out in fairly large areas. Moreover, it was told that the situation gets worsened with numerous vacant seats of field assistants which further enhances the coverage area of each serving FA.
- The representatives of the extension department reported that inadequate training facilities hinder the growth of the extension staff. The only input for training provided by the extension department is their publications including "Zaraat Naama" and other specialized booklets. However, there is no feedback mechanism to evaluate his knowledge retention, absorption and diffusion of that knowledge to farmers. The department even lacks basic training facilities like multi-media projector, audio-visual aids, etc.
- There is a huge information gap between the scientific and technological research and its dissemination to the field assistant, the main contact with farmer, who can translate that information in to action. Resultantly, farmers do not trust them due to their inadequate knowledge and therefore seek advice from multiple sources.
- The extension workers also find it difficult to impart knowledge to farmers because they lack an effective, affordable system for communicating with them. At one hand, they do not get any allowances for travelling and on the other, they have not been trained on communication skills and social mobilization techniques.
- The representatives of the extension department complained about the low motivational recognition for the extension staff which de-moralises their performance.
- Some of the extension workers are working on contract basis. Lack of job security was also reported as one of the factors that undermines commitment to their job.

6.3 Information needs

6.3.1 Sources of Information and strength of each medium

To derive the major sources of information being used by the farmers and reliability of each medium was of prime importance for the study. This objective was taken up in both the techniques i.e. FGD's and in-depth interviews. The various formal sources of information reported by the

farmers were government extension program workers, representatives of private agro-chemical companies, distributors/retailers of pesticides and fertilizers, electronic and print media. The informal flow of information travels from fellow farmers and role models in each village. Farmers have also developed networking with friends, family members in various places and with traders, etc. to gather various sorts of information.

Based on the observations of the research, the agricultural information landscape; its reach, depth and impact is described below.

6.3.1.1 Extension Services

- Out of the ten districts approached during the research, farmers in only two districts i.e. Daska and Toba Tek Singh, were satisfied with the role of extension workers. The most frequent complaint about these workers was that they are only approachable by big landlords, whereas the complaints and needs of the small farmers are not heeded to. Extension workers are engaged in other jobs or businesses to make their living and therefore, they have little interest in helping the farmers through with their problems. In some villages, they hardly visit the farmers once in six months. Moreover, the farmers do not consider them competent enough to address their queries. It was noticed in many areas that the farmers were not even familiar with the extension worker deputed in their area.
- The wide disparity in the quality of services is mainly subject to the field staff deputed in the specific area. In 80% cases there was a deep sense of aggression against the role of this department. Farmers were very cynical about their comments about the extension program to the extent that they suggested closing down the department and use the funds for some productive work.

High quality, reliable information to farmers through help line enables them better decision making throughout the preparation, planting, harvesting and marketing seasons (Smith, 2009). However, the knowledge about the existence of helpline by the extension department was found to be negligible in the survey population. There were hardly ten cases out of more than 400 farmers interacted during the research who had ever tried calling this helpline. There was just one case cited where this helpline proved beneficial. The rest of the respondents complained that it is not accessible and secondly, the technical personnel responding to the queries are not capable enough. There were instances quoted where the advice given by the helpline staff did not address their problem. A couple of respondents mentioned that when the advice proved to be unsuccessful, they reported it back to the helpline staff and requested for a physical visit but no action was taken.

- Similarly none of the respondents was aware of the agriculture related services offered by the various cellular companies.
- The results deduced from the in-depth interviews exhibit a dependence on three sources i.e. Field Assistant, fellow farmers and “Zaraat Naama” in accessing information (Annex-VI). However, the number of farmers mentioning the role of FA was 11% or below in all cases which is a very negligible response as opposed to the paraphernalia attached to this department. Fellow farmers and FA jointly make some reasonable share in the information dissemination efforts. On the contrary, the large farmers rely on multiple sources including “Zaraat Naama”, mobile phone, internet, private companies, dealer network, personal contacts, etc. Response for “Zaraat Naama” was only registered for large farmers. However, reliance on FA was more strengthened in citrus producing areas where the small farmers, having land holdings of below 4 ha were totally dependent on FA alone. Moreover, medium and large farmers in this region expressed their prime reliance on FA. This trend is relatively different from the results of FGD’s.
- One of the reasons attributed to this trend is the fact that the farmers contacted in citrus growing area were mainly large farmers and even the small farmers in this region are affluent.

As referred in the discussions during the FGD's, FA mostly approaches the farmers with large land holdings.

- The farmers contacted for in-depth interviews were of the view that they consider the information transmitted through FA as more credible and unbiased than the representatives of private companies or dealers who have their commercial interests involved. However, a valid issue pointed out was that there is no impact of this information being provided to the farmer. The farming techniques still present an outdated status which appears to be a phenomenon of dearth of information and technology. Moreover, this shows that either the information they are getting is not relevant or field staff lacks in skills of communications.

6.3.1.2 Other sources of information

- While discussing the other players on the information landscape, farmers were quite appreciative of the efforts put forth by the multi-national and private agro-chemical companies who provide them with knowledge and skill training. Despite realizing their commercial interest, farmers appreciated their role in educating them.
- The source of information being most extensively used by the farmers is their personal knowledge sharing. In all the villages, this was the most prominent factor. They follow the techniques used by the role models and discuss the problems within their peer group. They rely on each other for most of their advices as the frequency of extension workers visits is scarce and solutions given to them by Multi nationals are often too expensive for them.
- Information sharing among the farmers is fairly positive which clearly depicts that there is enough room for encouraging farmers to play the role of info-mediaries. This model is already intact in an informal way, hence, it can be formalized and used very effectively for information dissemination.
- Another major actor in this information flow is the distributor/retailer of pesticides and fertilizers. Farmers often resort to them for solutions to their problems. These are mainly those selling generic products as the farmers most of the times cannot afford to go to corporate shops because of high cost and cash flow problems.

The farmers had limited reliance on electronic and print media for accessing information except for weather forecast.

- There were a few villages where the farmers had access to internet as well. This was mainly in villages where fixed line of PTCL is available. There is a growing tendency among farmers to use internet facility for agricultural information especially weather.

6.3.1.3 Farmers' perception towards their existing level of information and knowledge

- There was mixed reaction towards farmers' perception of the level of their existing information and knowledge. The most commonly reported response was that they are aware of the traditional farming methods; they grew up with them. However, almost all the farmers acknowledged the scarcity of information on modern technologies.
- Farmers were of the view that their presence in the focus group discussions exhibits their interest in getting the latest information. They endorsed the fact that use of modern technologies would largely affect their livelihood. However, they insisted that the farmers need to be properly educated in accordance with their land type and resource budget. A very well thought out idea would totally fall short if the farmer cannot afford it.
- Moreover, the results from in-depth interviews clearly rated "lack of information" as the most significant reason for low yields (Annex-XVII, Annex-XIX). This was described as the foremost factor by more than 50% farmers in medium and large farmer category and one-third of the small scale farmers had a realization that information scantiness is adding to the agony of the

farmer. Resource limitation was also reported as an explanation to below average performance on farms; however, it still came after information.

- Discussing different regions individually, we found that farmers in Bhalwal were the most informed and engaged in latest farming mechanisms. They also had access to the internet and because of a higher literacy rate they were researching modern ways of farming. A few of them had exposure of living abroad and were quite enlightened about the latest technology. They still maintained that only agriculture production information cannot suffice; there is a need to make the farmer resourceful by educating them for better product planning and marketing of their produce in order to achieve the desired goal.
- Moreover, there were a couple of villages in Jhang and Kalar Kahar where NRSP (National Rural Support Program) and UNDP are already extensively working for land rehabilitation. These organizations are equipping the farmers with all sorts of information as well. The farmers, hence, in these areas were also not that deficient on information. This supports the notion that improved information flow can change the fate of farmers.
- In certain areas, there were wide disparities within the region. For instance, the two villages visited in Shujabad had different trend. Gardezipur had farmers with big land holdings, mostly mango farms. These were quite affluent and had access to latest technology to quite an extent; they had modern agricultural implements as well. On the contrary, the other village in the same district, “Moaza Wahi Rikki”, was very underprivileged. The land holdings were very small and they had very limited access to information. None of the farmers had ever met any official from government extension program and neither the private companies approach them because of small land holdings. This complements the observation that small holder farmers usually face lack of information and even the government extension workers do not approach them.
- Another case worth discussing is “Punj Hatha” in district Hafizabad. The unique feature in this particular village was that the younger generation has started contributing its share with the experienced farmers. The farmers had very strong networking here and they had registered them with livestock department for their advisory service. Moreover, they also had a weather service and every farmer uses this facility to get latest information on weather through their cell phones. It can be safely concluded that the younger generation is more prone to adopt measures to reach information and modern technologies.

6.3.2 Information needs

Despite the existence of quite an elaborate extension service mechanism of the government and additional support by a number of private and non-government organizations, working towards equipping farmers with the requisite information, farmers were completely dissatisfied. The case of small farmer is all the more worst. They do not get timely, complete and actionable information on crop issues, market prices, and range of topics affecting the farmer's livelihood. The information that reaches the farmer is mostly outdated, generalised and un-actionable, not taking in to account farmer's resources and land conditions. The farmer, hence, cannot translate this advice in to action.

Farmers enlisted their wish list for the kind of information needed. The main areas where they desire to seek help can be enumerated as follows:

- **Weather Information**

This was rated among one of the top priority areas; however, the farmers were of the view that they are able to gather information to quite an extent. There were certain farmers, especially belonging to an upper age bracket, who were confident about the old weather estimation tools they had learned from their ancestors. Moreover, most of the farmers get an overall weather update from Television. They, however, maintained that the weather information given on the electronic media is quite broad like for Southern Punjab or Northern Punjab and so on. They have estimated which closest region's weather update comes closer to their particular village. There were two villages, one in Hafizabad and another in Kalar Kahar, where farmers are using a proper weather forecast centre using their cell phones. The farmers in Hafizabad especially mentioned that they have benefited a lot from this service; their wastage of crop has been minimized immensely after the usage of this service.

In view of the importance of weather update for agriculture, farmers expressed their desire for provision of this information precisely according to their region.

- **Information about seeds**

A priority area of information mentioned by the farmers was seeds; their latest varieties, pricing and availability. Farmers were very displeased with the low grade seeds mixed with the prime quality. Seed is the basic input for the crop and therefore, they have to suffer a lot because of low grade seeds. Moreover, new varieties of seeds are not available to the farmers. Hence, information on better varieties and their availability would help them get prime quality seeds.

- **Information on trusted dealerships to avoid counterfeit pesticides and fertilizers**

Prevalence of counterfeit pesticides and fertilisers is another major impediment that farmers frequently encounter. They suggested developing a mechanism to blacklist dealerships selling fictitious products. Random samples should be taken from different retailers and list of trusted dealers should be circulated among farmers of each area. This piece of information would be very helpful for the farmer to get genuine inputs.

- **Information on sprays, crop diseases and their solutions**

Appropriate plant protection measures (PPMs) not only ensure higher yield but also lead to improvement in the quality of crops. PPMs are also needed because; certain importing countries have certain quality requirements. For example, countries like USA and Japan have strict phyto-sanitary requirements. Pakistan needs to learn from those countries, where best practices of plant protection are being followed (Urquhart, 1999).

Crop diseases and their solutions is another area of interest for the farmer. These have to be addressed according to the region. There are various problems prevalent in different regions, and the solutions have to be sought according to the land conditions. Area specific information was required by the farmers.

- **Information on soil and water analysis**

Agricultural soils lose their fertility by plant nutrient exhaustion which poses a humungous threat to food security besides making the livelihood of millions susceptible to further deterioration. The loss of fertility reduces yields and affects water holding capacity leading to greater vulnerability to drought, a fertile and productive resource for the farmer and the entire ecosystem. The solution lies in the use of nutrients like sulphur, zinc, and boron which can assist in restoring the productivity levels of these soils. Moreover, use of Gypsum is proposed for increasing the productivity levels of saline and sodic soils. However, to get information on the recommended nutrients, Soil & water analysis is the only answer.

The Government of Pakistan has established soil testing laboratories in Punjab at all District Headquarters with a mandate to provide advisory service to farmers and calibrates soil and water analysis data with crop response to rationalize the fertilizer use. Laboratory also provide information about soil health and suggest measures for improving its physico-chemical status through soil management practices, usage of suitable amendments and compilation of information's regularly through soil analysis regarding salt balance in soil. Knowledge transfer among farmers about the status of their soil and water is a pre requisite for conservation and higher productivity. Farmers should have the broad awareness and knowledge about the nature and behaviour of their land, water, plant resources so that they could harness the resources to ensure higher productivity (Hazoor M., Sabrir, 2006).

The results of in-depth interviews revealed a very low awareness on this important aspect (Annex-XVI, Annex- XVII). The farmers were generally not aware about the soil and water analysis and those who had some knowledge did not understand how to take samples, how frequently, where to go for analysis and the cost.

- **Information on specific land treatments**

Information on specific land treatments was of special interest for the farmers; there are various similar projects underway in specific areas. For instance, one was being funded by UNDP in Jhang for water logging and salinity; another was being handled by NRSP for arid land in Kalar Kahar; Water management and Irrigation department is also working quite extensively in Kalar Kahar for treatment of arid land and to support the irrigation system in the region. However, any research work done for rehabilitation of different land types would be a great piece of information for the farmers

- **Information on comparative pricing of crops and inputs**

Farmers were also anxious to get information on prices of different agriculture produce in different markets so they could compare and market their products in a better way. Moreover, pricing of various varieties of seeds and other agricultural inputs was also requested.

- **Information on the use of balanced fertilizers**

Balanced fertilization means application of essential plant nutrients, particularly the major nutrients, N, P and K in optimum quantity through correct method and time of application in right proportion. It is essential to encourage the use of nitrogenous, phosphatic and potassic fertilizers, so as to achieve the desirable consumption ratio of 2:2:1 to maintain the soil health and to sustain the crop productivity(Punjab-Government, 1983). As opposed to this, the in-depth interviews revealed the fact that none of the farmers is using the suggested dosage of fertilizers (Annex-X, Annex-XI). Lack of resources & information can be attributed as the major reasons. Moreover, during the FGD's, the farmers clearly stated their inability to use

this dosage because of inadequate resources. They suggested that dosage should be tailored according to the category of the farmer. For instance, three different options can be floated with varying degree of results and then leave it to the farmer to choose as per his resource limitations. These technological options for farmers are a major information need of the farmer, be it small or large.

The results of the in-depth interview revealed a lack of information on utilization of animal & green manure to enhance the soil fertility and decrease the environmental effects of farming. (Annex) Therefore, it was observed that there is need to educate the farmers about more efficient utilization of the nutrients which will reduce the mineral fertilizer applied and the influence on the surrounding environment. With the increase in off-take of fertilizers, the crop productivity has also increased but concurrently an excessive use of fertilizers has augmented the cost of production and incidence of insect, pest and disease attacks. Informing and diverting the farmers towards use of FYM (farm yard manure) & green manure can improve soil texture, structure, organic matter and water holding capacity of the soil besides bringing down the cost of inputs.

- **Information on marketing techniques**

One of the biggest obstruction reported by the farmers during the FGDs related to their lack of information about the existing markets, pricing, trends and non-familiarity with marketing strategies which leads to their inability to fetch good price for their produce. They fall prey to the ruthless tactics of the dealers in the proximity who take advantage of ill-informed farmers. They negotiate their own terms and conditions and farmers eventually bear a loss.

A wider view of markets, comparative prices and availability of relative options enable the farmer to make rational and relevant decisions. Market information needs of small scale farmers include information on product planning, current prices, forecast of market trends, sales timing to avoid market glut by staggering harvesting and quantity for marketing, group marketing through organized sales of marketable surplus and bulk transport of produce.

- **Information on food storage and minimising post-harvest losses**

The results of the in-depth interviews revealed that the farmers lack formal technical information for minimising crop losses; though they do make use of traditional methods for securing them. Moreover, farmers especially in the farm areas expressed unavailability of information on food storage to increase their losses. Farmers around Multan region especially mentioned that as there are techniques available for enhancing the shelf life of oranges, they require any technology to apply for mangoes as well. In case of heavy winds, farmers growing mangoes have to bear heavy losses.

- **Information on agriculture economics**

The interaction with the farmers revealed that they lack proper planning and a commercial thinking. There were very few farmers who plan for the year ahead. Moreover, most of them do not even maintain any formal accounts for assessing profit or losses for their crops. They do have a rough estimate of their expenditures but there is no proper method for maintaining records. One of the major reasons attributed to this attitude is lack of education and responsiveness towards the need for proper planning. Some of the farmers mentioned that they do not make enough profits so keeping accounts will only disappoint them all the more. This leads to strengthen the ritual mindset of farmers that they are unable to change their fates. There is a dire need to educate them on agriculture economics.

A farmer in Kot Baseera, Jehlum, was the most visionary farmer met during the whole exercise. He was a graduate and had served in army for a while. Training in a military environment had taught him some kind of discipline. He plans for the whole year ahead in a way where he gets enough cash flow in each month to meet his requirements for the

upcoming crop as well as personal expenditures. He splits the crop in a way that he exactly plans to generate enough cash for the upcoming inputs. He gave a complete breakup of crops for the year. Moreover, he does an analysis to maximize profit by sowing expensive crops, besides maintaining the major share of ritual crops of the area.

6.3.3 Farmers role as info-mediaries

- Farmers were very particular about listening to and learning new technologies; their attitude was visible during the group discussions. It was clearly noticed that farmers have quite a positive attitude towards the adoption of new technologies and retention of knowledge is fairly high.
- In most of the villages, farmers do play a role of informal info-mediaries. There are groupings within the farmers, however, they still discuss and share knowledge with each other. A traditional system of “Baithaks” and “Deras”, where they gather, is intact and this is a very viable mode of transmitting all sorts of information.
- Referring to the weather forecasts, a lead farmer in Daska uses the internet to get ten-day forecasts for his region. This is an area where they grow potatoes which are largely dependent on water management of the crop. The farmer told that he disseminates this information to the entire village by just telling it to one person who is referred to as the village **“news broadcaster”**.
- Water and irrigation department held seminars in Kalar Kahar for management and treatment of arid lands. The farmers had complete knowledge of the techniques taught during the program. As far as adoption of this knowledge, the rate was average; a few had utilised the techniques and there were many more who were actually waiting for the outcome of their counterparts. In case of successful results, the adoption rate would be fairly high, as the treatment was affordable and easily accessible. Therefore, the adoption rate depends primarily on the affordability, reliability of information source and finally the outcome of the treatment. If the solution is affordable and successful in resolving the issue, farmer can manage the accessibility issue.

6.3.4 Acceptance testing of use of Mobile phones

The findings of a workshop on ICT/ICM for National Agricultural Research Information Systems in the Asia-Pacific Region, FAO(2010), concluded that information is more critical for the small-holder and resource poor farmers and producers who have been facing challenges posed by income generation with the limited resources in the struggle for their livelihoods and sustenance. It is true that they are not only resource poor but also information poor(2010).

Farmers were finally questioned on their opinion towards the “Concept” of the research. The underlying idea was to test the model of utilising ICTs to provide low cost, timely and actionable information to the farmers. The information should be fully comprehensible so that the farmers could translate it to action and thereby increase their yields and eventually enhance their earning capacity.

The farmers expressed their dissatisfaction towards the reach of information and showed immense interest in getting equipped with the latest knowledge and techniques. The concepts of using different tools for dissemination of information were presented and their responses were recorded. The respondents were shown audio and video messages through cell phones and their comments were recorded. The observations towards this most important aspect of the research can be laid down as under:

- The concept of using mobile phones as a major tool for reaching out the farmers and transmitting timely and low cost information was highly applauded in all the villages. The idea was overwhelmingly approved by the respondents. Despite the varied levels of civilization in various villages, cell phone presence was found to be unquestionable. The final content of

each focus group discussion endorsed the notion of mobilising this medium to its utmost for approaching the maximum number of farmers. This is the only way of communicating with huge numbers in no time.

- Most of the respondents had cell phones in the price range of GBP 15 - 25, however, even the farmers are now getting conscious about buying better quality phones and a few had really good quality sets. Moreover, the average monthly spending on mobile phones ranged from a minimum of GBP 3-11. There were exceptional cases spending even more, however, the average spending comes to around GBP 6 a month. This usage is primarily for business purposes i.e. getting various kinds of information from fellow farmers, traders, dealers, Field assistants, etc.
- Cell phones are being used primarily for listening to or making calls, however, the younger group of farmers are engaged in messaging as well. The relatively younger group of respondents also download songs and ring tones. So, they are quite familiar with various attributes of mobile phones and they showed their willingness to download any piece of information which is useful for them.
- There was a unanimous response that “Audio calls” is the best solution for spreading out the information. Some of the farmers are already using this kind of service that has been launched by the livestock department.
- Farmers also proposed that a text message should be sent as a backup for the audio call. This would facilitate them to keep a record and access whenever they need to.
- Most of farmers were comfortable with Urdu as a language of preference for the audio as well as text message. However, farmers in Bhalwal were of the view that in Punjab, people would feel more at home if Punjabi language is used as a medium for communicating.
- The farmers liked the audio message without any background music. They were of the view that music brings distraction in the flow of information. They suggested to keep the audio message simple and without any background voices.
- Video messaging was also appreciated in view of its clarity and visual impact, however, farmers had not access to compatible mobile sets. The farmers expressed their interest in the video message and were excited about the features; however, they were of the view that expensive sets with large screens would be required for this kind of messages which they perceived would not be affordable for them.
- Downloading of information appeared to be a bit challenging for the farmers at the moment. There were a few farmers who expressed their consent to download any kind of information, but most of them were not equipped with such skills. Some of the farmers, however, suggested that they can take help from Field Assistant of Extension program, fellow farmers or any younger family member, if required. The younger generation of farmers are quite familiar with downloading ring tones and songs; therefore, they can assist in handling this information flow. It appears that if the farmers get accustomed to receiving information of their choice on the mobile phones, they would make efforts to use any kind of technology to get an access. This would just be a matter of some time to learn these skills especially when their next generation is already involved in downloading.
- Besides the use of mobile phones, farmers also approved the idea of releasing CDs and DVD's for complete information on modern farming techniques, land rehabilitation, crop specific information, and the like. They were of the view that this kind of information would be a permanent reference for us. This would resolve their complaints with the television programs being broadcast at inappropriate time slots.
- Some of the farmers emphasized the need of holding meetings alongside other ways of communicating. They were of the view that this facilitates two-way communication where they get answers to their queries. They stressed that the need for the meetings should not be undermined. Agriculture extension workers should at-least hold monthly meetings and information should be given before each crop.

- Farmers also drew attention towards the launch of a reliable helpline offering highly technical services for the farmers. They showed their dissatisfaction with the available facility by the extension program and insisted to develop a better solution for the farmers.
- In response towards the electronic media, farmers maintained that it would only be a help if the prime time is used for communication.
- Farmers also emphasized that they should get “Zaraat Naama” and other information brochures being published by the agriculture department.

Concept testing of mobile phones in FGD



6.3.5 Agents of “Most Significant Change”

Another approach of this research was to look up for factors leading to “most significant change” in their lives. Two specific cases were cited during the survey of twenty villages. Interestingly, both the cases relate to the use of mobile phone which changed the fate of the farmers.

The farmers in Punj Hathan, Hafizabad, were worried about the crop losses due to lack of access to valid and short term weather forecast. They could not take appropriate measures in advance to prevent these losses. A year ago, they were introduced to an upcoming new weather service “Shaheen Weather Service”. Almost every farmer has recorded the access number in his mobile phone and they get information on a regular basis. The crop losses due to weather uncertainty have gone down phenomenally.

Interestingly, there are just a couple of telephone lines serving the clientele. Due to limited access lines, it is extremely busy and requires a lot of time to get through. They provide a 4 day weather forecast on a district level. It clearly depicts the level of farmer’s concern in getting required information and the way they make effort towards this goal.

Another case extracted from this research is as follows:

Most of the farmers are involved in cattle breeding; they take it as a source of additional income and this is considered as a natural appendage to this profession as well. Since the farmers are not very literate and organized, they used to overlook certain vaccinations or other remedies to keep the animals healthy. The treatment is quite expensive and becomes an additional burden on the

farmer. The farmers recently got registered with the Livestock Department of Government of Punjab for their advisory service. Now, they get audio calls for advice on all kind of animal care including vaccination reminders and the like. The farmers were very satisfied and acknowledged the fact that this service has brought an exceptional change in their attitude towards livestock care.

7. Proposed ICT based services for Agriculture Extension

The proposed model is informed by the research findings and caters to the current telecom infrastructure. The model is designed to address challenges such as: converting extension information into digital form, user friendly access, literacy, impact and financial sustainability.

The model is aimed to achieve the following:

- On-Demand Provision of reliable and timely actionable information to farmers. The information will be about market prices of specific commodities, weather updates for their area, crop specific advice. The information will be requested and disseminated through mobile applications.
- Providing content in local language. In Pakistan this is relatively easier to achieve as there is one national language understood in the most of the country.
- Providing voice based content to farmers to overcome literacy barriers.
- In case of problems that cannot be addressed via mobile applications, establishing a help line backed by experts providing advice in real time..
- Automating the agriculture extension by using specialized applications on mobile phones. Especially, aiding in data collection for surveys for institutional users.
- Creating sustainability financially and technologically in terms of content.

Model Description

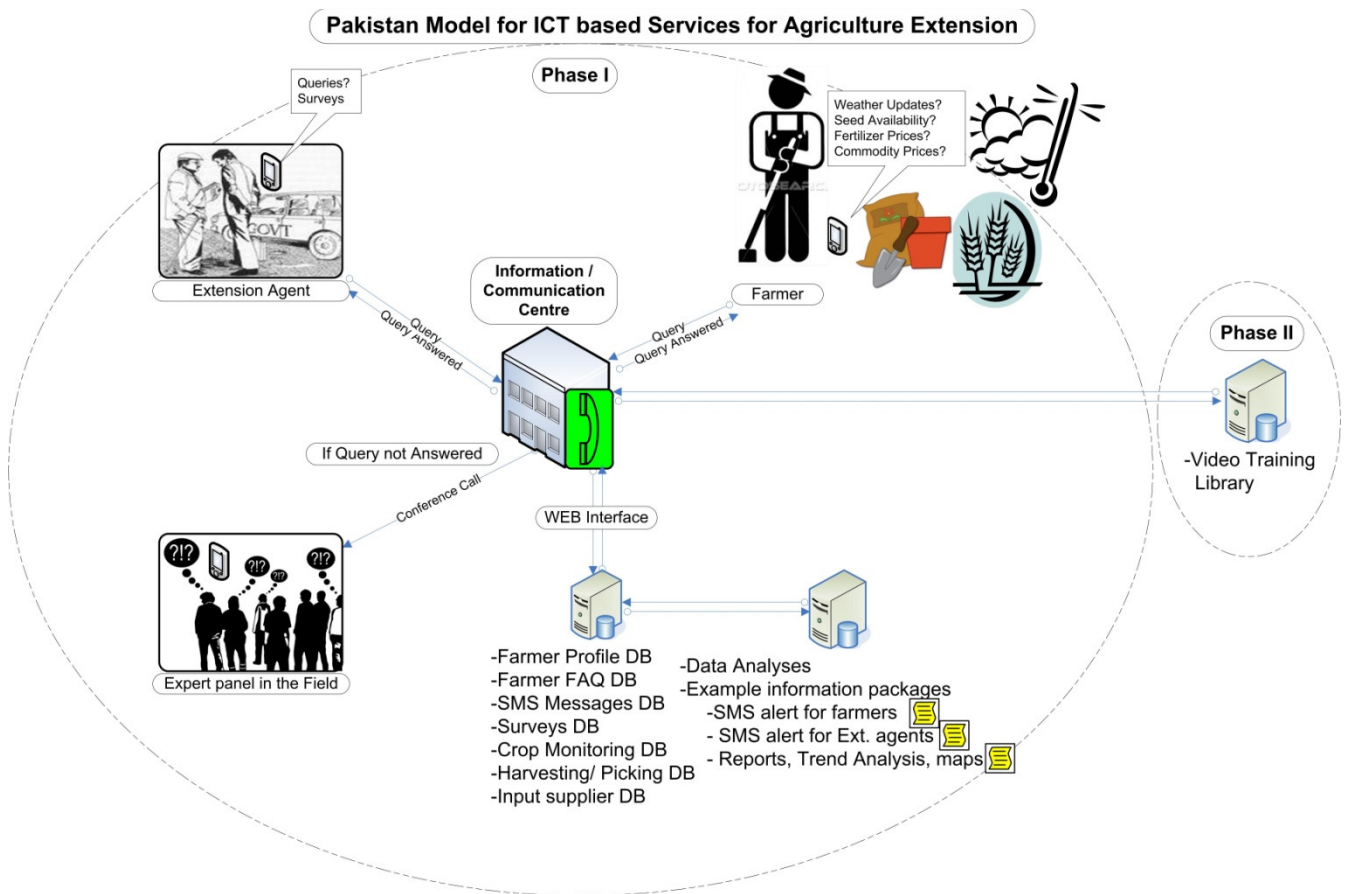
The farmer queries can be classified in to the following broad categories:

- ‘What’ type queries, asking for standard information e.g. weather, prices, input supplier contacts etc.
- ‘How’ type queries can be further classified as:
 - Asking about standard practices, e.g. how to take a sample for soil test
 - Asking about issues that need further assessment.

The ‘what’ type queries, alerts, queries regarding standard practices and data collection lend themselves best to mobile applications. The others may need solutions ranging from voice (help line), or demonstrations. The first phase of this model addresses all the aspects except demonstrations.

The demonstration can be an actual demonstration in the field or may be catered via video trainings on DVDs. The availability of cheap DVD players has made this a viable medium for self/group training. Video based training can serve as a self-training tool for the farmers. It can also serve as a standardized training aid to be used by extension staff, thus ensuring the same quality standard training aids for all trainings in the province/country. This also caters to the demand of the farmers that agriculture related programs are either not aired at the prime time or are too general for their use. The video training library and its operation is part of phase-II of this model.

Proposed Model



The main components of the model are:

- User base: Farming community, Agriculture extension workers and institutional users.
- User Interface: Mobile applications for farmers and field extension workers. Web based interface for institutional users.

Information and Communication Centre: This is the technology hub of the model and consists of:

- Technology Centre: This will consist of
 - Application Development: Standard user interface based mobile applications for farmers and field extension workers. Mobile applications at the moment are perceived to have two purposes;
 - Give information to the farmers/extension workers; The information to the farmer via mobile phones is envisaged to range from: area specific weekly weather updates, information about crop advice at pre-determined control points in the season, input supplier information, information about government schemes etc. The field survey has revealed that the farmers are heavy users of low cost phones manufactured by Nokia and others; the cost of these sets varies between £ 25- 50. The screen sizes of these devices are small and these are usually mono coloured. Another recent survey also shows that Pakistan's handset market is hugely dominated by Nokia handsets (Taimoor, 2011). Most of these sets are not programmable. Therefore, Unstructured Supplementary Service Data (USSD) protocol employed by most of GSM operators (Space, 2011) is proposed to be used for this set of applications. An

interesting feature of USSD is an open connection that enables a two-way handshake. The USSD software can be preloaded on mobile SIM cards, similar to Green SIM from IFFCO Kisan Sanchar or transferred Over the Air (OTA). The later one ensures the delivery of additional services can be made available on farmer's mobile devices. The only limitations are SIM card size and message length in characters exchanged in USSD message exchange.

- The second is survey type applications, to collect information from the field for institutional users. The automation of the surveys via mobile applications will ensure real time update to the databases and faster generation of reports. These applications will be more advanced than the applications for the farmers and are proposed to be deployed on smart phones. Google's Android and Windows 7 based phones present a good and relatively economical (£ 120/) option for such applications, the applications of the first type i.e. where the information is taken from the ICC will of course be available on these phones as well.
- Web based interface development and management for institutional users.
- Infrastructure management: Servers management, Call centre management, management of communication links (internet and phone)
- Knowledge Management: The function of the knowledge management is to make sense of the operational data and derive useful results from it. The aim is to provide more personalized, customized and usable information for the users delivered directly to their handsets or computers. The knowledge generated will be for two different categories:
 - Knowledge management for the research-users
Research users will include the farmers, field extension workers and public and private institutions providing extension services. Knowledge management will be supported by a set of discrete databases that store contextualized information. As the databases such as the farmer profile, query record mature over the period of time data analysis will be performed for: new mobile application development, trends, survey report generation for institutional users, new CoPs that can be developed in the community and content generation for mobile applications.
 - Knowledge management for researchers and Policy makers
The users here will include research and policy making institutes. The trend reports generated by combining information in contextualized databases and already synthesized information on various aspects can support research projects in specific areas and can serve as useful statistics for policy making and justification
- Help line: The help line is similar to the model of a call centre. Agricultural problems being diagnostic in nature cannot always be solved via mobile applications. Therefore farmers/extension workers can call the helpline. The helpline CSA (call service agents) will be agriculture graduates and backed by a FAQs database. For problems that cannot be answered by the help line staff, the call will be converted to a conference call and an expert in the field will be taken on board. The help line staff will update the FAQ database depending upon whether a solution was given to the farmer or more information was requested. The help line will also serve to generate basic data about the callers e.g. name, phone number, approximate area under cultivation, crops cultivated etc. this will help in building farmer profile. The query record will serve as the base data for building more customized mobile applications by linking farmer profile with the queries, it will also help in generating alerts/warnings by specifying/notifying areas in case similar problems are coming from the same area.
- Panel of Experts in the field: This is a distinguishing feature of the model. To support the help line a floating panel of experts is proposed. These experts will be experienced extension workers already working in the field on a particular crop or researchers in research stations who work on outreach activities. It is proposed that they work as consultants for the help line and give approximately 2 hrs/day of their time in a pre-determined time slot of the day (or pay as they serve- on per call basis). As these people are already working with the farming

community in the field on the particular crop, they are more attuned to the local problems. The queries that are not answered by the help line or by the field experts will be referred to the appropriate research institute.

Financial Stability

The sector's potential in poverty alleviation is evident by the fact that more than 62% of the rural population is directly involved in agriculture (Amjad, 2010). The aim of this model is to empower these small farmers with cheap, timely and reliable information for the whole agriculture life cycle.

Possible Business Partners: Donor Funding agency, Telecommunication Company, Agriculture Research Institute, Directorate of Agriculture Extension and Adoptive Research- Punjab, Directorate of Agriculture Information -Punjab. .

Product Services: The following is a brief description of the services enabled by the proposed model.

- Week wise location specific weather forecasts service
- Price information of commodities in the closest wholesale markets.
- Location specific availability of particular seeds
- Location specific, Agriculture input (pesticide, fertilizer) availability
- Platform similar to Google Trader to interface buyers and sellers
- GPS enabled mobile applications for extension workers to conduct surveys
- Knowledge management infrastructure for above collected data to generate useful reports for public and private agriculture extension, IGOs, NGOs, other organizations involved in rural areas .
- Management of farmer's profiles
- Facility to setup community of practices and ease communication among each other
- Personalize and customized extension support (voice communication) to farmer queries by mobile applications backed by help line support.
- Floating panel of Agriculture experts in the field to answer in real time the questions that are not answered by the ICC via conference call. The ICC staff to follow-up on the solutions.
- Register a visit request if the problem is still not resolved by the above.
- Autonomous mechanism to monitor and rate the performance of help line, panel of experts and extension workers.

Proposed activity plan:

- Develop detailed proposal and secure the seed funding.
- Partner with a mobile phone operator. Engage other partners e.g. Directorate of Agriculture Extension and Directorate of Agriculture Information.
- Start with 3 districts in Punjab
- Establish Information and communication centre
- Hire staff and identify field based panel of experts.
- Develop SOPs for help line.
- Develop SOPs for customer relationship management & development of farmers as trusted info-mediaries.
- Aggregate data from different sources e.g. the district extension offices (for farmer contacts, input suppliers contacts etc.) MET office, wholesale prices, field extension manuals etc

- Build mobile applications for dissemination of information, for survey data collection and FAQs database
- Develop short trainings in the use of mobile applications.
- Soft launch with the mobile operator in the specified districts. Market with the training materials.
- Institute methods for minimizing help line queries by automated answers via mobile applications.
- As databases mature and area coverage increases, market services to institutional users.
- Create web based interface in addition to mobile apps interface for institutional users.
- Institute mobile based competitions, spots polls, CoPs to keep the farming community engaged and interested. Design these with the aim of monitoring effectiveness of the services.
- Develop expertise (targeted solutions via mobile apps, more field experts identified) by crops and increase geographical coverage accordingly.
- Livestock is an important part of agriculture and is primarily managed by women of the farming household in Pakistan. Ensure participation of women by developing expert database for livestock queries.

Estimated Project budget

It is proposed that the service be run as a funded project in Punjab for three years. Punjab is selected as it has the maximum agricultural land amongst the provinces. Most of the crops and land types will be covered by running the service in Punjab. Thus it will be easy to scale it to other provinces.

The pilot funding will include costs for infrastructure, staff, SOP development, training, content development and in developing linkages with other institutions for content generation. It is estimated that a three year role out of this project would be in the region of £280k, broken down as follows:

Year	Estimated Budget
Year 1	£130,000
Year 2	£95,000
Year 3	£55,000

Operational Management, Partners and Location:

It is proposed that the project be based at Rawalpindi-Pakistan at the CABI-SA office. The project is proposed to be implemented in partnership with the Directorate of Agriculture Extension and Adoptive Research- Punjab, with CABI providing the ICT related services and the Directorate providing access to data at the provincial headquarters and at the district extension offices. The Directorate will also be expected to provide field staff for possible field visits to the farmers and also support in identification of the experts panel in the field. The other partner will be a telecom operator on whose network the mobile applications will be rolled out. The telecom operator is also expected to support these services in their marketing campaigns.

It is anticipated that once on its feet the project will evolve into a perpetual not for profit non-government entity serving farmers' extension needs.

Project Sustainability:

A subscription based model is proposed. All the above services are proposed to be provisioned on a partner telecommunication network and bundled with a pre-paid mobile subscription package.

Although in the proposed model the revenue will be generated from the beginning through the subscriptions, however it will not be enough to sustain the service at the beginning.

PTA estimates that 58.2 % of total populations are mobile phones users(PTA, 2010b). A survey conducted in 2008 revealed 59% of the rural population have access to mobile phones (Society, 2010).

The total subscriber base till December 2010, of Mobilink is reported as 31,794,292 (PTA, 2011b) and that of Telenor 20,275,002(PTA, 2011b). This research study found these two operators as the most popular amongst the rural subscribers followed by Ufone. This study further reports, that farmers on an average incur an expense of approximately £ 2.5 - £ 3.5 month for making voice calls to gather information on agriculture.

Based on above, hypothetically if 2% of the subscriber base (e.g. Of Telenore) spends approximately £ 1/month on agriculture services packages provided through any of these services, it is estimated to generate a revenue of £ 400K/month.

The other sources of revenue are the survey analysis and trend reports provided to public and private sector institutional users.

It is estimated that in about three years the subscriber base will increase to a point where the service may become self-sustaining.

It is proposed that the service package be marketed at a minimum rate initially with a few default services. This will help in making the farmer/extension worker comfortable with the use of the service. As the basic profile data of the farmers and the area builds, the quality of customization will also improve and the services will become more attractive for the farmers/extension workers.

Future Impact:

The project is perceived to have the following impact

- Equal access to information by the farming community. Improved access to information will have a positive impact on the decision making of the farmers and thus their incomes.
- Automation of surveys will not only lower infrastructure cost, remove inadequacies of manual data collection, increase accuracy and also aid in autonomous monitoring of field staff.
- The outputs of the project will directly impact policy making and improve work efficiencies of the field staff by making timely and accurate reports and analysis available to the concerned authorities.
- A future impact of the project is establishing community of practices (COP).

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Annex-I: Value Added Services in Pakistan

Service Name	Description	Price	Provider
Stock Watch	Get continuous updates on stocks listed on the LSE (Lahore Stock Exchange) or KSE (Karachi Stock Exchange) anytime. Available options <ul style="list-style-type: none"> Hourly Alerts Price Movement Alert KSE/LSE Index Alert 	Rs. 50 +tax/Month	Mobilink
SMS Banking	Remain updated with account transactions detail through SMS with banks like, <ul style="list-style-type: none"> Citibank MCB Bank SCB UBL EGIBL 	Rs. 2.0 +tax/SMS	Mobilink
Corporate SMS	Corporate SMS is an SMS Broadcast Application that enables corporate users to Send, Manage and schedule message broadcasts to multiple recipients on any mobile and land line number in Pakistan.	1-Signup : Rs. 1500 2-Line Rent: Rs. 3000 per 6 months 3-on-Net Rs. 0.5/SMS 4-off-Net Rs. 0.9/SMS	Mobilink
Conference Bridge	Schedule conference calls with up to 25 on-net and off-net users.	Rs. 50 +tax/Month	Mobilink
Missed Call Alerts	Service that notifies you about calls that you did not answer voluntarily. <ul style="list-style-type: none"> When you were out of the coverage area. You did not have call waiting. When handset was powered off. 		Mobilink
Voice Mail	<ul style="list-style-type: none"> Service that allows callers to leave a message when you are unable to take a call. Callers are diverted to your Mobilink V-mail where they are asked to leave a message. An automated SMS 	Rs. 1.0 +tax/ Min	Mobilink

	notification will inform you about every new V-mail message received		
Kisan Service	To help farmers realize a good yield and to put an end to their exploitation at the hands of the middlemen, Mobilink launched Kisan Helpline	Rs. 3.0 +tax/ Min	Mobilink
Mobi Track	Street level cell-phone navigation for its subscribers	30-day trial	Mobilink
Mobilink Yellow Pages	Service which lets you retrieve contact details of restaurants, hotels, retailer shops, local businesses, art galleries etc	Rs. 3.0 +tax/SMS	Mobilink
Prize Bond Service	Get Prize Bond Lucky Draw results through IVR and SMS.	Rs. 2.0 +tax/Min Rs. 2.0 +tax/SMS	Mobilink
GRPS/EDGE	<ul style="list-style-type: none"> With GPRS you can enjoy internet browsing. With EDGE you can download email or data faster than ever before. 	Rs. 18 +tax/MB Rs. 6.0 +tax/MMS	Mobilink
MyMail	Made it possible for you to access your emails with MyMail. wherever you are without ever using an Internet or GPRS/EDGE enabled phone.	Rs. 5.0 +tax/Week Rs. 20 +tax/Month Rs. 0.05 +tax/ dialling (*88#)	Ufone
Ufone GPRS/EDGE	Internet-based services.	Rs. 15 +tax/MB	Ufone
Awaz Email	Voice mail through IVR and SMS	Rs. 2.0 +tax/Min Rs. 0.5 +tax/SMS	Ufone
Ufone Mobile Magazine	Miniature version of magazine straight on your mobile	Rs. 15+tax/Month Rs. 0.5 +tax/Min IVR	Ufone
Ufone Visa Information Service	How does the UK Visa Information service work?	Rs. 10 +tax/Min	Ufone
Ufone Urdu Services	With this service you can send quotes, greetings, poetry, jokes in your local language instead of Roman Urdu	Rs. 2.0 +tax/SMS	Ufone
UJob portal	Finding your dream job is now, just an SMS away. Covers major cities of Pakistan and job categories such as Marketing & Sales, Production & Operations, Finance, IT, HR & Admin.	Rs. 20 +tax/Month	Ufone
Ufone Video News	News in video format	Rs. 50 +tax/Month Rs. 5.0 +tax/ 1Time	Ufone
UKisaan	Now you can get the latest information about the agriculture sector simply by making a call.	Rs. 3.0+tax/Min	Ufone

UTrack Business	These service will allow users to find or locate friends, family, POI near the user, or just monitor employees and work force. <ul style="list-style-type: none"> ● Team View ● Route View ● View Point of Interest 	Rs. 1000 +tax/Month (for each service)	Ufone
Tele Kisan 700	Weather Forecast, Commodity Price Agricultural, Info Pest Alert & Remedies, Agricultural News, Agricultural Tips.		Telenor
Meri Zuban	Roman Urdu to Arabic text conversion	Rs. 1.0+tax	Telenor
Mobile 7775 Akhbaar Service	Voice-based news and classified broadcast in different indigenous regional languages, Phusto, Sindhi, Punjabi.	Rs. 3.0+tax/Min	Telenor
EBuddy	Application based Private sms chat with friends	install and use	Telenor
Friend finder Service	Public chat rooms		Telenor
Auto Location			Telenor
Talkshawk Video Alerts	Vedio Alerts	Rs. 50+tax/Subs Rs. 2.0+tax/SMS	Telenor
Facbook upload	<ul style="list-style-type: none"> ● You can change your FACEBOOK status. ● Add new friends. ● Post on their walls. ● Send messages. 	Rs. 1.0+tax	Telenor
Talkshawk Voice Mail	leave messages on your mobile phone if you can not attend their call	Rs. 2.0+tax	Telenor
Telenor Pakwan Service 1310	Recipes of different categories	Rs. 7.0+tax	Telenor
My Virtual Office	<ul style="list-style-type: none"> ● Voice Mail busy not answered ● Fax Mail will receive all user faxes right on his handset and user can get the print out of its fax from PC or nearest fax machine. ● E-Mail receive your emails out of your office 	Rs. 50+tax/Activate Rs. 50+tax/Month	Warid
Warid Call Block 9211	Block all the unwanted callers	Rs. 19+tax/Month	Warid

Enterprise SMS Package	Bulk broadcast to the customers / clients as promotional activity	Rs. 20000/Month Rs. 30000/Month Rs. 40000/Month	Warid
ZongPrize Bond Service	Get Prize Bond Lucky Draw results through IVR and SMS.	Rs. 3.0 +tax/Min Rs. 5.0 +tax/SMS	Zong
Zong Visa Information Service	How does the UK Visa Information service work?	Rs. 10 +tax/Min	Zong
Call Me Back	Low on credit but need to make an important call? No worries! Just inform your friends or family.	Free	Zong
Corporate VPMN	Make calls within its group	Rs. 0.25+tax/Min	Zong

Annex-II: List of the reports to be submitted by the Field Staff of Agri. Extension Department to the higher ups (source: Directorate of Agriculture Extension & Adoptive Research)

- Variety wise area sown of different crops with method of sowing.
- Report about use & availability of different inputs in the field.
- Pest scouting reports of cotton, Rice and sugar cane.(Pest scouting report is only for these crops only)
- Insect & disease attack report on other crops.
- Rice nursery monitoring report.
- Cotton Ginning report.
- Calamity report.
- Canal closure report.
- Monitoring of irrigation water on tail.
- De-silting of canals report
- No of sprays on different crops.
- Harvesting/picking report.
- Thrashing report.
- Procurement of rice & wheat report.
- Cotton sticks removal report.
- Left over cotton bolls destruction report.
- Rice stubble destruction report.
- Seed grader working report.
- Horticultural activity report.
- Tube well tractor survey report.
- Agriculture censuses report.

Annex III: 0700 Agriculture related information provided by Telecom operators

Service	Description	Operator
Whole Sale Market Prices	Prices of commodities that day in different whole sale markets	UFONE, Mobilink, Zong, Telenore
Crop Technology	Menu presented for different crops. Very basic level information on economic importance, season and land type for planting and health benefits	UFONE, Mobilink, Zong, Telenore
Horticulture Crops Technology	Menu presented for different Horticulture crops. Very basic level information on economic importance, season and land type for planting and health benefits	UFONE, Mobilink, Zong, Telenore
Weather	Menu presented to choose a City wise temperature of the day. Some services give min-max temperature.	UFONE, Mobilink, Zong, Telenore
Livestock technology	Menu presented for diet, disease of livestock. Animal wise classification not available.	UFONE, Telenore
Non conventional crop technology	Menu presented for different Horticulture crops. Very basic level information on economic importance, season and land type for planting and health benefits	UFONE, Telenore

Annex- IV: Age of the respondents

Villages	Ages (18-40Y)	Ages (40- 65Y)	Villages	Ages (18-40Y)	Ages (40- 65Y)
Khanewal 152/R	10	10	Hafizabad – Waddaray	11	9
Khanewal 159/R	11	9	Hafizabad – Punj Hathan	3	17
Vehari 160 WB	7	14	Kalar Kahar – Dhalwal	12	8
Vehari 330 WB	9	11	Kalar Kahar – Khairpur	8	22
Shujabad --Gardezipur	9	17	Toba Tek Singh – 247 GB	6	15
Shujabad – Moaza Wahi Rikki	6	10	Toba Tek Sindh – 183 GB	12	7
Bhalwal 26 N	12	7	Jhang—181 GB	5	15
Puraana Bhalwal	7	13	Jhang –Wakeel Wala	10	10
Daska – Bharoke Khurd	5	15	Jehlum – Dharyala	5	15
Daska – Galotian Kalan	7	13	Jehlum – Kot Baseera	7	13

Annex-V: Size of land holdings

Village Name	Below 5 Hec.	5 – 12.5 Hec.	12.5 – 25 Hec.	25 – 50 Hec.	More than 50 Hec.
Khanewal 152/R	9	8	3	0	0
Khanewal 159/R	9	4	5	2	0
Vehari 160 WB	9	5	4	2	1
Vehari 330 WB	13	5	2	0	0
Shujabad –Gardezpur	11	11	4	0	0
Shujabad– Moaza Wahi Rikki	15	1	0	0	0
Bhalwal 26 N	9	6	4	0	0
Puraana Bhalwal	7	8	4	1	0
Daska – Bharoke Khurd	19	1	0	0	0
Daska – Galotian Kalan	13	6	1	0	0
Hafizabad – Waddaray	8	6	2	4	0
Hafizabad – Punj Hathan	14	5	1	0	0
Kalar Kahar – Dhalwal	9	8	2	0	0
Kalar Kahar – Khairpur	24	6	0	0	0
Toba Tek Singh – 247 GB	12	8	1	0	0
Toba Tek Sindh – 183 GB	14	5	0	0	0
Jhang—181 GB	18	1	1	0	0
Jhang –Wakeel Wala	9	11	0	0	0
Jehlum – Dharyala	16	3	1	0	0
Jehlum – Kot Baseera	2	6	10	1	1

Annex-VI: Education of the respondents

Villages	Illit.	Prim.	Middle	Metric	Inter.	Bach.	Mast.	Prof.
Khanewal 152/R	6	3	4	3	2	1	0	1
Khanewal 159/R	1	3	2	8	3	1	0	2
Vehari 160 WB	0	5	2	7	5	1	0	1
Vehari 330 WB	1	14	3	1	1	1	0	0
Shujabad –Gardezipur	0	12	8	4	2	0	0	0
Shujbd. –Moaza Wahi Rikki	0	8	7	1	0	0	0	0
Bhalwal 26 N	0	0	1	10	2	4	1	1
Puraana Bhalwal	0	2	2	8	3	4	1	0
Daska – Bharoke Khurd	9	6	2	3	0	0	0	0
Daska – Galotian Kalan	0	4	3	8	4	0	1	0
Hafizabad – Waddaray	0	6	5	7	0	2	0	0
Hafizabad – Punj Hathan	0	10	6	4	0	0	0	0
Kalar Kahar – Dhalwal	0	0	7	10	3	0	0	0
Kalar Kahar – Khairpur	0	3	18	9	0	0	0	0
Toba Tek Singh – 247 GB	0	0	6	10	3	2	0	0
Toba Tek Sindh – 183 GB	0	2	12	3	1	1	0	0
Jhang—181 GB	0	1	5	8	1	5	0	0
Jhang –Wakeel Wala	0	0	11	2	7	0	0	0
Jehlum – Dharyala	0	2	7	11	0	0	0	0
Jehlum – Kot Baseera	0	2	7	7	0	2	2	0

Annex-VII: Monthly Household income of the respondents

Villages	Below Rs. 10,000	Rs.10,000 – 25,000	Rs. 25,000 – 50,000	Rs. 50,000 and above
Khanewal 152/R	11	6	3	0
Khanewal 159/R	9	9	2	0
Vehari 160 WB	8	9	4	0
Vehari 330 WB	16	4	0	0
Shujabad –Gardezpur	18	8	0	0
Shujabad – Moaza Wahi Rikki	12	4	0	0
Bhalwal 26 N	5	9	5	0
Puraana Bhalwal	4	12	4	0
Daska – Bharoke Khurd	19	1	0	0
Daska – Galotian Kalan	12	7	1	0
Hafizabad – Waddaray	13	5	2	0
Hafizabad – Punj Hathan	16	3	1	0
Kalar Kahar – Dhalwal	13	7	0	0
Kalar Kahar – Khairpur	29	1	0	0
Toba Tek Singh – 247 GB	15	5	1	0
Toba Tek Sindh – 183 GB	16	3	0	0
Jhang—181 GB	12	7	1	0
Jhang –Wakeel Wala	18	2	0	0
Jehlum – Dharyala	12	8	0	0
Jehlum – Kot Baseera	7	13	0	0

Annex-VIII: Average Family Size

Villages	Avg. Family Size	Villages	Avg. Family Size
Khanewal 152/R	5.0	Hafizabad – Waddaray	9.7
Khanewal 159/R	6.4	Hafizabad – Punj Hathan	9.2
Vehari 160 WB	9.9	Kalar Kahar – Dhalwal	6.5
Vehari 330 WB	8.8	Kalar Kahar – Khairpur	6.5
Shujabad –Gardezipur	7.3	Toba Tek Singh – 247 GB	7.0
Shjbd.–MoazaWahi Rikki	7.0	Toba Tek Sindh – 183 GB	6.7
Bhalwal 26 N	6.1	Jhang—181 GB	8.2
Puraana Bhalwal	6.8	Jhang –Wakeel Wala	8.5
Daska – Bharoke Khurd	10.5	Jehlum – Dharyala	6.5
Daska – Galotian Kalan	6.4	Jehlum – Kot Baseera	8.3

Annex-IX: Selected villages with major crops, average yields and common crop diseases

Villages	Crops	Yield / hectare	Diseases
Khanewal	Cotton, Wheat, Corn & Fodder	Cotton BT 3500/1500 Kg. (Feb. crop/May crop), Other varieties of cotton 500 Kg., Wheat 3500 Kg.	Virus, Army worm, Pink Boll worm, Spotted Boll worm, Weeds,
Vehari	Cotton, Wheat, Rice & Sugarcane	Cotton 4500 Kg., Rice 4500 Kg.	Virus, Stem borer, Red Bug, Pyrella, Leaf Roller, Athid, White fly, Pink Boll worm, Army worm, American worm, Spotted Boll worm, Mealy Bug,
Shujabad	Cotton , wheat, sugarcane, Rice, Corn and mango	Cotton 2500 Kg., Wheat 3500 Kg., Rice 3500 Kg.	Athid, Mealy Bug, Stem Rot, Sudden death, Fungus, Fly, Virus, Weeds
Bhalwal	Wheat, Rice, Sugarcane, Fodder & Citrus	Wheat 2500 Kg., Citrus 20,000 Kg.	Athid, White fly, Mealy Bug, Sudden Death (Citrus)
Daska	Wheat, Rice, Potatoes, Melon & Sugarcane	Wheat 4000 Kg., Rice 4500 Kg., Potatoes 25000 Kg.	Athid, Fungus, weeds, Blost, Leaf Roller
Hafizabad	Wheat & Rice	Wheat 4500 Kg., Rice 4500 Kg.	Cut worm, Athid, Jhulsao, Leaf Roller
Kalar Kahar	Wheat, Barley, Mustard, Pulses, Corn & Vegetables	Wheat 1800/4500 Kg. (Arid/tube well fed), Barley 1000 Kg., Pulses 500 Kg.	No diseases, just weeds
Toba Tek Singh	Citrus, Sugarcane, Cotton, Corn & Wheat	Wheat 4500 Kg., Cotton 3000/8000 Kg. (Jun/Feb. Crop), Sugarcane 100,000-120,000 Kg., Corn 7500 Kg.	Virus, Sudden Death, Fly, Athid
Jhang	Rice, Wheat, Sugarcane & Cotton	Wheat 3000 Kg., Rice 4000 Kg., Cotton 2000 Kg., Sugarcane 60,000 – 80,000 Kg.	Stem Rot, Virus, Mealy Bug, American worm
Jehlum	Wheat, Cotton, Rice, Barley,	Wheat 3000 Kg., Rice 3500-4000 Kg., Cotton	Athid, Not much diseases

	Chick peas, Vegetables,	8000 Kg.	
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Annex-X: Use of fertilisers by wheat-rice farmers

Inputs Unit	Below 4 Hec. % age	4 – 10 Hect. %age	More than 10 Hec. %age
urea 1	69.4	41.7	0.0
urea 1.5	30.6	58.3	20.0
urea 2	0.0	0.0	80.0
DAP 1	72.2	66.7	0.0
DAP 1.5	27.8	33.3	40.0
DAP 2	0.0	0.0	60.0
K 0.5	2.8	8.3	0.0
K 1	0.0	16.7	30.0
K 1.5	0.0	0.0	0.0
Micronutrients	0.0	16.7	20.0

Annex-XI: Use of fertilisers by Citrus farmers

Inputs Unit	Below 4 Hec. % age	4 – 10 Hect. %age	More than 10 Hec. %age
urea 1	66.7	16.7	0.0
urea 1.5	33.3	83.3	42.1
urea 2	0.0	0.0	57.9
DAP 1	50.0	66.7	0.0
DAP 1.5	0.0	33.3	36.8
DAP 2	0.0	0.0	63.2
K 0.5	16.7	0.0	0.0
K 1	0.0	16.7	15.8
K 1.5	0.0	0.0	26.3
Micronutrients	0.0	0.0	0.0

Annex XII: Use of Farm Yard Manure and Green manure by the Wheat Rice farmers

Category	Land Holding	%age of response in affirmative
Knowledge about advantages of manure	Up to 4 Ha	24
	4 – 10 Ha	60
	More than 10 Ha	90
use of FYM	Up to 4 Ha	48
	4 – 10 Ha	60
	More than 10 Ha	90
Green manure	Up to 4 Ha	0
	4 – 10 Ha	18
	More than 10 Ha	40

Annex-XIII: Use of Farm Yard Manure and Green manure by the Citrus farmers

Category	Land Holding	%age of response in affirmative
Knowledge about advantages of manure	Up to 4 Ha	17
	4 – 10 Ha	67
	More than 10 Ha	53
use of FYM	Up to 4 Ha	33
	4 – 10 Ha	66
	More than 10 Ha	42
Green manure	Up to 4 Ha	0
	4 – 10 Ha	0
	More than 10 Ha	5

Annex-XIV: Present source of advice of rice Wheat farmers

Base: 58 respondents

Source of advice		Below 4 Hec. (36 farmers) % age	4 – 10 Hect. (12 farmers) %age	More than 10 Hec. (10 farmers) %age
A	FA	11.1	8.3	10.0
B	Radio	0.0	0.0	0.0
C	TV	0.0	0.0	0.0
D	Fellow Farmer	0.0	0.0	0.0
E	Dealers	0.0	0.0	0.0
F	Input supplier	0.0	0.0	0.0
G	help line	0.0	0.0	0.0
H	zaraat Nama	0.0	0.0	0.0
I	Newspaper	0.0	0.0	0.0
J	Literature	0.0	0.0	0.0
K	Phone	0.0	0.0	0.0
	A,B	2.8	16.7	10.0
	A, B, C	0.0	8.3	0.0
	A,D	50.0	33.3	20.0
	A,F	22.2	0.0	0.0
	A,H	5.6	0.0	20.0
	A,F,H	8.3	33.3	40.0
	Total	100	100	100

Annex XV: Present source of advice for Citrus farmers

Base: 31 respondents

Source of advice		Below 4 Hec. (6 farmers) % age	4 – 10 Hect. (6 farmers) %age	More than 10 Hec. (19 farmers) %age
A	FA	100.0	66.7	68.4
B	Radio	0.0	0.0	0.0
C	TV	0.0	0.0	0.0
D	Fellow Farmer	0.0	16.7	0.0
E	Dealers	0.0	16.7	0.0
F	Input supplier	0.0	0.0	26.3
G	help line	0.0	0.0	0.0
H	zaraat Nama	0.0	0.0	5.3
I	Newspaper	0.0	0.0	0.0
J	Literature	0.0	0.0	0.0
K	Phone	0.0	0.0	0.0
	A,B	0.0	0.0	0.0
	A, B, C	0.0	0.0	0.0
	A,D	0.0	0.0	0.0
	A,F	0.0	0.0	0.0
	A,H	0.0	0.0	0.0
	A,F,H	0.0	0.0	0.0
	Total	100	100	100

Annex XVI: Awareness & use of soil and water quality tests (wheat-rice)

Other Operations	Category	% age of farmers responding in affirmative
Soil test awareness	Up to 4 Ha	26
	4 – 10 Ha	50
	More than 10 Ha	70
Soil tested	Up to 4 Ha	14
	4 – 10 Ha	42
	More than 10 Ha	70
Water Tested	Up to 4 Ha	10
	4 – 10 Ha	18
	More than 10 Ha	40
Following recommendation	Up to 4 Ha	40
	4 – 10 Ha	100
	More than 10 Ha	100

Annex-XVII: Awareness & use of soil and water quality tests (Citrus region)

Other Operations	Category	% age of farmers responding in affirmative
Soil test awareness	Up to 4 Ha	0
	4 – 10 Ha	33
	More than 10 Ha	42
Soil tested	Up to 4 Ha	16
	4 – 10 Ha	33
	More than 10 Ha	42
Water Tested	Up to 4 Ha	33
	4 – 10 Ha	33
	More than 10 Ha	47
Following recommendation	Up to 4 Ha	0
	4 – 10 Ha	100
	More than 10 Ha	100

Annex-XVIII: Causes of low production of wheat – Rice farmers

Major Causes		Below 4 Hec. % age	4 – 10 Hect. %age	More than 10 Hec. %age
A	Information	30.6	58.3	50.0
B	Economic crunch	0.0	0.0	0.0
C	Inferior Inputs	0.0	0.0	0.0
D	Govt. Policies	0.0	0.0	0.0
	A,B	69.4	41.7	40.0
	A,B,D	0.0	0.0	10.0
	Total	100	100	100

Annex XIX: Causes of low production of wheat – Citrus Region

Major Causes		Below 4 Hec. % age	4 – 10 Hect. %age	More than 10 Hec. %age
A	Information	16.7	66.7	89.5
B	Economic crunch	0.0	0.0	0.0
C	Inferior Inputs	0.0	0.0	0.0
D	Govt policies	0.0	0.0	0.0
	A,B	83.3	33.3	10.5
	A,B,D	0.0	0.0	0.0
	Total	100	100	100

Annex-XX: Recruitment & Profiling Questionnaire

Name of Farmer: _____

Complete Address: _____

District _____

Phone #: _____

Name of Surveyor: _____

Date: _____

Group #: _____

S1. Kindly state your age.
(Only one response)

	Age in Years	
1	Below 18 years	Terminate the interview
2	18-40 years	Continue as per quota
3	40 - 65 years	Continue as per quota
4	65 years and above	Terminate the interview

S2. Status in decision-making

1	Core decision-maker	Continue as per quota
2	Influencer	Continue as per quota

S3. What is the size of your land holding?

	Size of landholdings	
1	Below 5 ha	Follow quota
2	5 - 12.5 ha	Follow quota
3	12.5 – 25 ha	Follow quota
4	More than 25 ha	Follow quota

S4. What is the educational qualification of the respondent and head of the household?

	Educational Qualifications	Respondent	Head of the HH
1	Completely Illiterate		
2	Upto Primary		
3	Middle		
4	Matric		
5	Intermediate		
6	Graduation		
7	Masters		
8	Professional education		
9	Any Other (Please Specify)		

S5. What is your family size?

S6. What is your average household income?

	HH Income	
1	Below 10,000	
2	10000 – 25000	
3	25000 – 50000	
4	More than 50000	

S7. Do you have any other source of income?

1	Yes (please specify)	
2	No	

S8. Do you have access to?

	Facilities	Availability in the area	Currently using
1	Radio		
2	T.V.		
3	Cable Network		
4	Landline phone		
5	Cell Phone		
6	Newspaper		
7	Magazines		

S9. What are the most watched channels on T.V, radio, newspapers and magazines?

	T.V.	Radio	Newspapers	Magazines
1				
2				
3				
4				
5				
6				

S10. What type of programs/specific programs do you generally watch or listen on radio and T.V.?

	T.V.	Radio
1		
2		
3		
4		
5		

S11. Do you watch movies through CD's or DVD's?

1	Yes	
2	No	

Annex-XXI: Moderators Guideline

- A thematic guideline would be developed to conduct the FGDs. The focus areas to be covered in the discussion would be as follows:
- Profiling of the farmers; age, education, family size, other means of income, size of land holdings, etc. (this would mainly be covered through the profiling questionnaire)
- Existing sources of information and level of awareness. Reliance on different sources of media, communication means being used, access to T.V, Cable, CD/DVDs, print media, radio, cell phone, landline, and so on.
- Media habits, favourite channels and timings, advertisement recall levels, interest in informative and political programs/news, to gauge their approach towards electronic media and its influence.
- Source of information about agriculture; most influencing sources Whether its media, peer group influence, role models, some family member, Government or private sector information awareness programs etc. to gauge their tenacity to existing practices and inclination to accept changes.
- Their own perception towards the level of existing information; do they have a feeling of dearth of information, are they willing to learn about new technologies, are they ready to accept new ideas, and so on.
- To assess the specific knowledge requirements of the farmers from their perspective in terms of enhancing the profitability alongside the emphasis on better produce. What are the weak areas where they require guidance to achieve these goals.
- To find out specific point of time they reach out for information; do they get it and from where?
- Identify the reach of existing flow of information/ICT based initiatives through Government extension plan or any other non-governmental bodies / private companies; draw an exact level of penetration and degree of trust on this information. What improvements they suggest to mend the existing programs and problem areas pertaining to these set ups.
- To assess if the information given by extension service (Agriculture officer/help line/etc) actionable or do the farmers need to confer/consult with other people to understand it? Networking groups: Do the various extension modes (e.g. Agri. Ext staff/help lines] encourage farmers to also play the role of info-mediaries to their fellow farmers?
- To identify case studies / stories, if any, using “Most Significant Change” methodology. This would help to spot specific issues / problem areas in the existing development models.
- The barriers to adopting and using new technologies.... Whether its un-awareness, lack of trust, economic factors, skill deficiency, access to information, availability of inputs, infra structure or any other social inhibitions.

Concept Testing of Different Communication Strategies

- The most important part of the discussion would be to sum up the debate by throwing different communication strategies to the audience and asking them to come up with their convenience, affordability and trust to use these. Among other techniques, use of mobile phone applications

would be tested to deliver information. An effort would be made to probe for the communication preference of the users; whether Text or graphics, preferred language support, proficiency in use of applications, cost element, etc.

- Similarly more interactive ideas like street theatres, traditional help-lines, “Baithaks”, FM based programs, other electronic media usage, Farmers networks, interesting school programs with fun elements built in the educative process, would also be discussed. The farmers would come up with their reactions towards different strategies, thus making it easier to develop an approach which is closer to their mindset. Moreover, we would be able to gauge an un-biased reaction to a proposed business model within a cluster of ideas.

Annex XXII: Profile of the Research Team

Elizabeth Dodsworth: overall Quality Assurance of the project. She has 23 years in information dissemination, publishing and editorial business, most recently directing and managing project and business development in CABI where she leads the CABI-wide Knowledge Management theme. She has experience of being the Project Executive for large Knowledge Management projects covering rural knowledge systems through to access to research information. She brings her experience of being Chair of the Board of Governors of the International Food Information Service (IFIS), a registered charity which produces databases and information products in food science and technology and a member of the Board of IAALD, the global association for agricultural information scientists.

Mahrukh Siraj: Project Manager. She is experienced in management of projects and is a certified PRINCEII practitioner. She has many years' experience in IT and technology management, and a special interest in applying ICTs for development. Of late she has been involved in studying the use of ICTs for the improvement of agriculture.

Dr M R Shafique: several years' experience at the senior most levels in the Directorate of Agriculture Extension Punjab. He brings a wealth of experience, knowledge of the extension system of the Punjab province and an insight into the pros and cons of the current model.

K A Raja: He has many years of experience in agriculture extension and has served at management levels in Agriculture Extension Punjab. He has been involved in implementing special projects in Punjab. In this project he was involved in identification of information needs of the farmers and the extension workers.

Akifa Ahmed and Ambreen Siddiqui: marketing and social research consultants mainly involved in

- Social and Developmental Research;
- Consumer Research;
- Qualitative Research.

In this project these team members provided an insight into the consumer behaviour in adoption of new technologies, factors in taking decisions with regards to farm profitability, etc.

Z Ahmed: currently a Senior Lecturer at Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Karachi, in the Computer Science Department. He is a teacher, software engineer and researcher. His role was to support the research in developing application definitions for the delivery of the identified content in accordance with consumer behaviour. He worked closely with the team members involved in business model definition and content definition.



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