

A Model for ICT based Services for Agriculture Extension-Phase-II

Second Progress Report

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Contents

1. Executive Summary.....	2
2. Logical Framework	3
3. Progress report.....	9
3.1 Output 1: A functional MIS for agriculture extension, helpdesk and mobile applications for use by the farmers and extension providers.....	9
3.2 Output 2: Content developed for the system	10
3.3 Output 3: Training and capacity building of extension services.....	11
3.4 Output 4: Scale-up and sustainability planning leads to development of a robust model for adoption of the service in other states/districts.....	11
Annex-A Business Analysis V2.....	13
Annex-B User Guide E-Zaraat	108
Annex-C FAQs	146
Annex-D Baseline Survey Report.....	179

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1. Executive Summary

This project aims to improve livelihoods for farmers in target states in Pakistan through improved reach and monitoring of extension services to the farming community at a lower cost. The report covers progress in achievement of output indicators presented in the newly constructed logical framework during the second reporting period of the project.

Output 1: A functional MIS for agriculture extension, helpdesk and mobile applications for use by the farmers and extension providers.

During this phase, the MIS application, consisting of a web interface and mobile survey application have been completed. The help desk has also been established.

Output 2: Content developed for the system.

More than 500 FAQs (Frequently Asked Questions) on the four target crops; cotton, rice, wheat and citrus have been developed. This content has been informed by workshops with extension workers, baseline survey and review of extension advisory materials from the Department of Agriculture – Punjab.

Output 3: Training and capacity development of extension services.

Training in the use of the MIS application has been provided to local champions from Vehari district. The application will be launched for all staff in Vehari by the end of this year (2012).

Output 4: Scale up and sustainability planning leads to development of a robust model for adaptation of the service in other states/districts.

A series of communication activities have been completed and the project has been presented at a seminar 'What can telecoms do for Agriculture' arranged by Pakistan Telecommunications Authority. The project was also presented at 12th IT and Telecom Exhibition and Conferences, a premier IT & Telecom event in Pakistan. At both events the project was much appreciated. The events provided an opportunity to network with other possible stakeholders and collaborators.

2. Logical Framework

The project impact, outcome and output indicators have been developed and are presented here. The report is structured to report against the output indicators

PROJECT NAME								
A Model for developing ICT based services for Agriculture Extension-Phase II								
IMPACT	Impact Indicator 1		Baseline	Milestone 1	Milestone 2	Target (date)		
Improved livelihoods for the farmers in target states	Improved earning capacity of the farmers	Planned	Baseline survey data on earnings from named crops			Not to be quantified in the lifecycle of the project. Aim is to collect data for possible follow-on studies.		
		Achieved						
			Source					
			Baseline Survey, and Follow up Survey collect potential impact data which would be useful should follow-up phases of the project be pursued.					
OUTCOME	Outcome Indicator 1		Baseline	Milestone 1	Milestone 2	Target (date)	Assumptions	
Improved reach and monitoring of extension services to the farming community at a lower cost	Farmer helpline reaches 30% of farmers in target districts	Planned	Government extension services reach 10% (tbc) of farmers currently through existing extension services (figure from agricultural extension services - or add comparable figure derived through baseline survey)	Follow-on survey April 2013		Follow-on survey April 2013 (note - possible final post-project survey Nov 2013 (post-harvest)	<ol style="list-style-type: none"> Extension workers adopt ICT systems & Methodology (the new model); Surveys collect gender disaggregated data; Current costs of extension services in target regions can be obtained from the relevant authorities. 	
		Achieved						
			Source					
			Extension department data; Baseline survey August 2012; follow-on survey in April 2013; possible post-project survey Nov 2013					

	Outcome Indicator 2		Baseline	Milestone 1	Milestone 2	Target (date)
	Directorate general office of AE&AR uses the system to monitor extension service performance	Planned	Current data collection forms are manually compiled and are prone to manipulation to falsify data	Automated data collection includes GPS stamp to verify data collector is at site (December 2012)	Directorate office has access to real-time survey dashboard (February 2013)	Directorate able to produce monthly summative reports from the system (February 2013), and have on-going access to real-time data
		Achieved		Yes		
			Source			
			System stats/reporting function; Stage reports			
	Outcome Indicator 3		Baseline	Milestone 1	Milestone 2	Target (date)
	Evidence obtained that unit cost of reaching farmer with extension advice is reduced	Planned	DG data. Note current budget for Punjab as a whole is £14.34m	Focus on Vehari as intervention as support is most intense in this area.		% increase in extension costs in target areas is lower than % increase in farmers reached. It is difficult to measure this and move towards a predefined target as disaggregated figures from Govt. are difficult to obtain. Final metrics tbc. Case study approach may be recommended if baseline data is difficult to come by.
		Achieved				
			Source			
			DG data, project financial data, projections of reach at project conclusion; scale-up plans			
INPUTS (£)	DFID (£)		Govt. (£)	Other (£)	Total (£)	DFID SHARE (%)
			0			100
INPUTS (HR)	DFID (FTEs)					

	Output 1 - Systems							
OUTPUT 1	Output Indicator 1.1		Baseline	Milestone 1	Milestone 2	Target (date)	Assumption	
A functional MIS for Agriculture Extension, helpdesk and mobile applications for use of the farmers and extension providers	Analysis of user need and current practice informs system development	Planned	Formal documentation of one extension system. Formal information processes do not exist in extension departments, nor does systematic data on farmer practice in region currently exist.	Business analysis (BA) version 1 (inclusive of MIS and Web specs); Farmer survey used to inform data structures (Aug-12)	BA final version (BA is a living document the application development will start as phases within BA are completed) Oct-12	Oct-12	<ol style="list-style-type: none"> the Directorate of Agri Extension and Adoptive Research will support the collection of information and will provide information on their current business processes the Directorate will share the data available with it. ICT services, especially mobile phone usage charges remain inexpensive and accessible to all. the mobile app-based services will be accepted and used by Extension workers and the farmers Changes in the economy and service provider do not affect ability to provide the service for free to end users (farmers) Political and security conditions in country remain conducive to travel. 	
		Achieved		Yes				
		Source						
		BA						
		Output Indicator 1.2		Baseline	Milestone 1	Milestone 2		Target (date)
		Working MIS and mobile apps	Planned	Only MS-Word and MS-Excel, MS-PowerPoint are currently used to electronically document extension information. Format of material collected is variable	Development of a prototype system and application for Vehari. Local Champions from Vehari trained in the use of application (Dec-12)	Roll out of the applications in the other 2 districts. Staff in Vehari and the Directorate of AE & AR staff are trained. Application is tested in the other 2 districts (Jan-13)		Jan-13
		Achieved		Yes				
	Source							
	The applications; evidence of testing and training presented in stage reports							

IMPACT WEIGHTING (%)	Output Indicator 1.3		Baseline	Milestone 1	Milestone 2	Target (date)	
45	Working helpdesk (call centre)	Planned	Call centre based help lines do not exist in Agri Extension	Call centre specification developed	Call centre operational	Call centre has received 500 enquiries per district	
		Achieved		01-Oct	Dec-12	Jun-13	
		Source					RISK RATING
			Call centre specification; system stats				
INPUTS (£)	DFID (£)		Govt (£)	Other (£)	Total (£)	DFID SHARE (%)	
	88716		0				
INPUTS (HR)	DFID (FTEs)						
	Output 2 - Content						
OUTPUT 2	Output Indicator 2.1		Baseline	Milestone 1	Milestone 2	Target (date)	Assumptions
Content developed for the system	FAQs developed for rice, cotton, wheat & citrus	Planned	No content currently in this format	Farmer surveys used to develop FAQs (July 2012)	Review of extension advisories and extension worker workshops in target districts (July 2012)	Jul-12	
		Achieved		Yes	Yes		
		Source					
		System					
	Output Indicator 2.2		Baseline	Milestone 1	Milestone 2	Target (date)	
	400 SMS messages delivered to 1200 users	Planned	Currently no SMS service delivered	5 messages per day are being delivered		Jun-13	
		Achieved					
		Source					
		System reporting function					
IMPACT WEIGHTING (%)	Output Indicator 2.3		Baseline	Milestone 1	Milestone 2	Target (date)	
30	360 Urdu Voice messages developed and delivered	Planned	Currently no service	360 messages recorded (Feb-13)		Jun-13	
		Achieved					
		Source					RISK RATING
		System reporting function					
INPUTS (£)	DFID (£)		Govt. (£)	Other (£)	Total (£)	DFID SHARE (%)	
	59,144						

INPUTS (HR)	DFID (FTEs)						
	Output 3 - Training						
OUTPUT 3	Output Indicator 3.1		Baseline	Milestone 1	Milestone 2	Target (date)	Assumptions
Training & Capacity building of extension services	Successful one-to-one training completed with support from CABI	Planned			Workshop completed for 3 districts and Lahore workshop (Jan-13; Feb-13)	Feb-13	1. Political and security conditions in country remain conducive to travel. 2. Local champions follow mentoring plan 3. Satisfaction with the course materials can be separated from fear of institutional changes in work practice
		Achieved					
		Source					
		Final report, workshop attendance sheet and materials					
IMPACT WEIGHTING (%)	Output Indicator 3.2		Baseline	Milestone 1	Milestone 2	Target (date)	
15	Training materials found to be useful to 70% of staff trained?	Planned		Document workflows in training manual (Dec-12)	Survey at training course indicates acceptability (Jan-13. Results compiled Feb-13)	Feb-13	
		Achieved		Yes			
		Source					
		Training course evaluation					
INPUTS (£)	DFID (£)		Govt. (£)	Other (£)	Total (£)	DFID SHARE (%)	
	29,572					100	
INPUTS (HR)	DFID (FTEs)						

	Output 4 - Scale-up and Sustainability							
OUTPUT 4	Output Indicator 4.1		Baseline	Milestone 1	Milestone 2	Target (date)	Assumptions	
Scale-up and sustainability planning leads to development of a robust model for adoption of the service in other districts/provinces	Scale up plan developed for deployment in other districts/provinces	Planned		Attend Meetings/Conferences to identify potential partners and collaborators to scale-up the project	Action plan to deliver scale-up (May-13)	May-13		
		Achieved						
		Source						
		Scale up report						
IMPACT WEIGHTING (%)	Output Indicator 4.2		Baseline	Milestone 1	Milestone 2	Target (date)		
10	Sustainability model is developed on the basis of making the service sustainable in a defined number of years. Aim is to move away from need to donor fund. Moving to local support or other revenue model, specifically reviewing models to examine likelihood of user pays sustainability after 5 years	Planned		Development & review of model (May-13)				
		Achieved						
		Source						RISK RATING
		Sustainability model						
INPUTS (£)	DFID (£)		Govt. (£)	Other (£)	Total (£)	DFID SHARE (%)		
	19,715					100		
INPUTS (HR)	DFID (FTEs)							

3. Progress report

3.1 Output 1: A functional MIS for agriculture extension, helpdesk and mobile applications for use by the farmers and extension providers

Output indicator 1.1: Analysis of user needs and current practice informs system development.

During the reporting period the Business Analysis document was revised and thus milestone 2 has been achieved

One workshop was held on October 4th & 5th to review the application prototype and to validate user requirements. Nominated staff from Vehari district and the Directorate General of Agriculture Extension and Adoptive research participated in the workshop. Based on their inputs the Business Analysis Document attached as Annex-A was revised.



Workshop to review application prototype and validate user requirements-Oct 2012

Output indicator 1.2: Working MIS and user apps.

A test launch of the ICT based web application to manage and report agriculture extension information and the mobile application to collect survey data was completed.

- Appropriate hardware; servers etc. were purchased and set up to run the application. The development of the application has continued and the necessary team members to run the MIS are in place.
- The web and mobile applications have been completed and ready for a test launch. A workshop with the end users from Vehari district was held in December, 2012 at CABI –Rawalpindi office to launch the ICT based services on a test basis. The participants were given walk through of the application and their feedback was obtained on any user experience related improvements that may be required. The application is now live on CABI servers and can be viewed at www.E-zaraat.org.
- It is planned that by the end of December the services will be launched for Vehari District, thus milestone 1 has been achieved.



Workshop for test launch of the application with local Champions- Dec 2012

Output indicator 1.3: Working help desk (call centre)

The call centre for the help desk has been established and tested for incoming and outgoing calls. The solution is based on open source software. It uses Asterisk on Linux to provide the help desk functions. The Business Analysis V2 attached as Annex-A has been expanded to include the requirement for the call centre. The call centre capabilities are discussed in section 5 of the Business Analysis document. Milestone 1 has been achieved.

3.2 Output 2: Content developed for the system

Output indicator 2.1. FAQs (Frequently Asked Questions) for Cotton, Wheat, Rice and Citrus:

Farmers were surveyed to develop FAQs. Three workshops were held in Vehari, Sargodha and Sialkot in July 2012. These workshops were targeted to elicit FAQs from the farmers to the local extension workers. Extension workers from the public and private sector were invited to understand and document their perspective on what farmer knowledge needs are with respect to the four target crops in the target districts. To get an overall picture of farmer knowledge needs and local issues extension workers from eight disciplines 1) agronomy, 2) soil science, 3) plant entomology, 4) plant pathology, 5) plant breeding and genetics, 6) horticulture, 7) agricultural economics and 8) agricultural extension participated in the workshops. The workshops were participatory in nature and the group work resulted in rather interesting insights. The workshops inadvertently also became a capacity building exercise for the extension workers as apparently so many disciplines had never worked together to understand farmers knowledge needs.

The baseline survey has been a very extensive exercise. In addition to collecting information on current use of ICTs the survey collected information on farmers' current agricultural practices, their issues/problems, yields, earnings etc. The results from the survey also informed the development of the FAQs. The detailed report on the base line survey conducted in the three districts is attached as Annex-D.

The advisory information issued by the Directorate of Agriculture Information about cotton, wheat, rice and citrus for the extension workers was reviewed to inform the FAQs. A short report detailing the development of the FAQs and the list of over 500 FAQs developed is attached as Annex-C. Milestones 1 and 2 have been achieved.

Output indicator 2.2: 400 SMS messages delivered to 1200 users

The conversion of the FAQs into advisory text messages to be sent to the farmers and other people registered with the help desk is in progress and will be completed in January 2013. The messages are being translated to Urdu (national language of Pakistan). The messages will be sent to the subscribers according to the crops of their interest and according to a message calendar. The message calendar will ensure appropriate advisory messages are delivered in a timely manner.

Output indicator 2.3: 360 Urdu voice messages developed and delivered

The conversion of appropriate text messages to voice messages is in progress and will be completed in January 2013. The voice messages will also be sent to the subscribers as per a message calendar and crop of interest.

3.3 Output 3: Training and capacity building of extension services

Output indicator 3.1: Successful one-to-one training completed with support from CABI

The training strategy is to first train a batch of nominated local champions. The local champions' training is held at CABI's Rawalpindi office. The local champions' training is followed by a one-day workshop in the target district for the other extension workers. The local champions will be supported via phone full time by CABI during the project duration to help one-to-one local training of the extension staff. Furthermore a user guide for E-Zaraat, attached as Annex-B, has also been provided to help train in the use of E-Zaraat application.

As Vehari has been nominated as the focal district by the Department of Agriculture, the first training has been done for this district.

A training event of nominated local champions from Vehari was held at CABI - Rawalpindi from Dec 11th- 13th, 2012

The participants were introduced to the web application and the mobile application. They were trained in the use of the application on the web using desktops. They were also trained on how to use the mobile based survey application. This opportunity was also used to test different sized phones and tablets to input data into the survey forms. Tablets ranging from screen sizes 5 to 7 inches were tested. Different Chinese brand tablets and Google Nexus 7 was tested during the workshop. So far Google Nexus 7 seems to be the tablet of choice due to its better touch function and better price. The tablets/end user devices will be explored further when the application is launched fully early in the next phase of the project.

This training will be followed by a training workshop in Vehari district for all the local Extension managers/workers late in December, 2012. The training events in Lahore (provincial capital) and other districts; Sargodha and Sialkot are planned in January - February, 2013.

Output indicator 3.2: Training materials found to be useful to 70% of staff trained

A user guide of the application has been developed and is attached as Annex-B

3.4 Output 4: Scale-up and sustainability planning leads to development of a robust model for adoption of the service in other states/districts

Output Indicator 4.1 Scale up plan developed for deployment in other districts/provinces

Regular presentations have been given to the Agriculture Department and Directorate of Agriculture Extension and Adoptive Research.

The project was presented at a seminar: "What can Telecoms do for Agriculture?"



CABI at 'What can Telecommunications do for Agriculture?' : Courtesy PTA

The seminar was the first of its kind and hosted by Pakistan Telecommunication Authority (PTA). The seminar was well attended by local and international donor agencies/NGOs, government agriculture agencies', telecom companies and technology companies. Presentations were made by Pakistani and international speakers from Sri Lanka (LIRN Asia) and Bangladesh.

The CABI presentation of the project was very well received. This was a good opportunity to present the work funded by DFID. It was also an opportunity to network with other organizations that may wish to collaborate in this project. CABI was also part of the panel to answer questions from the audience.

A presentation was made at the IT and Telecom Exhibition and Conferences Asia now in its 12th year; this is perhaps the longest running conference in the country on this subject. Almost all important brands and businesses display their products/solutions/services in the exhibition. The event provides an opportunity for business-to-business alliances and a leveraging of mutual strengths.



CABI at The 12th ITCN Asia conference: Courtesy ITCN Asia

This years' conference was held in Karachi. Mahrukh Siraj was invited as a speaker. During the conference the possibility of extending the model and working with Kyber Pakhtoonkhwa Khwa (KPK) province was also discussed with the chair of the session Mr. Usman Arbab, Director Projects and Administration, Khyber Pakhtoonkhwa Information technology Board.

The post event report is available online and can be downloaded from <http://www.itcnasia.com/download.php>.

Significant progress has been made towards milestone 1

Annex-A Business Analysis V2

Business Analysis

E-Zaraat: ICT Based Agri-Services for Agriculture Extension in Pakistan-Phase II

Zubair Ahmed, Mahrukh Siraj, Abdul Wahab

Contents

Acronyms	3
0. Document Management	4
1. Overview Introduction.....	5
1.1 Objectives / Business Goals	5
1.2 Intended Audience.....	6
1.3 Stakeholders	6
1.4 Business Dependencies and Constraints.....	6
2. Current Processes.....	7
2.1 Business Process Descriptions.....	7
2.1.1 ICT based Agriculture services by Telecommunication Operator in Pakistan:.....	8
2.1.2 ICT based Services by Agriculture Directorate:.....	8
2.2 Current System Context Diagrams	8
3. Business Requirements.....	10
3.1 Background	10
3.2 Functional Requirements	10
3.2.1 2G Mobile Application	11
3.2.2 Smart Phone Mobile Applications	11
3.2.3 Call Centre.....	11
3.2.4 Punjab Agri. Extension & Adoptive Research (PAEAR) Portal	11
3.3 Non-Functional Requirements	12
3.3.1 Cost.....	12
3.3.2 Reliability	12
3.3.3 Security	12
3.3.4 Availability.....	12
3.3.5 Usability.....	13
3.3.6 Scalability	13
3.3.7 End User Acceptance	13
4. Proposed Process	14
4.1 Proposed Software Architecture	15
4.1.1 Components Identified.....	15
4.1.2 Server Side.....	16
4.1.3 Client Side	16
4.1.4 E-Zaraat Survey App: Client Object Model.....	16
4.1.5 Entity Relationship Diagram.....	17
5. E-Zaraat Help Desk	20
5.1 CABI Help desk capabilities:.....	21
5.2 Reporting:.....	21
6. References:.....	22
7. Appendix	23
<i>Annex-1 List of Reports from Vehari District Office.....</i>	<i>23</i>
<i>Annex-2 E-Zaraat Survey App Web Configuration Interface.....</i>	<i>24</i>
<i>Annex-3 E-Zaraat Survey App Interface</i>	<i>25</i>
<i>Annex-4 E-Zaraat Mobile App (Activity classes)</i>	<i>28</i>
<i>Annex- 5 E-Zaraat Use Cases.....</i>	<i>29</i>

List of Figures

Figure 1 : Current situation.....	7
Figure 2 Current extension department workflow	9
Figure 3 Model for ICT based Agriculture Advisory Information Dissemination	10
Figure 4 E-Zaraat's eventual aim	14
Figure 5 Proposed system context diagram for DG AE & AR automation.....	15
Figure 6 Entity relationship diagram (part 1)	18
Figure 7 Entity relationship diagram (part 2)	19
Figure 8 Inbound call flow	20

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Acronyms

AO	Agriculture Officer
DG AE & AR	Directorate General of Agriculture Extension and Adoptive Research
DOA	District officer Agriculture
DDOA	Deputy District officer Agriculture
EDO	Executive District officer
FA	Field Assistant
IVR	Interactive Voice Response
EDR	Entity Relationship Diagram

0. Document Management

Date	Version	Change Reference	Author	Reviewed By
27/03/12	V0.1	BRS	Zubair Ahmed Mahrukh Siraj	Mahrukh Siraj
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16/12/2012				Phil Roberts

1. Overview Introduction

The role of agriculture in poverty alleviation and economic growth is well documented and understood. In a developing countries like Pakistan, it is recognized as a cross cutting sector playing an important role in fuelling other economic sectors but also directly employing half of its population. Agriculture technology is expected to change in order to keep pace with factors like population growth, social, economic and environmental challenges. The role of Agriculture Extension (AE) becomes of paramount importance in this regard. The AE's significance in Pakistan has been badly affected by fewer numbers of people to service a large farmer community, unavailability of experience staff, and lack of resources (e.g. transport) to reach the needy farmers etc. The weak linkages between the extension workers and farmers were limitations identified by the study in phase-1 **(1)**. In this phase, it is aimed to strengthen these by piloting the model in three: Vehari, Sargohda and Sialkot districts of Punjab, Pakistan.

The recent interviews **(2)** with the field extension workers has revealed that most of the extension knowledge is disseminated on mobile phones in an on-demand fashion with most of the calls from farmers landing on the extension worker's mobile set. Most of the originating calls from extension worker's mobile set are for conducting various surveys. In addition to phone calls, field visits are used as tools to collect valuable information about crops, yields and area cultivated.

The extension department is equipped with basic IT facilities (Desktop, Internet and Printer), but these are unfortunately only used for composition purposes. Every deliverable is first composed using these facilities and then mailed to intended recipient. Email can be thought as a second most useful application in the current scenarios. Email shrinks the time taken for a file to travel from one city/area to another but suffers from reliability issues. A file may be requested again and again as they overlooked (all emails look the same) by people operating the desktops, each operator needs to keep conversation record thus resulting in thousands of files in his/her mailbox. Reports are consolidated manually (but still digitized) by all the above efforts at various levels (DDOA & DOA offices) and are then converted into paper form for perusal. Information on paper obviously loses advantages gained by earlier digitization **(2)**.

These are just few of the problems plaguing efficiency of the extension department. With funding secured from DFID, CABI intends to automate all extensions activities and alleviate extension department from all inadequacies of paper flows, collation and analysis. The intended solution envisages a move towards demand based extension services thus helping extension agents to reach out to the most critical problems quickly and effectively. Currently, Pakistan is suffering from larger issues such electricity shortage and higher fuel prices. The intended automation efforts will thus result in helping Pakistan conserve already strained resources.

1.1 Objectives / Business Goals

E-Zaraat's business goals are manifold, the biggest remains poverty alleviation by ensuring that small/medium scale farmers are better equipped with credible and actionable agriculture advisory information while working in the fields. The following are more obvious Business goals:

- E-Zaraat will serve to have better linkages between extension experts and needy farmers
- The above will enable the farmers to enhance their yields' quality of produce and thus help them to get a better market price for their crops.
- Extension advisory is more of a scheduled effort at the moment, farmer trainings are planned well before the crop season. E-Zaraat will enable a more on-Demand extension advisory model that will help delegate scarce extension workforce to where they are more helpful and needed.

1.2 Intended Audience

The document serves to expose its benefits to interested parties as what may be useful to them. We identify the following as envisioned in the study of the phase-1(1)

- Directorate General of Agriculture Extension and Adoptive Research (DG AE & AR)
- Government and Policy makers who need timely and processed information for effective decision making.
- Telecommunication operators who can launch exciting new mobile applications for farmers.
- Private extension may be the biggest beneficiary as they can easily strategize their business priorities for prospective customers.

1.3 Stakeholders

User Name	User Type	Access Need	Roles
Farmers	Primary, Beneficiary	R	Primary beneficiary of the whole automation effort, can call to Call Centre or receive mobile based advisory information
Extension Workers	Supporting	CRUD	Information collection and dissemination
Mobile Network Operator	Supporting	Call Metering	Provide necessary air interface for voice and data based services
Directorate of Agriculture, Punjab	Beneficiary	CRUD	Primary beneficiary of the whole automation effort
Institutions users	Beneficiary	R	Perform analysis on provided information
Private Extension	Beneficiary	R	Farmer's information
Provider (CABI)	Supporting	CRUD	Lead and negotiate issues arising from conflicting business interests

1.4 Business Dependencies and Constraints

The project's success is dependent on number of variables as outlined below:

- The project's sustainability depends on suitable settlement of suitable revenue sharing (per call/sms) with mobile operators; Mobilink has shown commitment for free air time till the duration of this phase. As suggested in the first phase, E-Zaraat services are suggested to be kept at bare minimum in the start hence suitable phased revenue sharing mechanism needs to be struck among stakeholders at a suitable time.

- Availability of electricity seems to be the biggest constraint that can undermine project's usefulness. With increasing electricity load-shedding in rural areas of Pakistan it can seriously affect project's progress.
- DG AE & AR is both primary and supporting user in E-Zaraat project. DG AE & AR's staffs' familiarity with IT based systems and their agility in providing required data can be considered as factors that may affect project's completion time.

2. Current Processes

This section includes observations from previous study already published as "A Model for ICT based Services for Agriculture Extension in Pakistan" (1) in which the limitations of the existing efforts in Telecommunication and Agriculture domains were highlighted and an ICT based model to improve upon these inadequacies was proposed. This section is also augmented by a recent and more detailed study that involved three of the model districts i.e. Vehari, Sargodha and Sialkot. Most of the work presented here comes from Vehari district as it was found to be more automation ready than other target districts.

2.1 Business Process Descriptions

Already highlighted in [<http://www.dfid.gov.uk/r4d/Output/187171/Default.aspx>], currently no system exists that provisions support to farmers and extension workers combining strengths of three domains i.e. Telecommunication Network Operators, Directorate of Agriculture Extension and Agriculture Research Institute like CABI. Moreover there is no specialized Agriculture Call Centre existing in public or private domain working to provision specialized timely and actionable agriculture related information to farmers as depicted in the below diagram.

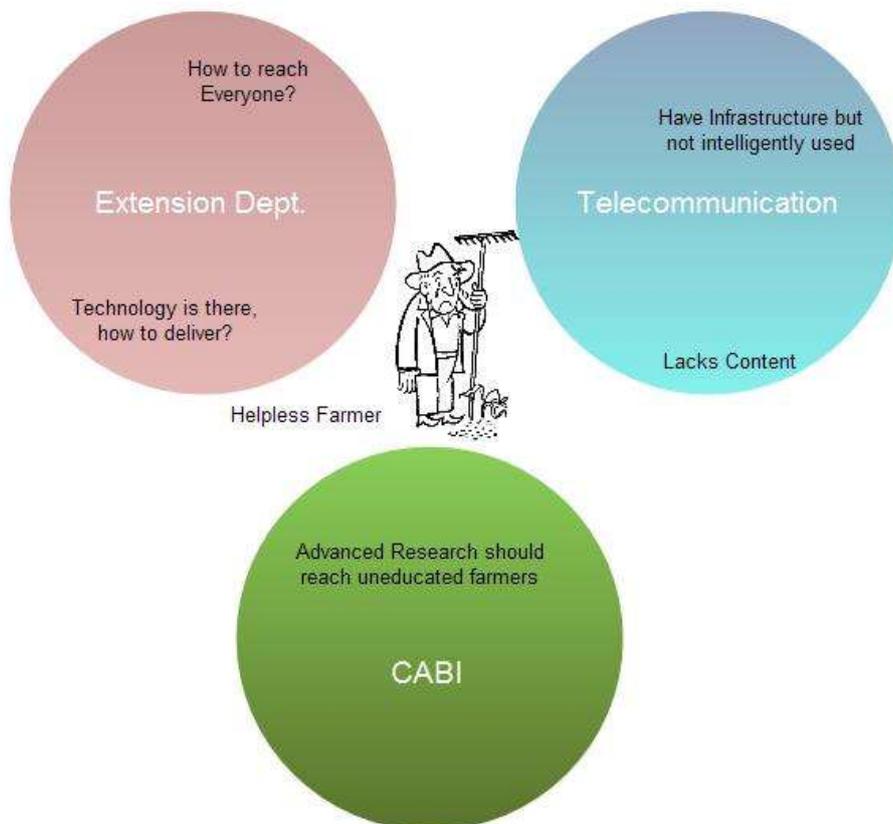


Figure 1 : Current situation

What is discussed below is concise description of what we has already been discussed in report of phase-1 (1). The description is further augmented by the recent study of the target districts.

2.1.1 ICT based Agriculture services by Telecommunication Operator in Pakistan:

Currently all five mobile operators have launched some form of agriculture advisory services for fellow farmers. Nearly all the services are IVR based; usefulness of these services is affected by lack of content and technology constraints.

Agriculture content development is a specialized field in its own which was something telecoms didn't anticipated earlier. This resulted in launch of services that were not useful and have therefore not been successful. Secondly these services are only Interactive Voice Response (IVR) based, this poses a problem as agricultural advice, sometimes diagnostic in nature cannot all be delivered through a single, IVR based approach only. Content development was thus more difficult for such IVR based services. Telecoms have started looking for other lucrative and manageable business models for similar services where their role is more of a participatory nature. Mobilink, a leading telecommunication operator has agreed to partner E-Zaraat project with CABI.

2.1.2 ICT based Services by Agriculture Directorate:

Department of Agriculture, Punjab is divided into various sub directorates. This work involves improving and automating practices at two such directorates, Directorate of Agriculture Information (DAI) and Directorate General of Agriculture Extension and Adoptive Research (DG AE & AR). As identified in (1) weak linkages exists between the two directorates. Though both the directorate provide agricultural advisories to the farming community the major differentiation between the two is that former is tasked with finding ways and means for better information dissemination (publications, radio programmes etc.) whereas the latter actually delivers the information by physically meeting/training the farmers onsite.

Already highlighted, DG AE & AR is facing severe issues in reaching all the farmers due to increasing costs, lack of skilled man power, large area covered by each extension agent and a lack of resources etc. In order to overcome these limitations they have tried ICT based services. An interesting development (ICT based) at Vehari District was use of SMS messages for disseminating agriculture advisory information. The deal was negotiated with Telenor Pakistan and advisories were issued almost 5000 mobile phones numbers on Telenor Network. However the service could not continue due to differences on tariffs between the two parties. It was also discovered that there is no record of the messages that were delivered using this service.

Much of the work conducted by extension department begins at the lowest level by personal and group visits by field's assistants and agriculture officers. The impetus of these meetings is to deliver the advisory guidelines and announcement of various schemes for the farmers by the DG AE & AR. The field extension staff also collects data and compiles reports for the DG AE & AR. Annex-1 lists the reports that Vehari's District officer Agriculture (DOA) is produces for the DG AE & AR.

2.2 Current System Context Diagrams

Currently the process is completely manual. Fields assistants are the ones who have the closest contact with farmers. All of the information they keep is on paper, to be exact, in diaries that are maintained by each field assistant. The information is then again collated by hand in a more clearer and structured manner in registers maintained by respective Agriculture Officers (AO). The AOs when prompted for a particular report information (report list can be found in Annex-1) lookup these respective registers and provide information to respective Deputy District Officers Agriculture (DDOA).

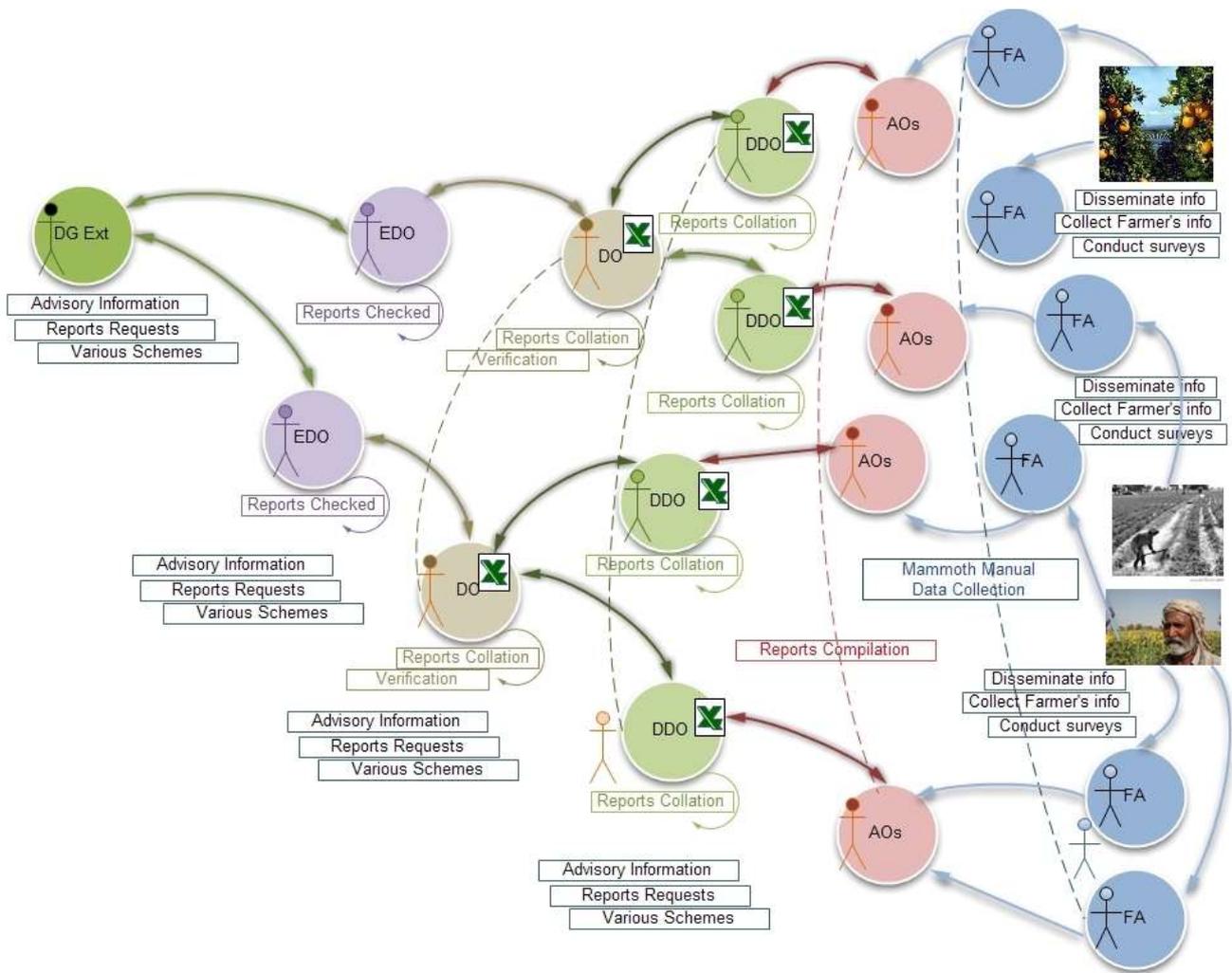


Figure 2 Current extension department workflow

DDOAs sit at Tehsil level and are provided with basic Information Technology setup i.e. Internet connection, Desktops and Printers to manage their ongoing activities. DDOAs thus compile these reports in electronic formats after consulting paper registers and reports provided by AOs and email it to District Officer Agriculture (DOA). District Office is where all the major collation and compilation takes place. Any issues of missing information is communicated to respective DDOAs and AOs through phone and emails. At Vehari, the processes for first filing every correspondence from Director Generals office and then moving it in both ways were found to be in place.

As depicted in the above diagram, agriculture advisory, report requests and agriculture scheme announcements first travel downwards and then upwards from each Field Assistant (FA) to the DG AE & AR. As can be observed, there is a huge data collection on paper at the field assistant level and most of the compilation in MS-Excel form takes place at DOA office. The process obviously suffer from severe paper based issues, such as duplication, redundancy and incase of an AO or an FA being transferred or loss of a diary the effort needed re-capture the information has to be practically started from a scratch.

3. Business Requirements

Following is a summary of what was covered in the earlier study of in phase-1 (1) to develop a better understanding of the functionalities discussed later.

3.1 Background

As depicted in the below the aim is to better facilitate better communication between farmers, fields assistants and higher authorities involved in policy making.

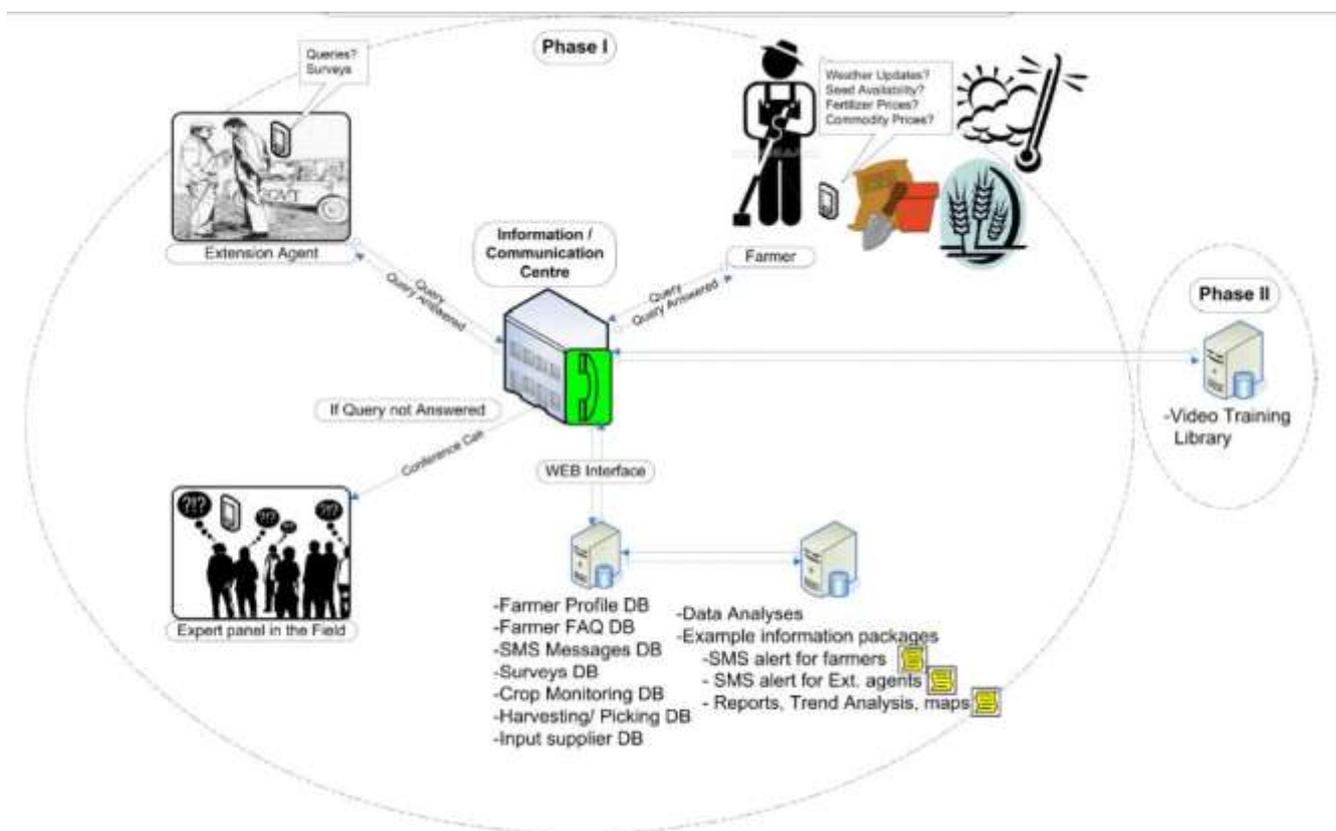


Figure 3 Model for ICT based Agriculture Advisory Information Dissemination

The current focus is to pilot the model proposed Phase I. Information and communication center (A Call Center Setup) is the hub of all the communication that takes place between the farmers and agriculture extension workers. The functional and non-functional requirements are outlined in more detail below.

3.2 Functional Requirements

The project can be segregated into three major components that are linked to complete the whole picture.

- 1) 2G technology Based Mobile Applications
- 2) 3G or Smart Phone based Mobile Applications
- 3) Call Center Solution to answer live phone calls initiated by farmers which may be converted into conference calls to liaise with extension experts.
- 4) A portal for Punjab Agriculture Extension and Adoptive Research

A more detailed description of the functional requirements in above categorizations are listed below:

3.2.1 2G Mobile Application

1. Farmer should be able to receive agriculture advisory messages in both textual(Urdu),voice and Voice messages. The message should be composed and be vetted by an agriculture expert.
2. Farmer should be able to demand basic contact info of Field Assistant who is incharge of his vilage
3. Farmer can demand approved variety of seeds (by composing a sepcial SMS) and its yeild predictions
4. Farmer can demand approved pesticide dealer (by composing a sepcial SMS) and may also be prompted in future to rate the pesticide quality of that dealer
5. Farmer can demand approved Fertilizer prices and its dealers information in his/her vicinity
6. Farmer can complain against any of the input's dealer's malpractice
7. Farmer can call E-Zaraat's Call Center by using his landline or mobile phone
8. Farmer can register for any scheme annouements initiated by the Government of Punjab.
9. Farmer can demand current prices for any commodity in the local market or Govt. fixed prices

3.2.2 Smart Phone Mobile Applications

- a. Field Assistants equipped with smart phones can input survey information.
- b. Field assistants should have already synced advisory information that they can provide to respective farmers.
- c. Field assistants should have already synced input dealer's information.
- d. Field assistants should have already information on approved seeds information by Govt.
- e. Field assistants should have already synced price information of various crop and Govt. fixed prices.

3.2.3 Call Centre

- a. Every call to the Call Centre is first checked for caller information in the caller profile DB. If this information does not exist the caller will be prompted via IVR input his/her basic information. The data requirements are discussed later in a separate section.
- b. As Call Center agent may be hired for different crops and speaclities, it will be divereted to an appropriate agent.
- c. The calls must be logged for quality and transcription purposes.
- d. After above selections, Call will be picked by a Call Center agent and his/her display will be fed with relative agriculture advisory information.
- e. The prospective caller may be asked to rate the solution provided by Call Center Agent.
- f. The Call Center may also serve as monitoring facility, as comments can be taken to assess usefulness of Field Assistant and Agriculture officer in Caller's vicinity.
- g. The Call Center's transactional data will enrich the data warehouse that can archive it to query information over a longer period of time.

3.2.4 Punjab Agri. Extension & Adoptive Research (PAEAR) Portal

- a. A dynamic portal based on the Enterprise Resource Planning principle is to be constructed that can automate all the workflows and prevalent practices at provincial level
- b. Initially the portal's interfaces will be used to collect data about farmers, input dealers, contact number of warehouses, fertilizer depots etc.
- c. The above information will be made updatable at each district level to reflect the current scenarios
- d. Separate web interfaces will be provided to show and maintain localized information at District and Tehsil levels
- e. The flow of various reports is to be automated through the intended portal
- f. Portal should allow the login/logout functionality to each staff member of DG AE & AR and its field offices

- g. Portal should allow Head office to generate any kind of reports based on the data inputs provided by the field staff.
- h. Portal should provision support to transfer all the transactional data of the season to a warehouse.
- i. Reports generated at each level (e.g. AO level) can be checked and verified for accuracy/completeness at a higher level (DDOA in this case) and may be rejected for rework.
- j. The portal should provision readymade forms for use at FA/AO levels. In particular cases e.g. pest scouting reports, these may be already filled by Fields Assistants who use Smart phone apps for enter the data

3.3 Non-Functional Requirements

The following non-functional requirements are deemed utmost important to the project's success.

3.3.1 Cost

The first and the foremost concern will be the project cost. The scope of the project is vast and therefore needs a clear understanding of various cost elements involved in the project such as software development, mobile phones sets, Servers, web-hosting and premises to host Call Center setup are just a few to be highlighted.

The project from the beginning was envisoined to run on open source technologies, negotiating free Air-Time (from Mobilink) during testing the various mobile apps and involving DG AE & AR's resources; staff and additional hardware for the successful project deployment.

This factor will be most dominant non-functional requirement in coming days of this project.

3.3.2 Reliability

The application should be reliable in many ways. First it should not breakdown as it houses more data or as more users start using it. Secondly, the most important function would be guarantee against any data loss. Although 100% reliability is hypothetical and seems very difficult to achieve but using already tested and tried methodologies can help in this regard. Mobile applications are intrinsically resilient to data and power loses by design. Web technology is quite mature and can provision better results with current tools and technologies available.

3.3.3 Security

Security is a multi-tiered concern. The physical, virtual and citizen level security needs to be addressed in this application. Physical security is quite obvious and can be achieved by providing replication and backup according to the application needs. Virtual security here means, access control to all application interfaces. By assigning access maps delineating user rights and privileges protected and controlled access can be provided to each user. Citizen level security is normally protected by legislation and ensuring compliance to it we can ensure that citizen's information is not shared without his/her own permission to interested parties.

3.3.4 Availability

Electricity seems to be one of the biggest challenges in current times for Pakistan. In order to cater to this problem it is planned to enable the application on mobile phones and tablets etc. In addition to these, power generator and Uninterruptible Power Supply units may also be added for successful deployment. Enterprise application availability seems minor problems as plethora of technology options are available to remedy this issue.

3.3.5 Usability

Usability heavily dominates the current business analysis efforts. Users' limitations and technology constraints are studied in greater detail to make the application more acceptable by personnel at all levels in DG AE & AR. Trainings have been built into the project plan. It is planned to test the level of training required with a select number of field extension staff. This will help in either modifying application interfaces or putting in more focus in preparing better training material.

3.3.6 Scalability

Application is destined to be implemented at three model districts i.e. Vehari, Sialkot and Sargodha however the aim is to eventually implement it at the province level. System's architecture is designed to cater this important requirement in mind. The application design can be equipped to be more resilient to growing hits and lagers data volume requirements. It is always easy to buy expensive hardware and solve scalability issues but better application design such as concurrency, parallelism, better memory use, and minimizing useless I/O can yields better results.

3.3.7 End User Acceptance

The end user acceptance is vital part of the deployment of the services. A plan for end user acceptance testing will be developed. The major criteria for end use acceptance are:

- a. The choice of the device for collecting data from the field is very important. Interviews with the field extension worker and the state of electric power in the districts clearly suggest use of mobile devices for data entry. Various models of smart phones with different screen sizes will be field tested in Vehari district to select the most appropriate device for use in the field.
- b. Once developed each use case will be tested and approved by a focal group of the extension staff the 2G applications will be tested with a focal group of farmers.
- c. The web portal will be tested and approved by the DG AE & AR and DAI staff based at the provincial headquarters.
- d. All the functional and non-functional requirements listed in sections above will form part of the end user acceptance testing plan.

4. Proposed Process

E-Zaraat has been described in detail in the business requirements section. At a higher level, it envisions combining efforts of three domains as their combination can yield better results.

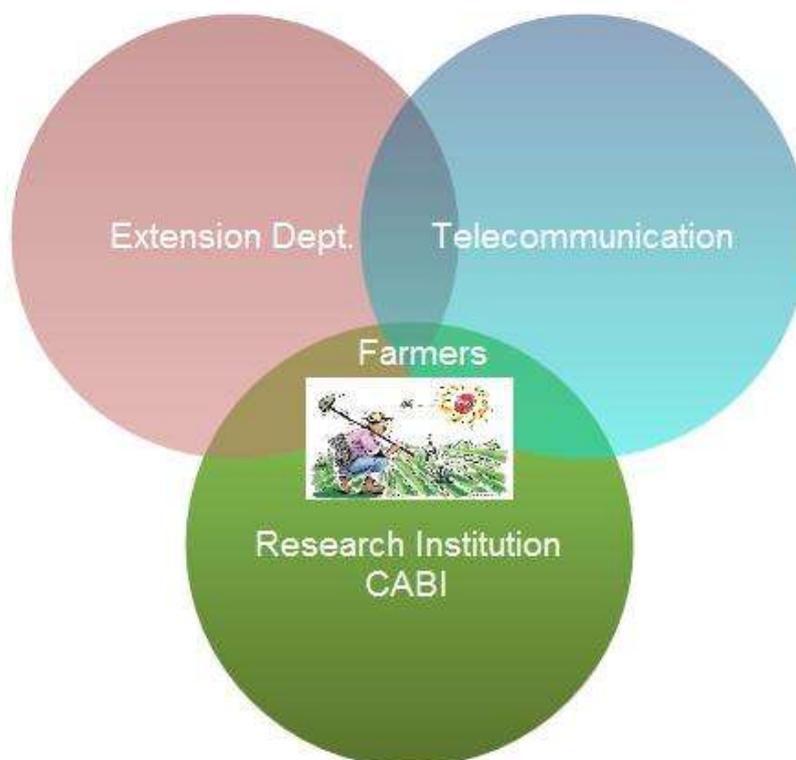


Figure 4 E-Zaraat's eventual aim

Proposed business process includes what has been depicted by figure 4 and is now augmented by study to automate DG AE & AR's internal working for reaching farmers working in fields. The diagram below (figure 5) has a close resemblance to current system context diagram captured in figure 2.

As depicted in figure 2, agriculture extension staff is already using MS-Excel to compile reports at the DDOA's office. The information is then emailed to DOA office where all the information is collated and then sent from EDO to DG AE & AR to be further compiled and collated. It is after such a huge manual and time consuming effort that the DG AE & AR has the final information on the situation in the field.

As depicted in figure 5 the digitization starts at the FA level. Field Assistants are provided with mobile phones for entering their day to day information. The application requirements are kept flexible at this end, as there might be cases where FAs do not have mobile phones and are instead provided with internet enabled forms which can be filled after successful login to the application at DDOA's office or any other place internet facility is available. The Agriculture Officer (AO) thus gets information that is already filled in by FAs hence his job may be limited to viewing it over the web, making amendments if required and validating the data for use at the next level. The AOs input will then be collated at DDOA level. DDOA thus has a similar role of checking/verifying what has been sent by the AOs. A caveat can be DDOA rejecting certain report during scrutiny of the compiled report and may ask a particular AO to resend his/her report with amendments. It is after amended report's arrival and its collation with the rest of the reports' data that a successful compilation completes. DDOA will accept the report and it will become available for use at the EDO office. EDO's role is almost similar to DDO and after his/her acceptance it is forwarded to the DG office for final collation at the provincial level.

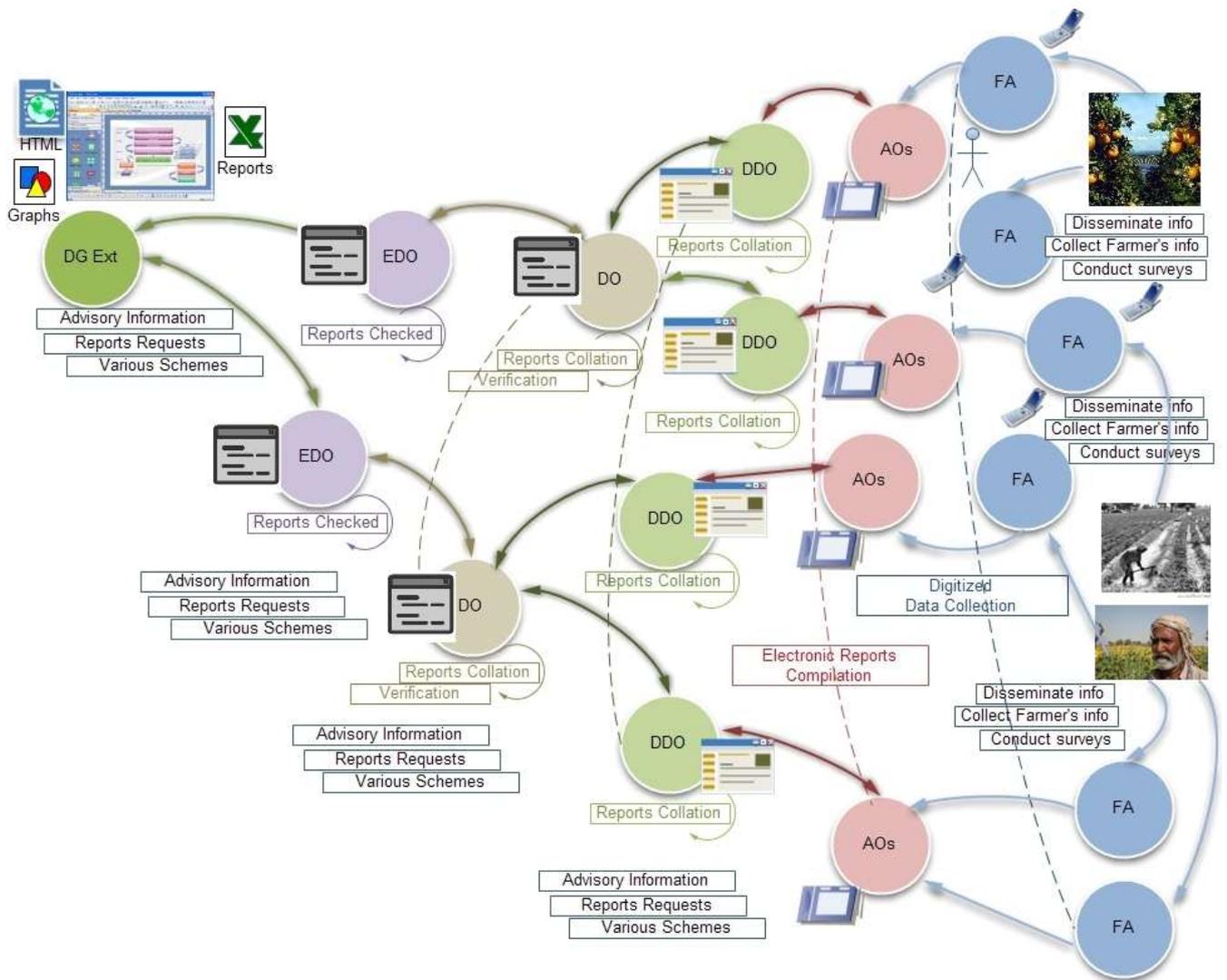


Figure 5 Proposed system context diagram for DG AE & AR automation

4.1 Proposed Software Architecture

4.1.1 Components Identified

The below discussion covers, already mentioned processes thus reflects in our initial formulation of The Software Architecture of E-Zaraat. Two of the most major components of EZaraat project are highlighted below as:

- A mechanism to generate variable format (columns) reports that are kept centrally at the DG level. (**E-Zaraat Survey App**)
- A mechanism to move the data bundles from one entity (AO, DDOA, DOA etc.) to another.

The first component was identified after visits and interviews with extension staff at Vehari and Sargodha, as some of the report formats that existed earlier were changed to newer ones. The second component is pretty obvious from the above diagram as information bundle has to move forward and backwards. Two competing technological solutions exist to handle the latter one and are known as workflow and Business Process Management (BPM). Workflow technology has seen quite a period but is dominated by relatively new BPM products. As the analysis is going to take on perspectives of the headquarters in the next stage, it is planned to choose a suitable BPM solution to suit eZaraat's needs.

A working prototype is developed at CABI South Asia, Pakistan office to create variable formats for data input forms that can be used for survey data collection on mobile devices. The application is developed in Android operating system due to its open source and free delivery mechanisms. The functionality can briefly be summarized as follows:

4.1.2 Server Side

- Login/logout facility for overall administrator
- After successful login, administrator through a form based facility create the survey name, the controls that needs to be placed on the form such as a form may contain textbox for storing name and a radio button for storing gender information, it may also contain a select box with predefined fields for selecting city/village, checkbox and other controls such as text area etc.
- The administrator can assign this form to a particular field staff by entering his/her basic information, his/her password and also his/her mobile device IMEI number. This would make sure that the application if installed would still not be able to run if it is not allowed by the administrator.
- Administrator can create more than one form that can be synced on the devices, administrator can even change the forms that are assigned to another field staff at any particular instant.

4.1.3 Client Side

- The field staff logs in with credentials maintained at the server side by the administrator.
- As he/she logs in, the forms created for him/her are synced on the device for data entry.
- In the absence of the Internet, the data remains stored in the client device's local database.
- The field staff after completing the data entry and connecting to the internet connectivity (autonomously by WiFi) will upload the data.
- As the field staff, captures survey data, timestamp and GPS/WIFI/Internet coordinates are also captured automatically.
- The field staff can also take image of the desired location/plant etc.

The same application is planned to be adapted to Web-to-Web model from its current Web-to-mobile model.

4.1.4 E-Zaraat Survey App: Client Object Model

The mobile application development approach is proposed to be modified to a completely modular approach. The application is to be divided into packages, each of which signifies the 5 separate layers of the application. At the top most layer, sits the user interface or the application screens. The operation functions sit below the aforementioned layer which aid in the retrieval and generation of data from the layers below. The enumerated functions at the layer below identify the types of various functionalities that are to be processed from the layers below and pushed to the above layers. The data object classes which are the exact replicas to the ones in the web application sit on the next and the fourth layer. These are to be utilized by the application's last layer, the configurations, which communicate with the internal device database and the web to synchronize the data between the device and the web application.

Support for multi lingual form is proposed to be added to the web and Android application. This would add the ability to compose forms, produce results and display data in multiple languages, in the current scenario the "multiple languages" would be Urdu and English. "Form" is the most important class that represents a form (already configured on the server side) that has to be synced on a field staff's device. Form has an array of controls that can be displayed on the field staff's device for data collection. The controls are first retrieved from the database and then displayed on the form. The Android platform provides a flexible facility to generate any complex controls from basic ones. In the

prototype only TextView(labels), EditText (text boxes), Spinner (dropdown menus), RadioGroup (radio buttons), and CheckBox (check boxes) are used. A very simple example of combining two basic controls could be a control generated by combining drop down menu control with check box such that we may get a Spinner(dropdown menus) that allows the user to choose multiple options, i.e. instead of a single choice from the dropdown menu, the user could choose more than one option for that single dropdown menu.

Further proposed additions to the Android user interface controls include: the Date Picker dialog which would allow the user to select dates from a scrollable calendar, pop ups and dialog boxes are added to the application to view the "Loading" and similar messages to the user while the device is busy processing data. A splash screen is proposed to be integrated into the application, signifying the e-Zaraat application's logo. The other classes are self-explanatory as Device class captures characterises of a particular device supported by the solution, either its supports GPS location or not. Session abstracts a particular time when a user is recording survey data in the survey application. The data stored is in the local database of the mobile phone as internet connectivity is not usually available in the rural areas. Annex-3 contains images from the website (<http://www.e-zaraat.org/EZaraat/>) and E-Zaraat Survey App.

The class diagrams of various Android Activities and Database Accesses classes for SQL Lite is attached as Annex-4.

4.1.5 Entity Relationship Diagram

Entity relationship diagram (EDR) depicted in figure 8, includes support of the Use Cases and the Survey Application proposed for E-Zaraat application. For most of the cases that for each new form created and assigned to a field staff, no changes are required in the existing database i.e. no new table is required to be created. We may also like to clarify that this database schema can be thought of more as a transactional store and warehouse structure will be different from it.

As depicted in the EDR diagram, there are two separate entities to store farmer's and Extension department personnel's (user table) information. The user type captures various designations and function description of these staff members. The location is identified by one to many relationships from province to village level. It is only at Tehsil level that information about various input dealers is kept and hence there is only have Tehsil's ID in Dealers table. One dealer can supply various input as captured by DealerType entity. It is the same table from where different surveys originate at the Tehsil level. Roles and userRoleMaps are tables that are dedicated for access control privileges. The project enrolment tables are for recording the data of the various schemes announced by the Govt. of Punjab for farmer to improve agriculture methods and enhance their yield quality.

The tables Forms, User-Form-Association (not following the actual names for clarity), Controls and Control-Form-Association are what is used by the Survey Mobile application for configuration of forms that will be used to collect field data. In order to sort out individual records on survey, forms and their records there are tables, forms, Records and Data-Records. The design is flexible enough to accommodate new controls and forms to be recorded in the database.

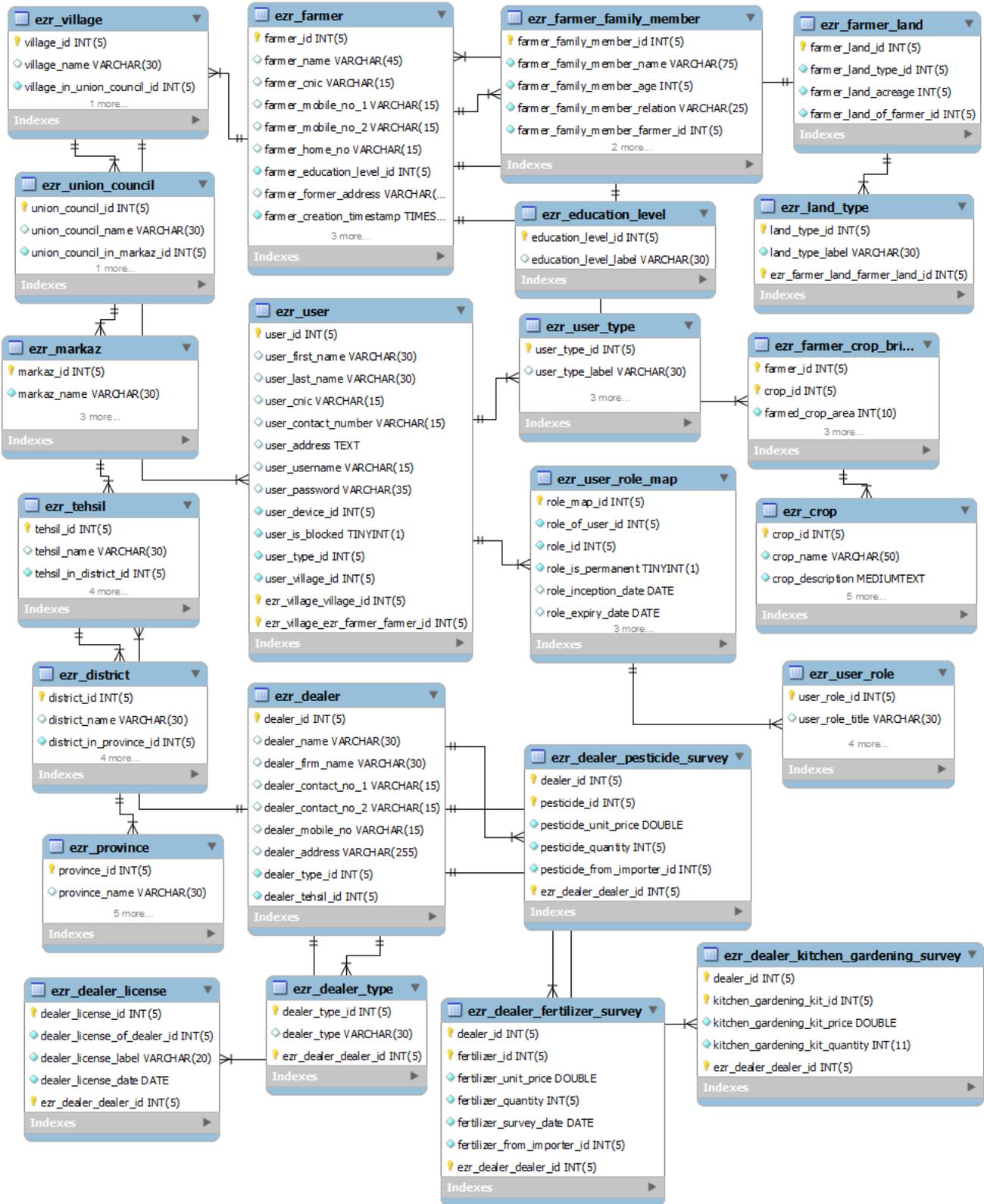


Figure 6 Entity relationship diagram (part 1)

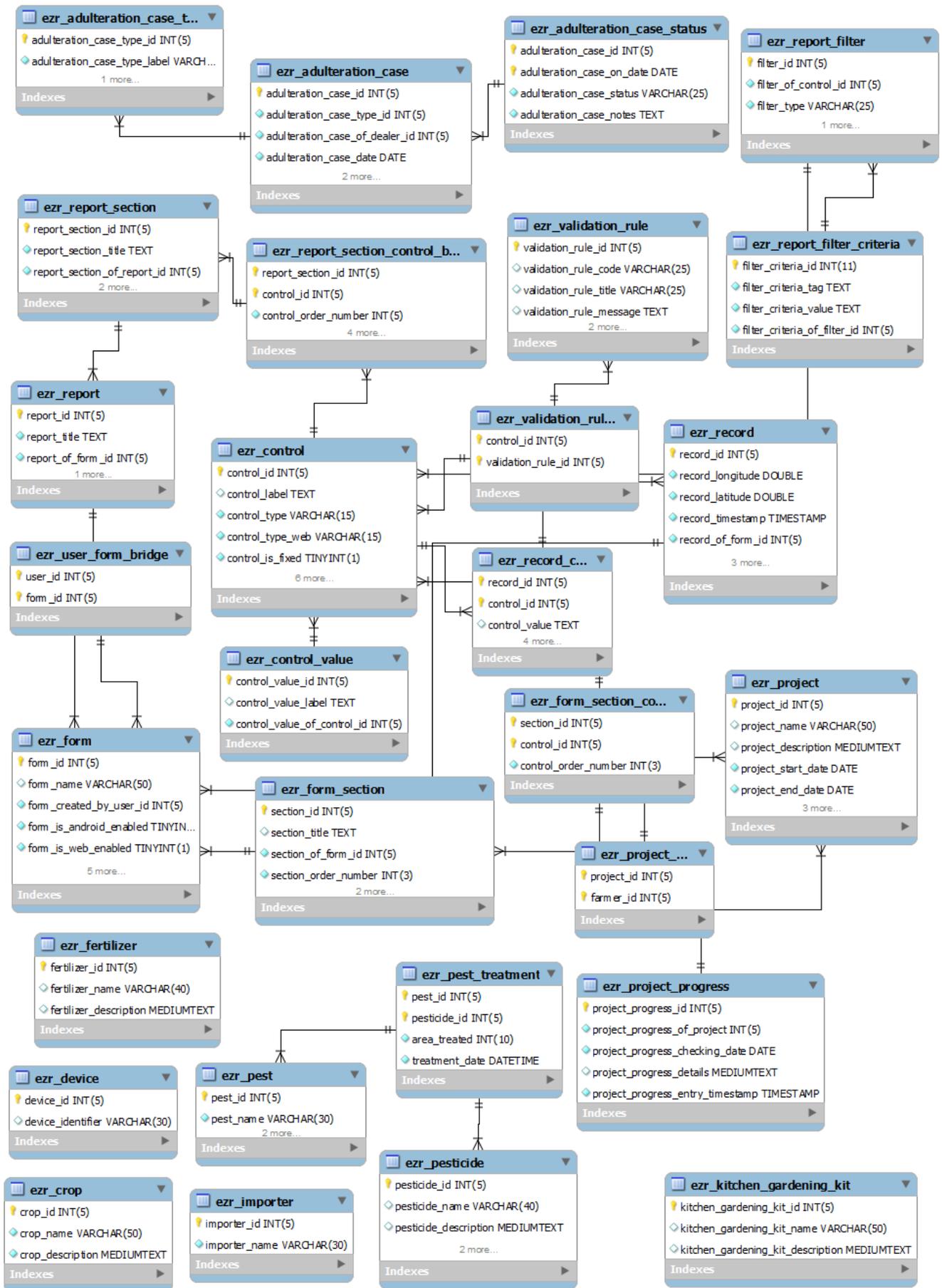


Figure 7 Entity relationship diagram (part 2)

5. E-Zaraat Help Desk

CABI's help desk solution is designed for receiving and transmitting a large volume of calls. Inbound calls can be made by customers, for example field agents or farmers to obtain information or ask for some help. In contrast, outbound calls are made by call centre agents to field agents or farmers. Call centre staff will be organised into a multi-tier support system for more efficient handling of calls. The first tier consists of operators who will initially answer calls and provide general information. If a caller requires more assistance, the call will forward to the second tier (in the appropriate department/field agent depending on the nature of the call). In some cases, there can be three or more tiers of support. Typically the third tier of support is formed of highly skilled technical support staff. The diagram below will explain the inbound call flow.

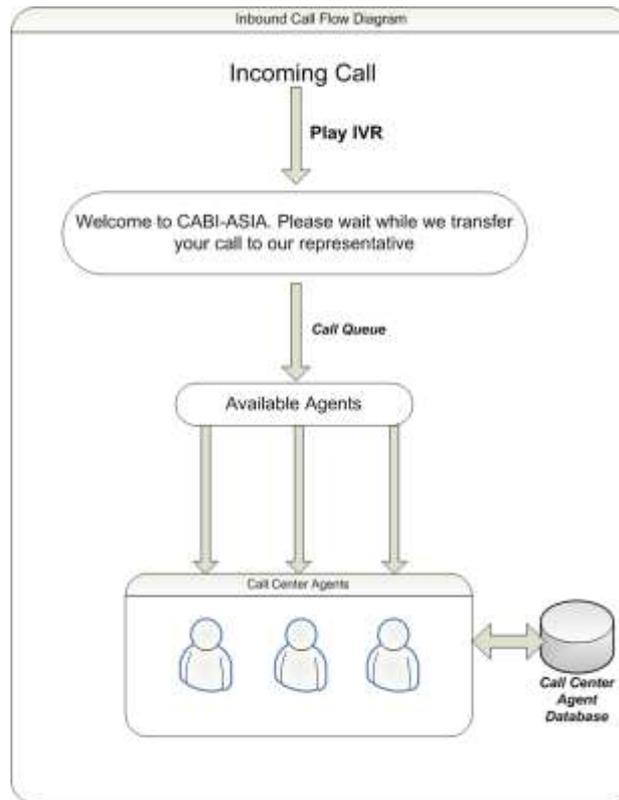


Figure 8 Inbound call flow

The help desk is proposed to be an Asterisk based call centre solution. Asterisk is a Linux based, Open Source and free Call Centre software, that provides all the features expected from a fairly complex Call Centre. Asterisk is designed to allow new interfaces and technologies to be added easily. Its goal is to support every kind of telephony technology possible (4).

SIP, Session Initiation Protocol, is used as VoIP Protocol for the help desk. SIP is an application-layer control (signalling) protocol for creating, modifying and terminating calls.

Database, mysql is used as the database for Asterisk. Database is proposed to be configured/installed on the same server on which Asterisk is installed. The database will store following type of data:

- Call Center Agent ID/Password
- Stats of Call Center Agents i.e. number of calls handled or answered by a call center agent

5.1 CABI Help desk capabilities:

System should be scalable enough to handle multiple Call Centre Agents with 100 simultaneous inbound/outbound calls. Additionally, the help desk should be able to cater to the following requirements:

- Incoming call
- Outgoing call
- CLI
- Internal calling
- Caller Line Identification Presentation
- Call Transfer
- Three way calling
- Ring Group
- Multiple IVRs and Auto attended
- Multiple Music on Hold
- Multiple Queues
- Call Recording
- Time based announcement/IVR
- Pickup group
- Call forwarding
- Abbreviated dialling
- Conference Room
- Incoming call screening
- Call monitoring
- Call recording
- Auto Dialler
- BLF (Busy Lamp Field)
- Echo cancellation

5.2 Reporting:

Call Center System should provide following type of reporting for Call Center Agents:

Total number of answered calls	Total number of answered calls in a queue and total number of answered calls by an agent.
Total number of abandoned calls	Total abandoned calls in a queue
Total talk time of an agent	Total talk time of an agent
Total answered calls of an agent	Total number of answered calls of an agent
Total and average hold time	Report should give full information of total hold time of calls that remained in a queue unless it was attended and average hold time for all calls landed in a queue.
Hourly, Daily, Monthly and yearly base call log of agents	All upper reported should be available in Hourly, Daily, Monthly and yearly basis.

6. References:

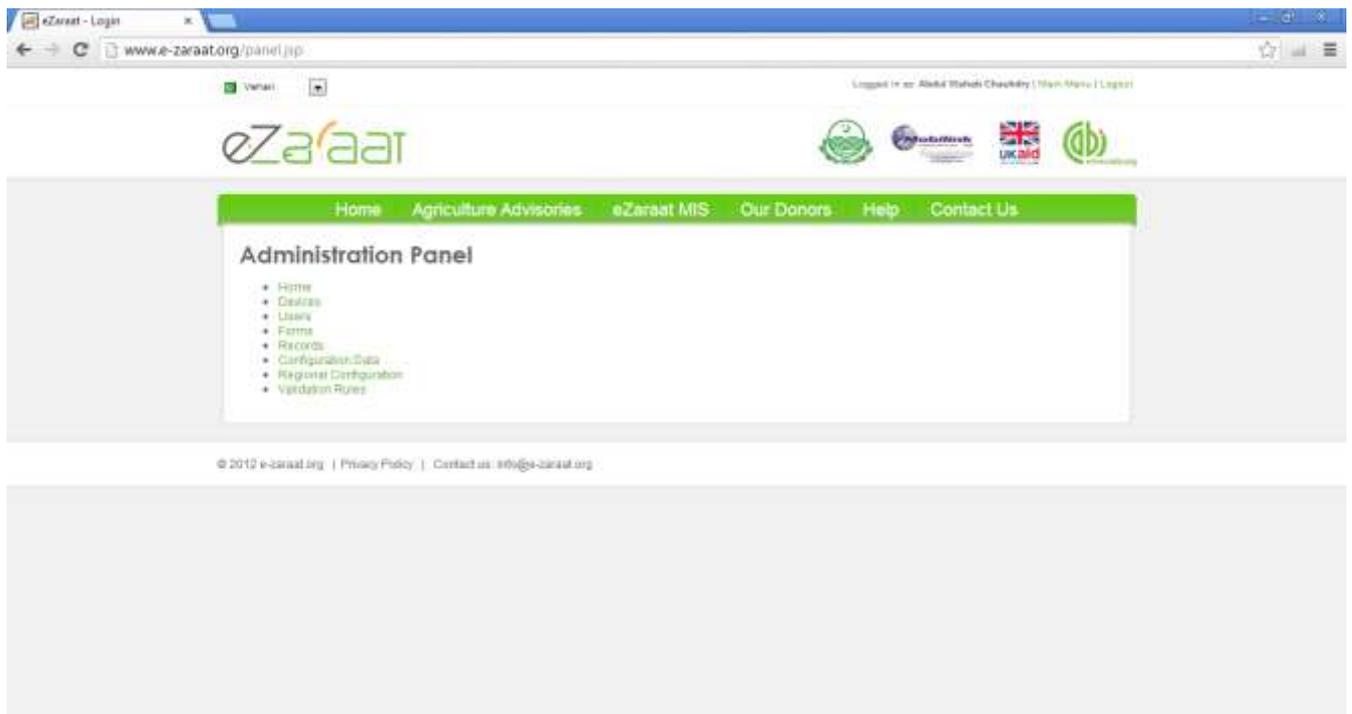
- 1) Siraj, M. A model for ICT based services for agriculture extension in Pakistan. R4D. [Online] March 2010. <http://www.dfid.gov.uk/r4d/Output/187171/Default.aspx>
- 2) Extension Dept in Vehari, Sargodha and Sialkot. January and March 2012.
- 3) Mahmood, Tariq, et al., et al. Meeting to Review the E-Zaraat Design. CABI-Rawalpindi, October 4th & 5th, 2012.
- 4) Digium the Asterisk Company. [Online] www.digium.com

7. Appendix

Annex-1 List of Reports from Vehari District Office

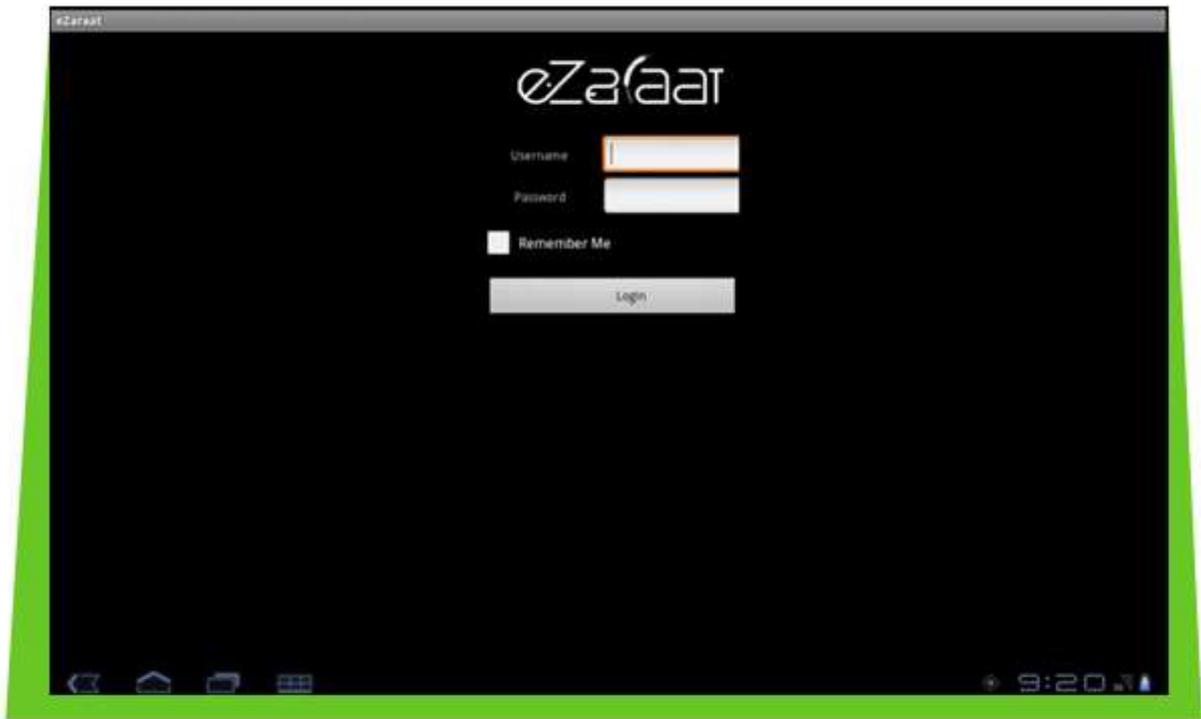
	Report Description
1	Daily ABC Urea
2	Daily Progress of Kitchen Gardening Sale of See Kits
3	Rain Fall as and When
	Weekly Reports
4	Monitoring of Fertilizer Rates
5	Canal Water Supply Position
6	Sowing position of Rice Crop
7	Sowing position of Maize Crop
8	Sowing position of Sugar Cane crop
9	Sowing position of Sunflower
10	Sowing position of Wheat Crop
11	Sowing position of Cotton Crop
12	Pesticide and Fertilizer Sample Drawn
13	Pest Scouting of Cotton Crop Drawn
14	Farmer training programmes
15	Progress of Seed Graders
16	Stock Position of Fertilizers
	Monthly Reports
17	Crop Situation
18	Pesticide Sample
19	Fertilizer Sample
20	Weather Data
21	Maintain record of fertilizer micronutrient products
22	Monitoring of anti-adulteration Campaign of Pesticide on A & B Performa (Inspector-wise)
23	Monitoring of anti-adulteration Campaign of Fertilizer on A & B Performa (Inspector-Wise)
24	Monitoring of urea Fertilizer Activities against high pricing during
25	Summary of fertilizer cases status wise from 1998 to _____
26	Summary of fertilizer cases from 1998 from September 2011
27	Pesticide fertilizer raids from January to fortnight summary of samples
28	Pesticide fertilizer on Performa ABC & A to G Performa
29	Temperature data

Annex-2 E-Zaraat Survey App Web Configuration Interface

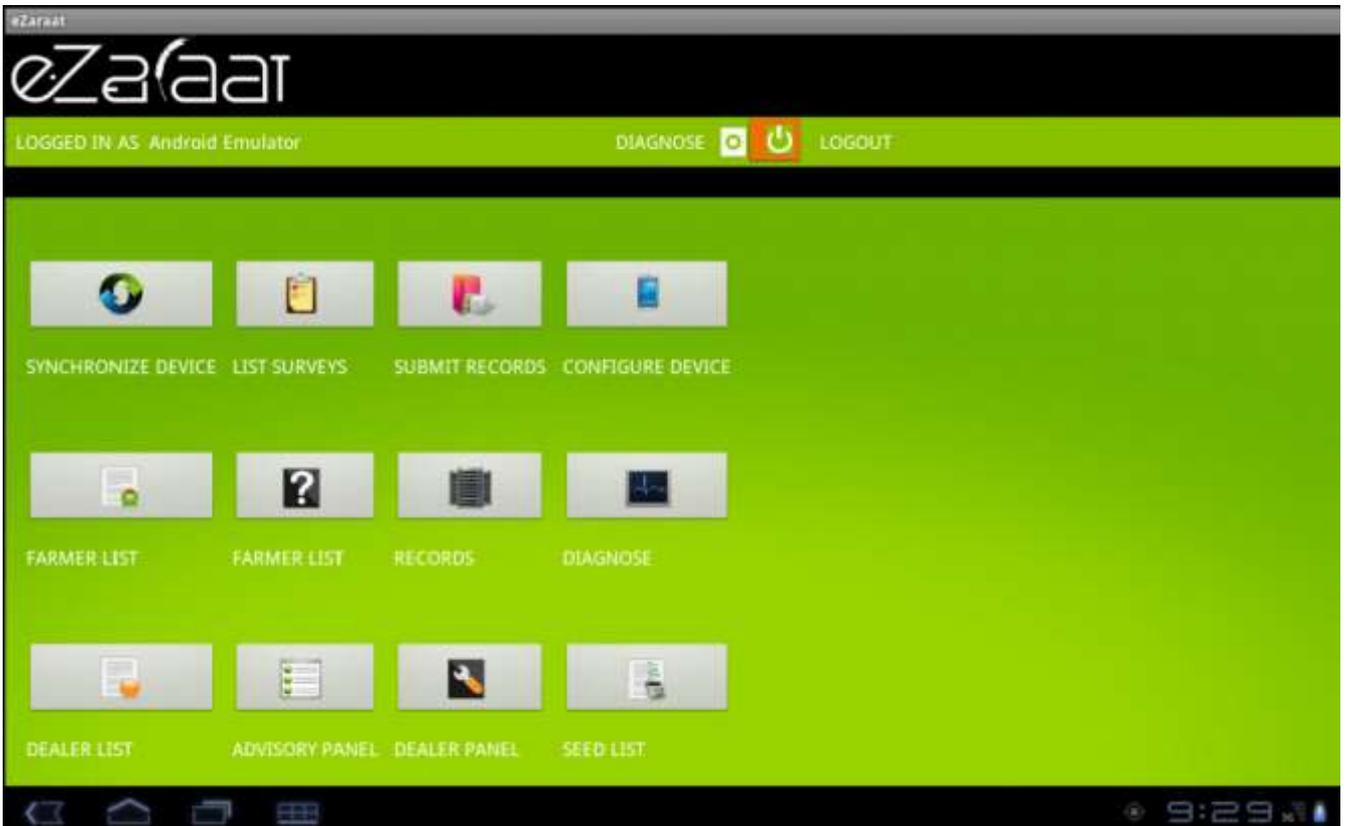


Survey App Configuration Screen

Annex-3 E-Zaraat Survey App Interface



Login Screen

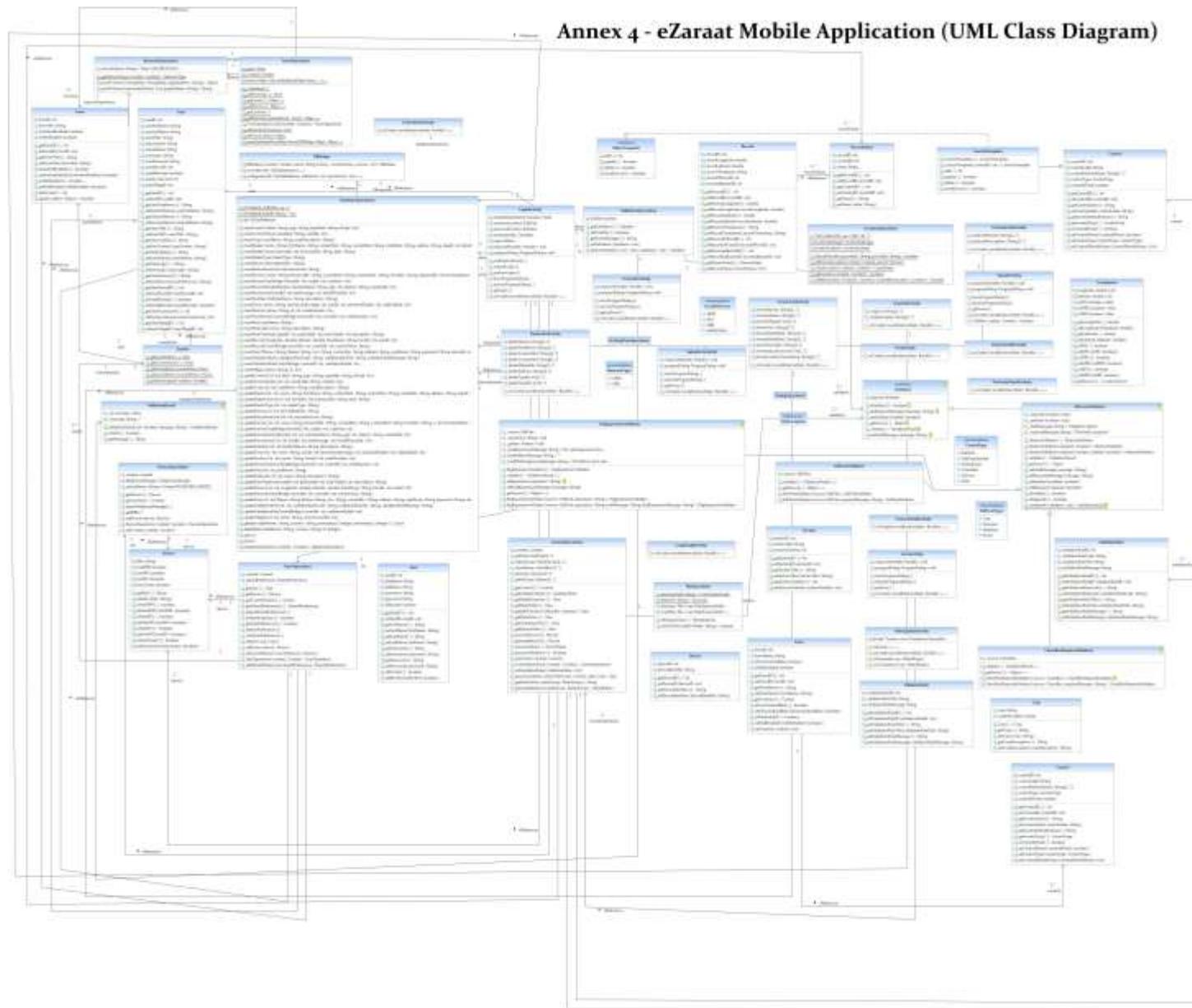


Welcome Screen



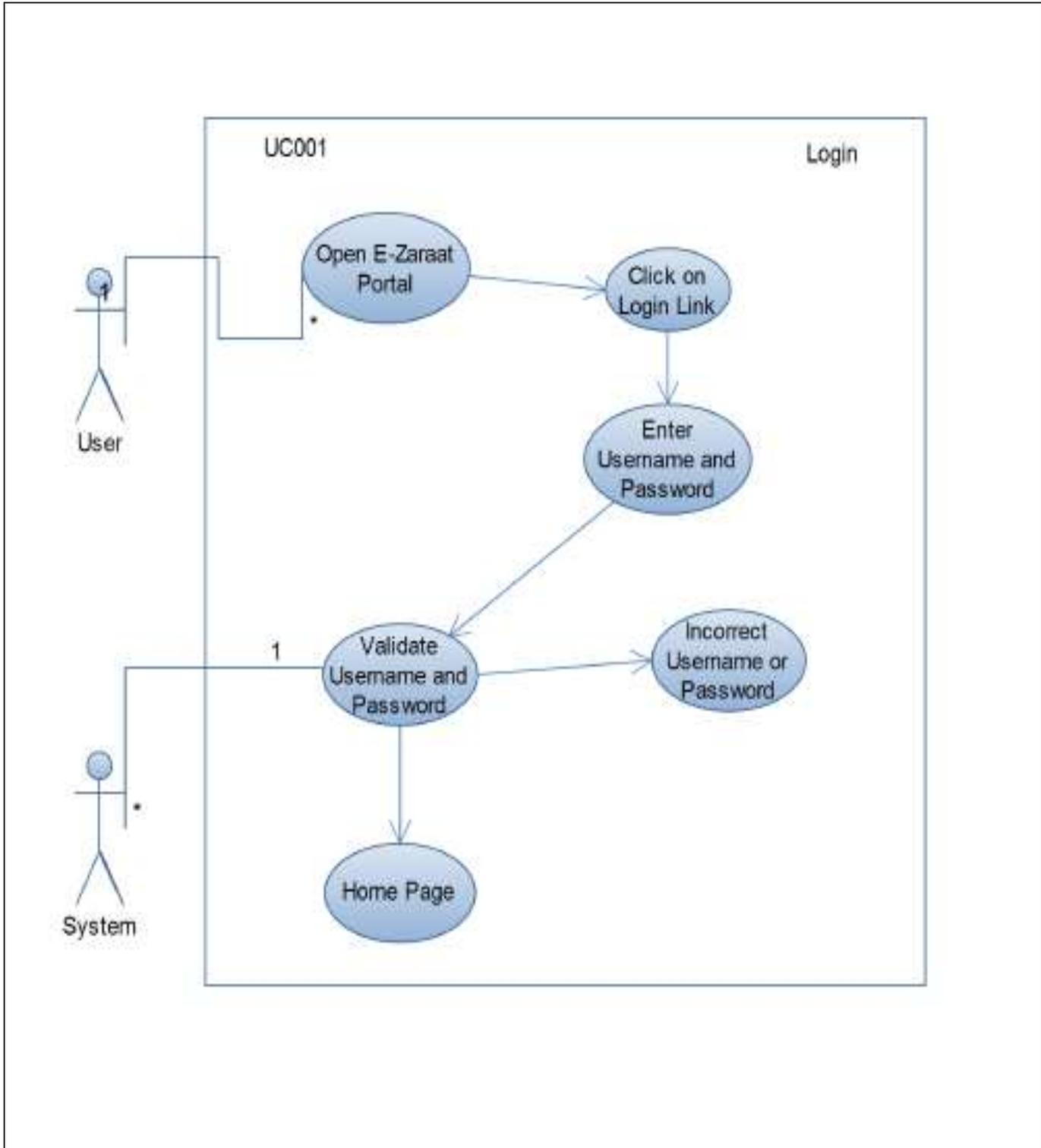
A Sample Survey Screen

Annex-4 E-Zaraat Mobile App (Activity classes)



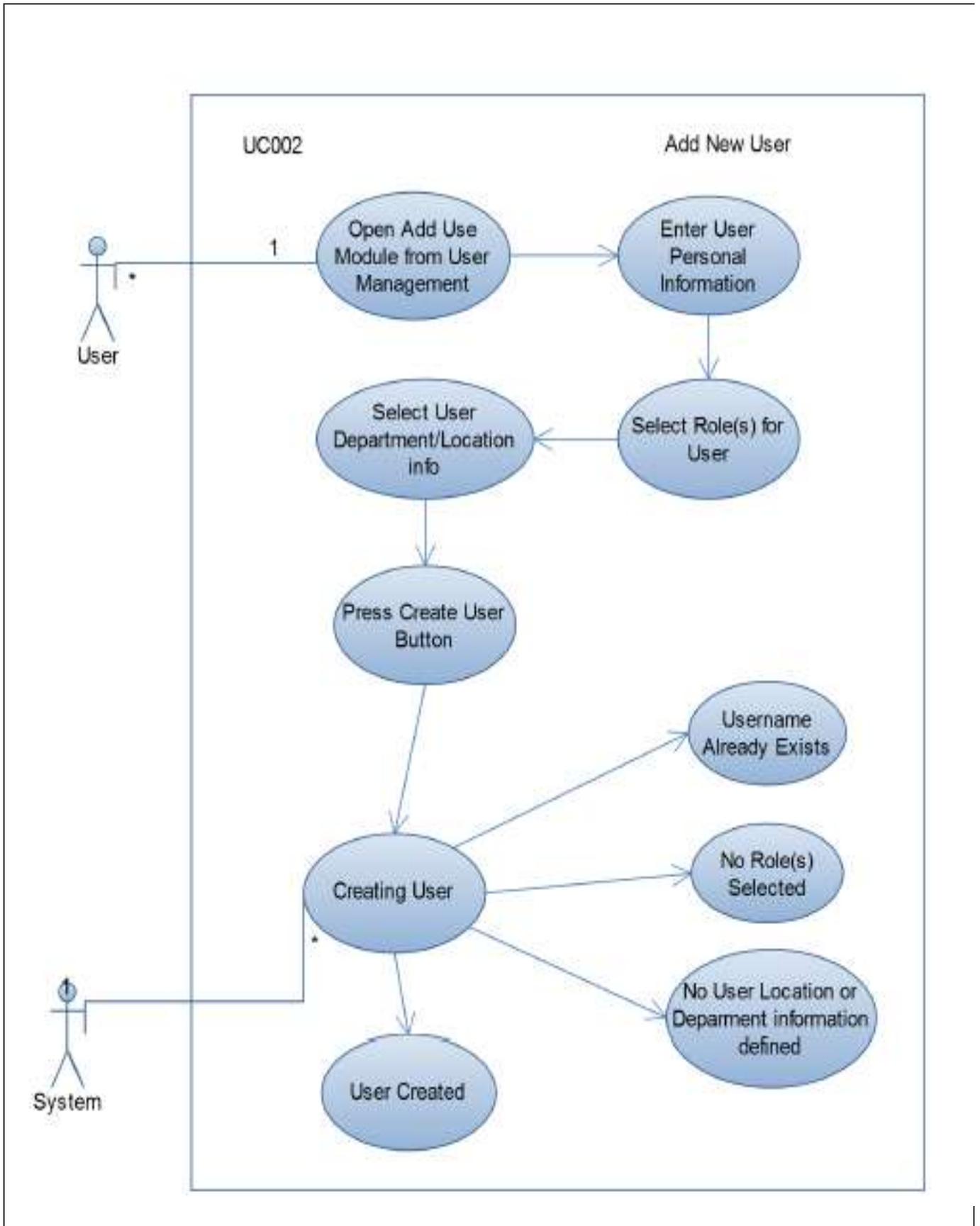
1. Login

User Case Ref	UC001	
User Case Name	Login	
Description		
This user case is to login user into system		
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User Open E-Zaraat Portal 2. Click on Login link 3. Enter User Name and Password 4. System will re-direct user to his/her home page according to role assigned 	<ol style="list-style-type: none"> 1. System shows error if user name or password field are empty 2. System shows error if user doesn't exist in system 	
Non-Functional Requirements	N/A	
Pre-Conditions	User account must be created	
Post Conditions	User is logged in into system	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



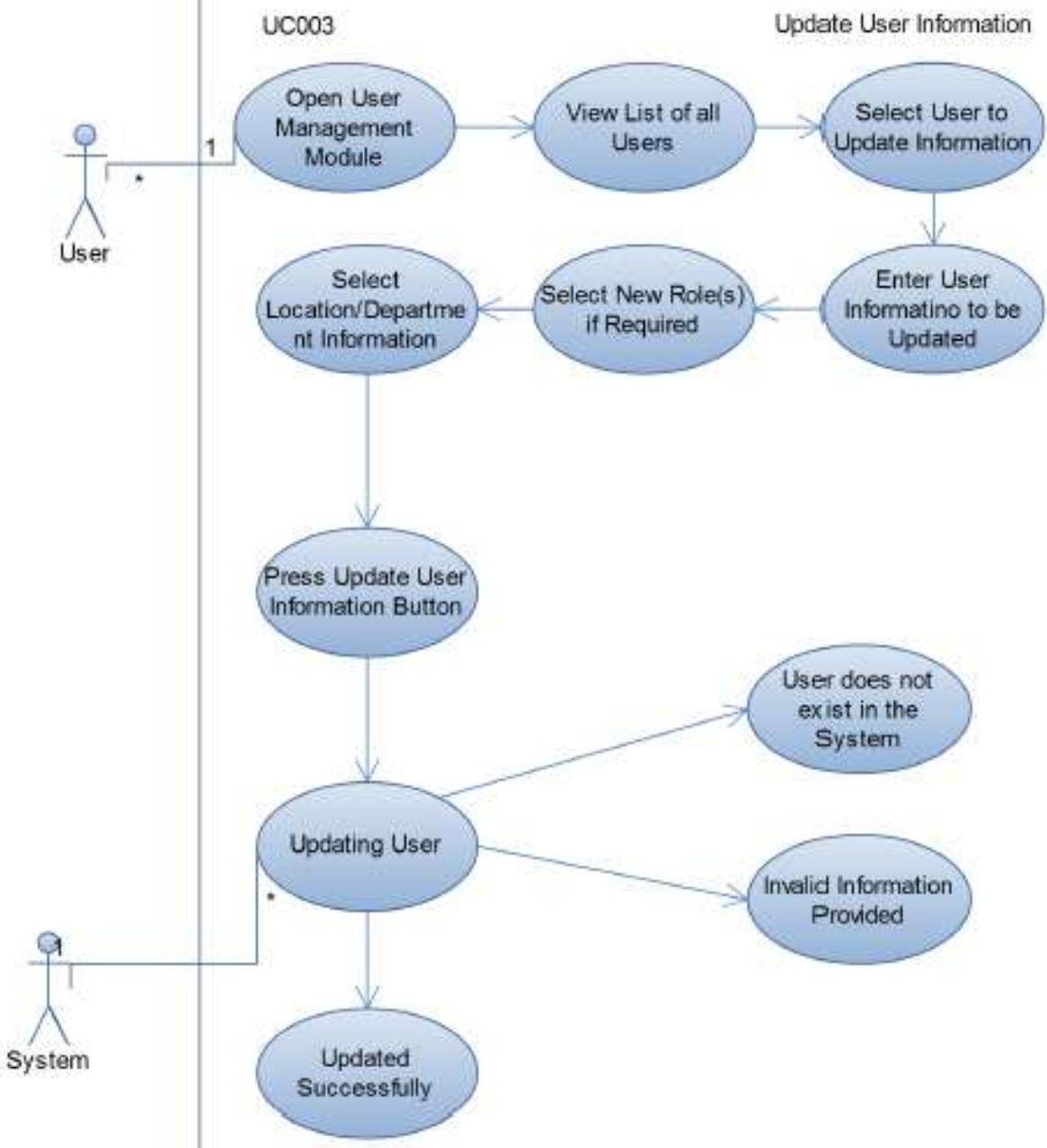
2. Add New User

User Case Ref	UC002	
User Case Name	Add New User	
Description		
This user case is to add new user in system		
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. Open User Management add user module 2. Enter user personal information 3. Select role(s) for user 4. Select User department /location info 5. Press create user button 6. System will create new user in system and will show appropriate message 	<ol style="list-style-type: none"> 1. User name already exists 2. System will prompt message if admin haven't selected role(s) 3. System will prompt message if admin haven't selected new user location and department information 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to create new users 	
Post Conditions	<ol style="list-style-type: none"> 1. New user must be created in system and he must be assigned a role 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



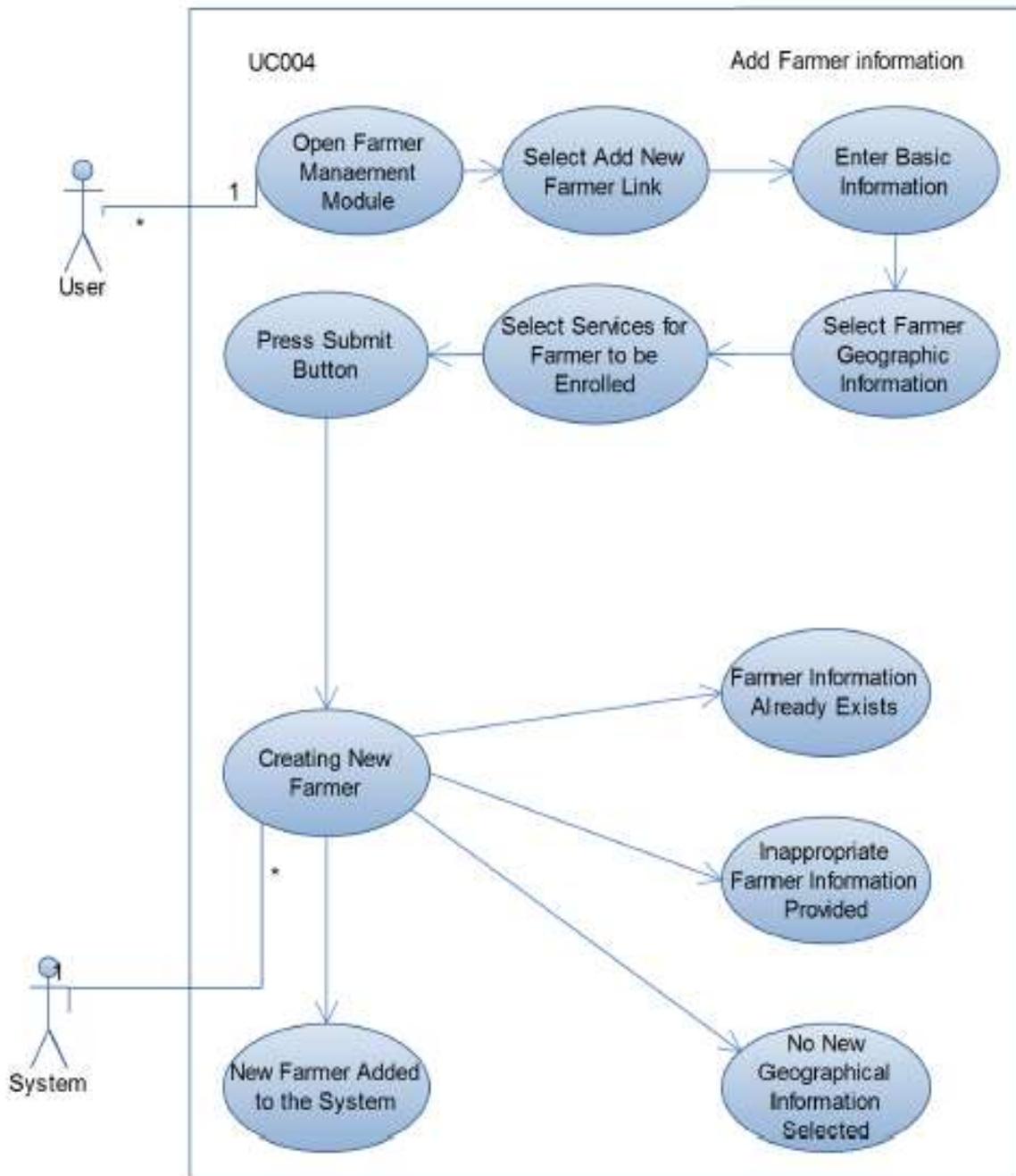
3. Update User Information

User Case Ref	UC003	
User Case Name	Update user information	
Description	This user case is to update already exist user information	
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. Open User Management module 2. View list of all users 3. Select user to update information 4. Enter user information to be updates 5. Select new roles if required 6. Select location/department info 7. Press Update user info button 8. System will update user information and show appropriate message 	<ol style="list-style-type: none"> 1. User doesn't exists in system 2. System will prompt message if admin has entered invalid information 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must be logged in as admin 2. User must exist in system 	
Post Conditions	<ol style="list-style-type: none"> 1. User information has been updated 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



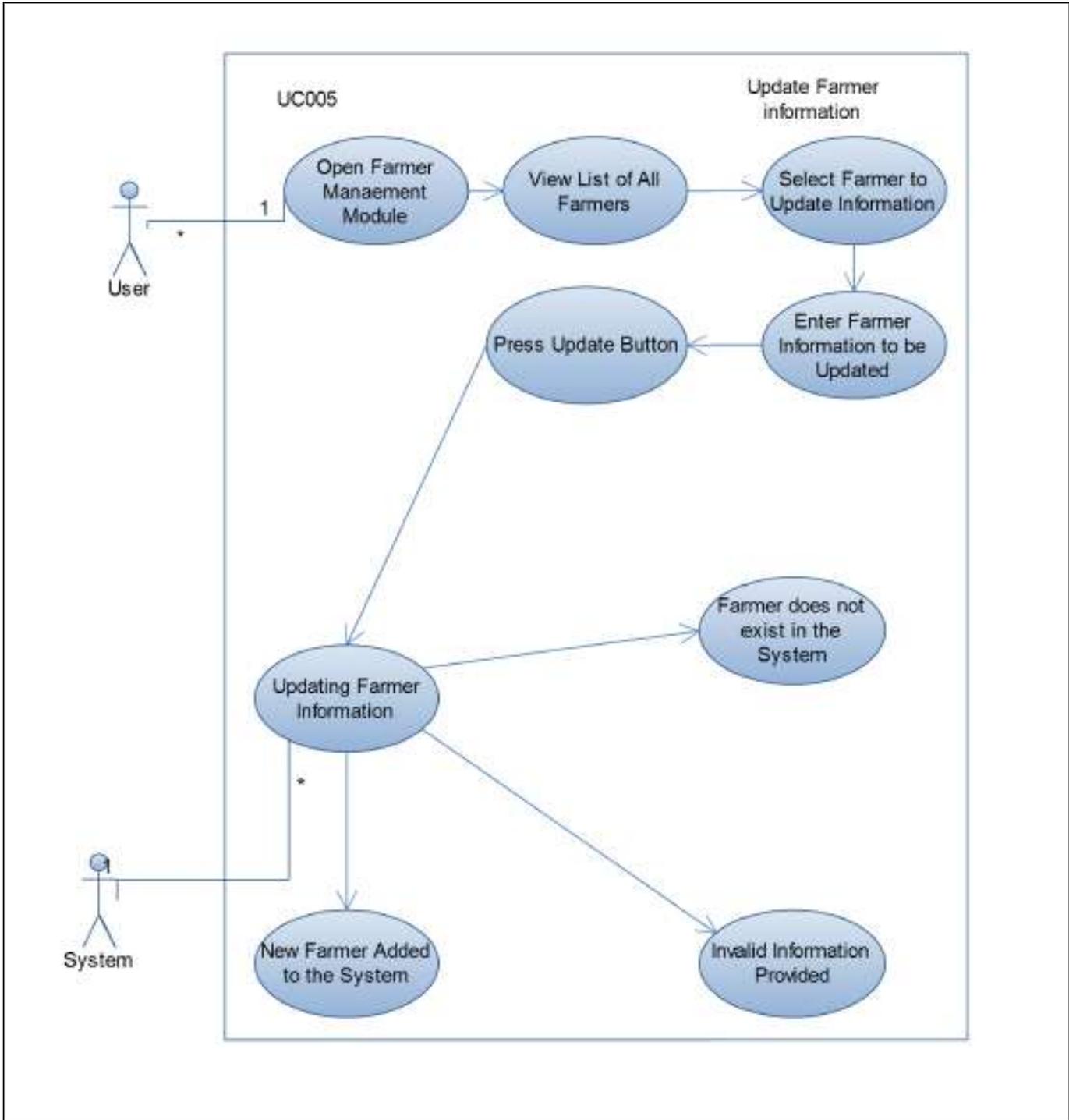
4. Add farmer Information

User Case Ref	UC004	
User Case Name	Add former information	
Description	This user case is to add new farmer information in system	
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. Open farmer management module 2. Select add new former link 3. Enter farmer basic information 4. Select farmer geographic information 5. Select services for farmer to be enrolled 6. Press submit button 7. System will create new farmer in system and will show appropriate message 	<ol style="list-style-type: none"> 1. farmer information already exists 2. System will prompt message if admin haven't entered appropriate farmer info 3. System will prompt message if admin haven't selected new farmer geographical information 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must be logged in as admin 2. User must have role to create new farmer 	
Post Conditions	<ol style="list-style-type: none"> 1. Farmer information have been added to system 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



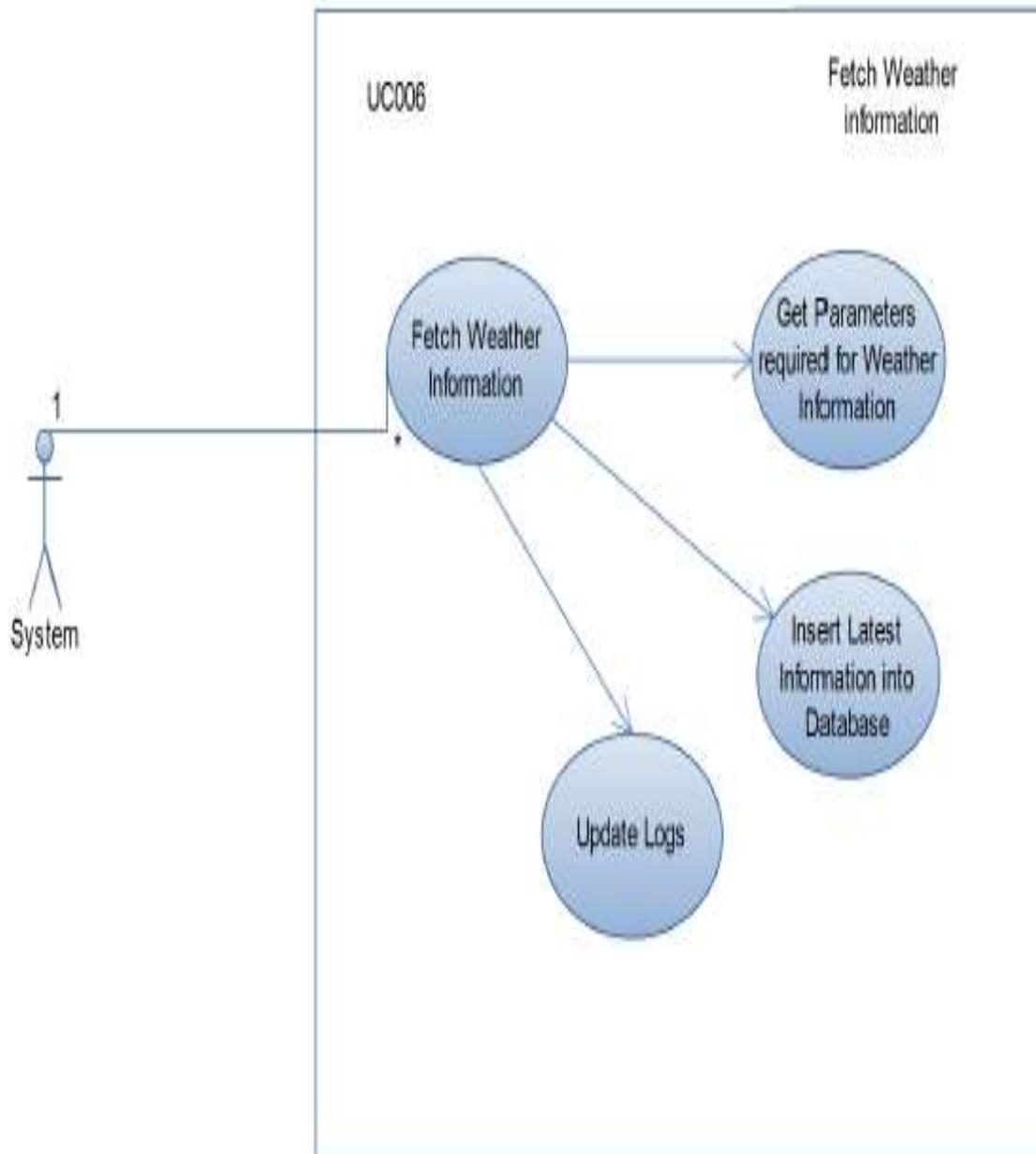
5. Update Farmer Information

User Case Ref	UC005	
User Case Name	Update farmer information	
Description	This user case is to update already exist farmer information	
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. Open farmer Management module 2. View list of all farmer 3. Select farmer to update information 4. Enter farmer information to be updates 5. Press Update button 6. System will update farmer information and show appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if farmer doesn't exists in system 2. System will prompt message if admin has entered invalid information 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must be logged in as admin 2. Farmer information should exist in system 	
Post Conditions	<ol style="list-style-type: none"> 1. Farmer information should be updated into system 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



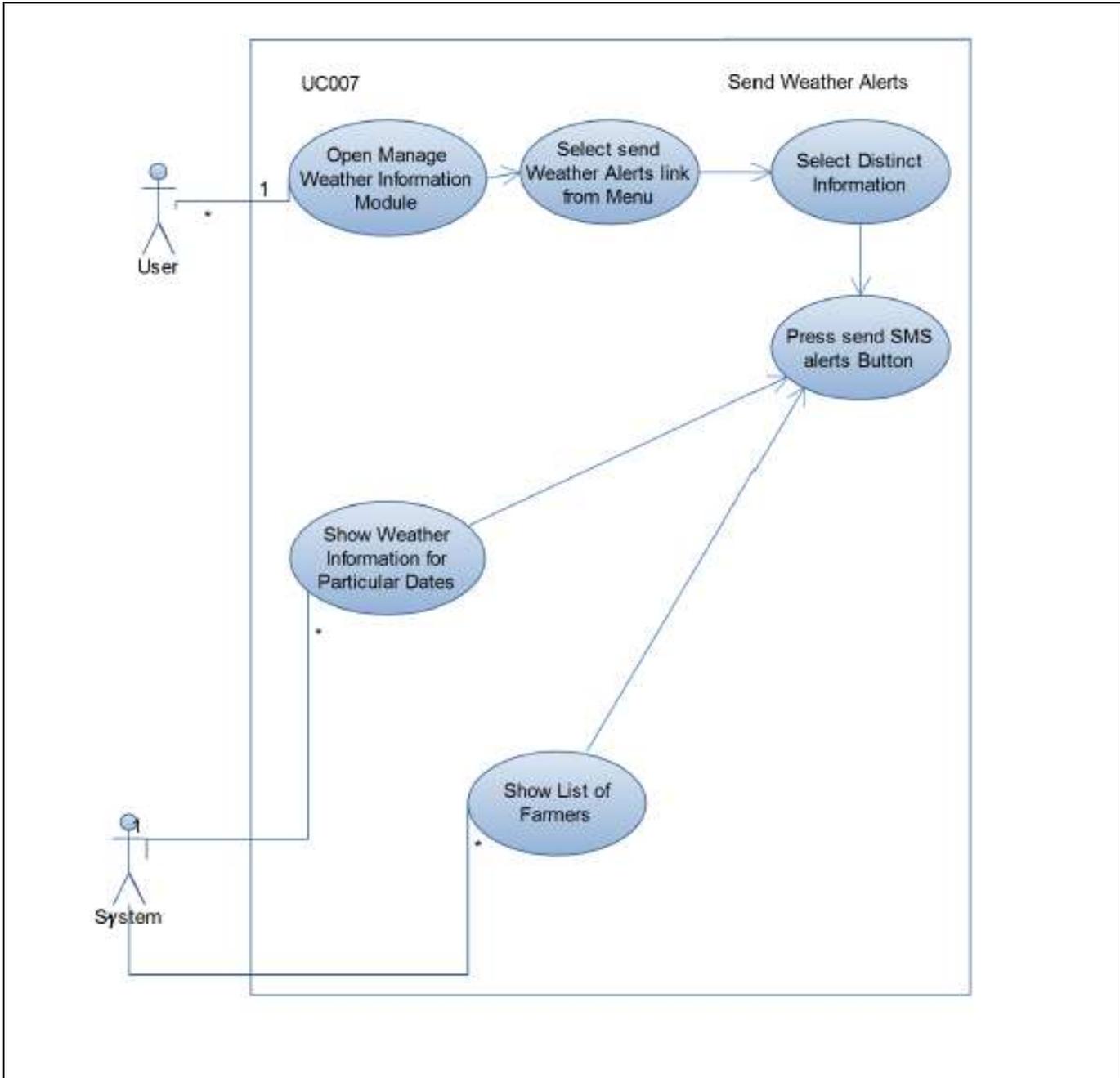
6. Fetch Weather information

User Case Ref		UC006
User Case Name		Fetch Weather information
Description		
This Use case is to fetch weather information on particular day from weather websites through weather information web service using a schedules process		
Actors		System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. System will invoke this functionality at certain time of day to fetch weather information 2. Process will provide parameters required for weather information 3. Process insert latest weather information into database 4. Process will update logs 		<ol style="list-style-type: none"> 1. Process will insert log if connection with weather information service or RSS feed failed
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. Weather information web service configuration information must exist in system 2. Process must be schedule to fetch weather information 3. Process should be rights to access weather information services
Post Conditions		Weather information must be updated in database
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



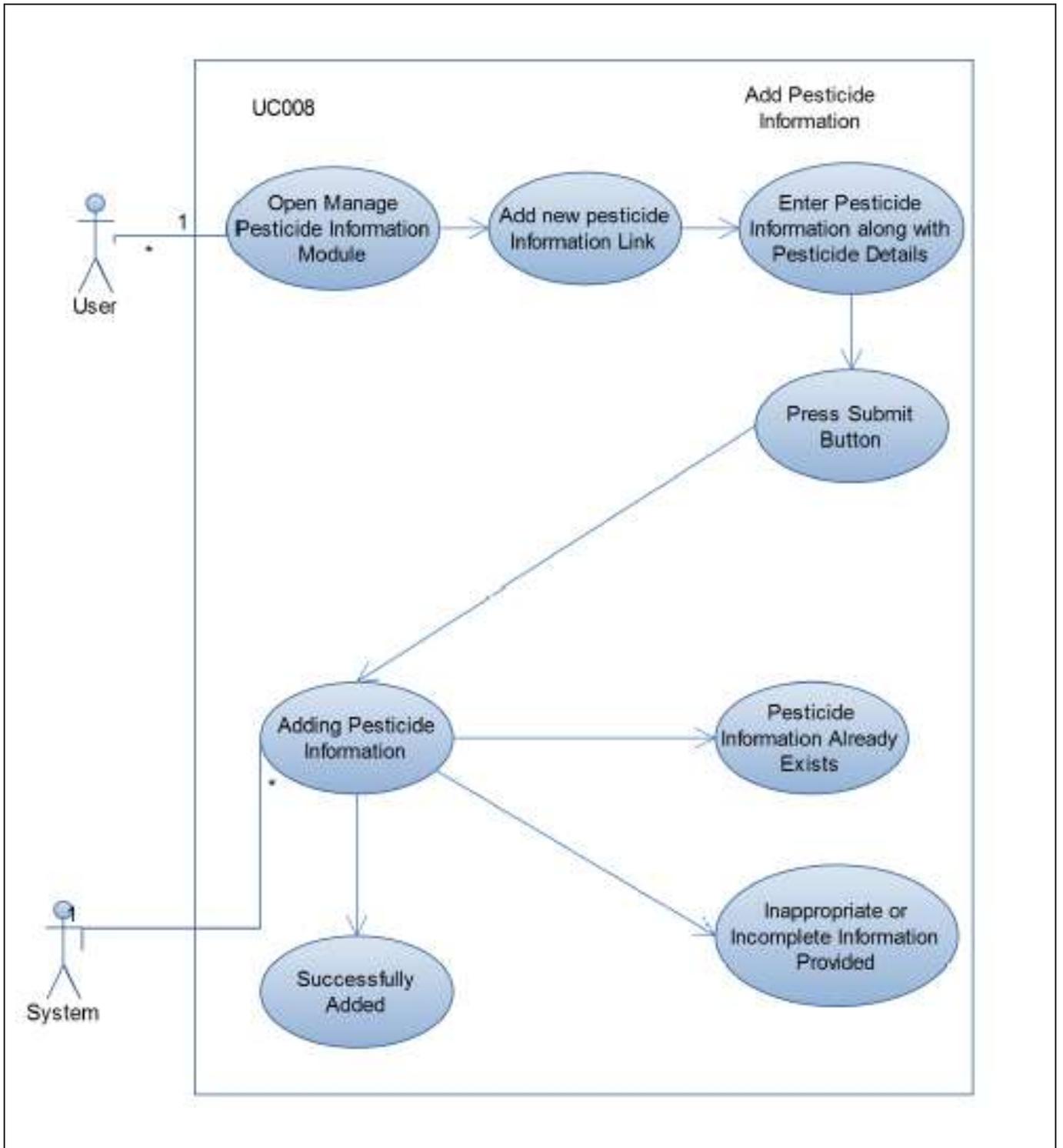
7. Send weather Alerts

User Case Ref	UC007	
User Case Name	Send weather alerts	
Description	This Use case is to send weather alerts to farmers who have subscribed for weather information alerts	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage Weather Information module 2. User will select Send weather alerts link from menu 3. User will select start and end date to fetch weather information 4. User will select district information 5. System will show weather information for particular dates from database 6. System will show list of farmers 7. Press send SMS alerts button 8. System will send weather information along with dates to farmers includes in list and prompt appropriate message to user 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if user has not select district information 2. System will prompt appropriate message weather information does not exist for certain dates 3. System will prompt appropriate message if none of the farmers have subscribed to SMS alert service 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to send SMS alerts 2. The weather information for certain district must exist in database 3. List of farmers must exist with valid cell phone numbers 	
Post Conditions	SMS alerts must be send to farmer and other management peoples	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



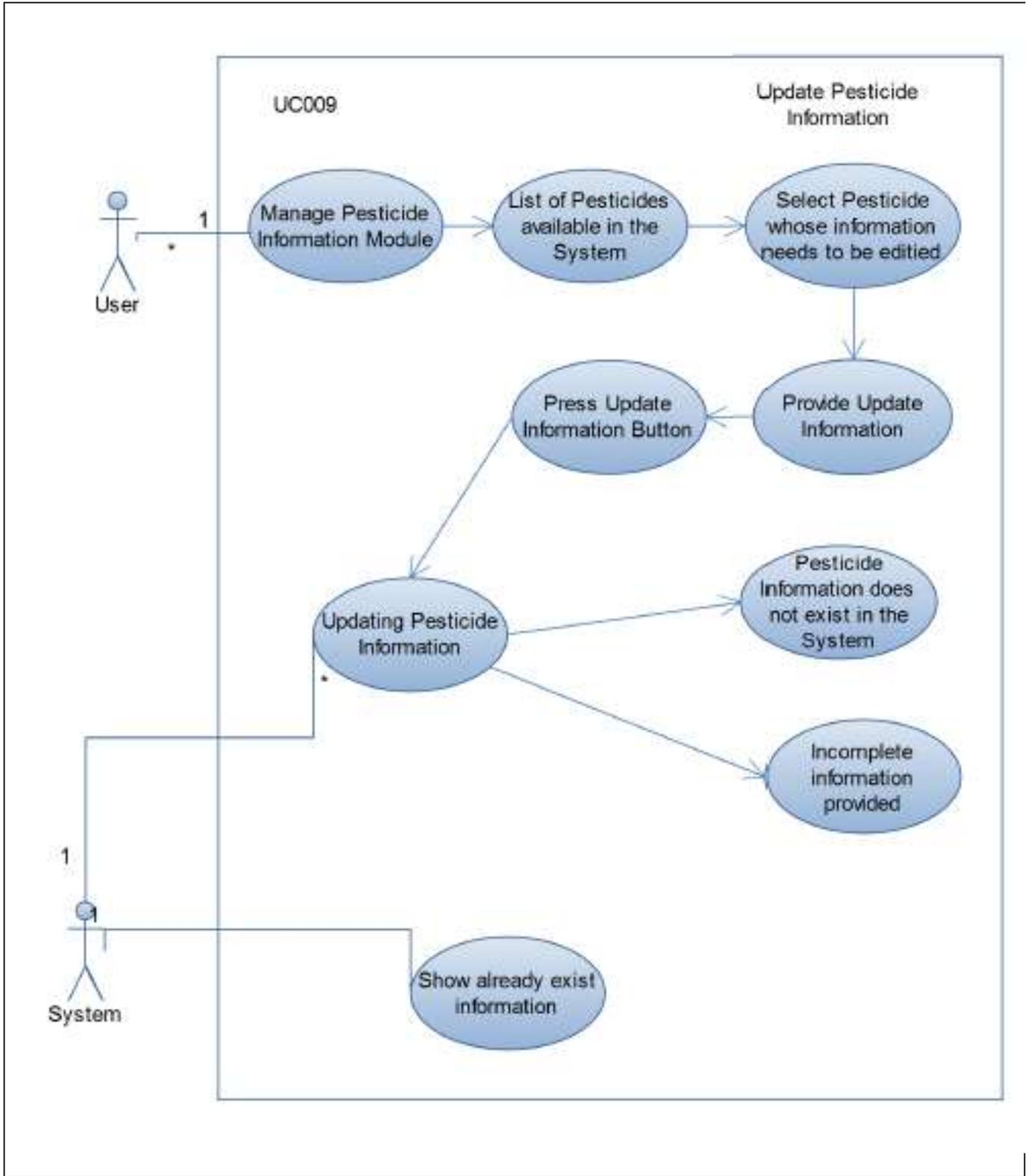
8. Add Pesticide Information

User Case Ref	UC008	
User Case Name	Add pesticide information	
Description	This Use case is to add pesticide information into database	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manager pesticide information module 2. User will select add new pesticide information link from menu 3. User enter pesticide information along with details of pesticide. 4. User press submit button 5. System will add pesticide information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if pesticide information already exists in system 2. System will prompt appropriate message if user have not provided necessary information of pesticide 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage pesticide information 	
Post Conditions	<ol style="list-style-type: none"> 1. Pesticide information must added in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



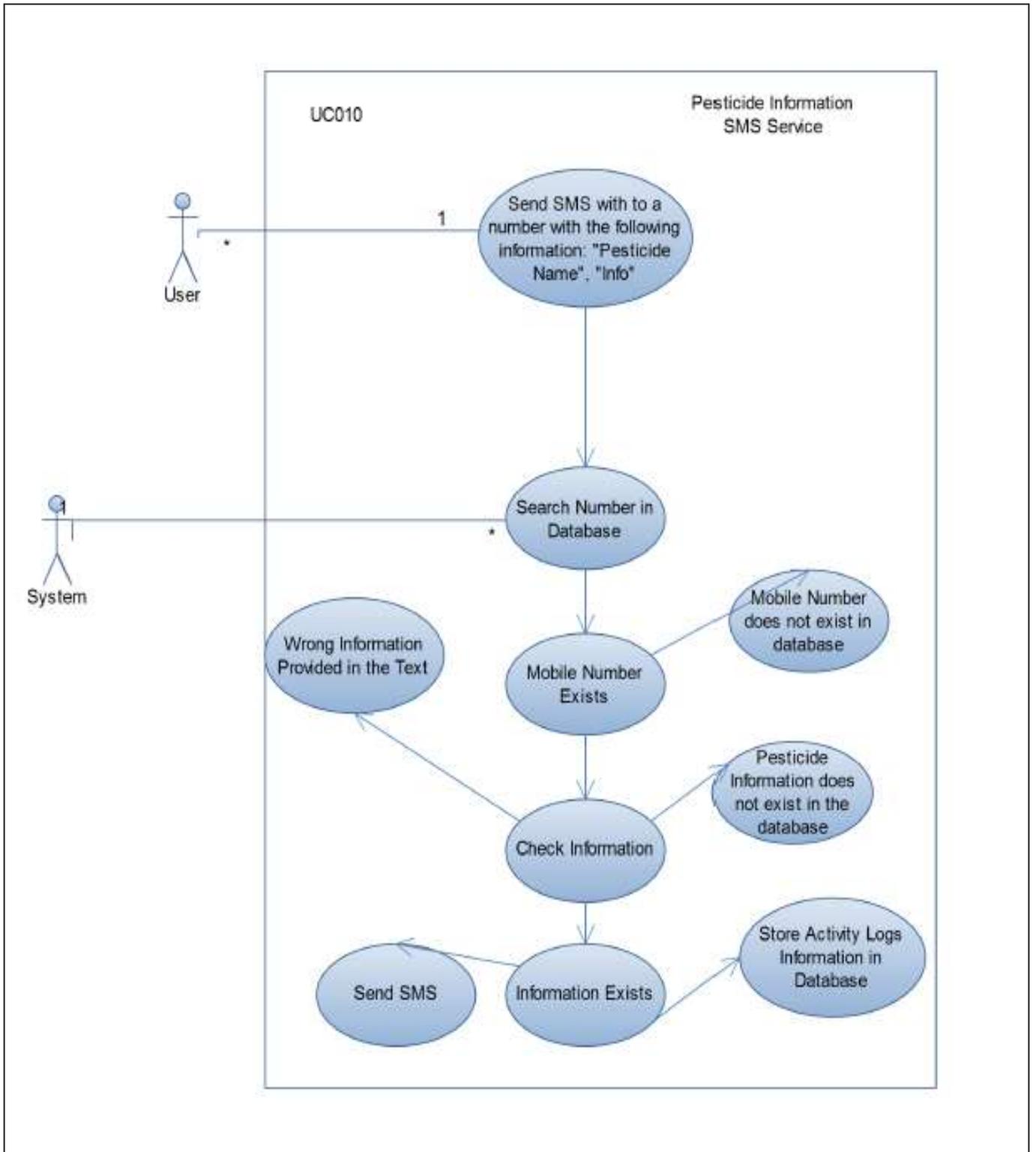
9. Update Pesticide Information

User Case Ref	UC009	
User Case Name	Update pesticide information	
Description	This Use case is to update pesticide information into database	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User open Manage pesticide information module 2. System shows list of pesticides available in system 3. User select pesticide whose information need to edit 4. System show already exist information 5. User provide update information and press update information button 6. System will add pesticide information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if pesticide information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of pesticide 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage pesticide information 	
Post Conditions	<ol style="list-style-type: none"> 2. Pesticide information must updated in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



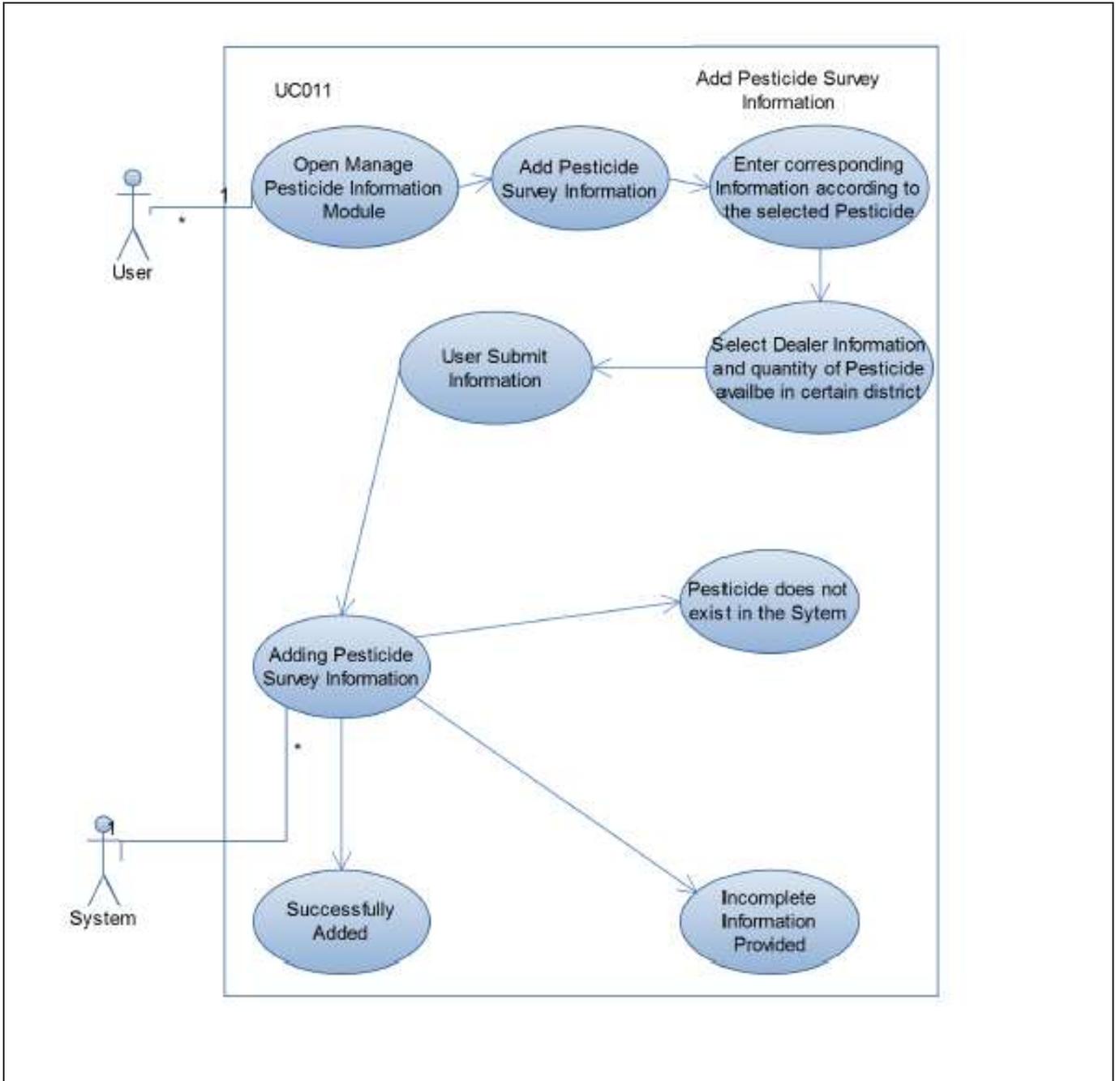
10. Pesticide Info SMS Service

User Case Ref	UC010	
User Case Name	Pesticide Info SMS Service	
Description	This Use case is get pesticide information from system using SMS	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User send SMS to certain number with following info in SMS “pesticide name”, “info” 2. System search database against cell number. If cell number exist in database system will move further 3. System will search database to get pesticide information 4. If information exist system will send SMS alert to mobile number 5. System will store activity logs information in database 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if mobile number is not registered in database 2. System will prompt appropriate message if user has sent wrong text information 3. System will prompt appropriate message if pesticide information does not exist in database. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User mobile number must exist in database 2. Pesticide information must exists in database 	
Post Conditions	<ol style="list-style-type: none"> 1. User receive SMS alert which contain information about pesticide 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



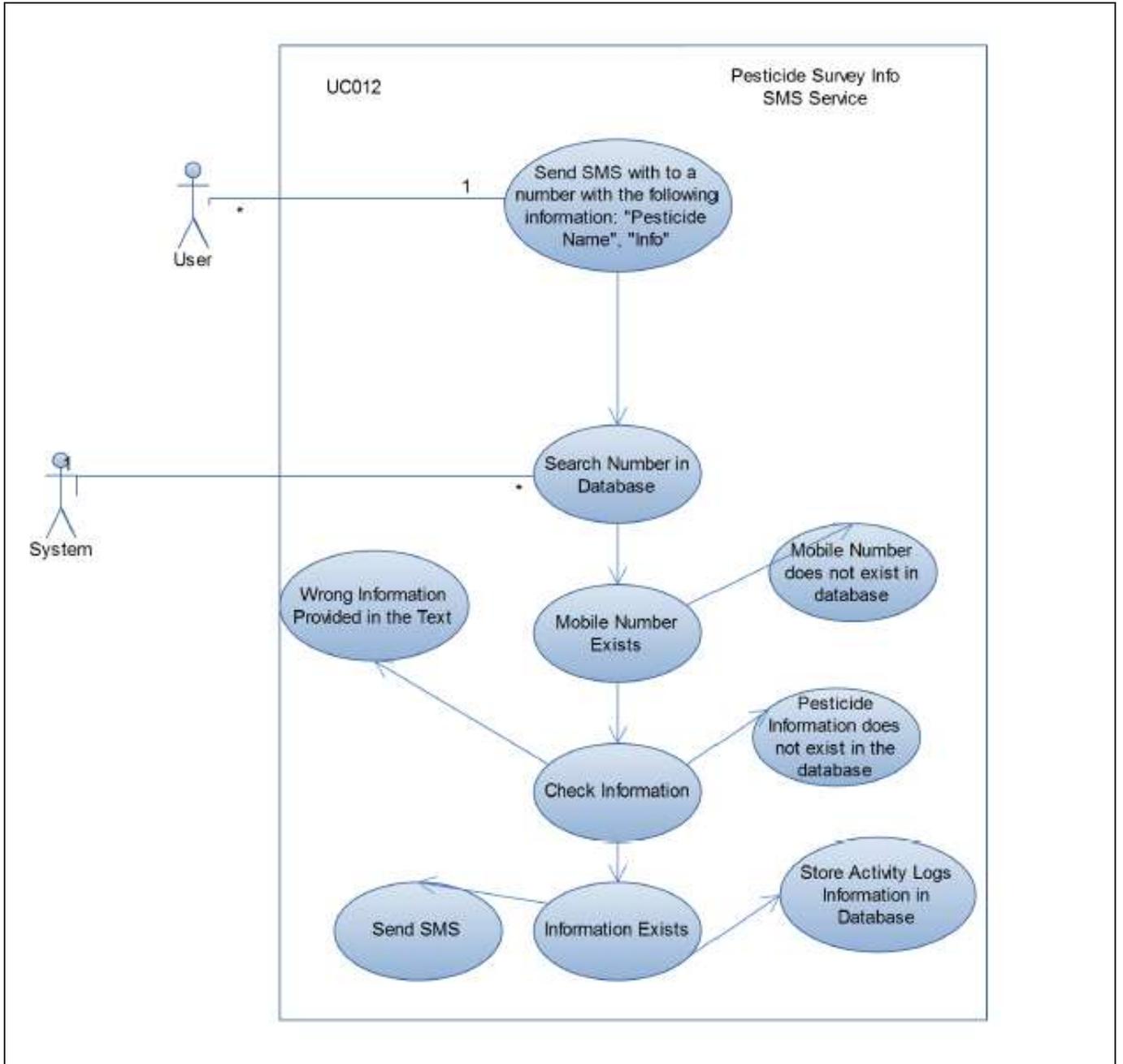
11. Add Pesticide Survey Information

User Case Ref	UC011	
User Case Name	Add pesticide Survey information	
Description	This Use case is to add pesticide survey information. This information include latest prices quantity available at different dealers	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User open Manage pesticide information module 2. User select Add Pesticide Survey information 3. User enters survey information for certain pesticide select from dropdown 4. User select dealer information and quantity of pesticide available in certain district 5. User submit information 6. System will add pesticide information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if pesticide information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of pesticide survey. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage pesticide information 2. Pesticide information must exists 3. Dealer information must exist for select district 	
Post Conditions	<ol style="list-style-type: none"> 1. Pesticide survey information must exist in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



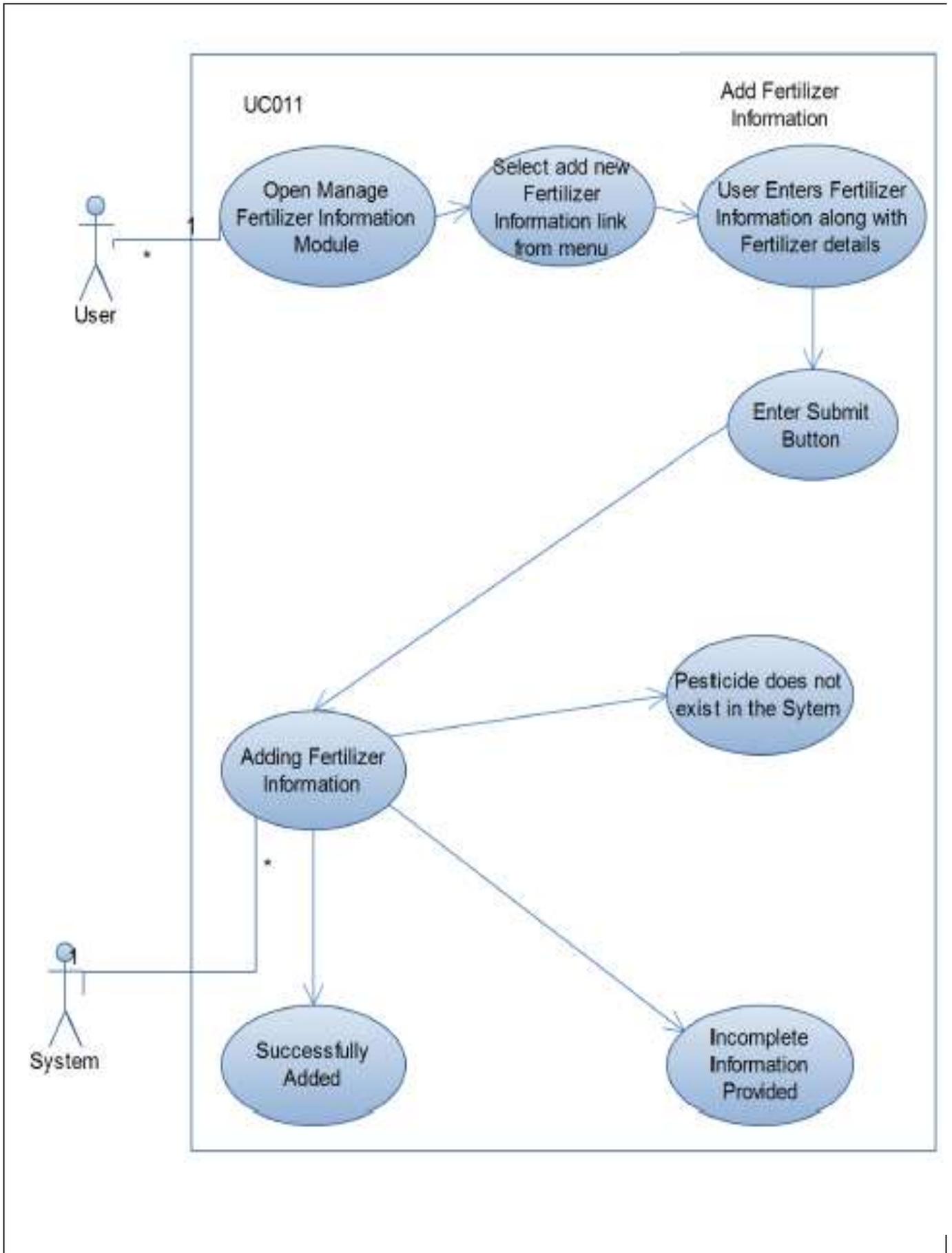
12. Pesticide Survey Info SMS Service

User Case Ref	UC012	
User Case Name	Pesticide Survey Info SMS Service	
Description	This Use case is get pesticide quantity and its availability information in certain city	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 6. User send SMS to certain number with following info in SMS “pesticide name”, “city name” 7. System search database against cell number. If cell number exist in database system will move further 8. System will search database to get pesticide survey information like its availability from certain dealer in given city, its current price. 9. If information exist system will send SMS alert to mobile number 10. System will store activity logs information in database 	<ol style="list-style-type: none"> 4. System will prompt appropriate message if mobile number is not registered in database 5. System will prompt appropriate message if user has sent wrong text information 6. System will prompt appropriate message if pesticide survey information does not exist in database. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 3. User mobile number must exist in database 4. Pesticide survey information must exists in database 	
Post Conditions	<ol style="list-style-type: none"> 2. User receive SMS alert which contain information about pesticide quantity , price and availability with certain dealer 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



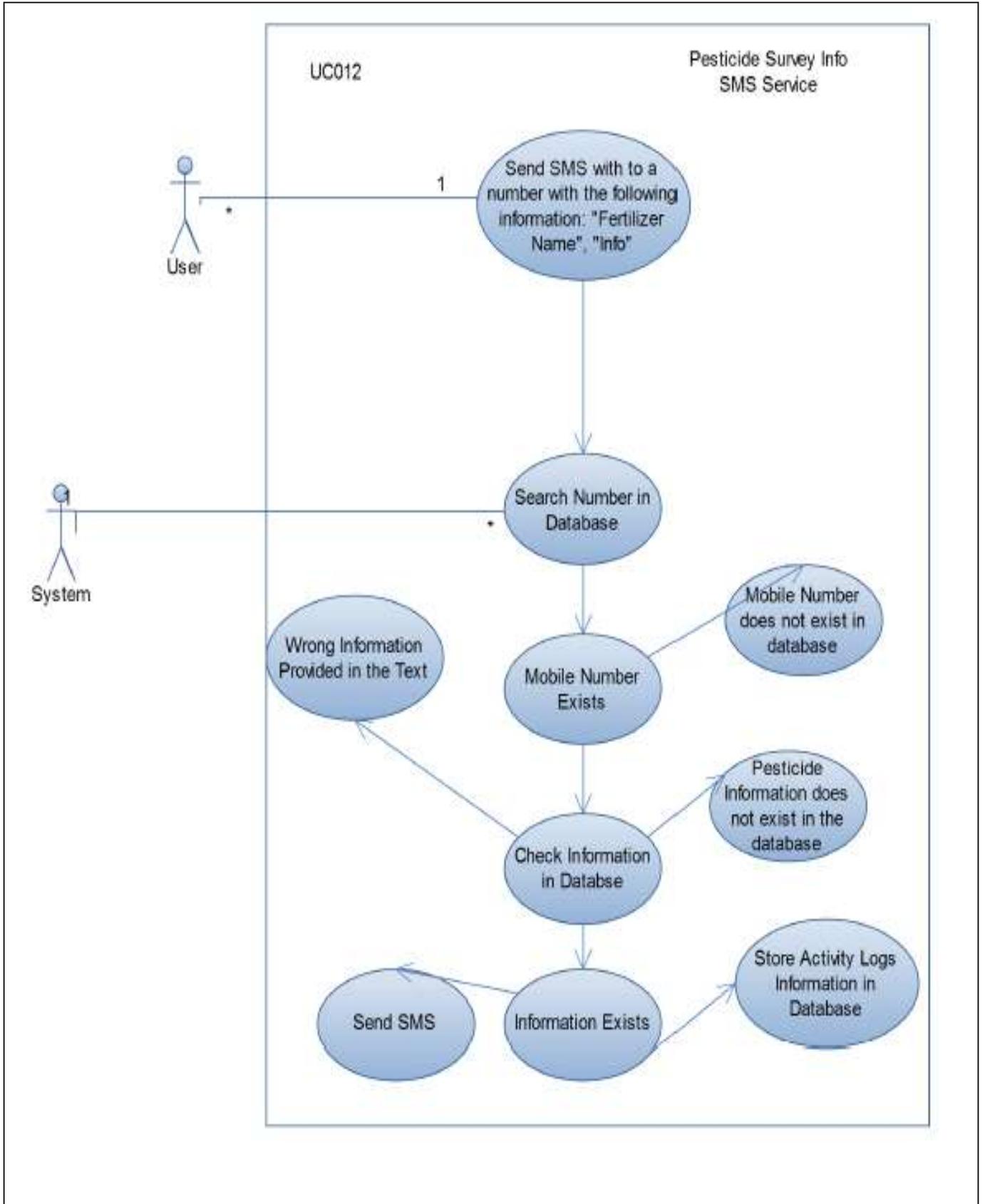
13. Add Fertilizer Information

User Case Ref	UC013	
User Case Name	Add fertilizer information	
Description	This Use case is to add fertilizer information into database	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 6. User will open Manager fertilizer information module 7. User will select add new fertilizer information link from menu 8. User enter fertilizer information along with details of fertilizer. 9. User press submit button 10. System will add fertilizer information and will prompt with appropriate message 	<ol style="list-style-type: none"> 3. System will prompt appropriate message if fertilizer information already exists in system 4. System will prompt appropriate message if user have not provided necessary information of fertilizer. fertilizer 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 2. User must have role to manage fertilizer information 	
Post Conditions	<ol style="list-style-type: none"> 3. fertilizer information must added in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



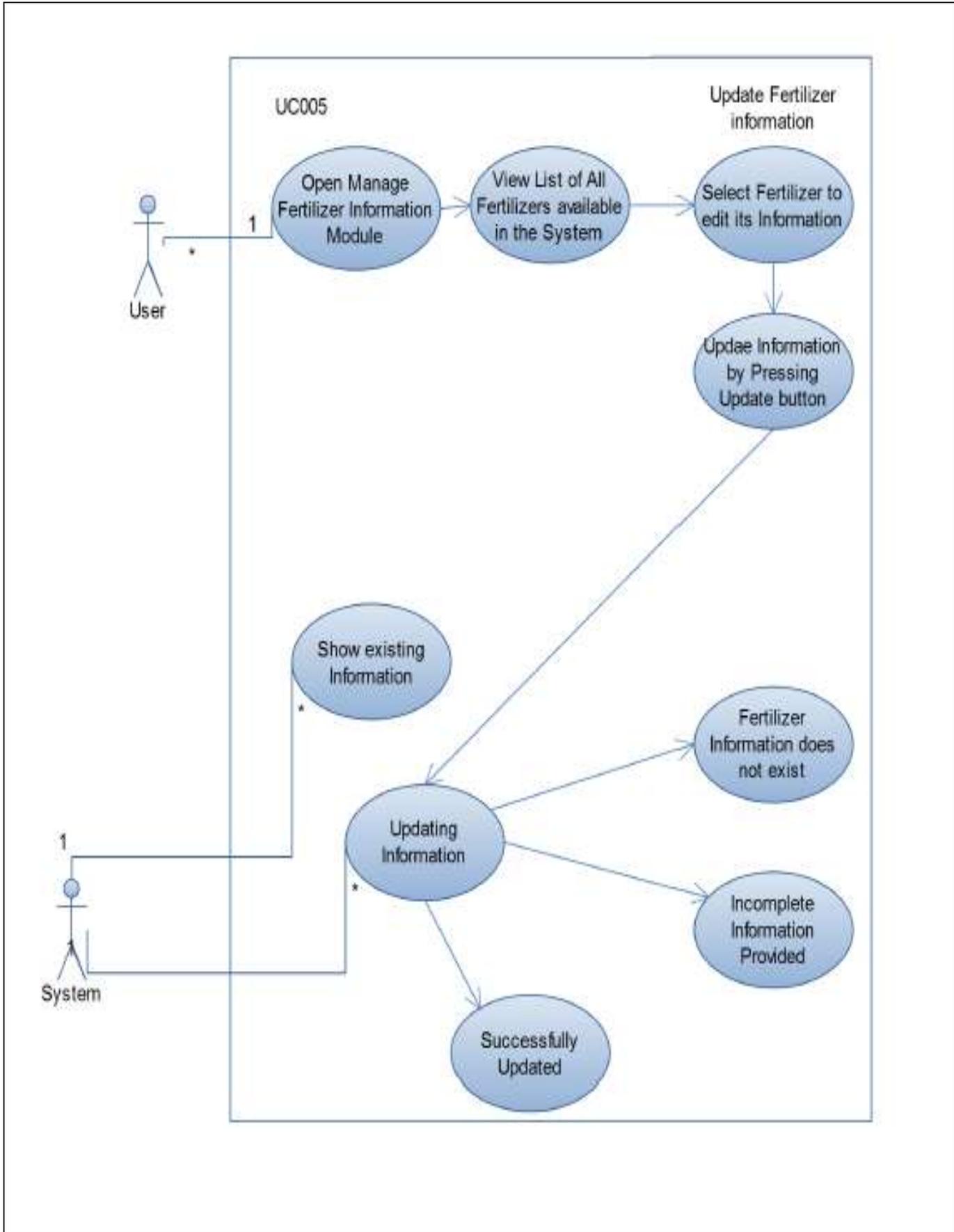
14. Fertilizer Info SMS Service

User Case Ref	UC014	
User Case Name	Fertilizer Info SMS Service	
Description	This Use case is get Fertilizer information from system using SMS	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ul style="list-style-type: none"> 11. User send SMS to certain number with following info in SMS “Fertilizer name”, “info” 12. System search database against cell number. If cell number exist in database system will move further 13. System will search database to get fertilizer information 14. If information exist system will send SMS alert to mobile number 15. System will store activity logs information in database 	<ul style="list-style-type: none"> 7. System will prompt appropriate message if mobile number is not registered in database 8. System will prompt appropriate message if user has sent wrong text information 9. System will prompt appropriate message if fertilizer information does not exist in database. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ul style="list-style-type: none"> 5. User mobile number must exist in database 6. fertilizer information must exists in database 	
Post Conditions	<ul style="list-style-type: none"> 3. User receive SMS alert which contain information about fertilizer 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



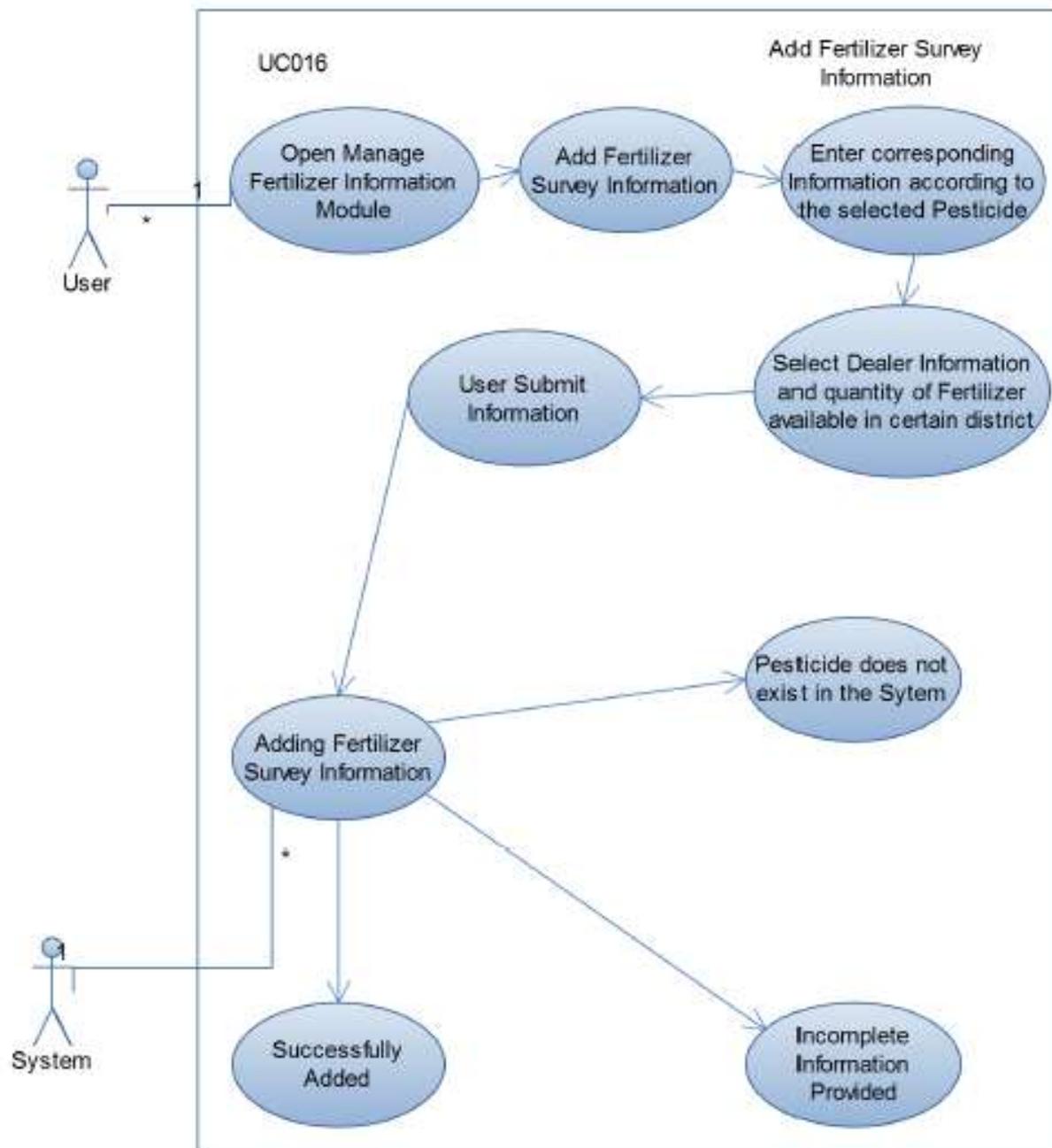
15. Update Fertilizer Information

User Case Ref		UC015
User Case Name		Update fertilizer information
Description		
This Use case is to update fertilizer information into database		
Actors		User, System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User open Manage fertilizer information module 2. System shows list of fertilizer available in system 3. User select fertilizer whose information need to edit 4. System show already exist information 5. User provide update information and press update information button 6. System will add fertilizer information and will prompt with appropriate message 		<ol style="list-style-type: none"> 1. System will prompt appropriate message if fertilizer information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of fertilizer
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User must have role to manage fertilizer information 2. fertilizer information must exist in database
Post Conditions		<ol style="list-style-type: none"> 1. fertilizer information must updated in database
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



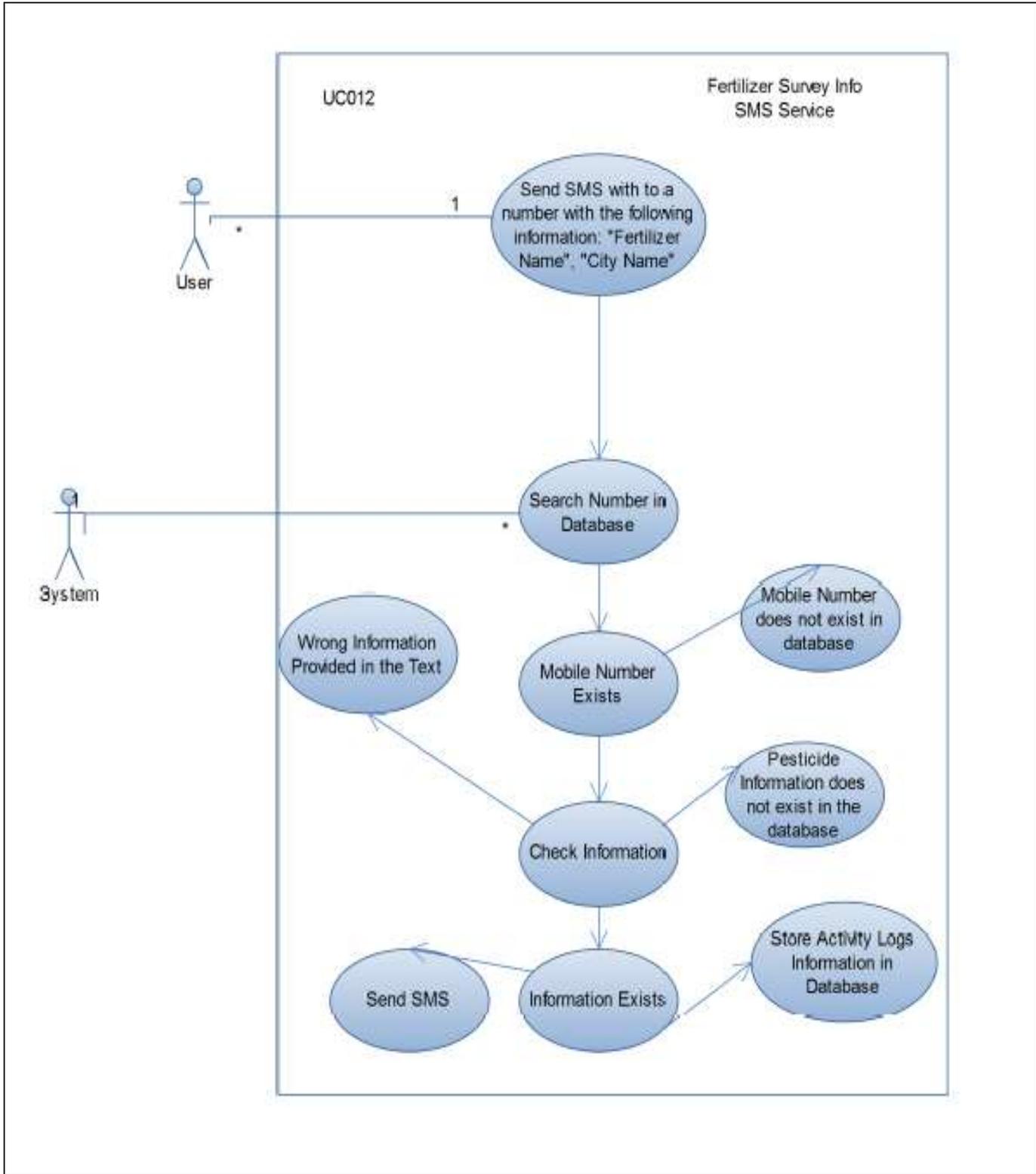
16. Add fertilizer Survey Information

User Case Ref		UC016
User Case Name		Add fertilizer Survey information
Description		
This Use case is to add fertilizer survey information. This information include latest prices quantity available at different dealers		
Actors		User, System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User open Manage fertilizer information module 2. User select Add fertilizer Survey information 3. User enters survey information for certain pesticide select from dropdown 4. User select dealer information and quantity of fertilizer available in certain district 5. User submit information 6. System will add fertilizer information and will prompt with appropriate message 		<ol style="list-style-type: none"> 1. System will prompt appropriate message if fertilizer information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of fertilizer survey.
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User must have role to manage pesticide information 2. fertilizer information must exists 3. Dealer information must exist for select district
Post Conditions		<ol style="list-style-type: none"> 4. fertilizer survey information must exist in database
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



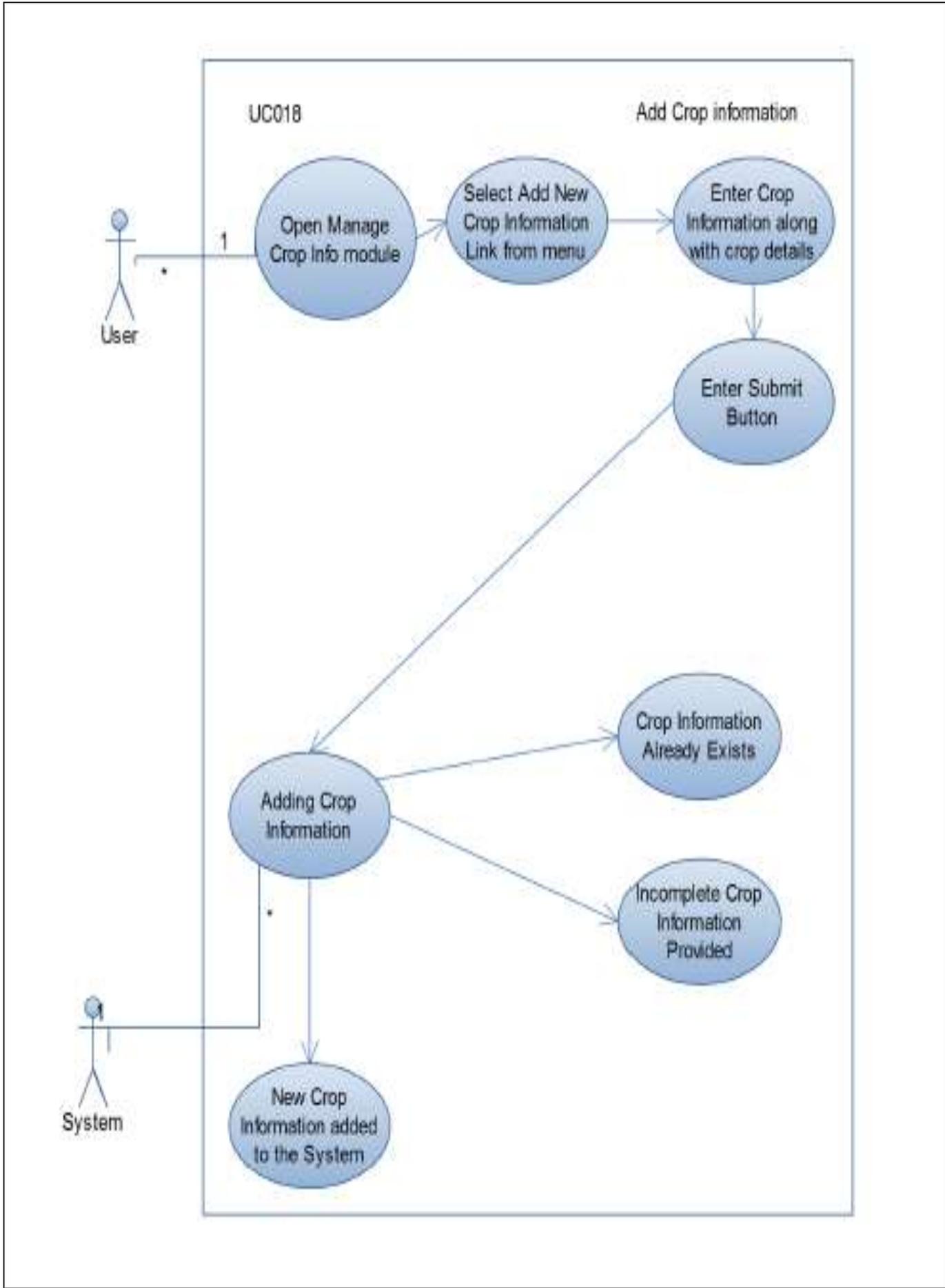
17. Fertilizer Survey Info SMS Service

User Case Ref	UC017	
User Case Name	Fertilizer Survey Info SMS Service	
Description	This Use case is get Fertilizer quantity and its availability information in certain city	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User send SMS to certain number with following info in SMS “Fertilizer name”, “city name” 2. System search database against cell number. If cell number exist in database system will move further 3. System will search database to get pesticide survey information like its availability from certain dealer in given city, its current price. 4. If information exist system will send SMS alert to mobile number 5. System will store activity logs information in database 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if mobile number is not registered in database 2. System will prompt appropriate message if user has sent wrong text information 3. System will prompt appropriate message if Fertilizer survey information does not exist in database. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User mobile number must exist in database 2. Fertilizer survey information must exists in database 	
Post Conditions	<ol style="list-style-type: none"> 1. User receive SMS alert which contain information about Fertilizer quantity , price and availability with certain dealer 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



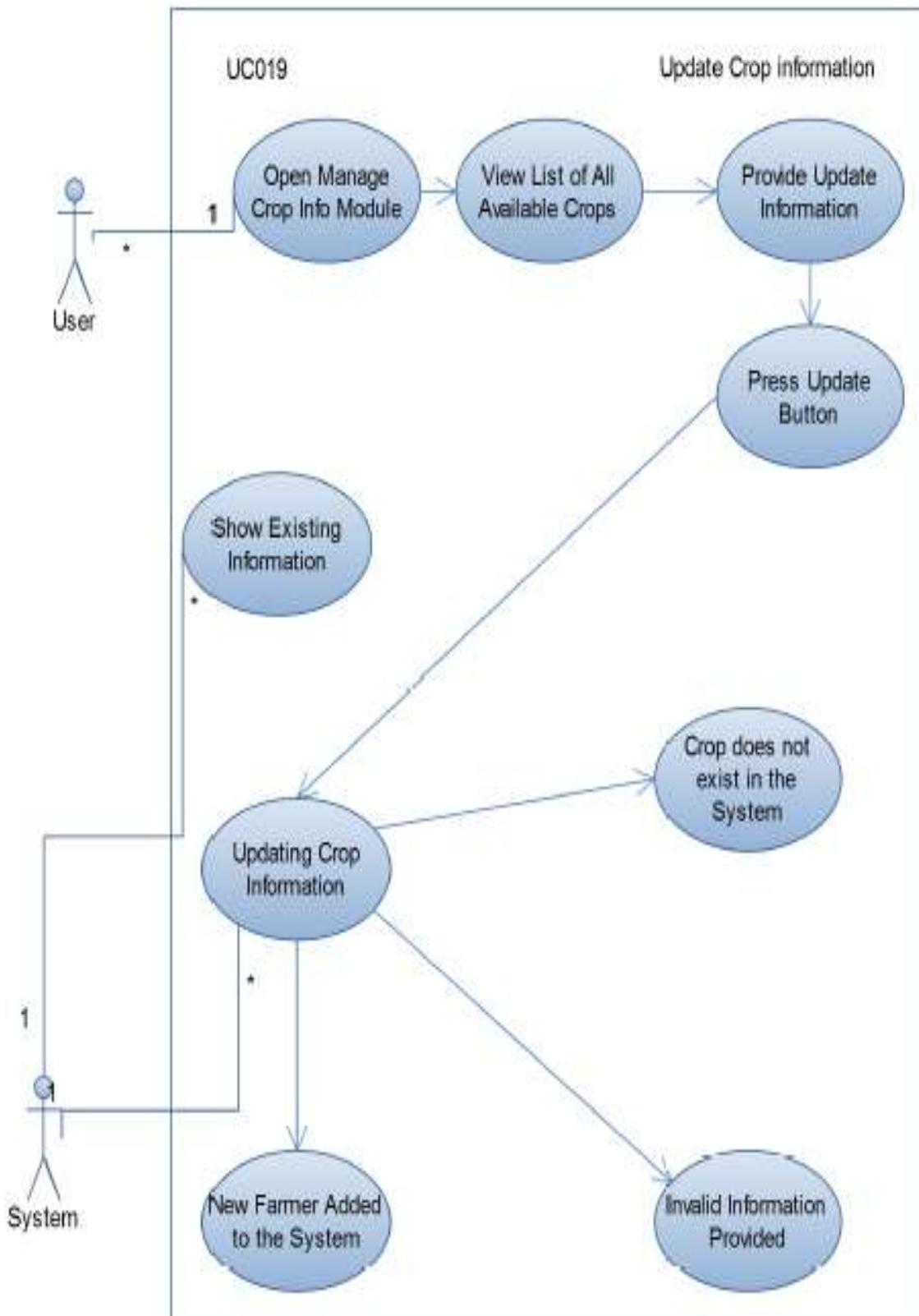
18. Add Crop Information

User Case Ref	UC018	
User Case Name	Add Crop information	
Description	This Use case is to add crop information into database	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage crop information module 2. User will select add new crop information link from menu 3. User enters crop information along with details of crop. 4. User press submit button 5. System will add crop information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if crop information already exists in system 2. System will prompt appropriate message if user have not provided necessary information of crop. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage crop information 	
Post Conditions	<ol style="list-style-type: none"> 1. crop information must added in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



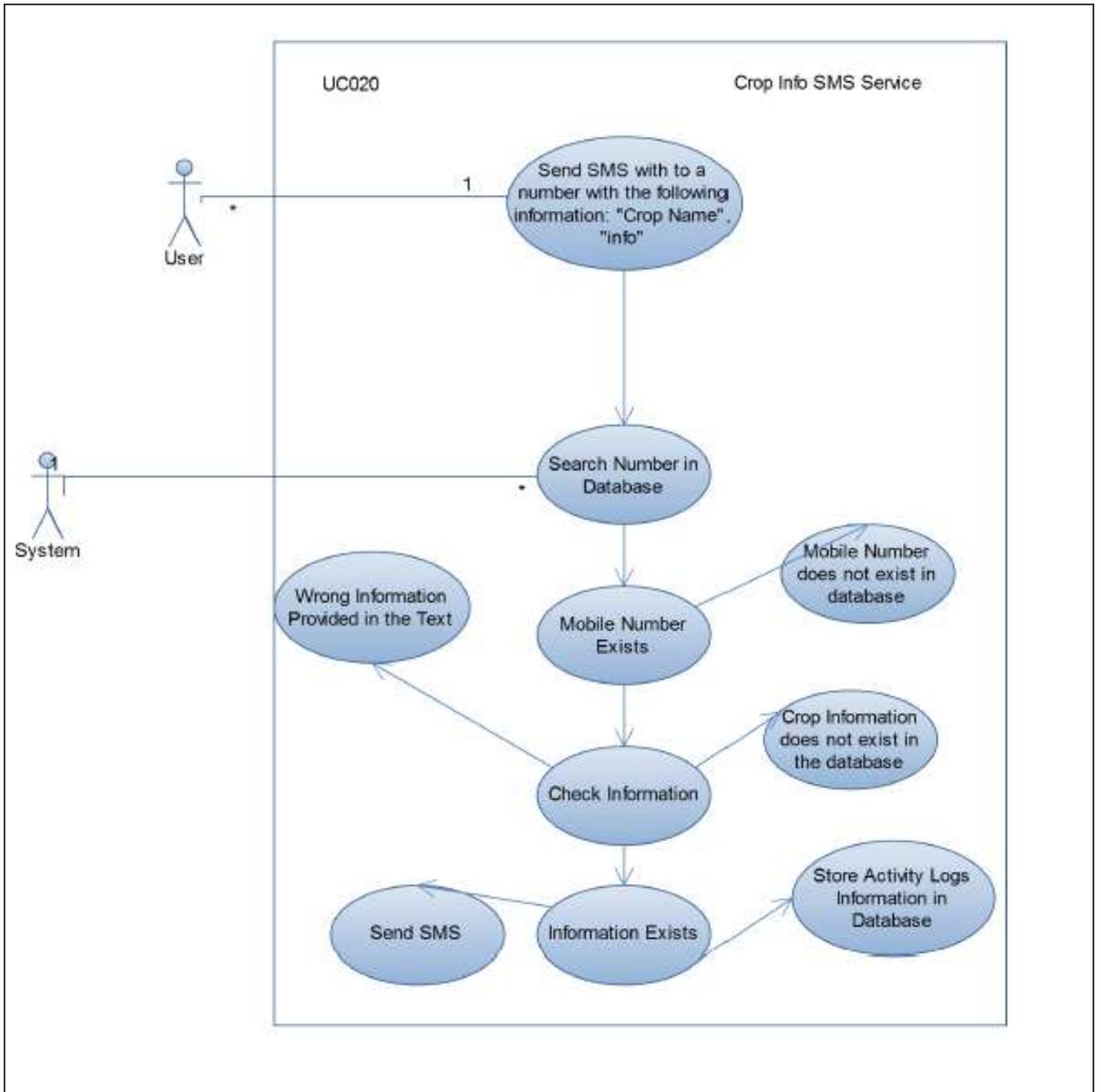
19. Update Crop Information

User Case Ref	UC019	
User Case Name	Update crop information	
Description	This Use case is to update crop information into database	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User open Manage crop information module 2. System shows list of crop available in system 3. User select crop whose information need to edit 4. System show already exist information 5. User provide update information and press update information button 6. System will add crop information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if crop information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of crop 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage crop information 2. crop information must exist in database 	
Post Conditions	<ol style="list-style-type: none"> 1. crop information must updated in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



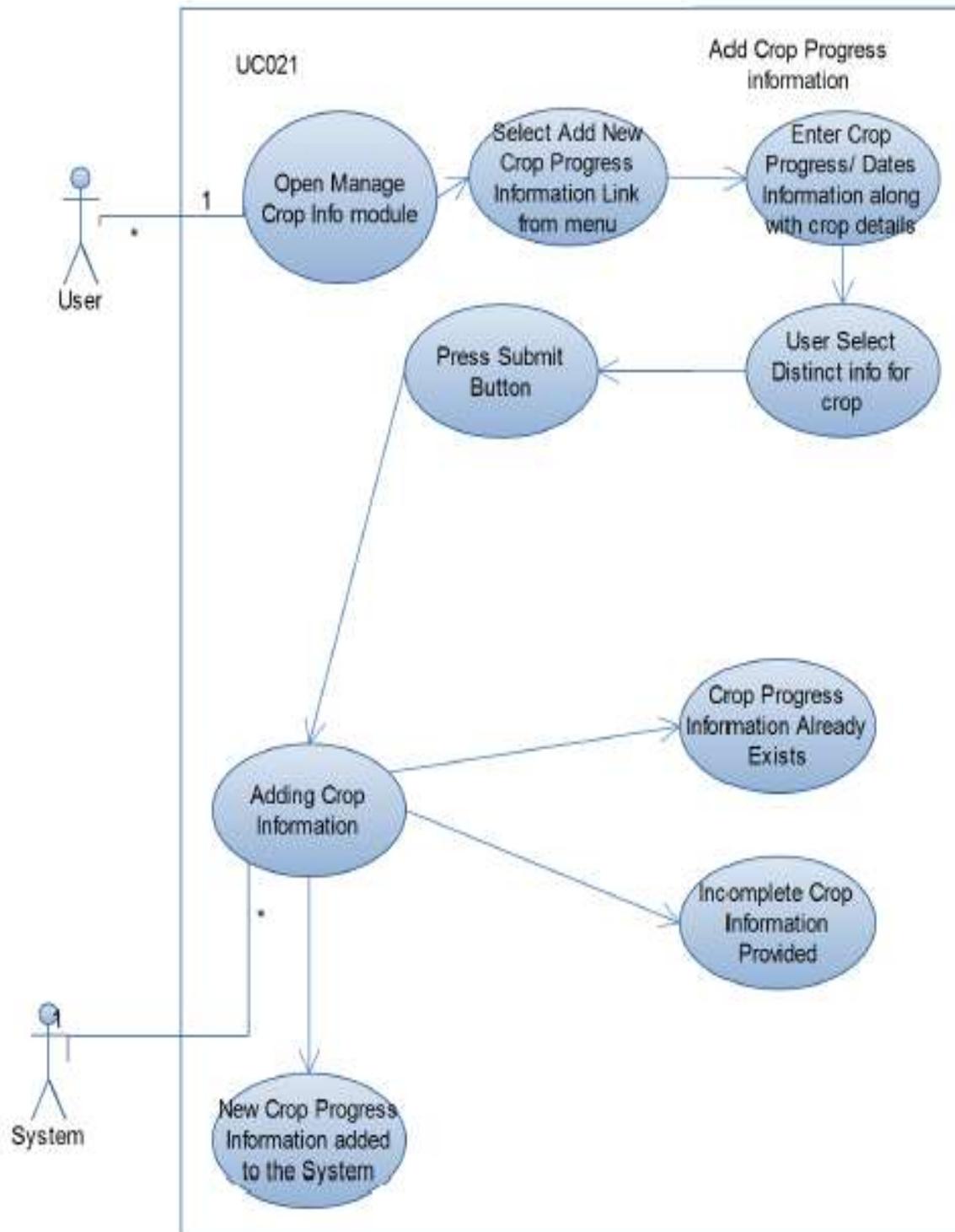
20. Crop Info SMS Service

User Case Ref		UC020
User Case Name		Crop Info SMS Service
Description		
This Use case is get System will provide service to provide complete information about sowing, fertilizer, harvesting , pesticides for certain crop.		
Actors		User, System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User send SMS to certain number with following info in SMS “crop name”, “info” 2. System search database against cell number. If cell number exist in database system will move further 3. System will search database to get crop information 4. If information exist system will send SMS alert to mobile number 5. System will store activity logs information in database 		<ol style="list-style-type: none"> 1. System will prompt appropriate message if mobile number is not registered in database 2. System will prompt appropriate message if user has sent wrong text information 3. System will prompt appropriate message if crop information does not exist in database.
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User mobile number must exist in database 2. crop information must exists in database
Post Conditions		<ol style="list-style-type: none"> 1. User receive SMS alert which contain information about crop
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



21. Add Crop Progress Information

User Case Ref		UC021
User Case Name		Add Progress information
Description		
This Use case is to add information about crop sowing season in different areas and different dates for first timings watering and fertilizer timings according to districts		
Actors		User, System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User will open Manage crop information module 2. User will select add new crop progress information link from menu 3. User enters crop progress/dates information along with other details. 4. User select district information for certain crop 5. User press submit button 6. System will add information and will prompt with appropriate message 		<ol style="list-style-type: none"> 1. System will prompt appropriate message if crop progress information already exists in system 2. System will prompt appropriate message if user have not provided necessary information of crop.
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User must have role to manage crop progress information
Post Conditions		<ol style="list-style-type: none"> 1. Crop progress information must added in database
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A

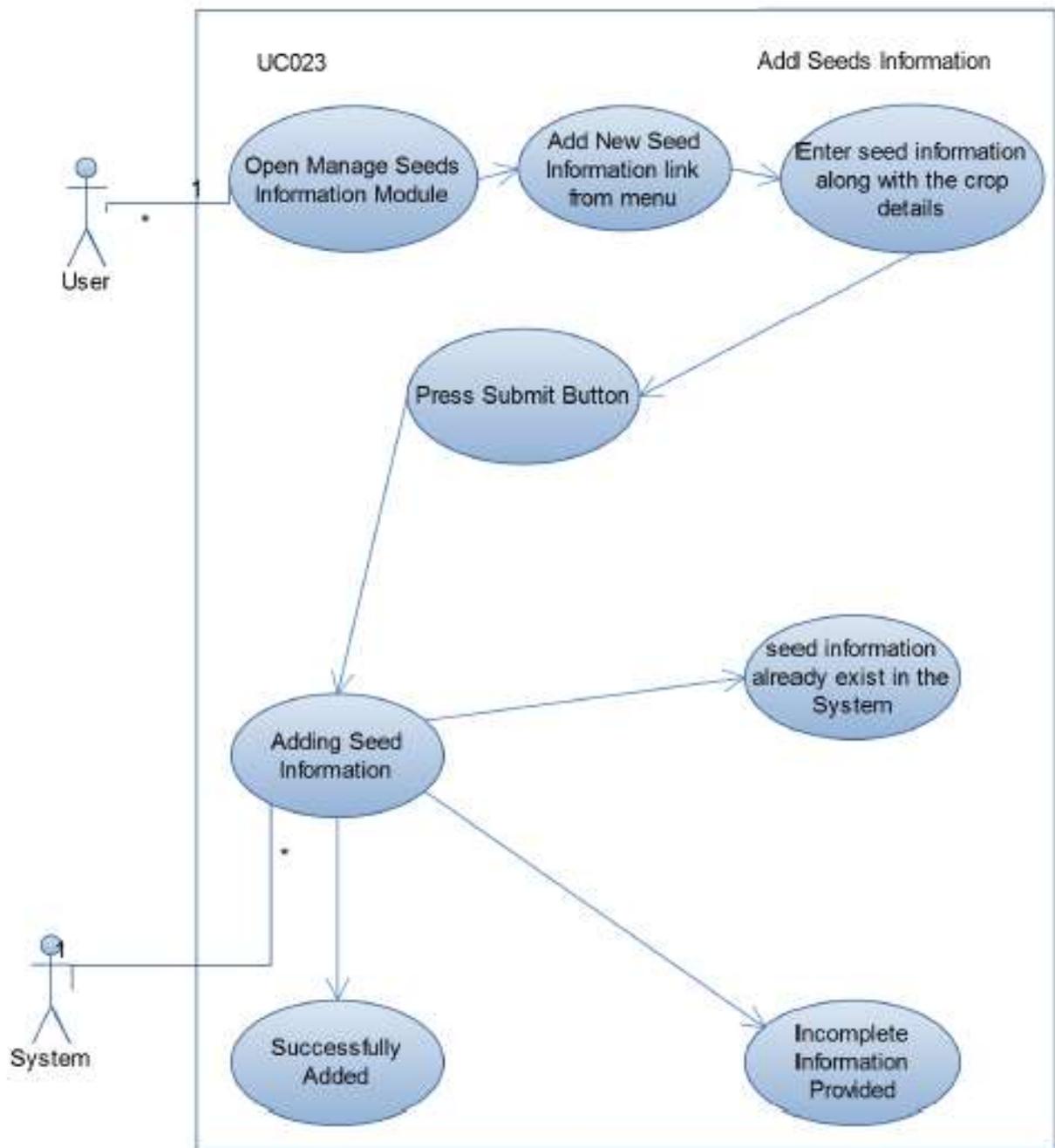


22. Update Crop Progress Information

User Case Ref	UC022	
User Case Name	Update crop progress information	
Description	This Use case is to update crop progress information	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User open Manage crop progress information module 2. System shows list of crop progress info system 3. User select crop progress whose information need to edit 4. System show already exist information 5. User provide update information and press update information button 6. System will add crop progress information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if crop progress information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of crop progress details 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage crop information 2. Crop progress information must exist in database 	
Post Conditions	<ol style="list-style-type: none"> 1. Crop progress information must updated in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A

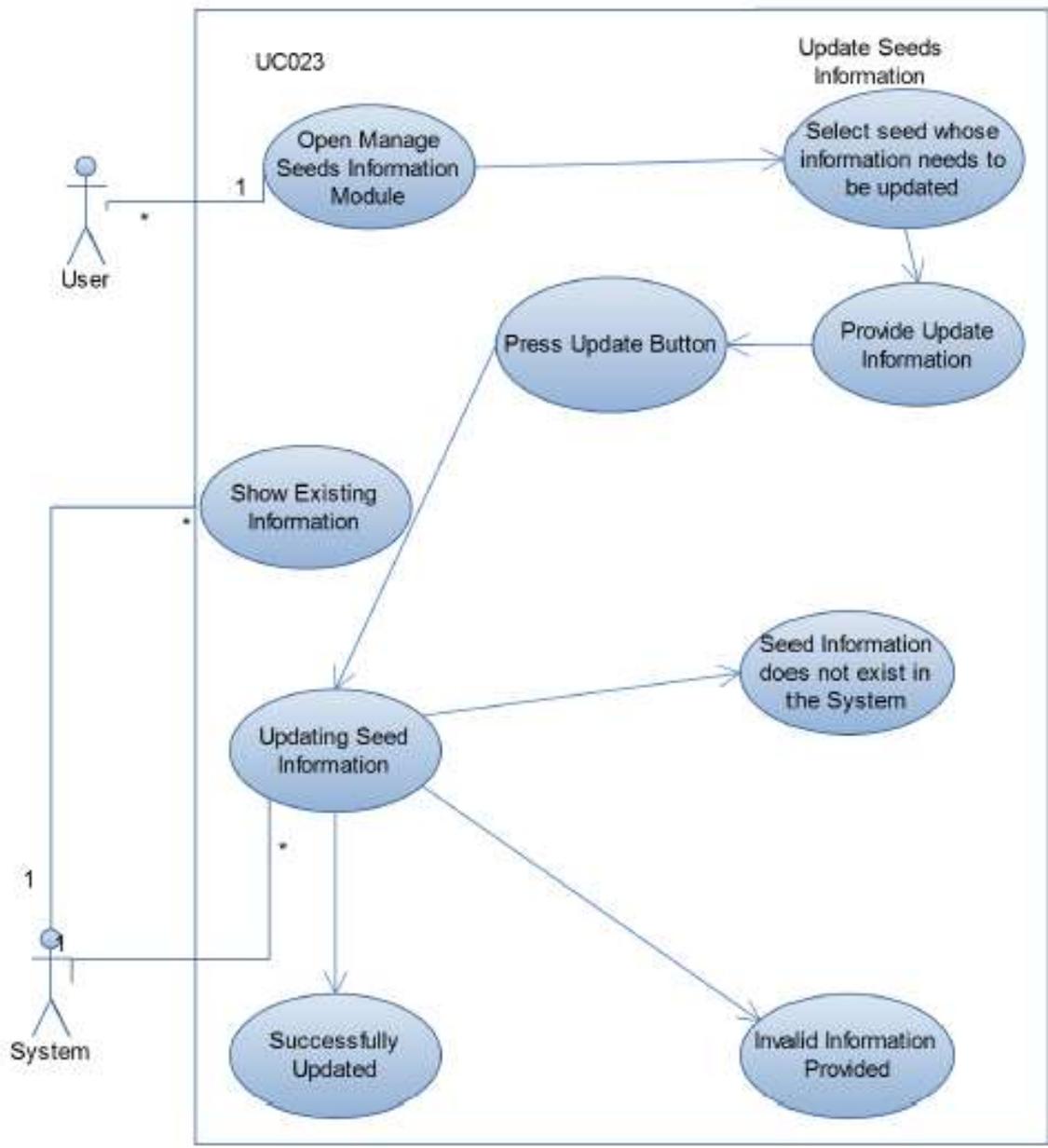
23. Add Seeds Information

User Case Ref	UC023	
User Case Name	Add Seeds information	
Description	This Use case is to add seed information into database	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage Seeds information module 2. User will select Add New Seed information link from menu 3. User enters seed information along with details of crop. 4. User press submit button 5. System will add seed information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if seed information already exists in system 2. System will prompt appropriate message if user have not provided necessary information of seed. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage seed information 	
Post Conditions	<ol style="list-style-type: none"> 1. seed information must added in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



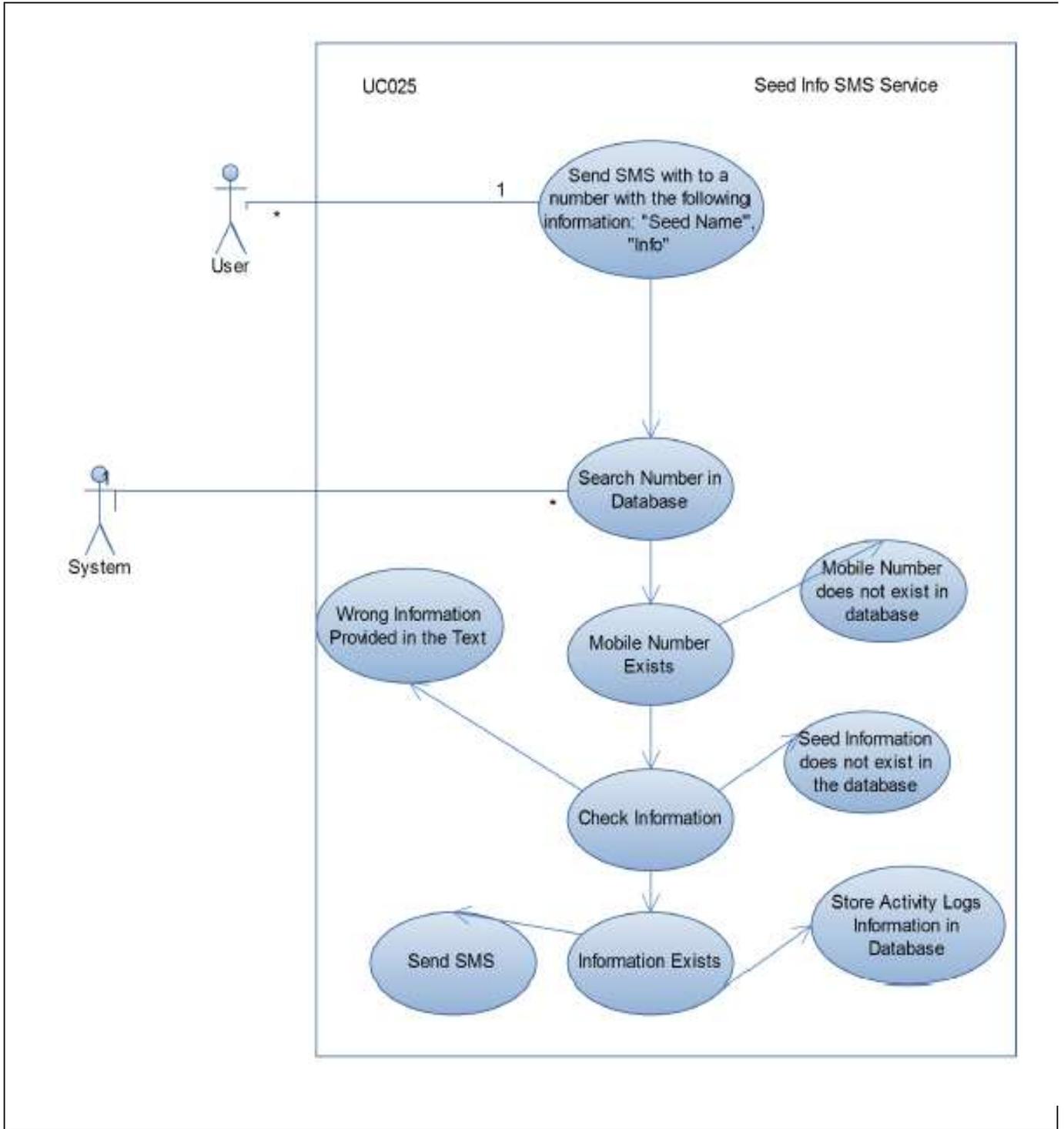
24. Update Seeds Information

User Case Ref	UC024	
User Case Name	Update seed information	
Description	This Use case is to update seed information into database	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User open Manage seed information module 2. System shows list of seed available in system 3. User select seed whose information need to edit 4. System show already exist information 5. User provide update information and press update information button 6. System will add seed information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if seed information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of seed 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to manage seed information 2. seed information must exist in database 	
Post Conditions	<ol style="list-style-type: none"> 1. seed information must updated in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



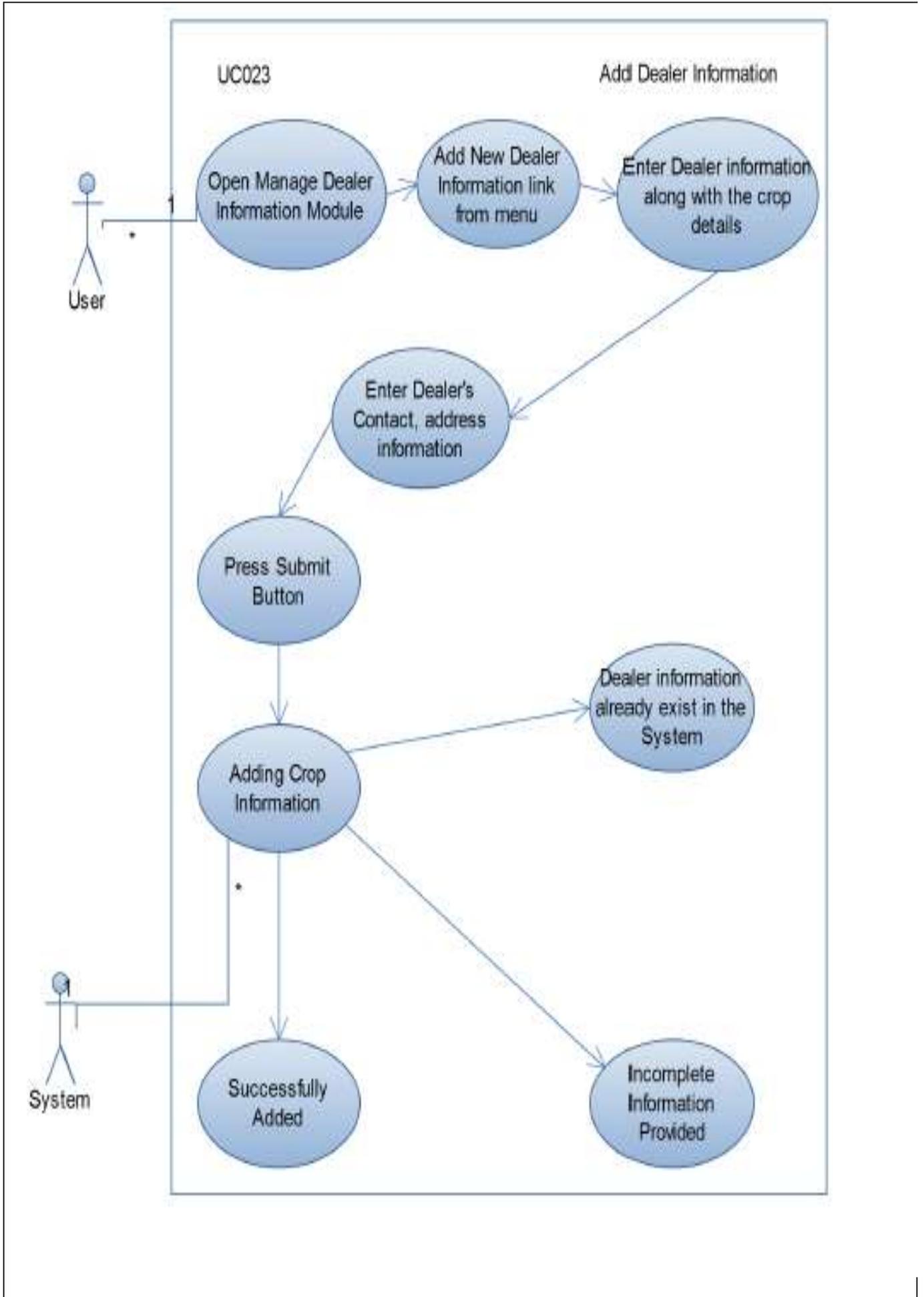
25. Seed Info SMS Service

User Case Ref	UC025	
User Case Name	Seed Info SMS Service	
Description	This Use case is get System will provide service to provide complete information about sowing, fertilizer for certain type of seeds pesticides for certain seed.	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User send SMS to certain number with following info in SMS “seed name”, “info” 2. System search database against cell number. If cell number exist in database system will move further 3. System will search database to get seed information 4. If information exist system will send SMS alert to mobile number 5. System will store activity logs information in database 	<ol style="list-style-type: none"> 4. System will prompt appropriate message if mobile number is not registered in database 5. System will prompt appropriate message if user has sent wrong text information 6. System will prompt appropriate message if seed information does not exist in database. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 3. User mobile number must exist in database 4. seed information must exists in database 	
Post Conditions	<ol style="list-style-type: none"> 2. User receive SMS alert which contain information about seed 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



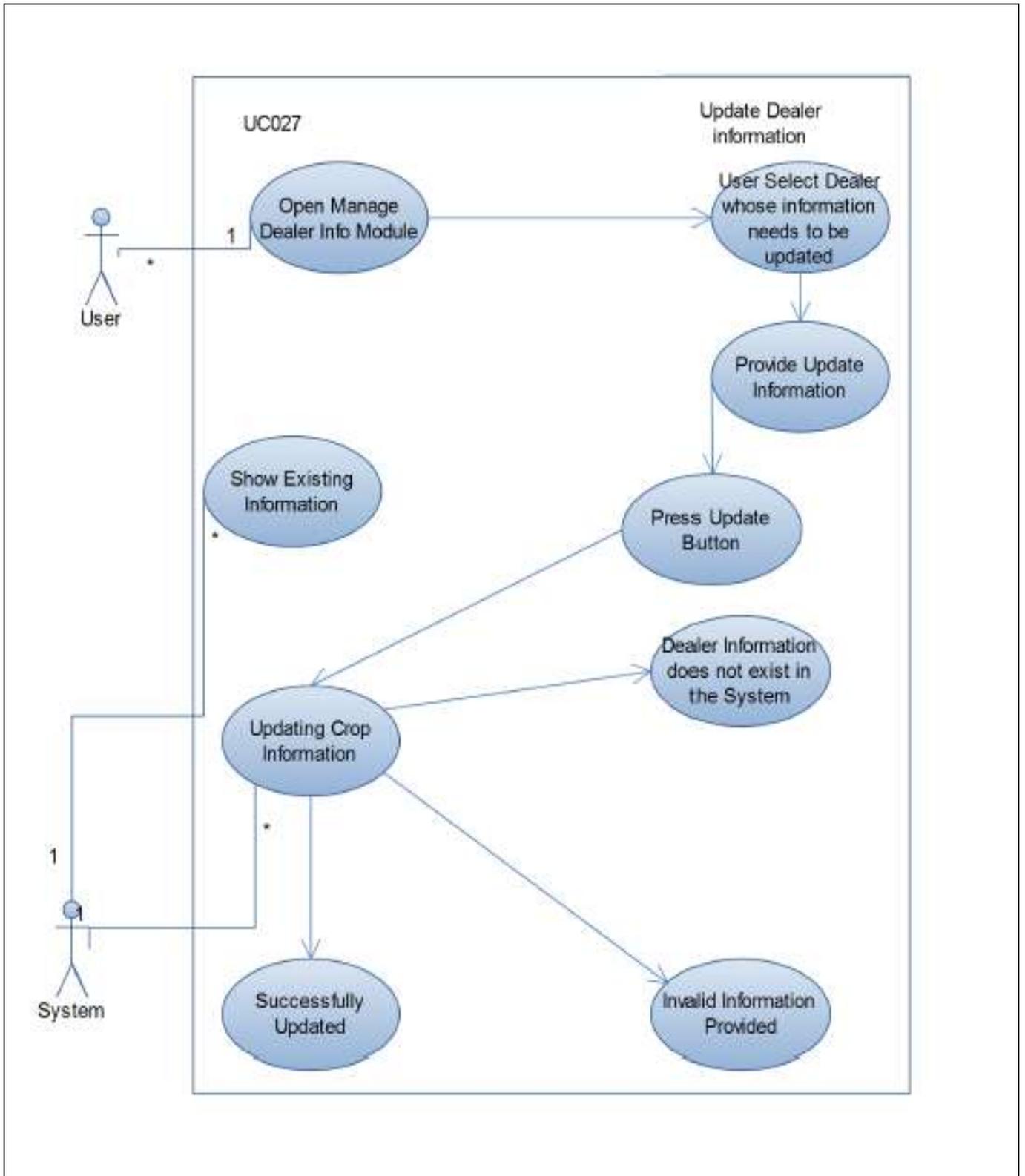
26. Add Dealer Information

User Case Ref	UC026	
User Case Name	Add Dealer information	
Description	This Use case is to add information of Dealer into system	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage Dealer information module 2. User will select add new dealer information link from menu 3. User enters dealer information along with details of crop. 4. User enter dealer's contact ,address information 5. User press submit button 6. System will add crop information and will prompt with appropriate message 	<ol style="list-style-type: none"> 3. System will prompt appropriate message if dealer information already exists in system 4. System will prompt appropriate message if user have not provided necessary information of dealer. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 2. User must have role to manage dealer information 	
Post Conditions	<ol style="list-style-type: none"> 2. Dealer information must added in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



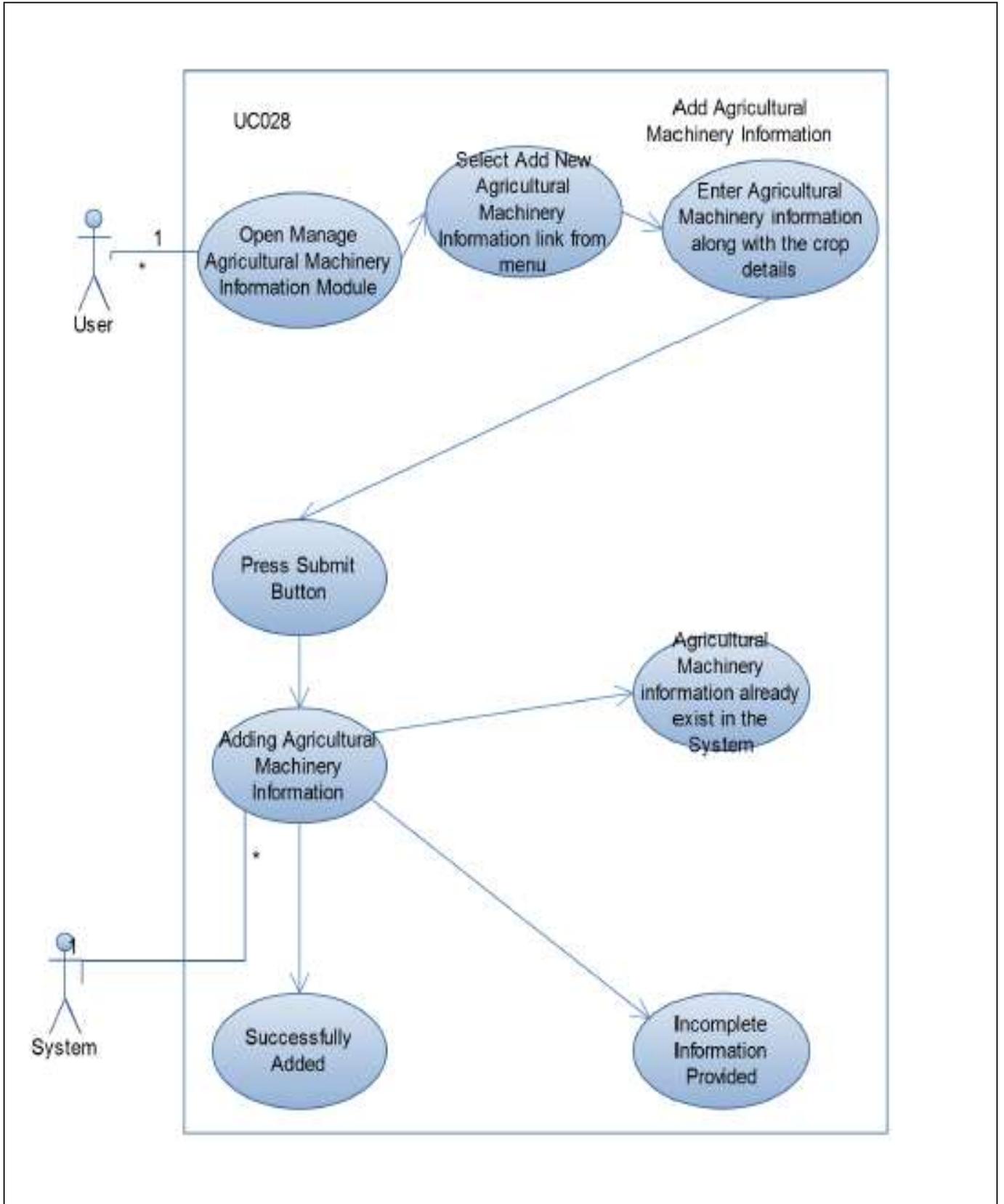
27. Update Dealer Information

User Case Ref	UC027	
User Case Name	Update Dealer information	
Description	This Use case is to update dealer information into system.	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User open Manage Dealer information module 2. System shows list of Dealer available in system 3. User select Dealer whose information need to edit 4. System show already exist information 5. User provide update information and press update information button 6. System will add Dealer information and will prompt with appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if Dealer information doesn't exists in system 2. System will prompt appropriate message if user have not provided necessary information of Dealer. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 3. User must have role to manage Dealer information 4. Dealer information must exist in database 	
Post Conditions	<ol style="list-style-type: none"> 2. Dealer information must updated in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



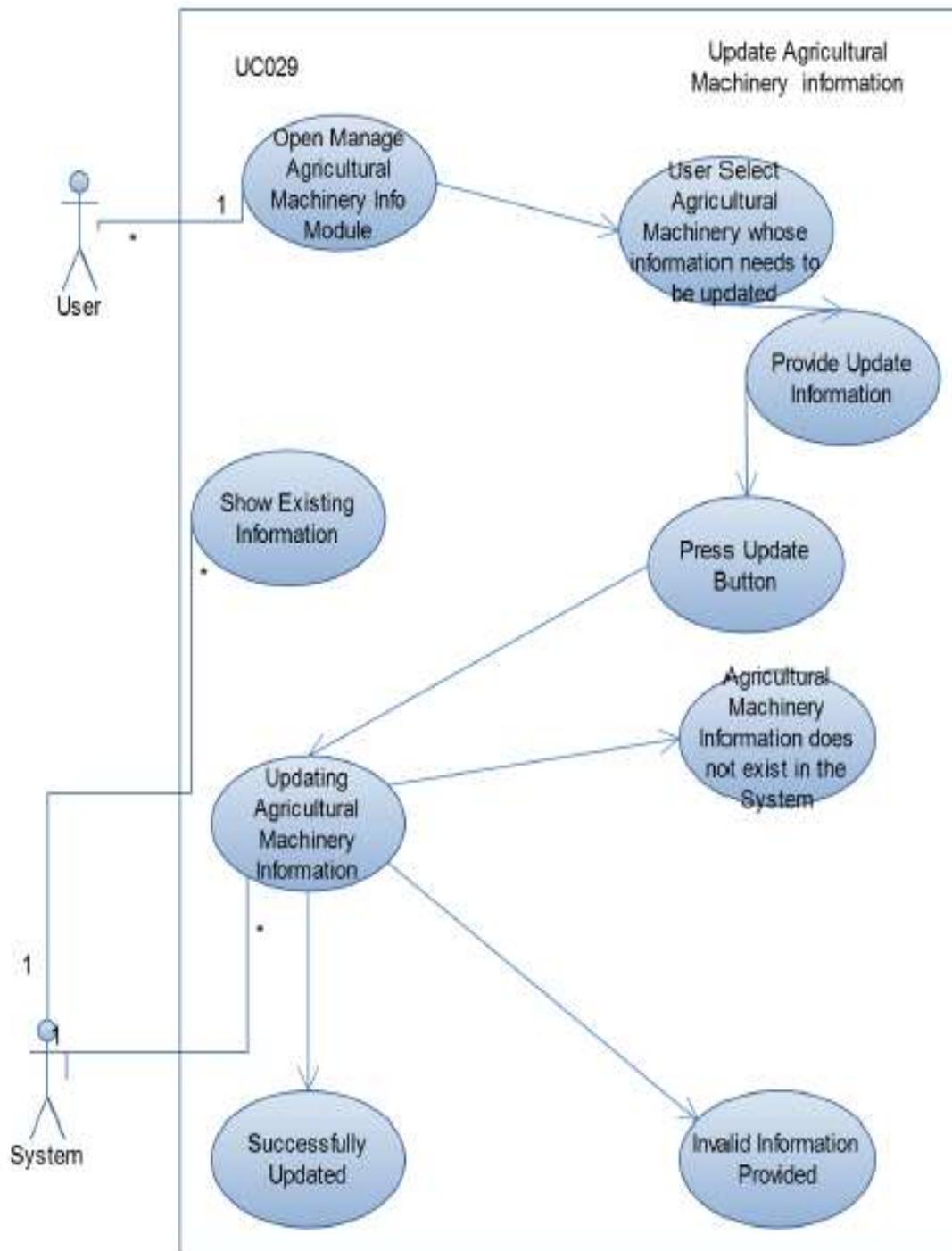
28. Add Agricultural Machinery Information

User Case Ref	UC028	
User Case Name	Add Agricultural machinery information	
Description	This Use case is to add information about agricultural machinery so that farmers can get latest information about pricing , usefulness of certain machinery in their area	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage Agricultural machinery information module 2. User will select add new Agricultural machinery information link from menu 3. User enters Agricultural machinery information along with details of crop. 4. User press submit button 5. System will add Agricultural machinery information and will prompt with appropriate message 	<ol style="list-style-type: none"> 5. System will prompt appropriate message if machinery information already exists in system 6. System will prompt appropriate message if user have not provided necessary information of machinery. 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 2. User must have role to manage Agricultural machinery information 	
Post Conditions	<ol style="list-style-type: none"> 2. Agricultural machinery information must added in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



29. Update Agricultural Machinery Information

User Case Ref		UC029
User Case Name		Update Agricultural machinery information
Description		
This Use case is to update information of Agricultural machinery already added into system		
Actors		User, System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 7. User open Manage Agricultural machinery information module 8. System shows list of Agricultural machinery available in system 9. User select machinery whose information need to edit 10. System show already exist information 11. User provide update information and press update information button 12. System will add machinery information and will prompt with appropriate message 		<ol style="list-style-type: none"> 3. System will prompt appropriate message if Agricultural machinery information doesn't exists in system 4. System will prompt appropriate message if user have not provided necessary information of Agricultural machinery.
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User must have role to manage Agricultural machinery information 2. Agricultural machinery information must exist in database
Post Conditions		<ol style="list-style-type: none"> 2. Agricultural machinery information must updated in database
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A

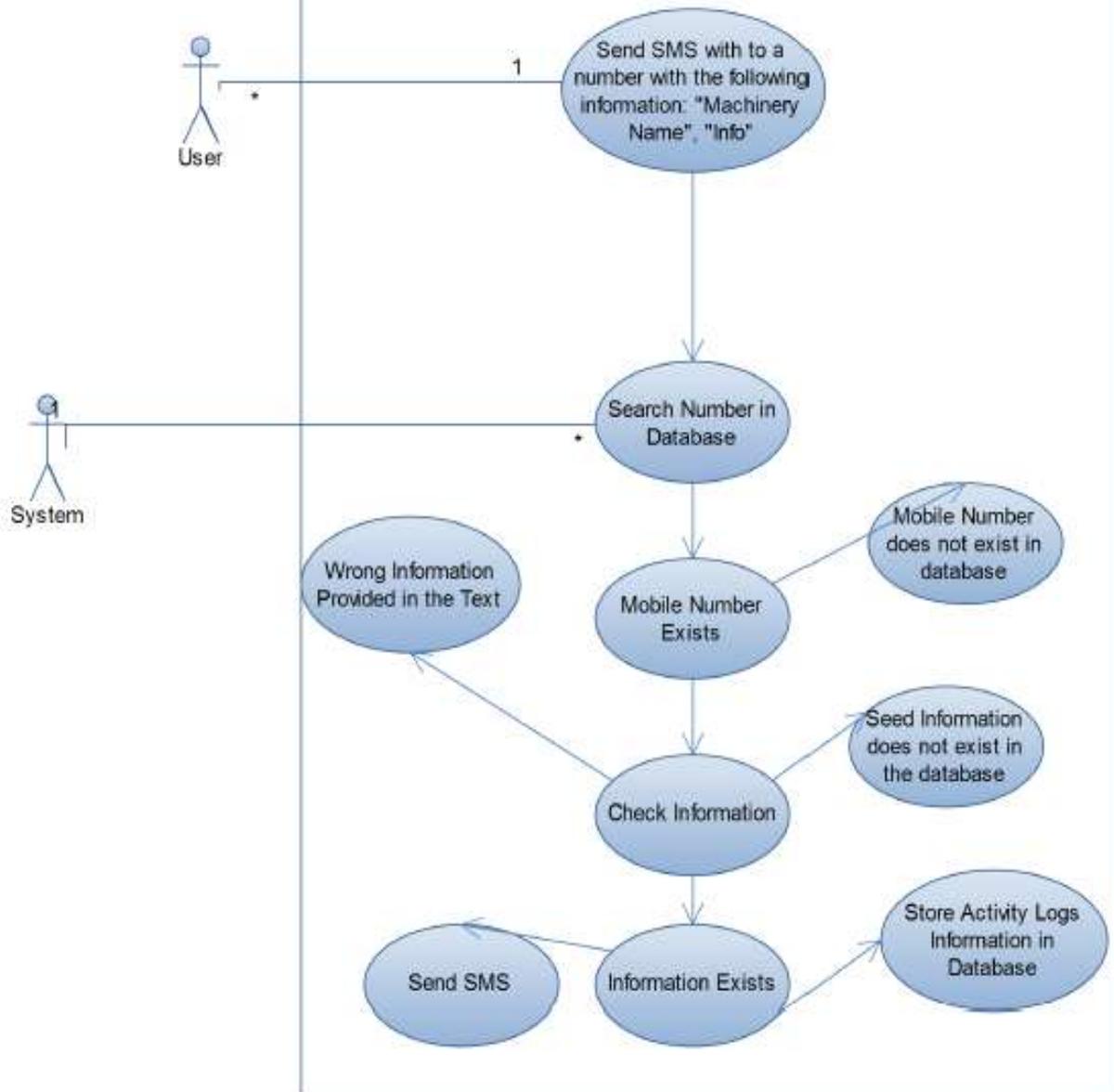


30. Agricultural machinery Info SMS Service

User Case Ref		UC030
User Case Name		Agricultural machinery Info SMS Service
Description		
This Use case is get System will provide service to provide complete information about Agricultural machinery , its price and usefulness in certain area		
Actors		User, System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User send SMS to certain number with following info in SMS “machinery name”, “info” 2. System search database against cell number. If cell number exist in database system will move further 3. System will search database to get machinery information 4. If information exist system will send SMS alert to mobile number 5. System will store activity logs information in database 		<ol style="list-style-type: none"> 1. System will prompt appropriate message if mobile number is not registered in database 2. System will prompt appropriate message if user has sent wrong text information 3. System will prompt appropriate message if machinery information does not exist in database.
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User mobile number must exist in database 2. crop information must exists in database
Post Conditions		<ol style="list-style-type: none"> 1. User receive SMS alert which contain information about crop
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A

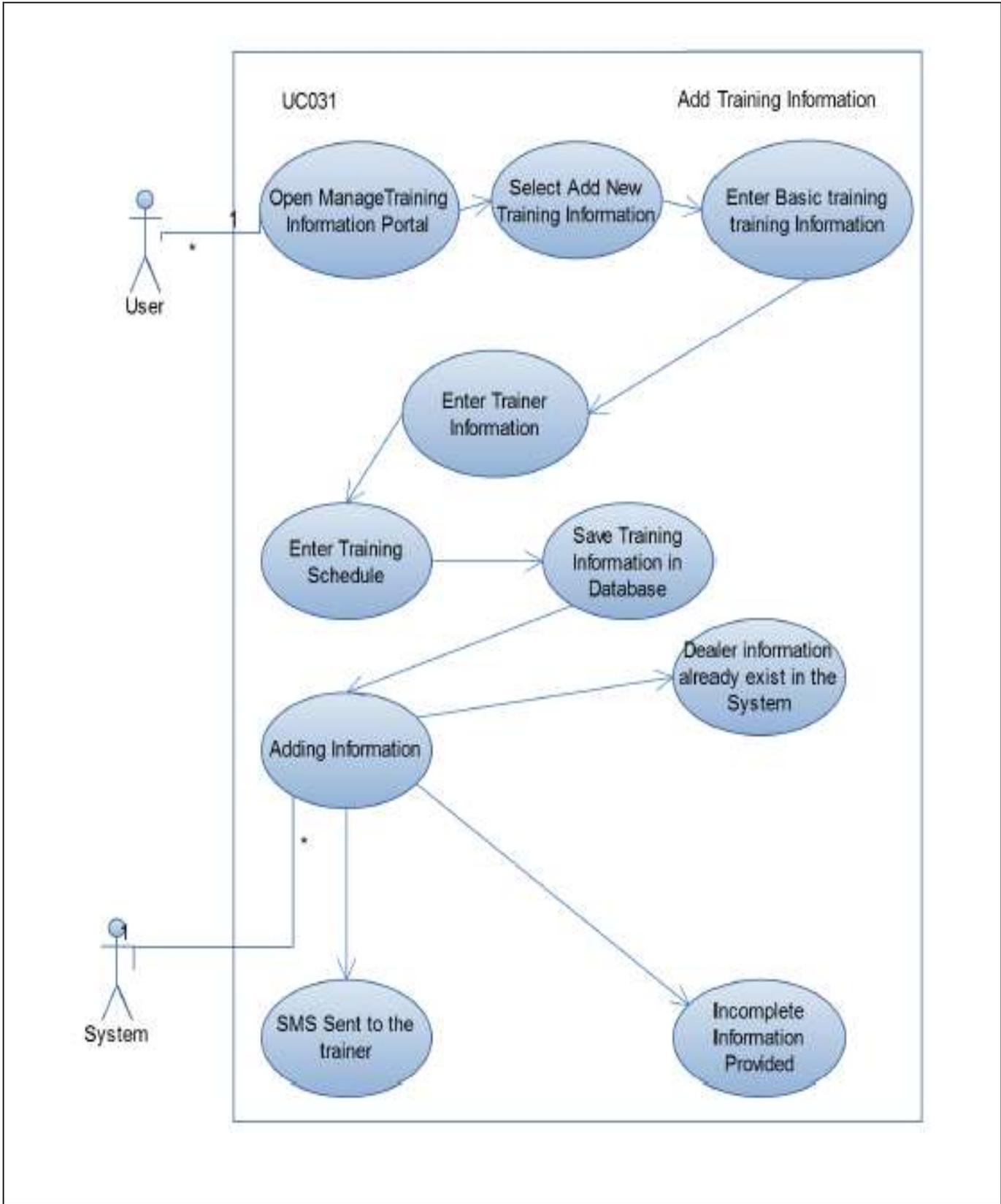
UC030

Agricultural Machinery
Info SMS Service



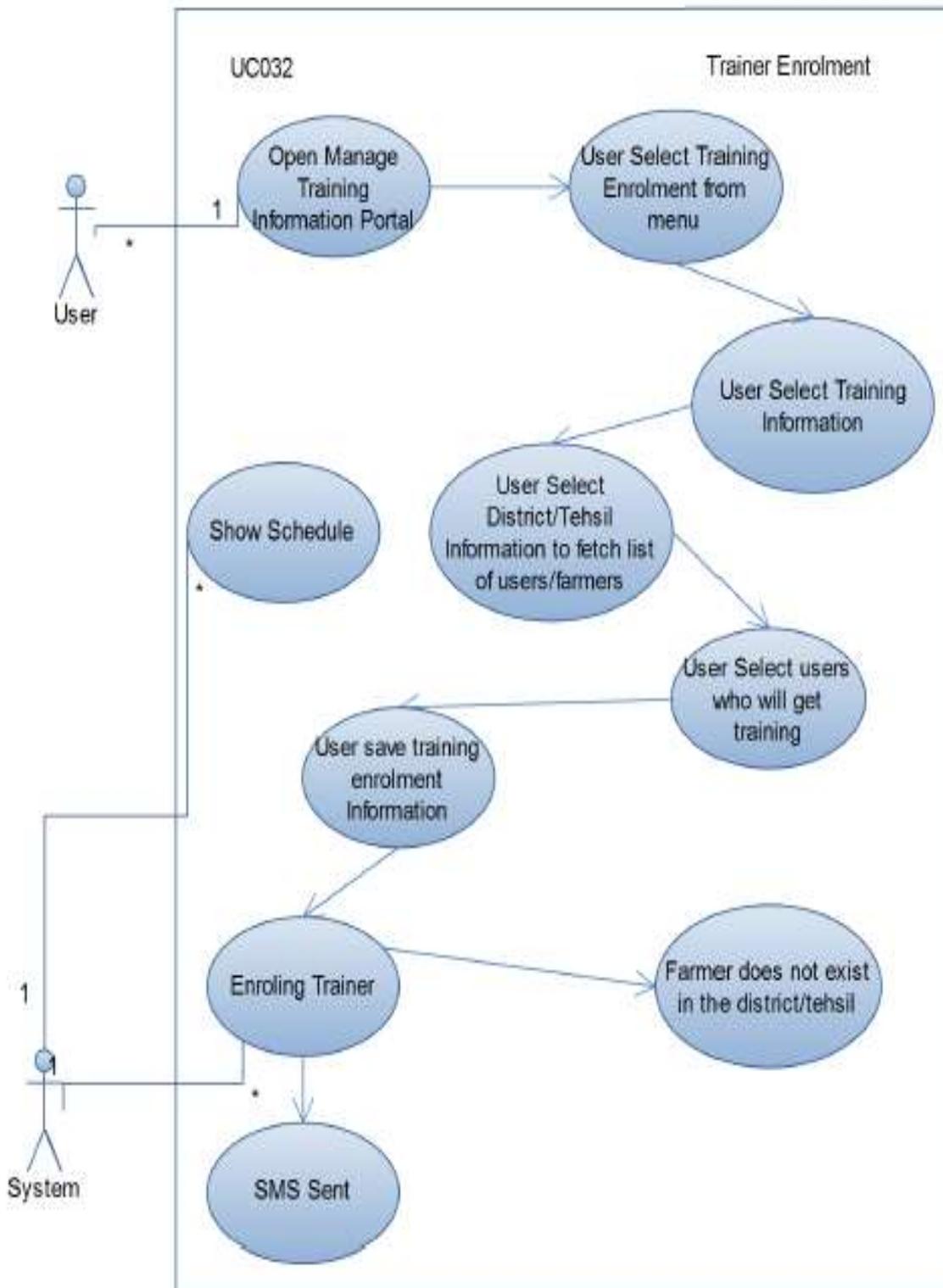
31. Add Training Information

User Case Ref		UC031
User Case Name		Add Training Information
Description		
This user case to add and schedule training information in system		
Actors		User, system
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User will open Manage Training Information portal 2. User select add new training information 3. User enter training basic information 4. User enter trainer information 5. User enter training schedule 6. User save training information in database 7. System prompt appropriate message about training and send email/SMS alerts to trainer 		<ol style="list-style-type: none"> 1. System prompt appropriate message if necessary information of training is not provided 2. System prompt appropriate message when user does not define schedule and trainer information
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User must have role to Manage Training information
Post Conditions		<ol style="list-style-type: none"> 1. Training information should be added into system
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



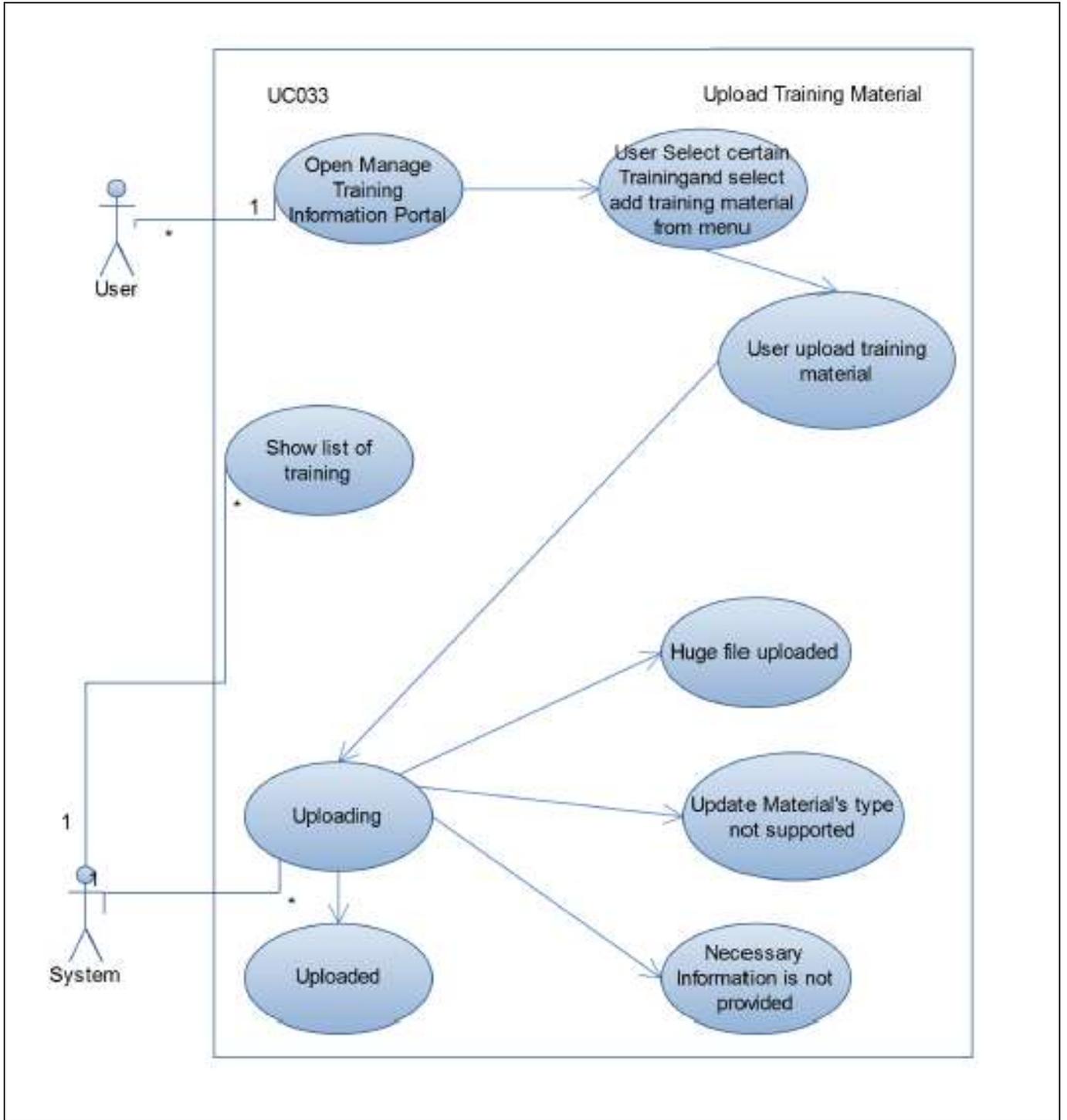
32. Training Enrolment

User Case Ref	UC032	
User Case Name	Training Enrolment	
Description	This user case to add peoples (farmers, staff) to training	
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage Training Information portal 2. User select Training Enrolment from menu 3. User select training information 4. System shows its schedule 5. User select district/tehsil information to fetch list of users/farmers 6. User select users who will get training 7. User Save training enrolment information 8. System send SMS alerts/email to management, trainees, trainer about schedule 	<ol style="list-style-type: none"> 1. System prompt appropriate message if farmers doesn't exist in certain district/tehsil 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 2. User must have role to Manage Training information 	
Post Conditions	<ol style="list-style-type: none"> 2. Users should be enrolled for certain training 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



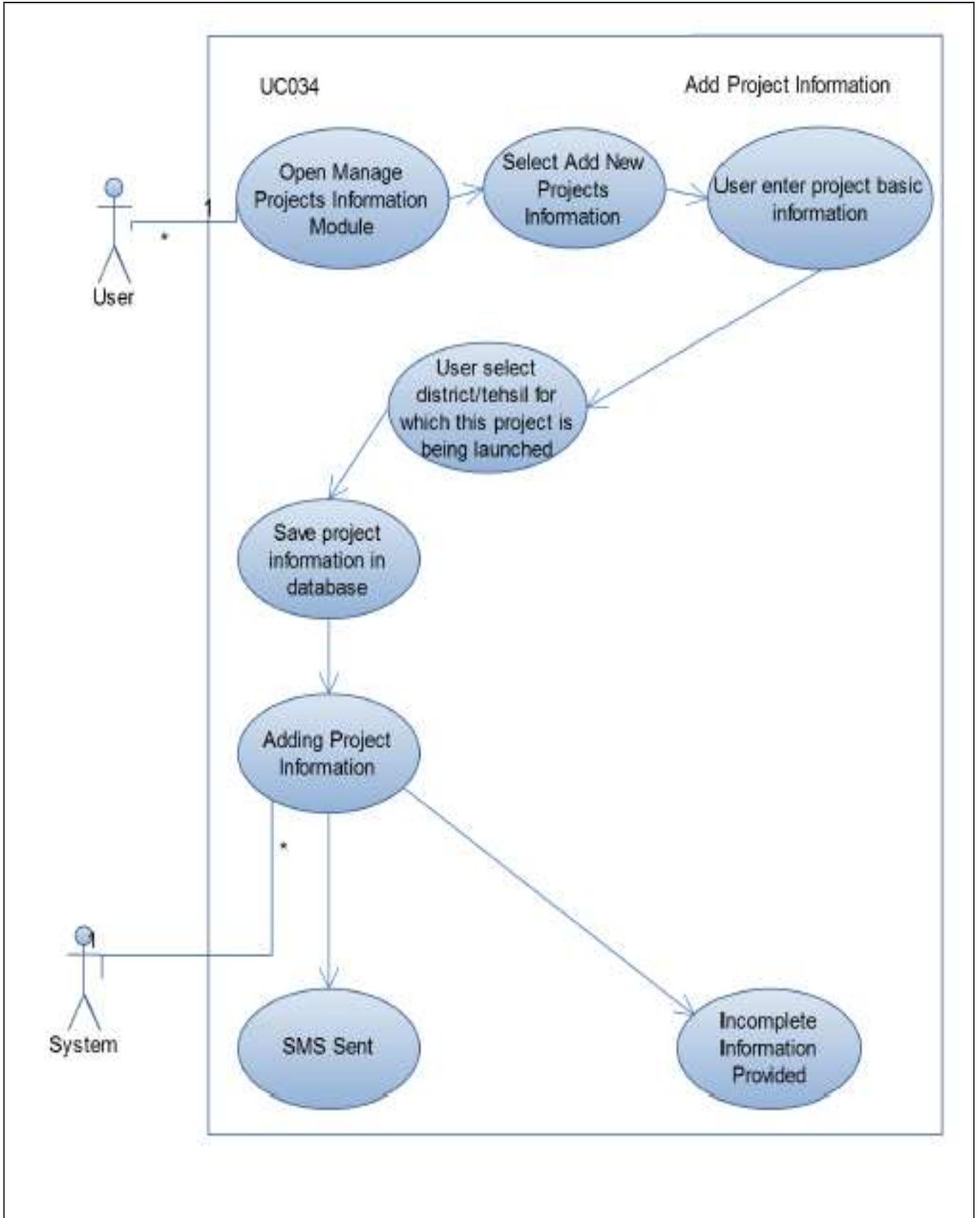
33. Upload Training Material

User Case Ref		UC033
User Case Name		Upload Training Material
Description		
This user case to add training material such as document, videos to enable users to view training information later on		
Actors		User, system
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User will open Manage Training Information portal 2. System show list of training 3. User select certain training and select add training material from menu 4. User upload training material 5. System shows appropriate message and send alerts to trainees 		<ol style="list-style-type: none"> 1. System prompt appropriate message if necessary information of training is not provided 2. System prompt appropriate message when user upload invalid or not supported type of material. 3. System shows message when user upload large files.
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User must have role to Manage Training information
Post Conditions		<ol style="list-style-type: none"> 1. Training material should be uploaded and viewable to other users or public portal under training information
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



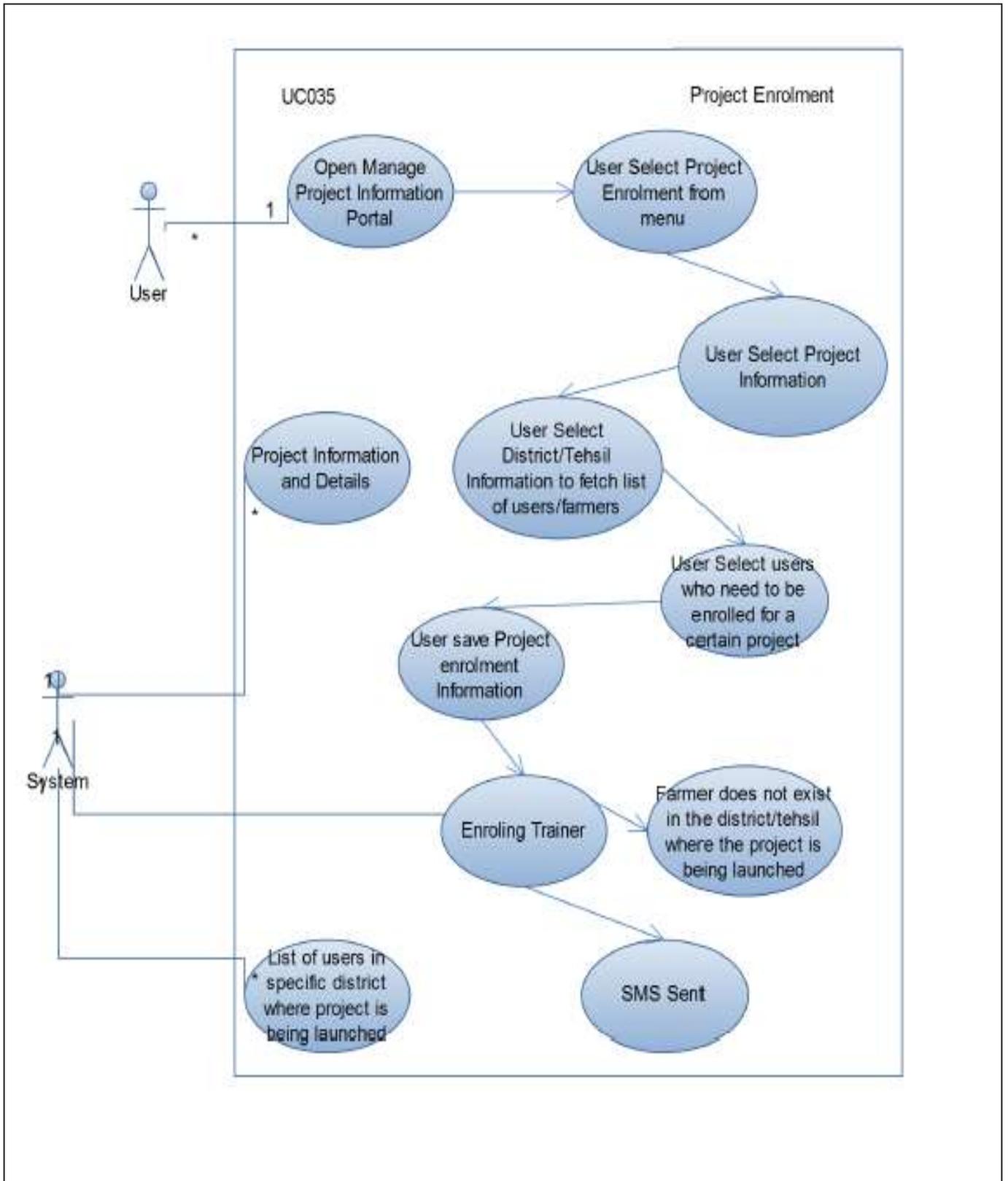
34. Add Project Information

User Case Ref	UC034	
User Case Name	Add Project Information	
Description	As government introduce new projects to farmers like kitchen gardening. Our system will maintain information of project and enrolment. This use case is to add new project information in database	
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage Projects Information portal 2. User select add new project information 3. User enter project basic information 4. User select district/tehsil for which this project is being launched 5. User save project information in database 6. System prompt appropriate message about training and send email/SMS alerts to trainer 	<ol style="list-style-type: none"> 1. System prompt appropriate message if necessary information of project is not entered 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to Manage Project information 	
Post Conditions	<ol style="list-style-type: none"> 1. Project information should be added into system 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



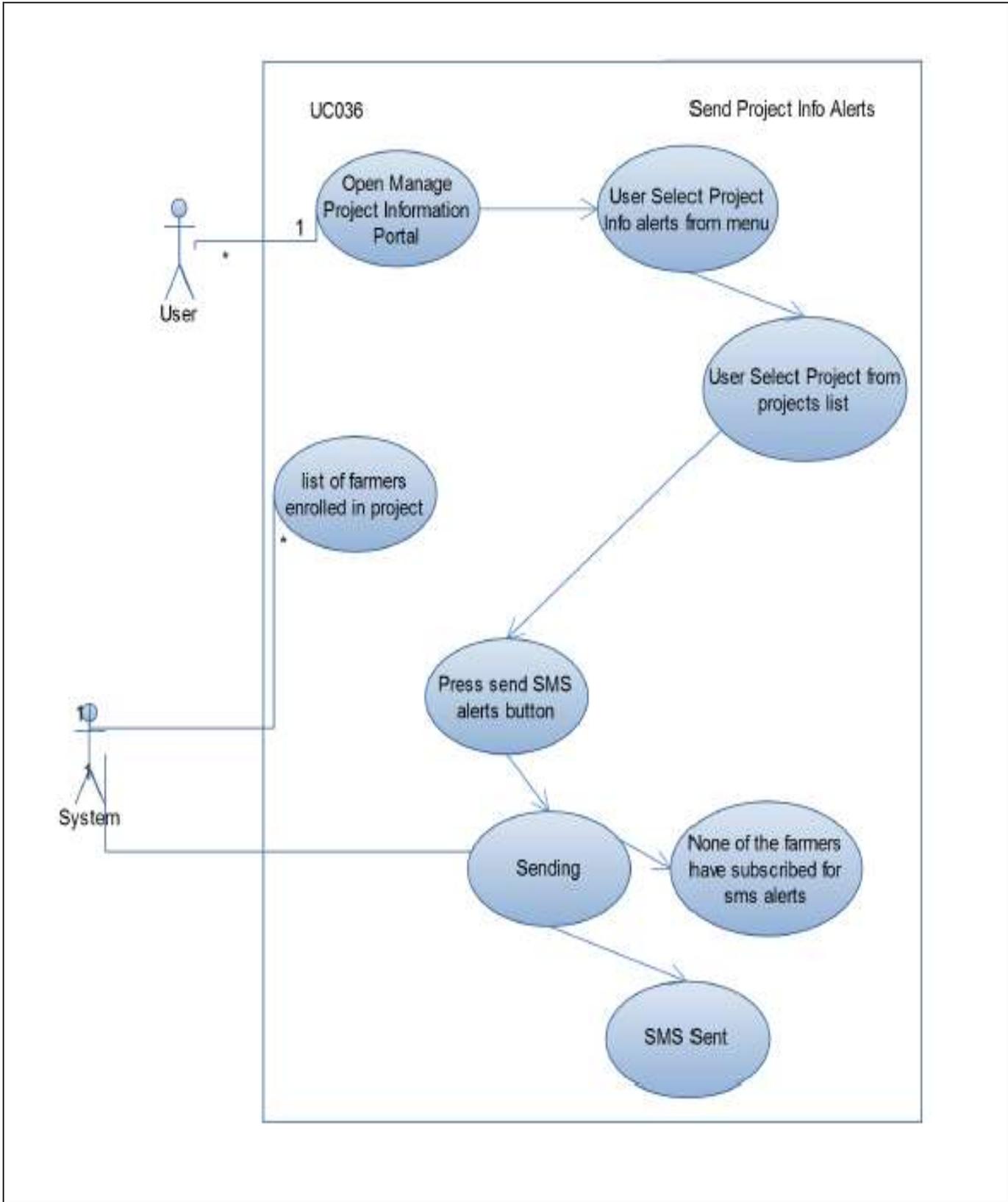
35. Project Enrolment

User Case Ref	UC035	
User Case Name	Project Enrolment	
Description	This user case to enroll farmers for certain project offered by government	
Actors	User, system	
Business Rules		
Basic Flow	Alternate Flow	
<ul style="list-style-type: none"> 9. User will open Manage Project Information portal 10. User select Project Enrolment from menu 11. User select Project information 12. System shows project information and details 13. System shows list of users in specific district where project is being launched. 14. User select users who need to be enrolled for certain project 15. User saves project enrolment information 16. System send SMS alerts/email to management, farmers about project enrolment 	<ul style="list-style-type: none"> 2. System prompt appropriate message if farmers doesn't exist in certain district/tehsil where project is being launched 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ul style="list-style-type: none"> 3. User must have role to Manage Project information 	
Post Conditions	<ul style="list-style-type: none"> 3. Users must be enrolled in project and sms alerts must be sent 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of "inherited from parent" use cases
N/A	N/A	N/A



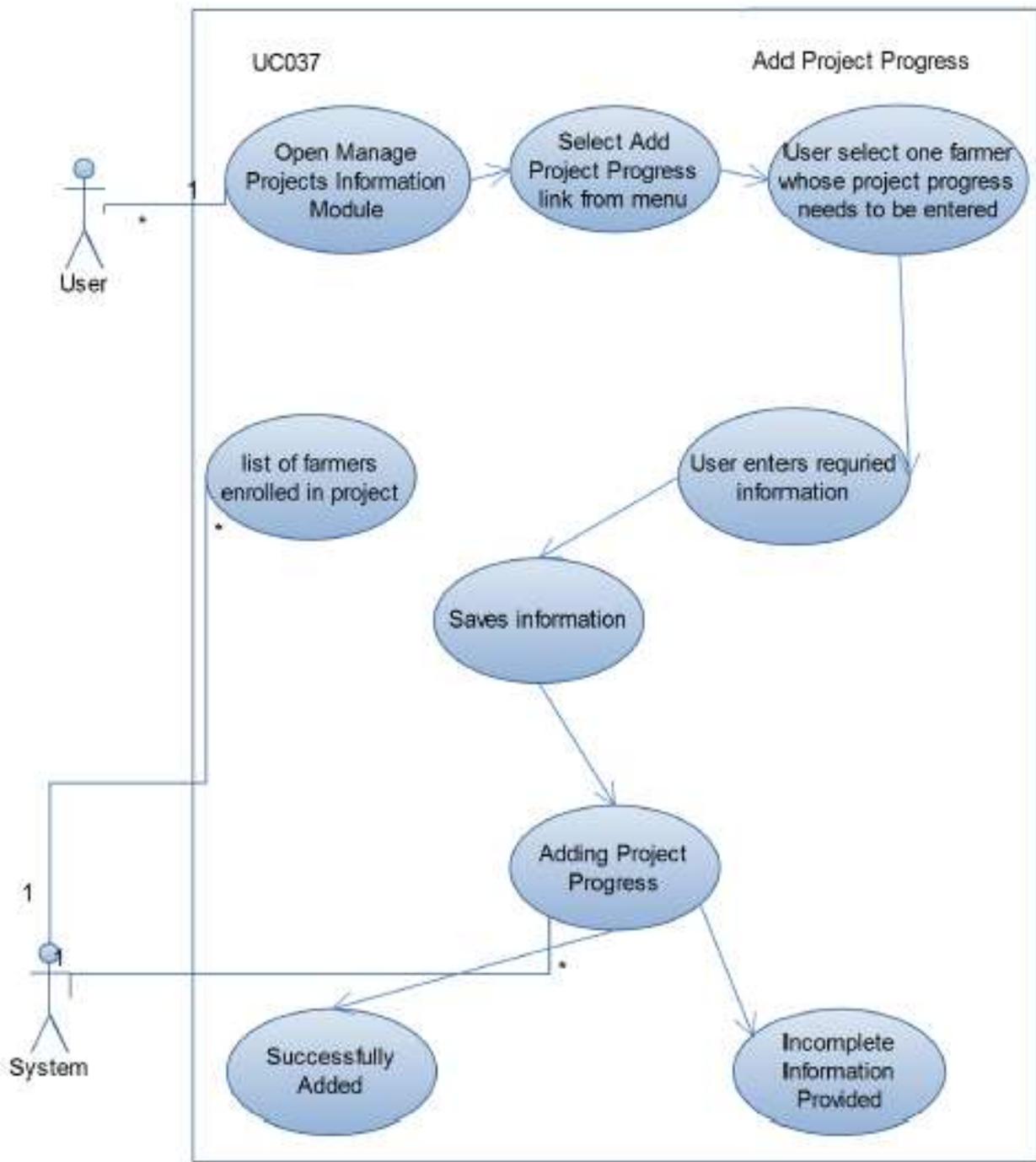
36. Send Project info Alerts

User Case Ref		UC036
User Case Name		Send Project Info alerts
Description		
This Use case is to send alerts about project to create awareness and to send certain instructions about project		
Actors		User, System
Business Rules		
Basic Flow		Alternate Flow
<ol style="list-style-type: none"> 1. User will open Manage Project Information module 2. User will select Send Project alerts link from menu 3. User will select project information from projects list 4. System will show list of farmers which are enrolled in project 5. Press send SMS alerts button 6. System will send project information to users 		<ol style="list-style-type: none"> 1. System will prompt appropriate message if none of the farmers have subscribed to SMS alert service
Non-Functional Requirements		N/A
Pre-Conditions		<ol style="list-style-type: none"> 1. User must have role Manage Project Information 2. List of farmers enrolled in project must exist with valid cell phone numbers
Post Conditions		<ol style="list-style-type: none"> 1. SMS alerts must be send to farmer and other management peoples
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



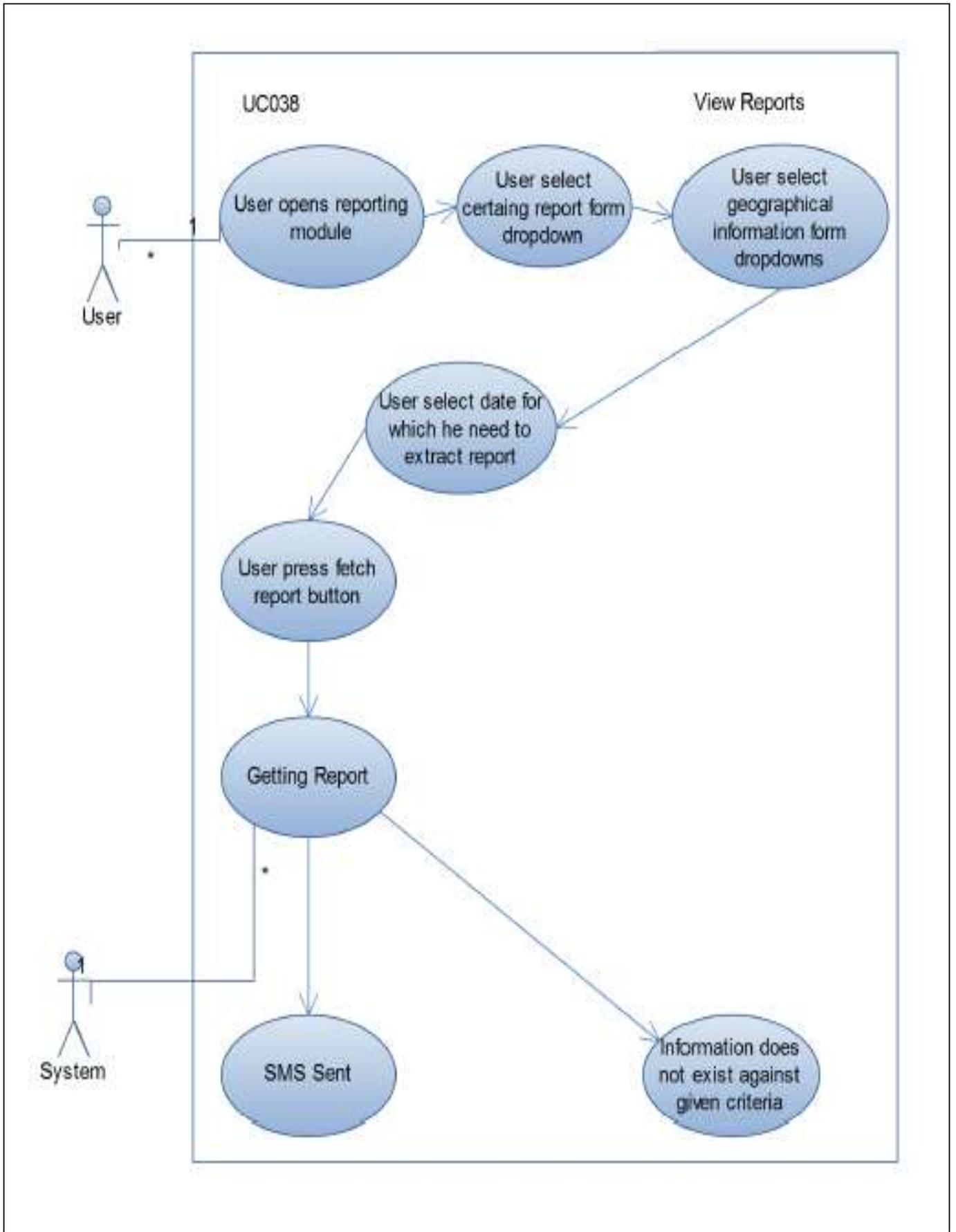
37. Add Project Progress

User Case Ref	UC037	
User Case Name	Add Project progress	
Description	This Use case is to add progress of farmer on certain project periodically which will be collected through different sources	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Manage Project Information module 2. User will select Add Project progress link from menu 3. System will show list of farmers enrolled in project 4. User select one farmer whose project progress need to be entered 5. User enters required information and saves information 6. System prompt appropriate message 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if user have not provided necessary data of project progress 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role Manage Project Information 	
Post Conditions	<ol style="list-style-type: none"> 1. Project progress should be added against a farmer 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



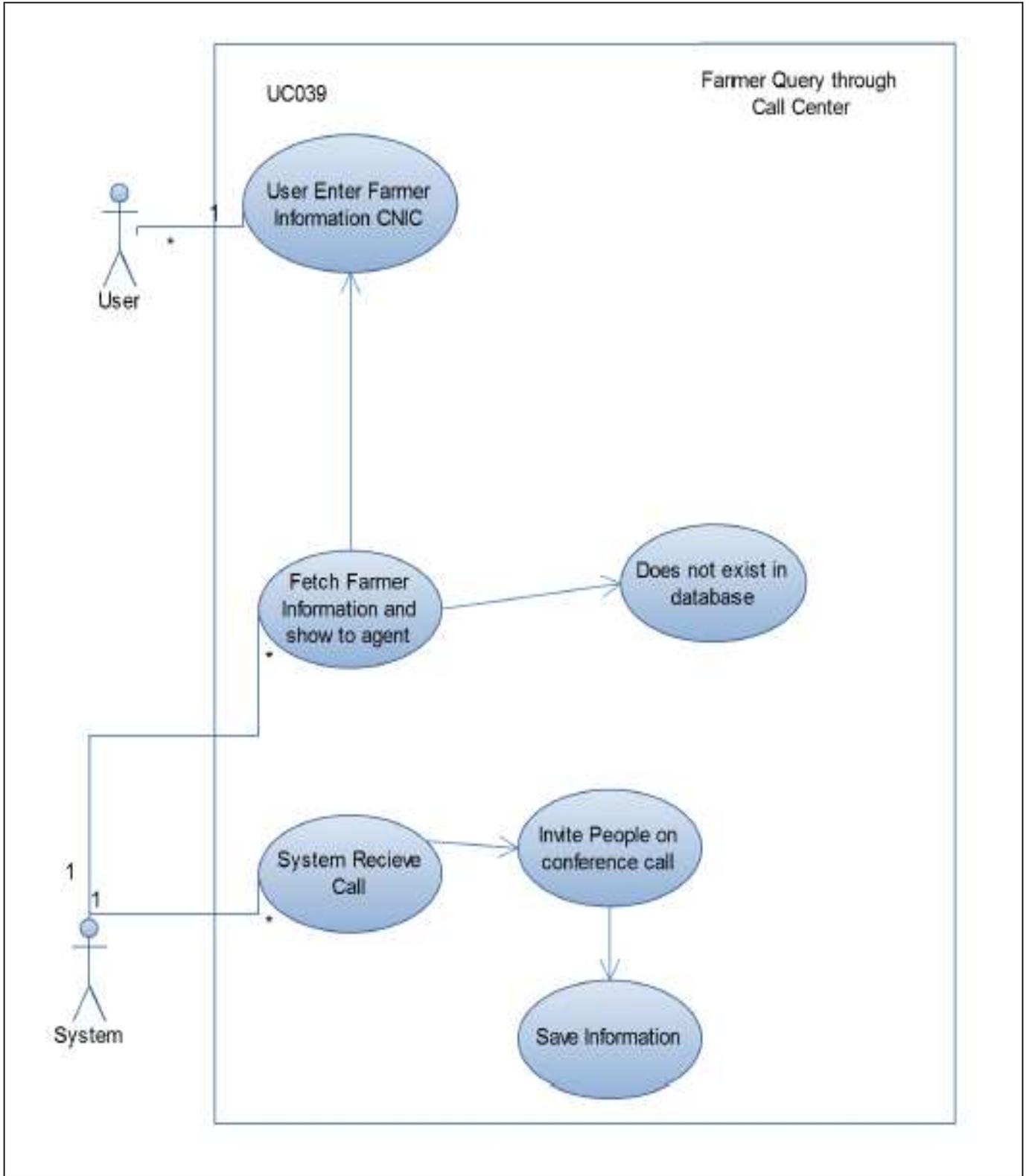
38. View Reports

User Case Ref	UC038	
User Case Name	View Report	
Description		
This Use case is to view report by management user		
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. User will open Reporting module 2. User select certain report from dropdown 3. User select geographical information (province, district, tehsil) from dropdowns 4. User select dates for which he need to extract report 5. User press fetch report button 6. System shows complete report according to certain criteria 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if information does not exists against selected criteria 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to view reports 	
Post Conditions	<ol style="list-style-type: none"> 2. System show should correct report 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A



39. Farmer Query through Call Center

User Case Ref	UC039	
User Case Name	Farmer Query though call center	
Description	This Use case is to handle farmer queries through call center	
Actors	User, System	
Business Rules		
Basic Flow	Alternate Flow	
<ol style="list-style-type: none"> 1. System receive call 2. User enter farmer information CNIC 3. System fetch farmer information and shows it before agent 4. Call center agent resolve issue or forward the call or invite people for conference call 5. Call center agent saves information provided to farmer in system to be used later for reference/FAQs 	<ol style="list-style-type: none"> 1. System will prompt appropriate message if farmer information does not exists in database 	
Non-Functional Requirements	N/A	
Pre-Conditions	<ol style="list-style-type: none"> 1. User must have role to enter call information 	
Post Conditions	<ol style="list-style-type: none"> 1. System must have farmer query and resolution logs saved in database 	
Extension Points	Extension Condition	Extending Use Case
N/A	N/A	N/A
List of <<include>> use cases	List of <<extended>> use cases	List of “inherited from parent” use cases
N/A	N/A	N/A





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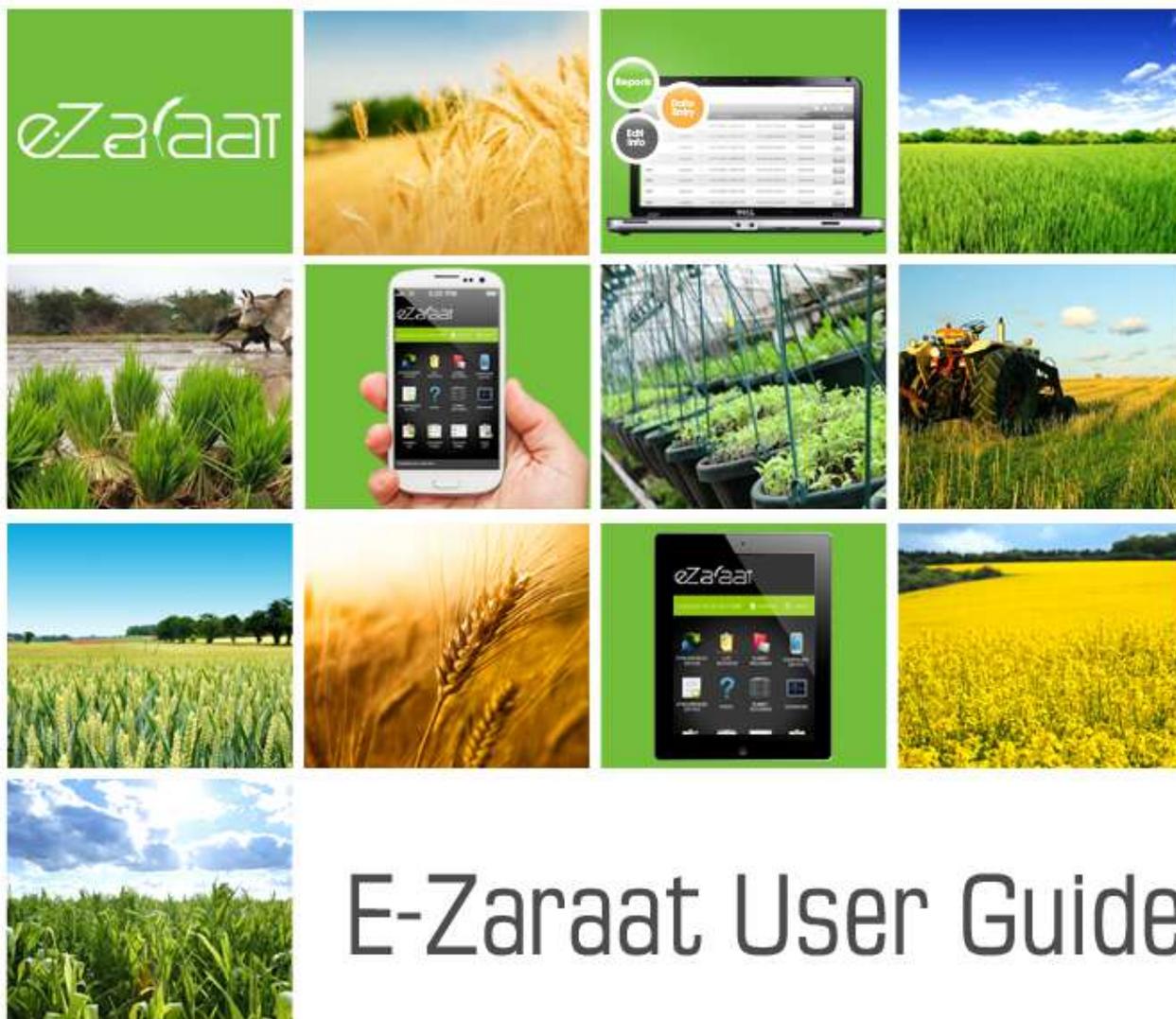
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Annex-B User Guide E-Zaraat



E-Zaraat User Guide

Developed by: Abdul Wahab, Mahrukh Siraj

Contents

Contents.....	1
1. Getting Started.....	2
2. User Guide for eZaraat Web Application (Administrators).....	3
3. eZaraat Web Application.....	11
4. eZaraat Mobile Application.....	21

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1. Getting Started

The e-Zaraat application has two major components. One is the web application and the other is the mobile application. e-Zaraat web application runs on any computer with a web browser. The mobile application is designed to run on Android based mobile phones and tablets.

The Web application is designed to perform the following roles:

- Administration
- Data entry
- Report generation

The first section of the guide describes the web application and also for people who are designated a 'User' role.

The Mobile application is designed to run on android based phones and tablets. In this guide, Google Nexus 7 has been used as a device of choice. The mobile application is designed to enter data from various surveys conducted by the field staff of the Directorate General of Agriculture Extension and Adoptive research. The application is designed to query and report on basic configuration data as well.

2. User Guide for eZaraat Web Application (Administrators)

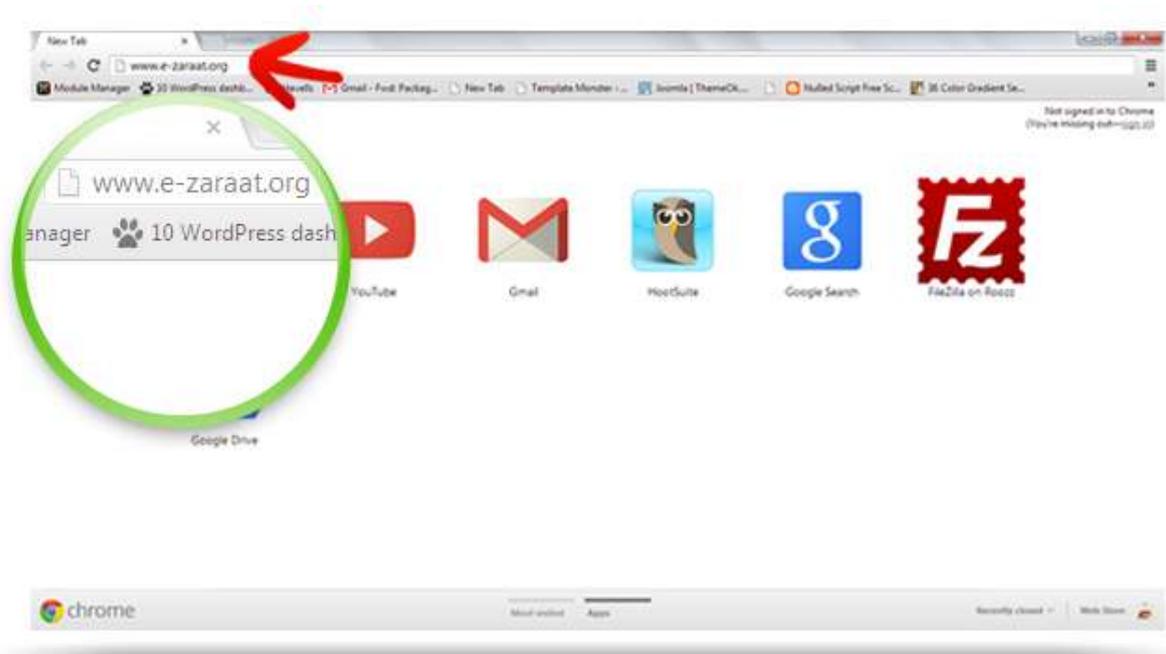
The users with the Admin role can perform the following tasks:

- User Administration
- Mobile Device Registration (the application is designed to run only on registered mobile devices)
- Creation and assignment of new survey/input forms to users.

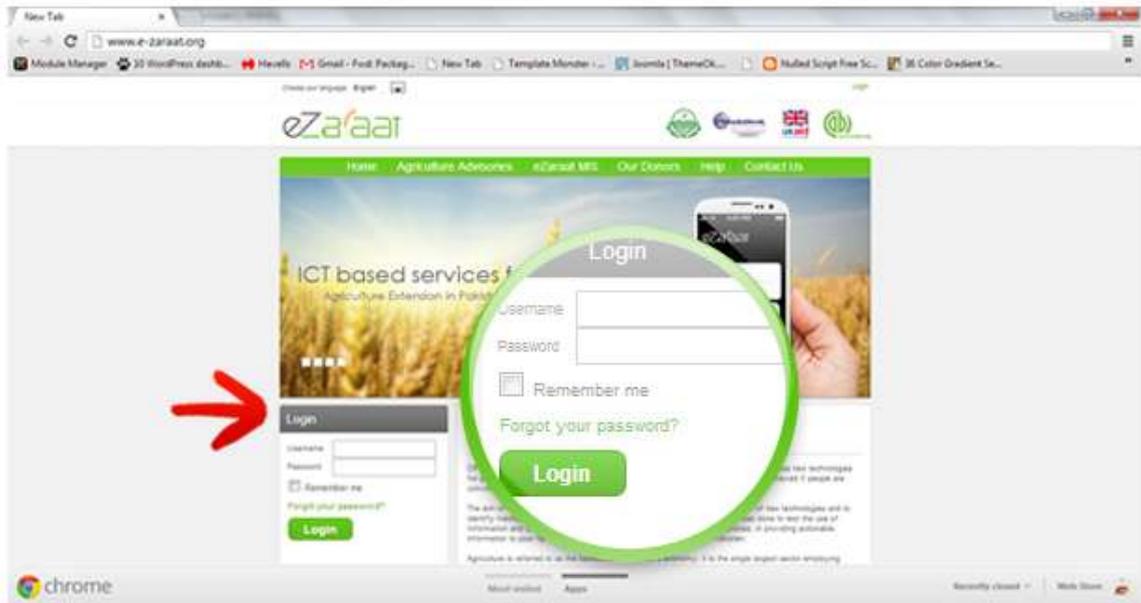
The following describes how to perform the admin tasks for E-Zaraat.

1. Power on your computer. The power on key should be on the top or middle of your desktop PC.
2. Once the operating system (Windows etc.) has loaded, open your browser (Internet Explorer/Mozilla Firefox/Google Chrome etc.).

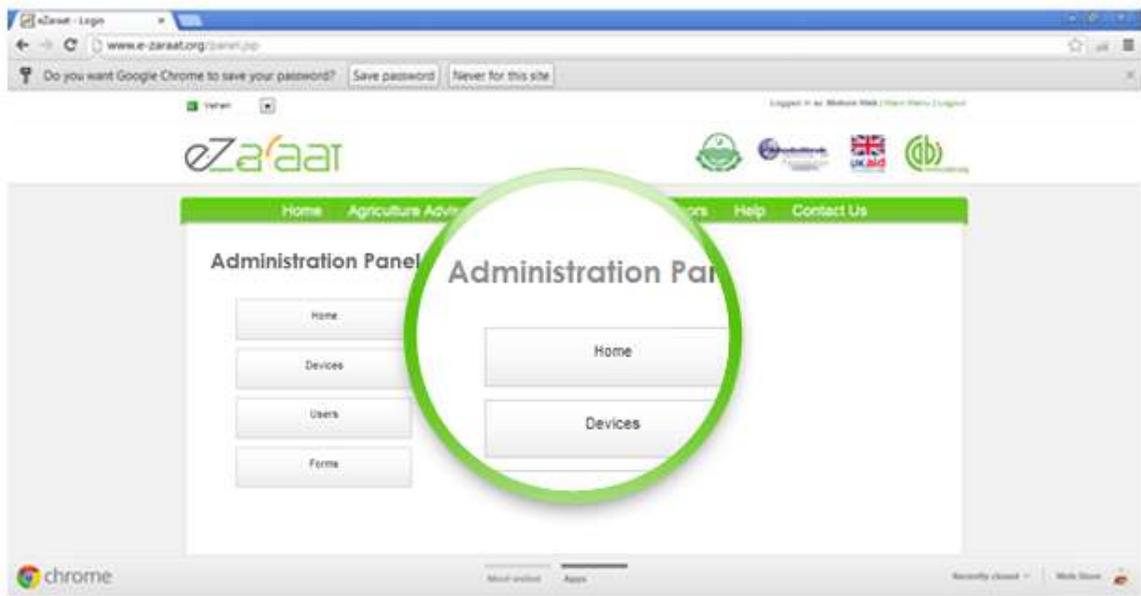
Note: For this guide, we are using Google Chrome, which along with Mozilla Firefox, are the preferred browsers of usage.



3. As shown in the above image, enter the URL "www.e-zaraat.org" into the browser and press enter.
4. Once you see the page below, enter your login credentials (Administrator) to the Login section in the bottom left and click on the "Login" button or press enter.



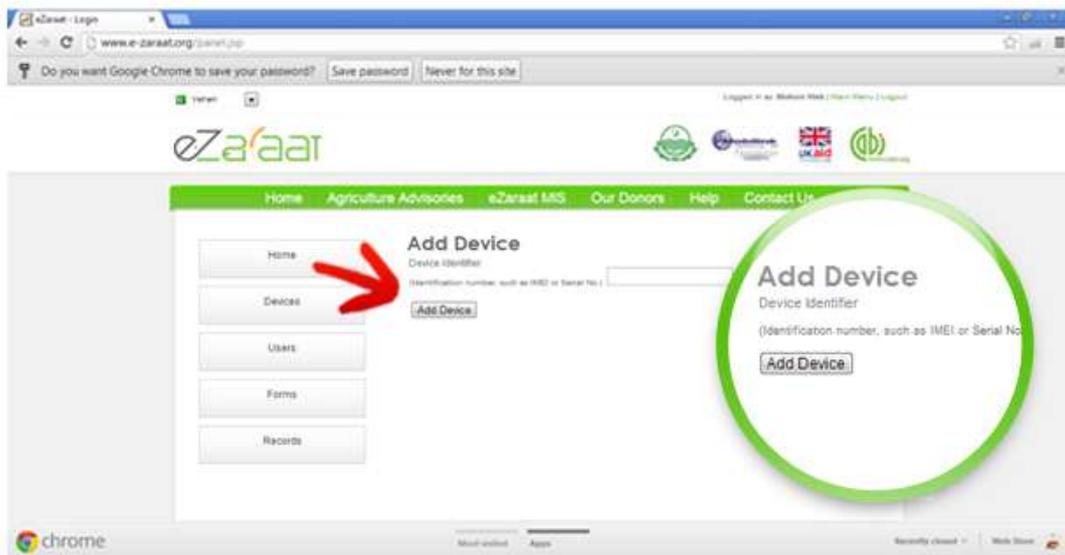
5. Once logged in, you will see the Administration Panel with a list of menus, as shown below.



6. In order to view currently existing devices in the databases, click on the Devices link, as shown above, which will show the following screen.



7. As shown above, click on the "Add New Device" button to insert a new device into the database.

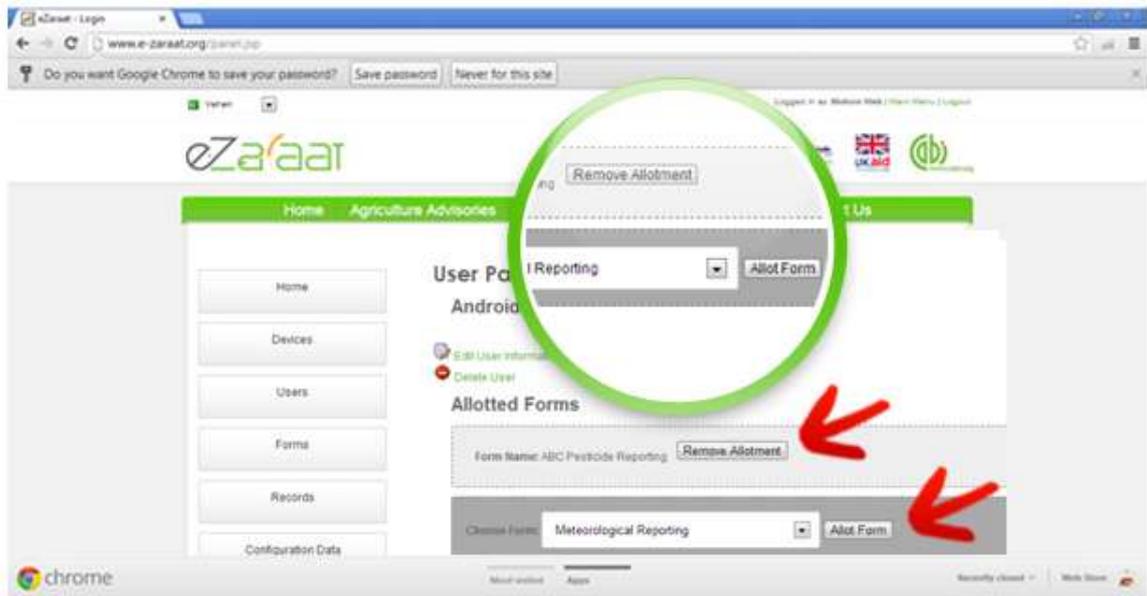


8. As shown above, the Add Device page appears which gives you an input box to insert the device identification number, which can be either the IMEI number for devices which support a GSM network, or WiFi MAC addresses for devices that do not support GSM networks (mostly tablets). Once done, click on the "Add Device" button (as shown above) to insert the device into the database.

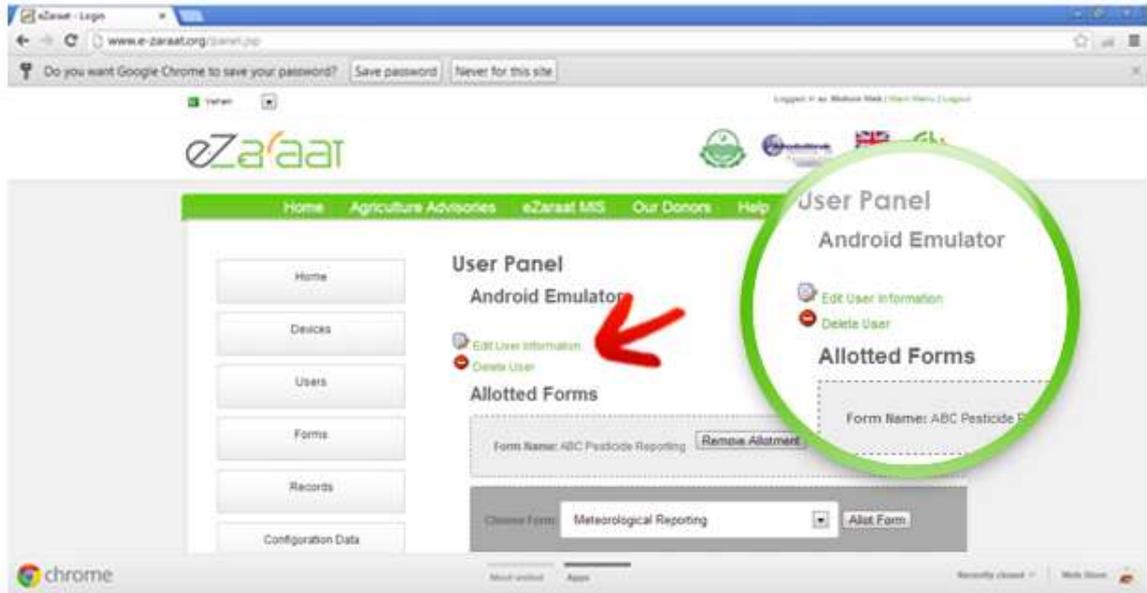
9. As shown below, click on the Users button to view the existing users in the database.



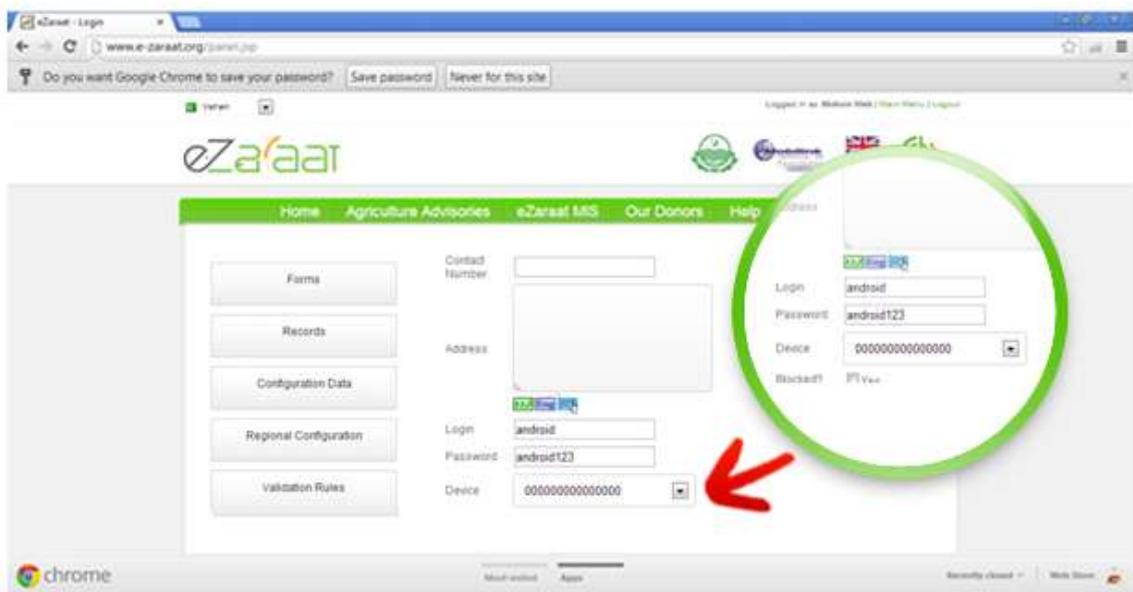
10. Click on the black box (panel button) to assign survey forms to the users that they will synchronize on their Android devices or will be able to view them on their Web panels.



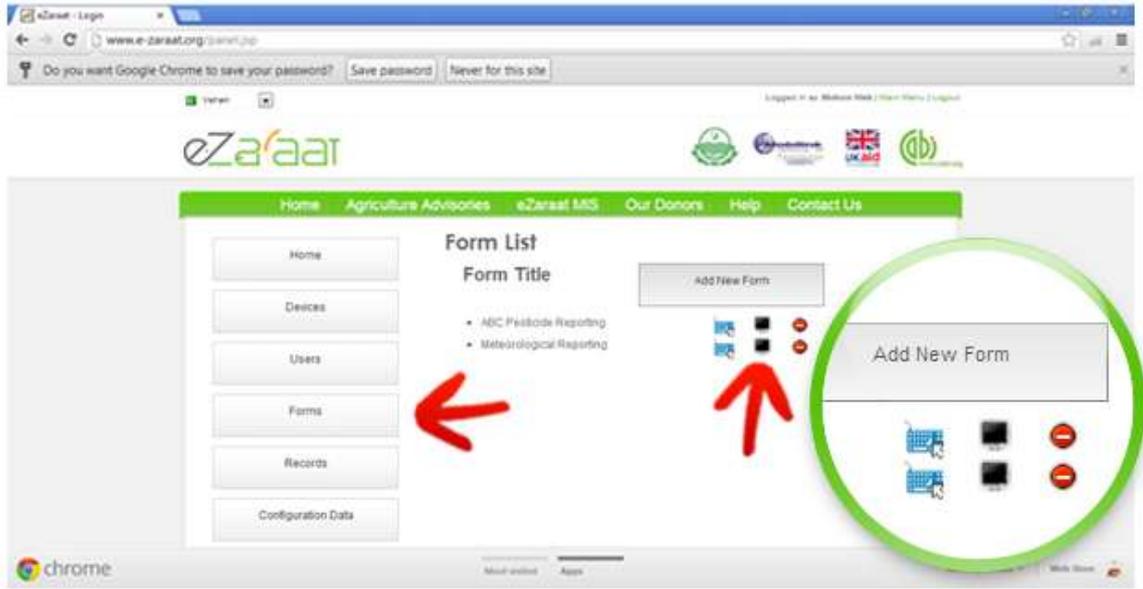
11. In order to allot new forms to the user, click on the "Allot Form" button, as shown above by the black arrow. In order to remove the form from the list of allotted forms, click on the "Remove Allotment" button as shown above by the blue arrow.



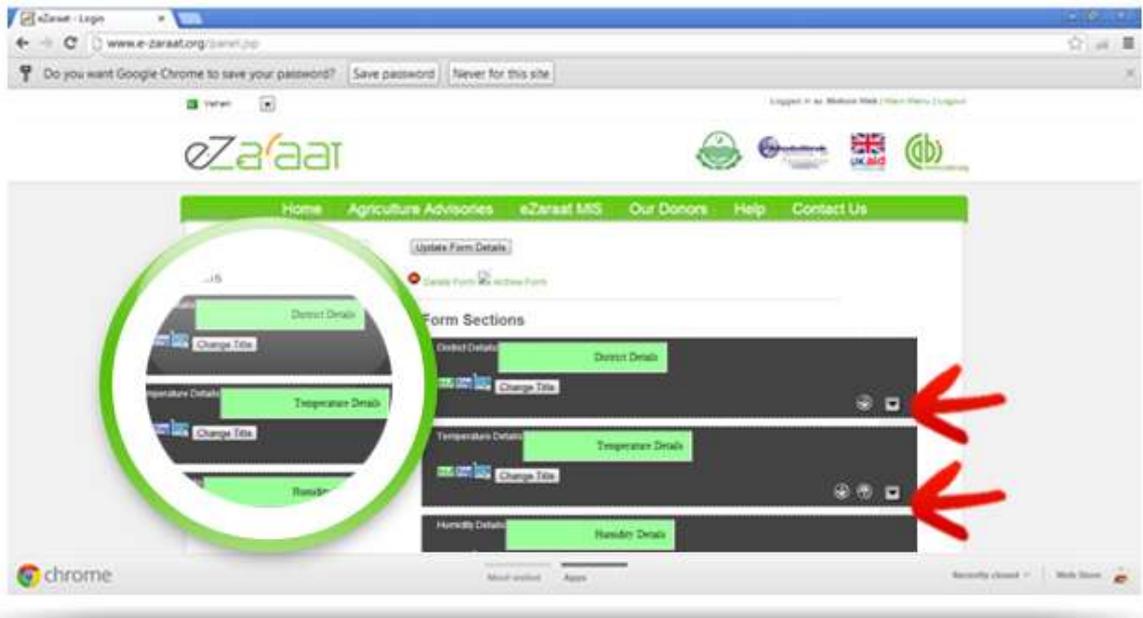
12. In order to edit the user's information, click on the Edit User Information link, as shown above. The following image shows the screen where the user's information can be modified. The devices entered previously appear in the list highlighted below.



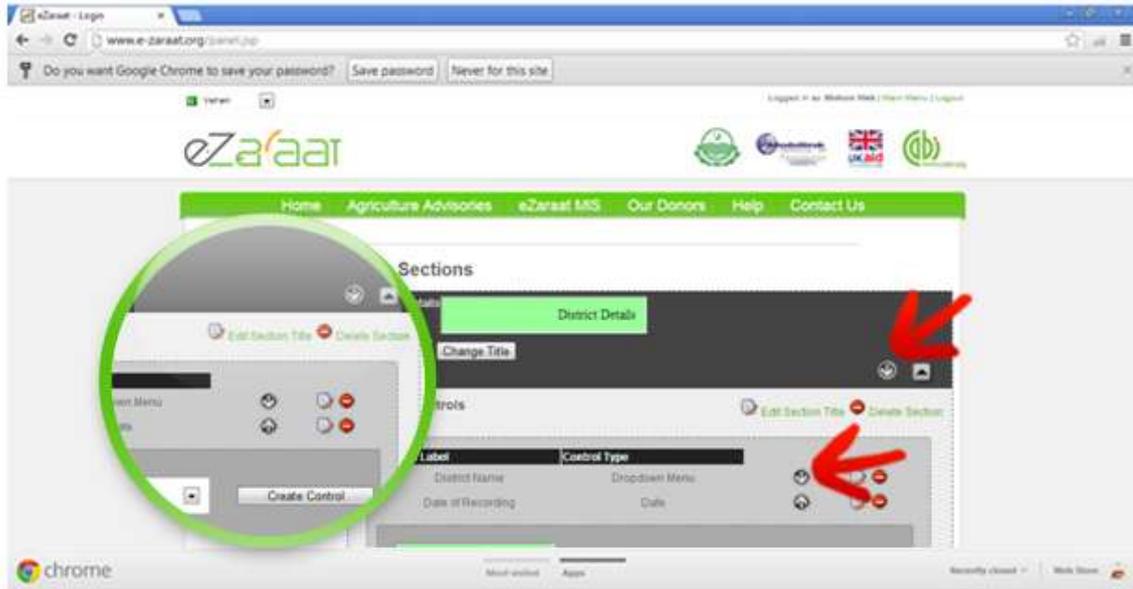
13. In order to view the existing survey forms composed and stored in the database, click on the "Forms" button as displayed below.



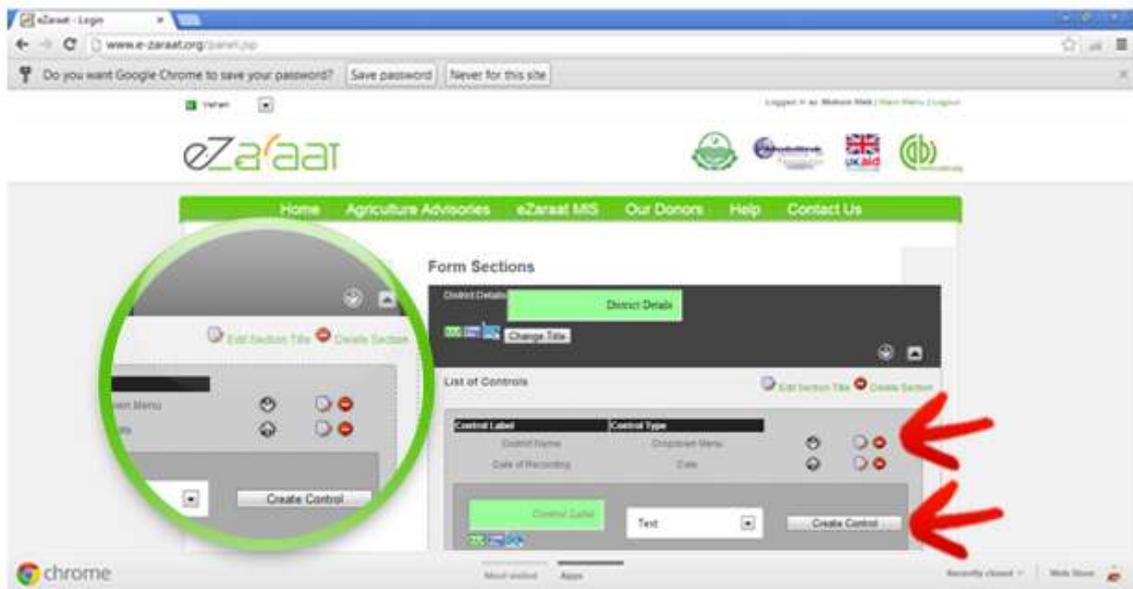
14. In order to compose a new survey form, click on the black box (panel button) as shown above by the blue arrow.



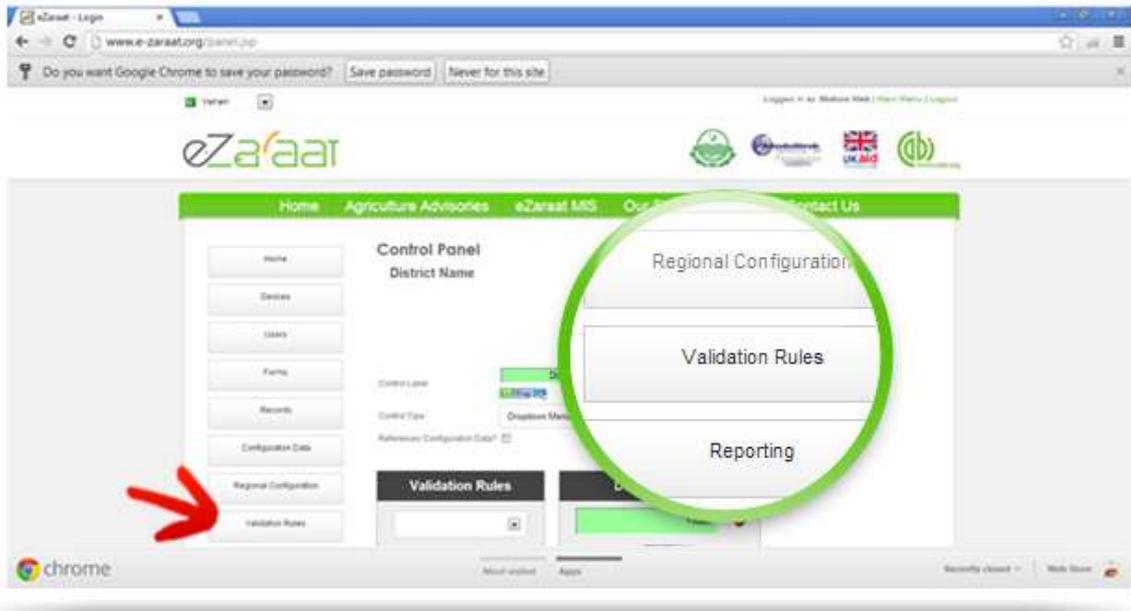
15. The order toggle buttons as shown below are used to toggle the order of both the sections and their respective questions (or controls) in which they are listed.



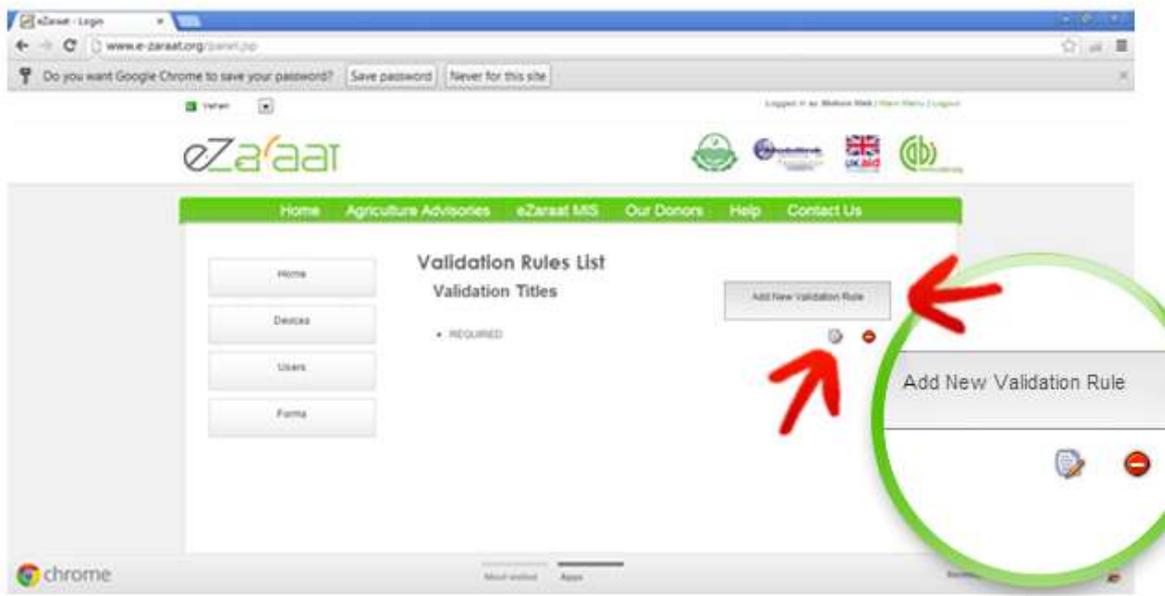
16. Additionally, new questions (or controls) can be added to the survey form by placing them in their relative sections, entering their label, choosing the type of the control and clicking on the Create Control button, as shown below by the blue arrow. Currently existing controls can be edited or deleted by the buttons indicated by the black arrow.



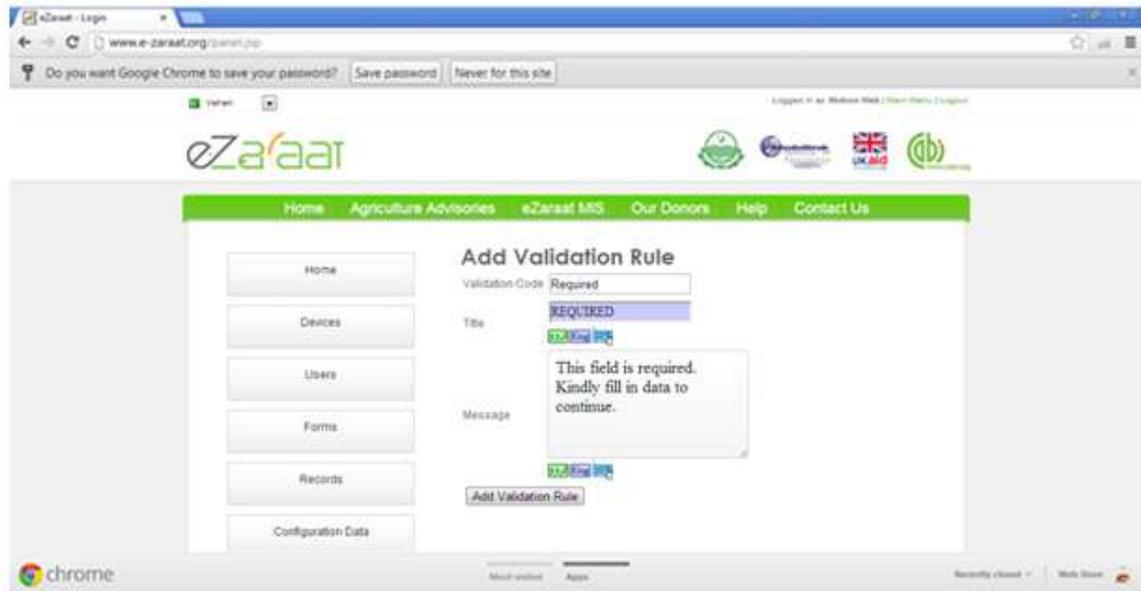
17. The controls can be edited on the Control Panel. It gives the functionality to the users to apply any validation rules such as "Required" etc to the control. Also, any default values can be attached to that control.



18. In order to insert validation rules into the database for use with the above controls, click on the "Validation Rules" link as shown above.



19. The above screen appears which shows all currently existing validation rules. In order to enter a new validation rule, click on the "Add New Validation Rule" button as shown by the black arrow. In order to remove or edit a currently existing validation rule, click on the buttons indicated by the blue arrow.

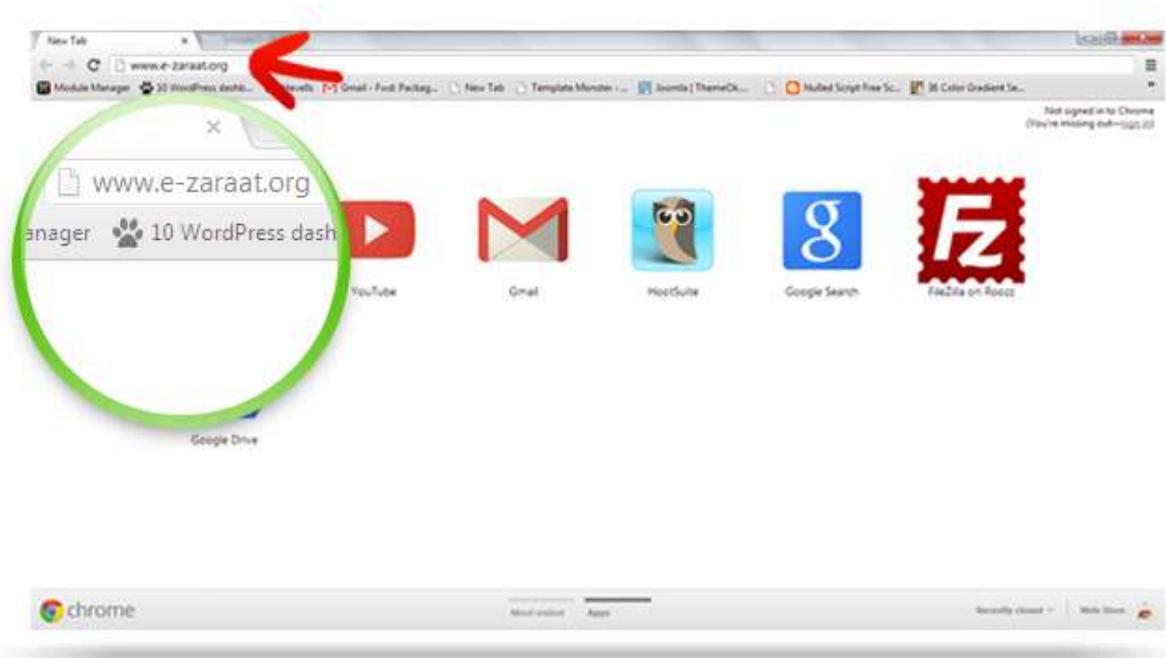


20. If you proceed to create a new validation rule or edit an existing validation rule, the form on the above screen appears.

3. eZaraat Web Application

1. Power on your computer. The power on key should be on the top or middle of your desktop PC.
2. Once the operating system (Windows etc.) has loaded, open your browser (Internet Explorer/Mozilla Firefox/Google Chrome etc.).

Note: For this guide, we are using Google Chrome, which along with Mozilla Firefox, are the preferred browsers of usage.



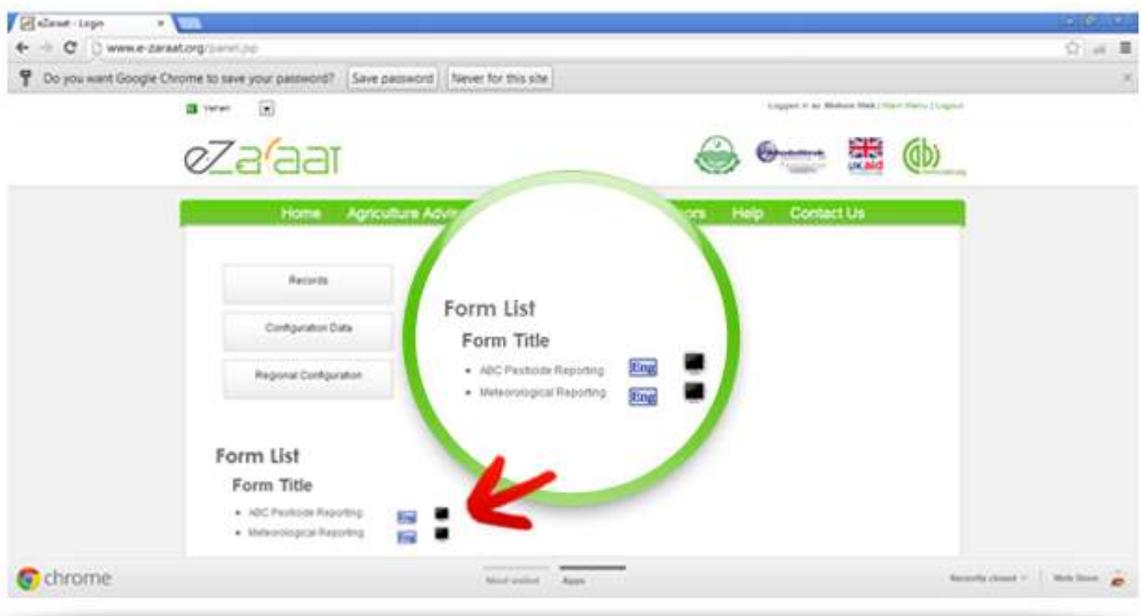
3. As shown in the above image, enter the URL "www.e-zaraat.org" into the browser and press enter.
4. Once you see the page below, enter your login credentials to the Login section in the bottom left and click on the "Login" button or press enter.



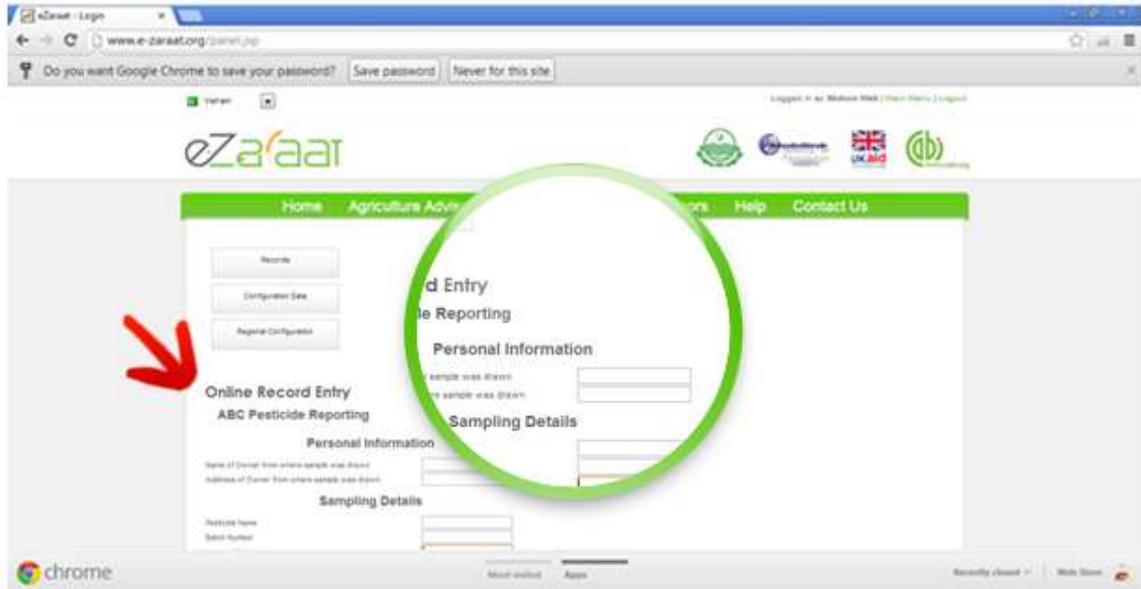
5. Once logged in, you will see the User Panel with a list of menus, as shown below.



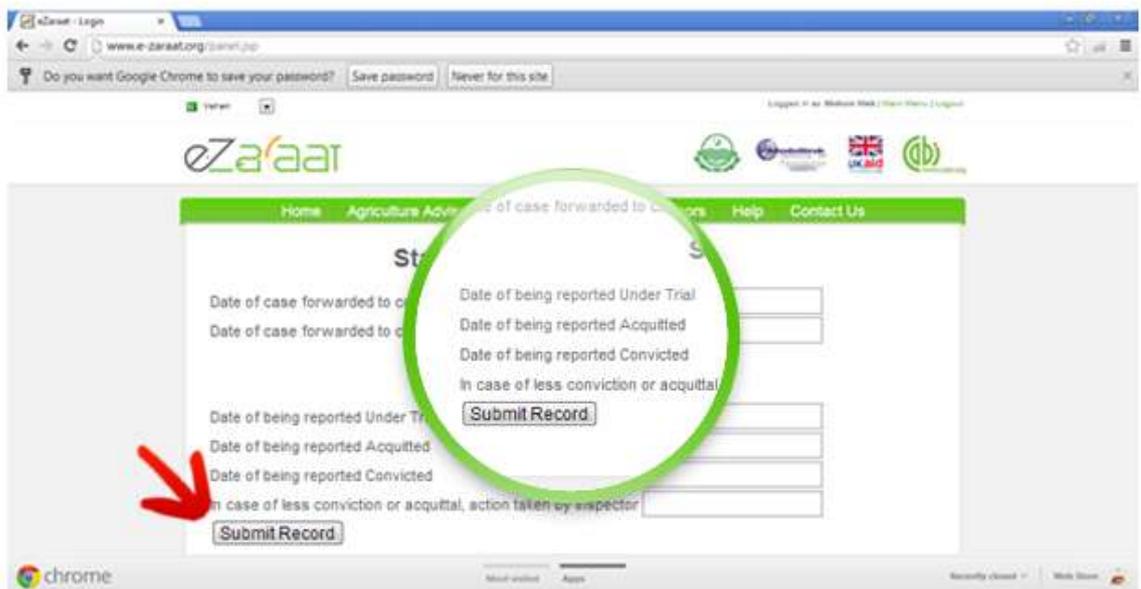
6. In order to enter new records, click on the Records link, as shown above, which will show the following screen.



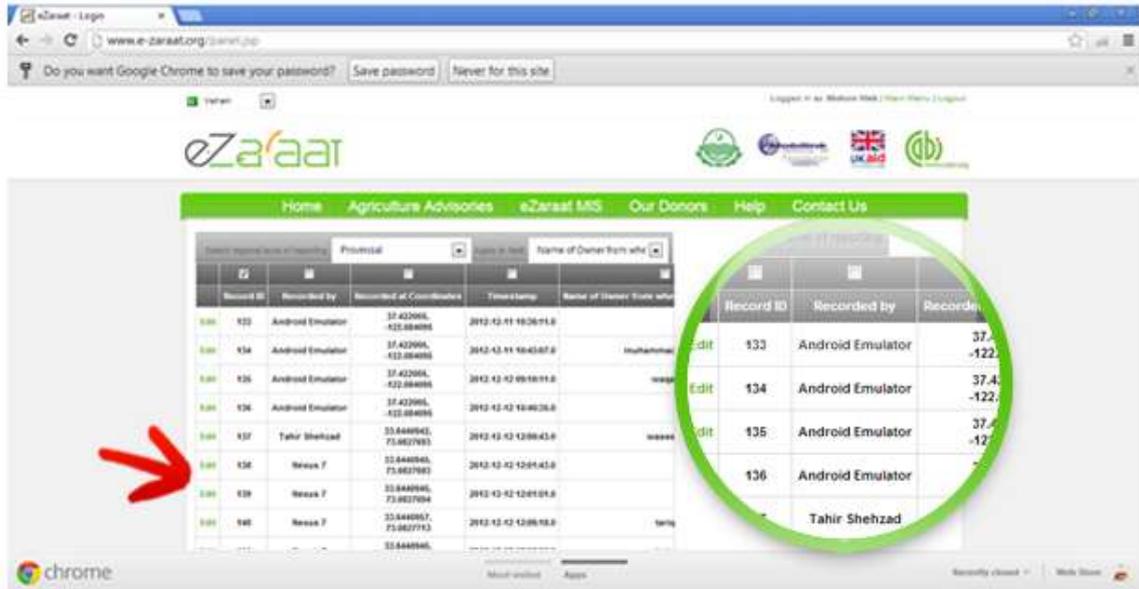
7. As shown above, click on the button labeled "Eng" to preview the survey form in English, as shown below.



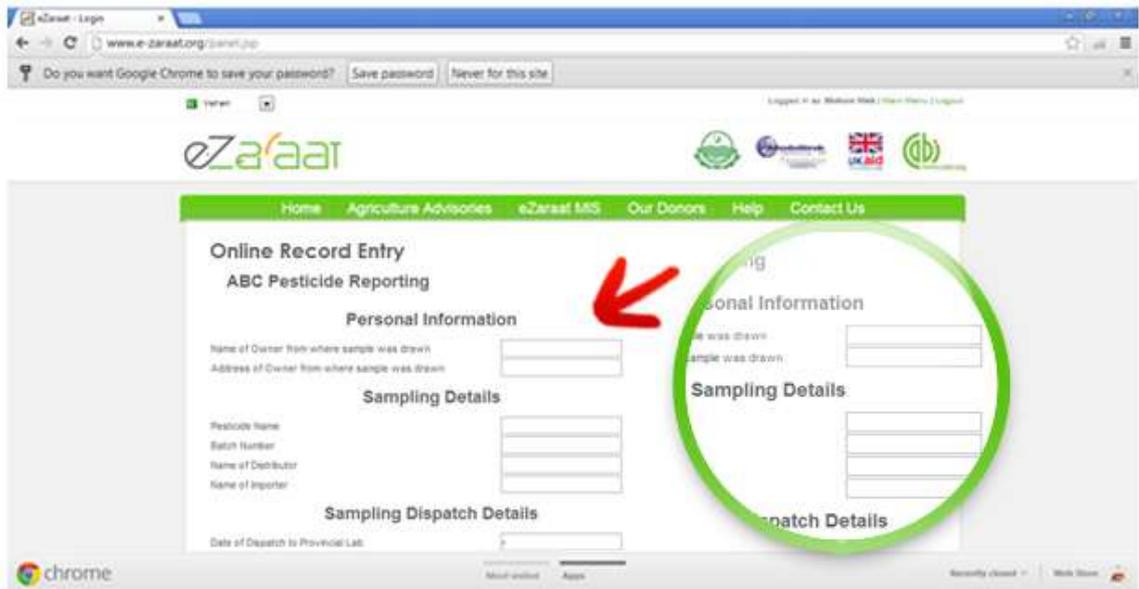
8. After you have filled in the survey, click the submit button (shown below), at the bottom of the page to save the record into the database.



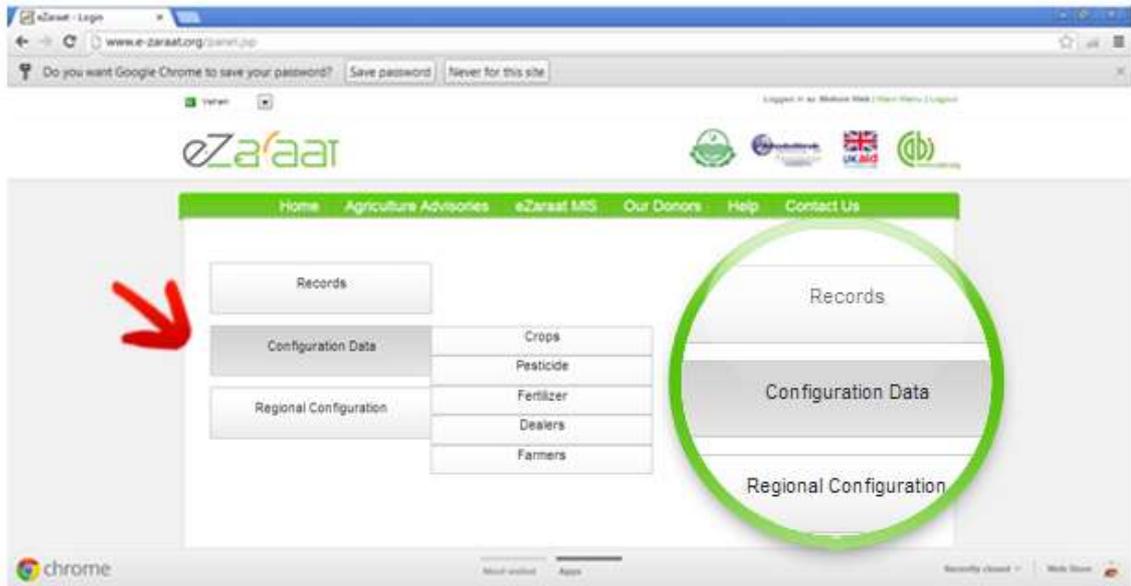
9. To preview entered records, as shown below, click on the black screen icon (panel button) against the form name. (Step 6)



10. Every record can be edited, by clicking on the Edit button, which is visible before every record, as shown above.



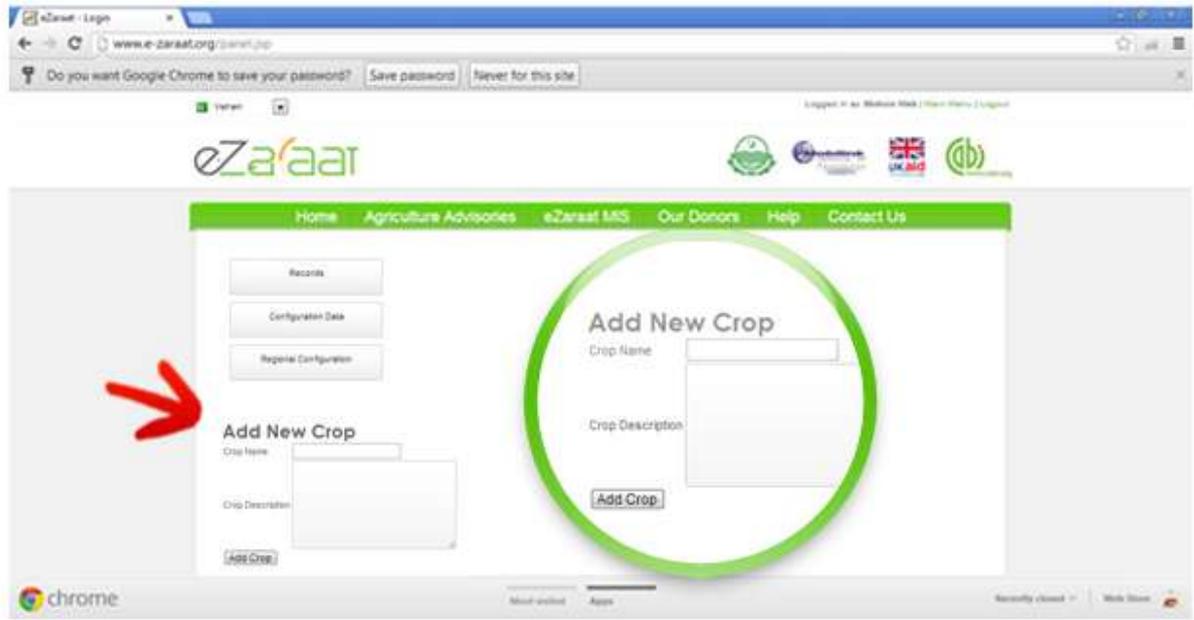
11. To insert reusable static (configuration data), hover on the Configuration Data link, which will show the options for which the data can be entered, as shown below.



12. Clicking on the "Crops" link, opens the list of currently existing crops in the database.



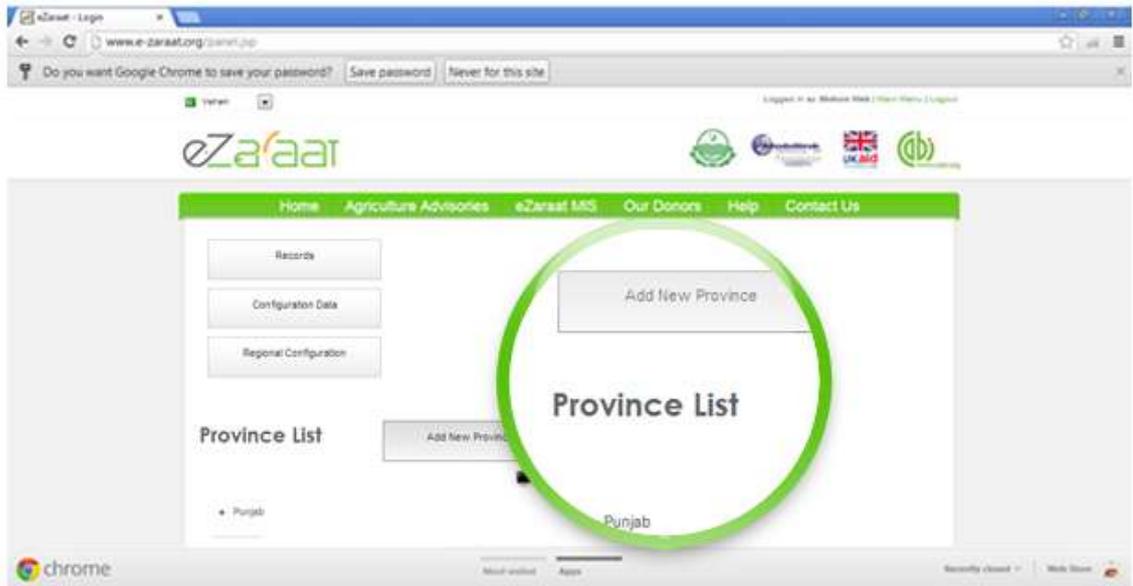
13. Clicking on the "Add New Crop" link (shown above) provides you with a form in which you can enter the crop's name, shown below.



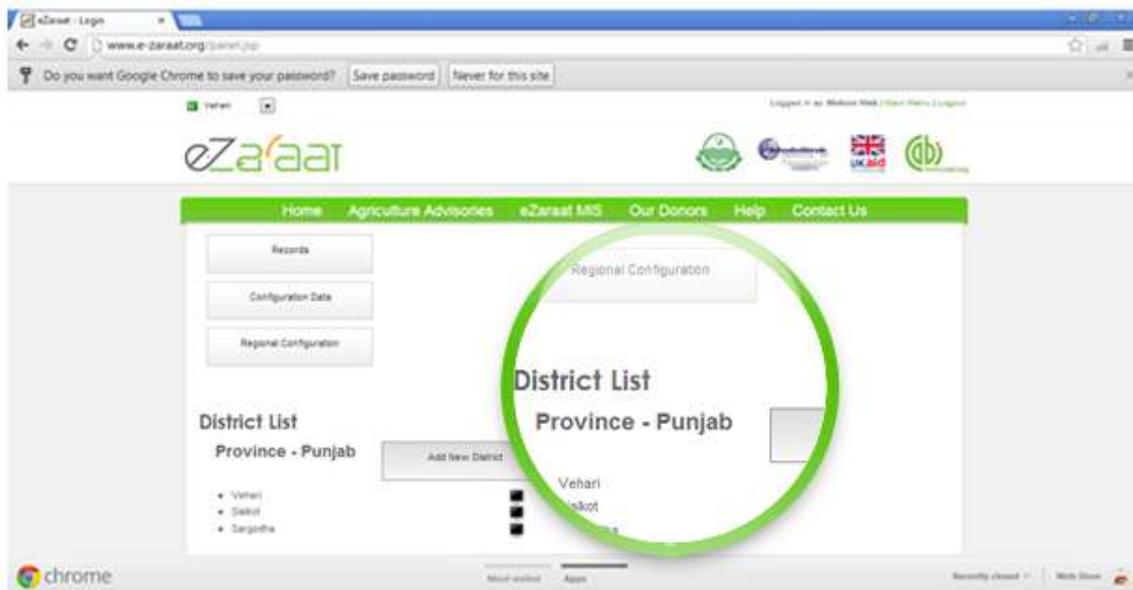
14. All other configuration data, for pesticides, fertilizers, dealers, dealer types, and farmers and their education levels can be entered in the same way as described above for Crops.
Note: The fields would be different in all the configuration forms, as per the requirement of that specific form.
15. Regional Configurations give a regional hierarchy, as depicted below:
- Province
 - District
 - Tehsil
 - Markaz
 - Union Council
 - Village

All this data needs to be entered in the same hierarchy, as shown below in the following diagrams:

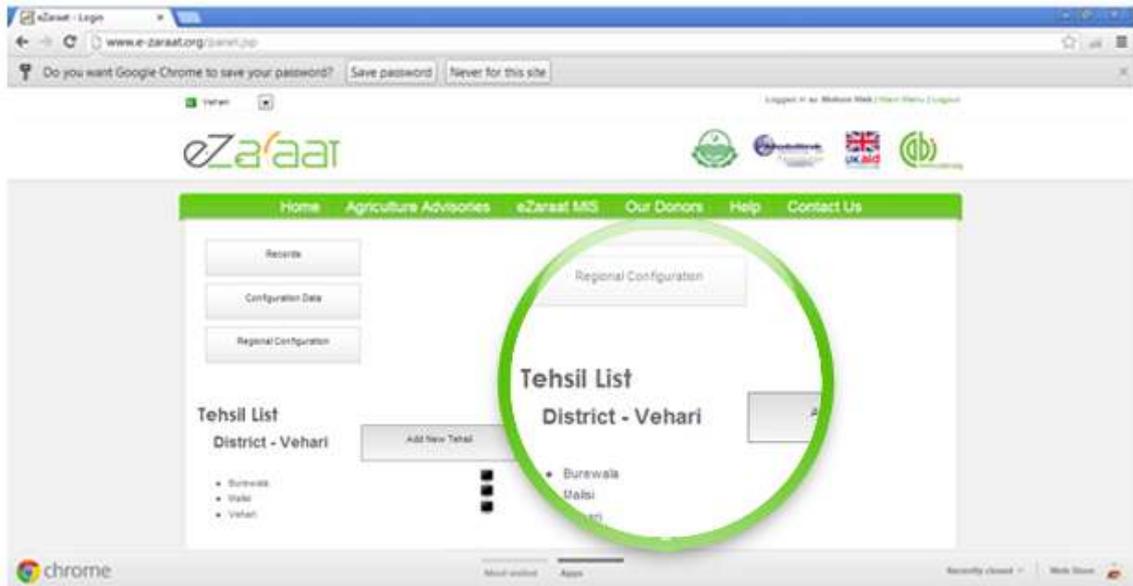
- Province



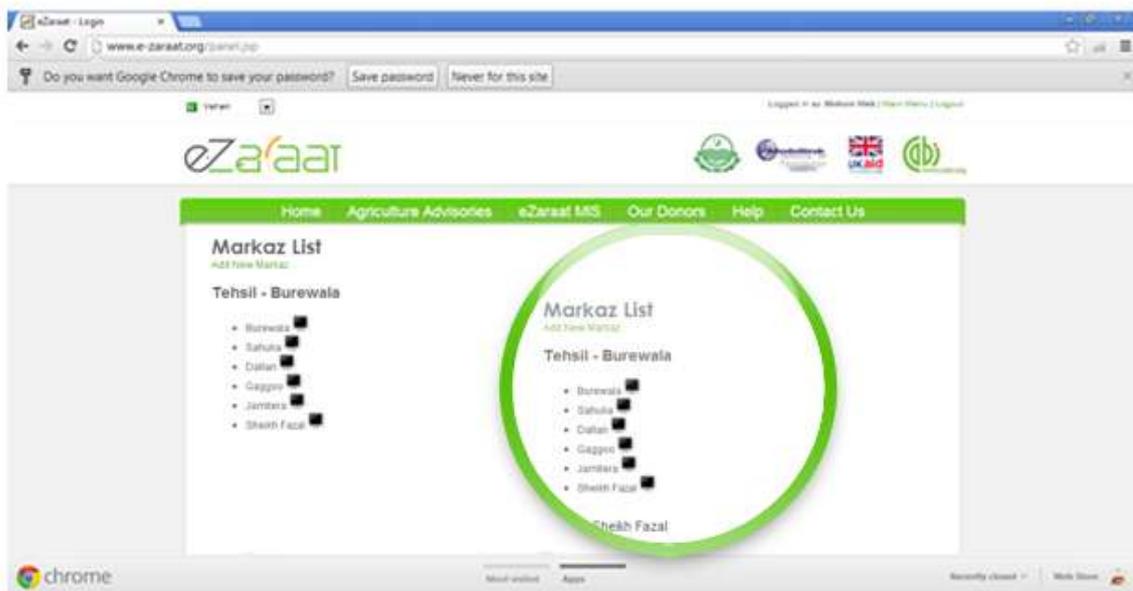
b. District



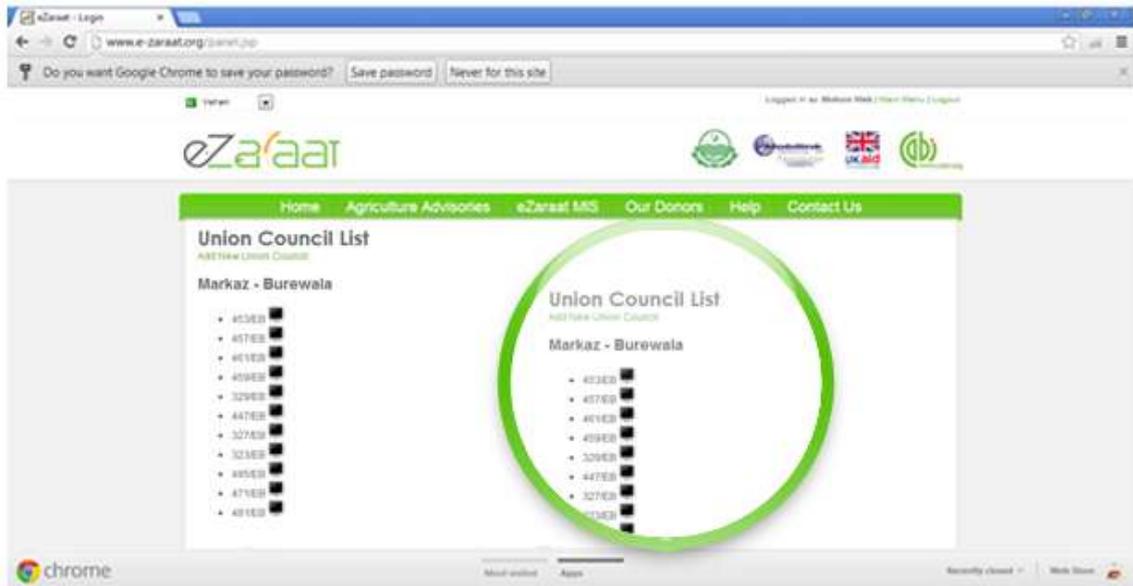
c. Tehsil



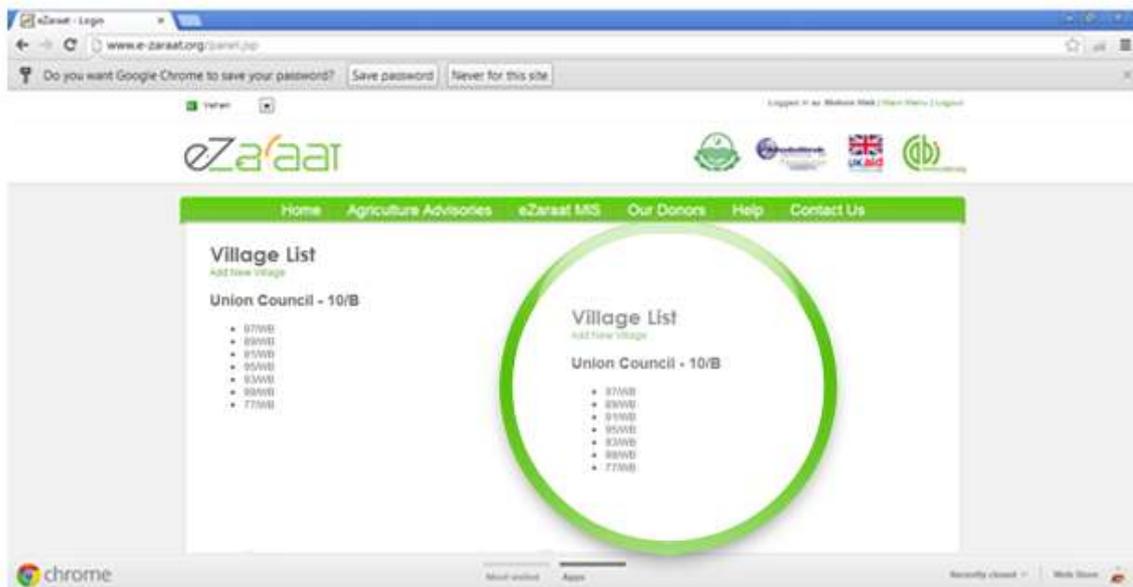
d. Markaz



e. Union Council



f. Village



4. eZaraat Mobile Application

1. Click on the power on button of the tablet and keep it pressed on for 3 to 5 seconds to power up.



2. After your device boots up, you will see the following screen. This device will stay as long as the device is being loaded, which is about 30 seconds to 1 minute.



3. When your device has booted, it will show the following screen with a lock in the middle.



4.

Tap on that lock and drag the lock to the "unlock" icon which will unlock the device.



5. Now you will see the home screen which shows your shortcuts, much like how it is shown on a computer desktop screen.



6. You can swipe your hand across the screen to left or right to preview other home screens which can have different widgets or shortcuts.

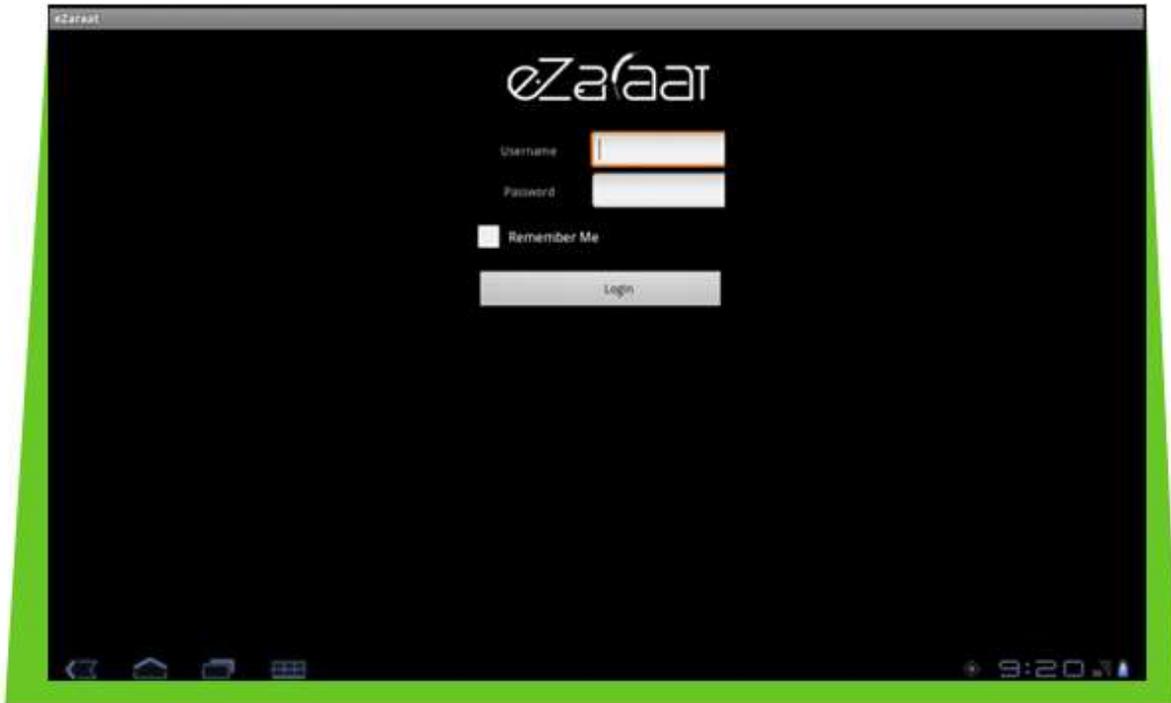


7. Now click on the circle with 6 dots, as pointed in the previous screen, which will show all the installed applications in the form of a menu.

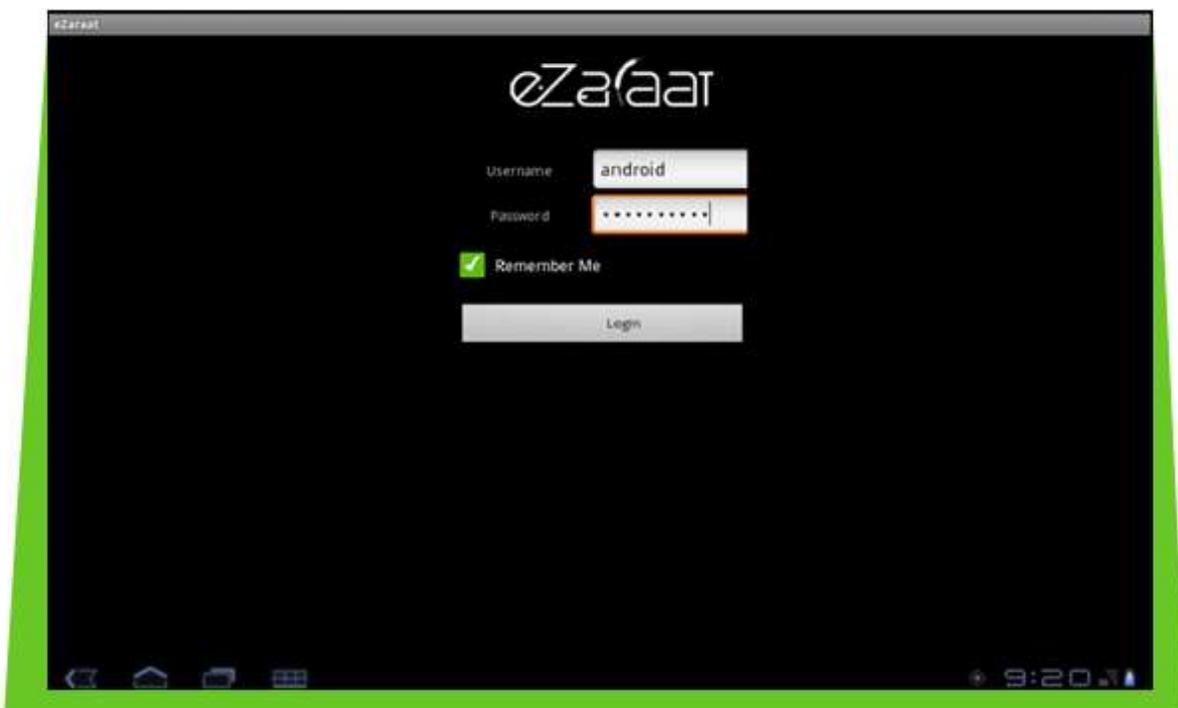


8. This screen shows all the applications installed on the device. In order to start the eZaraat application, click on the CABl logo, as pointed in the above image.

9. Clicking on this icon will show the following login screen.



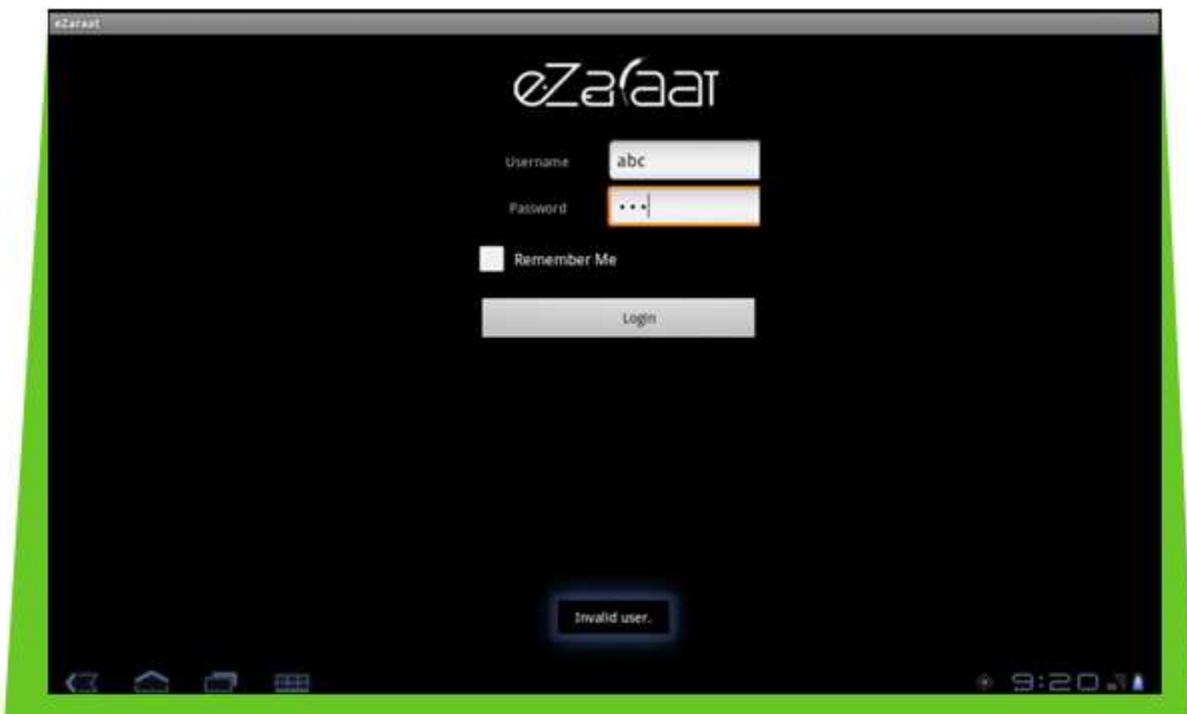
10. Enter your credentials and click on the submit button. If you want the device to remember your credentials, tap the "Remember Me" option before clicking on the submit button.



11. If your login is successful, you will see the following eZaraat logo screen.



12. In case of a failure, you will see a message that "Invalid User". in which case you need to enter your credentials again.



13. After the eZaraat logo screen, you will see a menu, which will show all the options for the application. Tap on Synchronize Surveys to update the device with the latest survey forms from the server.



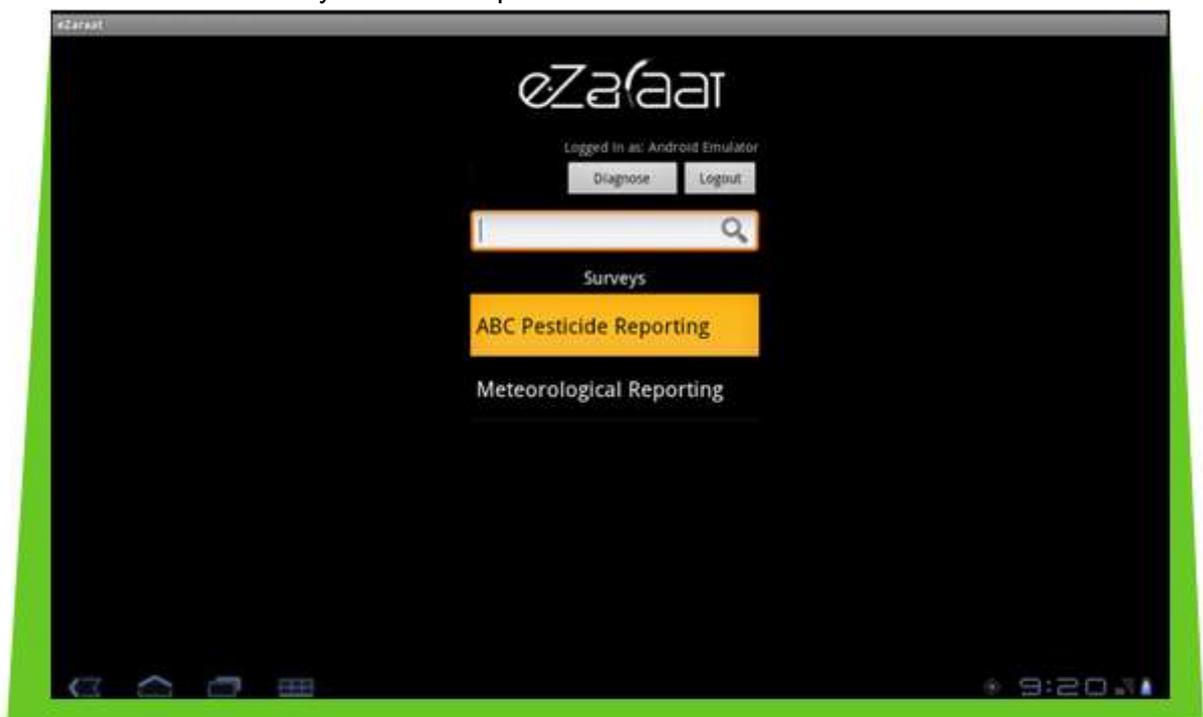
14. After this, tap on List Surveys to view the list of survey forms.



15. This will show a list of forms in which you can input the data.



16. Click on the form in which you wish to input data.

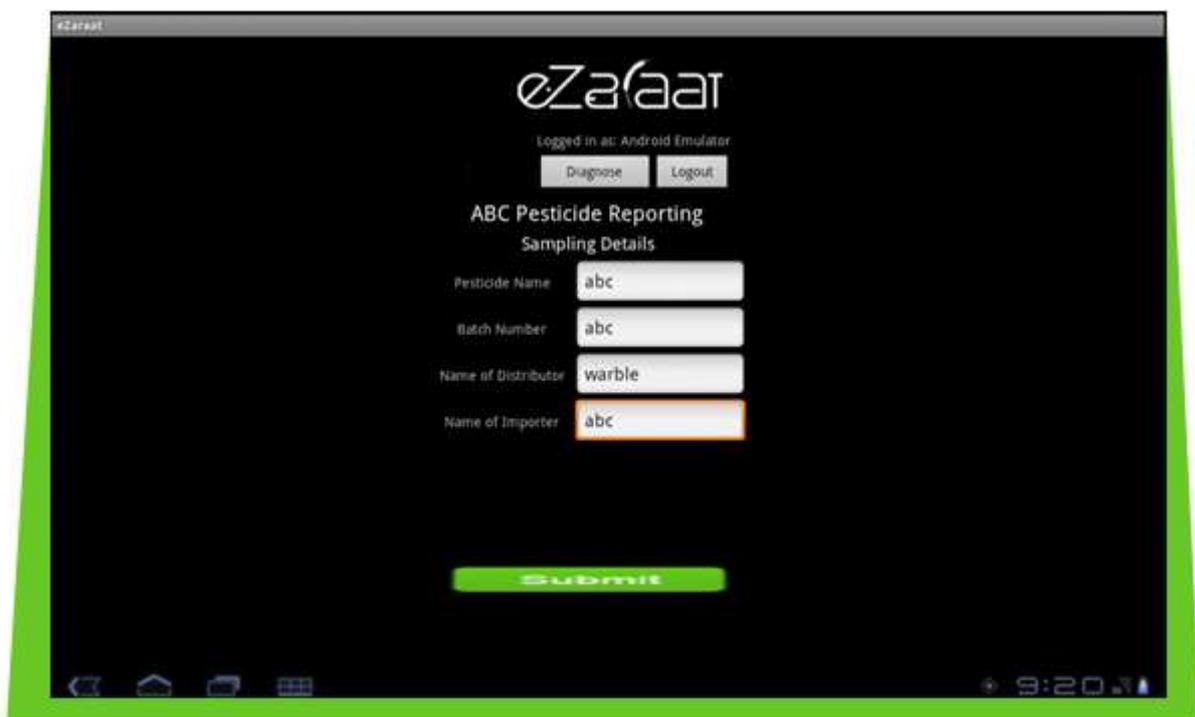


17. This will show the following screen showing the first section of the survey form.



18. Enter the data into these forms.

19. Swipe across the screen to left or right to move between the form's sections.



eZaraat

Logged in as: Android Emulator

Diagnose Logout

ABC Pesticide Reporting

Sampling Dispatch Details

Date of Dispatch to Provincial Lab

Dispatch Number to Provincial Lab

Date of Dispatch to Federal Lab

Dispatch Number to Federal Lab

Type of Sampling

Routine

Raid

eZaraat

Logged in as: Android Emulator

Diagnose Logout

ABC Pesticide Reporting

Results

Date of Results received

Was sample fit?

If not, what was the type of unfitness?

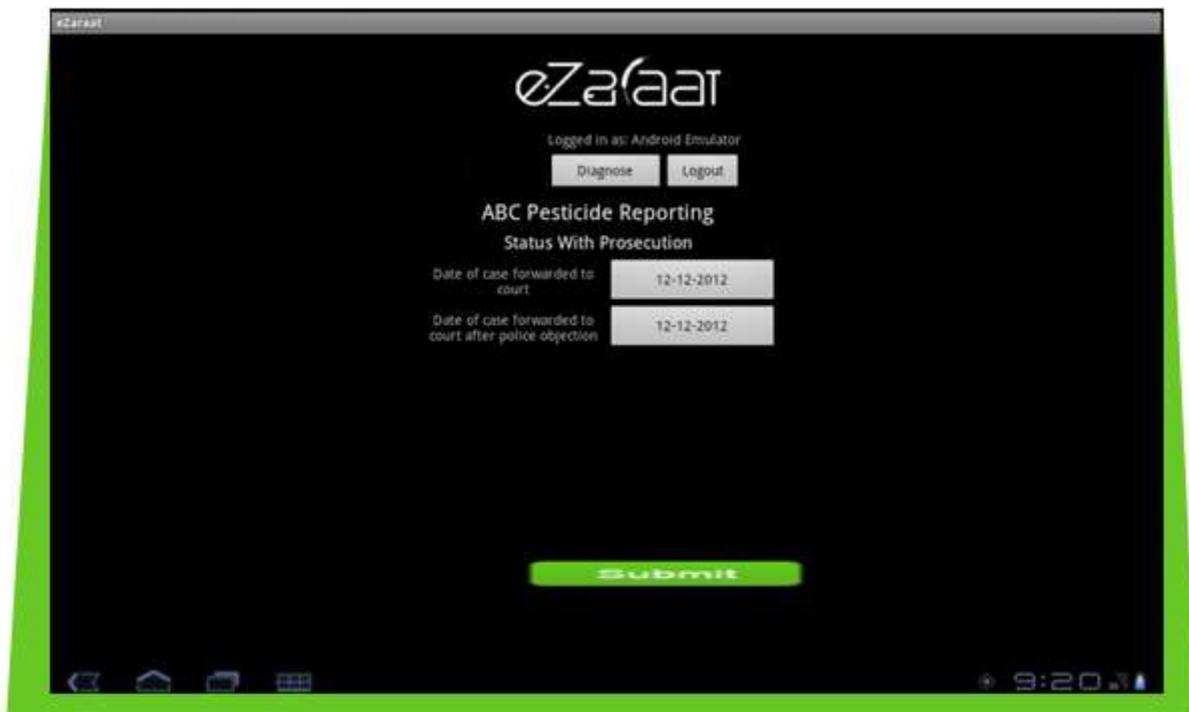
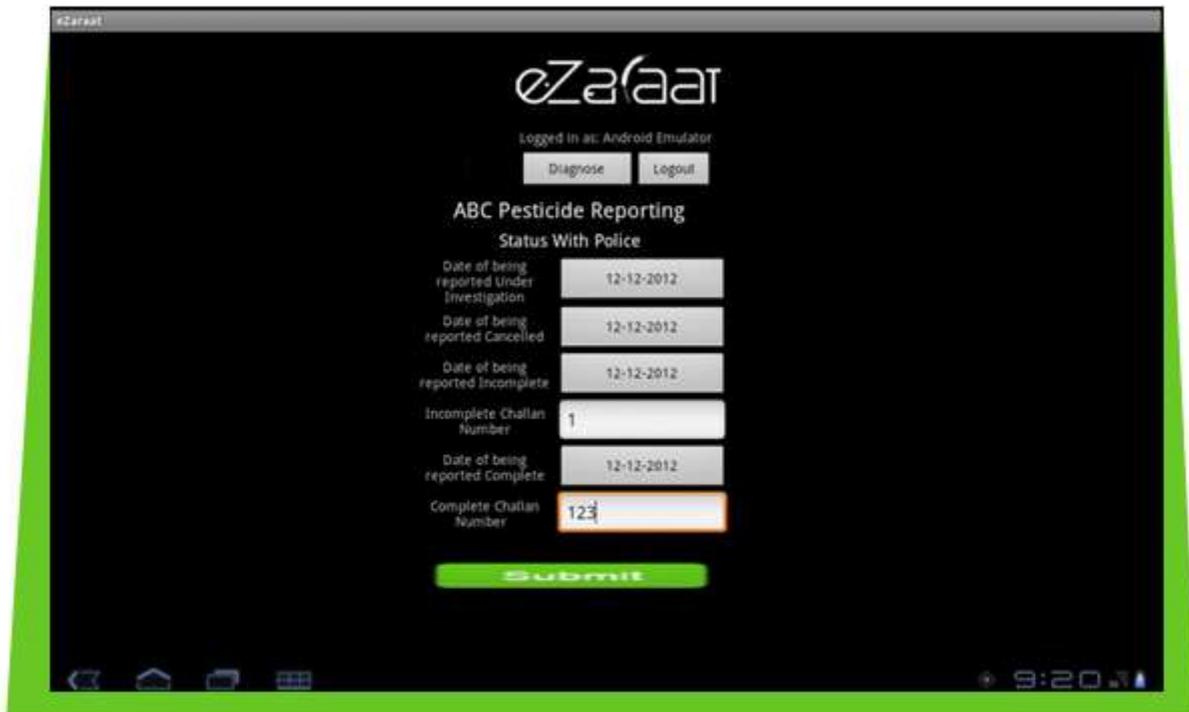
Adulterated

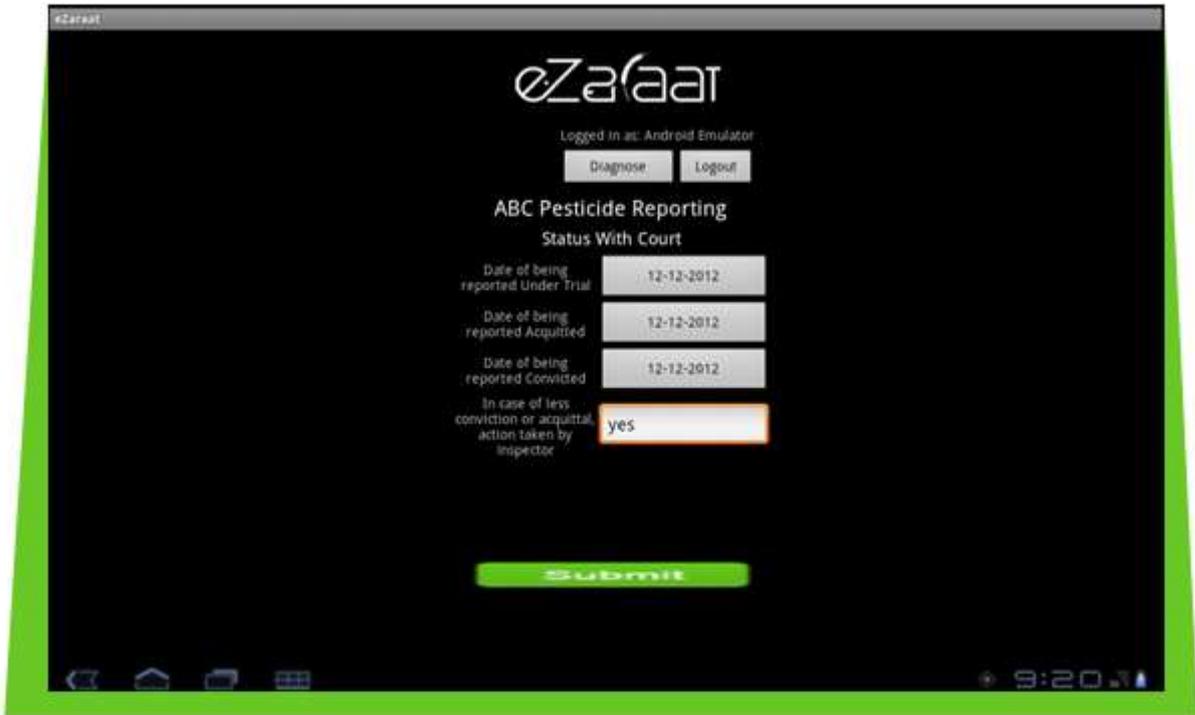
Substandard

If FIR filed, FIR number

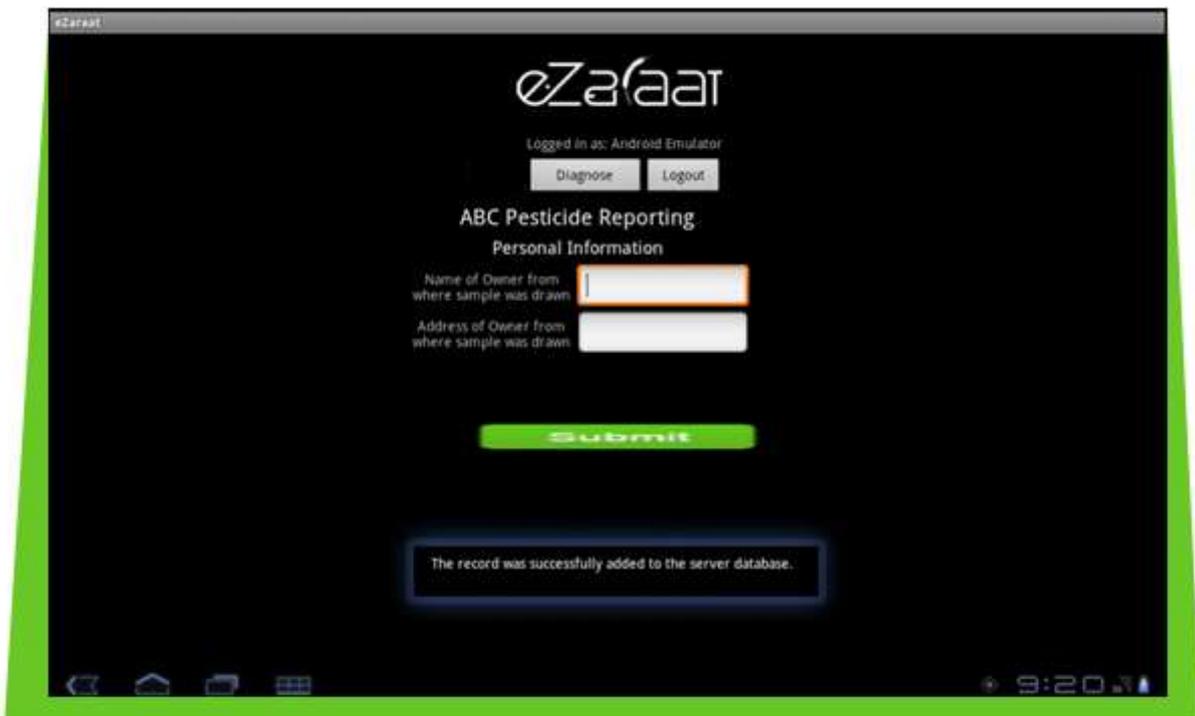
Date of FIR

Name of Police Station where FIR was filed





20. When you have entered the data, tap the submit button. If you're data is successfully submitted, you will receive the following success message.





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Annex-C FAQs

Frequently Asked Questions

Cotton, Rice, Wheat and Citrus

Dr. Atiq ur Rehman, Mahrukh Siraj

December 2012

Contents

Introduction:.....	2
FAQ Development Methodology:	2
Farmer Knowledge Needs Assessment Workshops with Extension Workers in Target Districts:.....	2
Base Line Survey; Vehari, Sargodha and Sialkot (1).....	4
Review of Agriculture Extension advisories Issued by the Directorate of Agriculture Extension and Adoptive Research	4
FAQ Validation:	4
Additional Sources Consulted for Preparing FAQs.....	4
References:	6
Annex-1 ~ Attendance Sheets:	7
Annex-2 ~ An Advisory Issued by the Directorate General of Agriculture Extension & Adoptive Research	13
Annex-3 ~ Frequently Asked Questions ~ Cotton.....	14
Annex 3 ~ Frequently Asked Questions ~ Wheat	19
Annex 3 ~ Frequently Asked Questions ~ Citrus	22
Annex 3 ~ Frequently Asked Questions ~ Rice	27

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Introduction:

This report covers the Frequently Asked Questions (FAQs) by the farmers. The aim of this activity is twofold:

1. Develop a protocol whereby the first set of FAQs are developed
2. Develop the first set of FAQs to provide standard information to the extension workers and the farmers.

The FAQs are proposed to be part of the knowledge database that will be used to respond to the queries of the farmers through the help desk. The FAQs will further inform and form the basis for the text/messages that will be sent to the farmers.

FAQ Development Methodology:

The FAQs are informed by:

- Three workshops conducted in the target districts with the public and private extension workers.
- The base line survey conducted in the three target districts (1)
- Review of Agriculture Extension advisories issued by the extension department for the three target districts.

Once the FAQs are developed these are further reviewed by the Adoptive Research department of the Directorate of Agriculture Extension and Adoptive Research Punjab.

Farmer Knowledge Needs Assessment Workshops with Extension Workers in Target Districts:

One workshop each was conducted in the target districts with the public and private sector extension workers in July 2012. The objective of the workshops was:

1. To document the FAQs/information that the local Extension workers believe farmers ask them most about.
2. To document information the local Extension workers believe farmers should have in order to increase the quality and quantity of their produce.

In order to achieve above, extension workers from eight disciplines of agriculture were agriculture participated in the workshops i.e. 1) agronomy, 2) soil science, 3) plant entomology, 4) plant pathology, 5) plant breeding and genetics, 6) horticulture, 7) agricultural economics and 8) agricultural extension. Furthermore, it was ensured that extension providers from both public and private sector participated in the workshops so as to obtain the overall view from both the sectors. Attendance lists of the participants of the three workshops are attached as Annex - 1



Farmer Knowledge Needs Assessment Workshop-Vehari



Farmer Knowledge Needs Assessment Workshop-Sialkot

Each workshop was divided into two sessions, morning session covering the cash crop of the district and the afternoon session covering wheat.

In Vehari the morning session was focussed on Cotton, in Sialkot it was dedicated to Rice and in Sargodha the focus of the morning session was Citrus.

The participants were divided into groups (based on their area of specialization) and each group was assigned a particular area of the target crop.



Farmer Knowledge Needs Assessment Workshop-Sargodha

The topic distribution for Cotton was:

- Land Preparation / Selection of Seed / Seed Treatment / Sowing / Irrigation Practices / Water Analysis
- Soil Analysis / Nutrition Deficiency / Fertilizer selection and application practices
- Plant Protection – Diseases, Pests / Viral/Fungal / Insect Attacks: Pest scouting / Symptoms/ Diagnosis, Preventive and Curative Measures / Weeds Control
- Picking / Harvesting / Storage / Marketing Practices / Others

The topic distribution for Rice in Sialkot was:

- Land Preparation for nursery / Selection of Seed / Seed Treatment / Sowing of Nursery / Rice Nursery Management / Transplantation / Land Preparation for Rice Fields
- Water Analysis / Irrigation Practices / Soil Analysis / Nutrition Deficiency / Fertilizer selection and application practices
- Plant Protection – Diseases, Pests/Viral/Fungal/Insect Attacks: Symptoms/Diagnosis, Preventive and Curative Measures / Weeds Control
- Harvesting / Husking / Storage / Marketing Practices / Others

The topic distribution for Citrus in Sargodha was:

- Land Preparation, Nursery Management, Selection / Purchase of Nursery Plants / Designing Orchard Layout, Preparing pits, Plantations etc.
- Water Analysis / Irrigation Practices / Soil Analysis / Nutrition Deficiency / Fertilizer selection and application practices / Grafting etc.
- Plant Protection – Diseases, Pests/Viral/Fungal/Insect Attacks: Symptoms/Diagnosis, Preventive and Curative Measures / Weeds Control.
- Harvesting / Picking / Storage / Marketing Practices / Others

The topic distribution for Wheat was:

- Land Preparation / Selection of Seed Treatment / Sowing / Irrigation Practices / Nutrition Deficiency / Fertilizer selection and application practices
- Plant Protection / Weeds Control / Harvesting / Threshing / Storage / Marketing / others

The groups were asked to list the queries related to their assigned topics and then present their group work. The FAQs were transcribed using a computer while the presentations were being made. This final list of questions was printed at the end of the presentation sessions. This was then circulated amongst the workshop participants to rate the questions for importance on a scale of 1-5, where 5 was the most important and 1 the least important. Thus a consensus of all workshop participants on validity and importance of the questions was obtained.

Though it was not a direct objective of the workshops, the workshops resulted in capacity building of the extension workers as well. Apparently, these workshops were a first in the line of participatory workshops with such a mix of agriculture expertise focussed on farmer knowledge needs. The FAQs developed and vetted during the workshops helped build the capacity of the participants as well, who received exposure to agriculture areas other than their immediate expertise and to farmers' problems/queries in those areas.

Base Line Survey; Vehari, Sargodha and Sialkot (1)

An extensive baseline survey of the three target districts: Vehari, Sargodha and Sialkot was conducted in June-August 2012. The objectives of the research were:

- To determine the profile of farmers in the project areas.
- To evaluate the infrastructure available to the rural areas in terms of road network, educational facilities, health network, access to various TV channels, landline and mobile phone coverage
- To gauge the existing knowledge base of farmers and sources thereof.
- To probe for a deep understanding of their current agricultural practices for each and every farming stage of major crops in the project region i.e. from land preparation; to seed selection; seed treatment; use of fertilizers, weedicides and pesticides; water management; harvesting; post harvesting, and so on.
- To evaluate the role of women in the household, level of financial empowerment, access to mobile phones and their familiarity with usage of various functions, participation in agricultural matters, financial gains from work, etc.

The information obtained regarding the existing knowledge base of the farmers, their understanding of the agriculture practices was used to guide the development of the FAQs.

Review of Agriculture Extension advisories Issued by the Directorate of Agriculture Extension and Adoptive Research

The directorate of Agriculture Extension and Adoptive research issues crop advisories for the extension workers. These advisories are in Urdu language. A sample advisory is attached as Annex-2. The advisories for the target crops were reviewed in detail to develop FAQs and answers thereof.

FAQ Validation:

The FAQs were validated within the Farmer Needs Assessment Workshops. At a second level these were sent to the Department of Adoptive & Adaptive Research of the Directorate of Agriculture Extension and Adoptive Research for final validation. The Frequently Asked questions for Cotton, Rice, Citrus and Wheat are attached as Annex-3

Additional Sources Consulted for Preparing FAQs

Besides above, following additional sources were also consulted for preparing FAQs:

- Zaraat Nama (2), a fortnightly official publication of the Department of Agriculture Information,, Government of Punjab
- Journals of agriculture:
 - Pakistan Journal of Agricultural Research (3)
 - The Journal of Agricultural Research (4)

- Meetings with:
 - University of Agriculture Faisalabad
 - Arid Agriculture University, Rawalpindi
 - University of Sargodha
 - PARC, (Pakistan Agriculture Research Council)
 - National Fertilizer Development Centre (NFDC)
- Web resources, especially <http://www.pakissan.com/>
- Interviews with farmers

References:

1. **Rehman, Atiq ur, Siddique, A and Siraj, M.** *Baseline Survey Report-Vehari, Sargodha and Sialkot. An interim output for 'ICT based services for Agriculture Extension'*. 2012.
2. **Miscellaneous.** *Zaraat Nama, a fortnightly publication.* s.l. : Directorate of Agriculture Information, Governement of Punjab, Pakistan, 2012.
3. —. *Pakistan Journal of Agriculture Sciences.* s.l. : Pakistan Agriculture Research Council, 2012.
4. *Journal of Agriculture Research.* s.l. : Directorate of Agriculture Information, Department of Agriculture, Govt. of Punjab, 2011-2012.

Annex-1 ~ Attendance Sheets:

Attendance Sheet. Farmers' Knowledge Needs Assessment Workshop 9-07-2012
Vehari

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13-02-2012

فروری کے دوسرے پندرہ واڑے میں گندم کی بہتر نگہداشت کے لیے حکمت عملی

- ◆ گندم کو دوسرا پانی پھینکیں کے 80 تا 90 دن بعد یعنی گوبہ کے وقت لگائیں۔ اس وقت سٹ پودے کے اندر بن کر باہر نکلنے کے مراحل میں ہوتا ہے اگر باہر سرطلے پر پانی نہ دیا جائے یا تاخیر سے دیا جائے تو سٹے چھوٹے رہ جاتے ہیں اور سٹوں میں دانوں کی تعداد کم ہو جاتی ہے۔
- ◆ اس موسم میں گندم کی فصل پر ست تیلے کا حملہ بھی ہو سکتا ہے۔ اس لیے ست تیلے کے مربوط انسداد کے لیے درج ذیل سفارشات پر عمل کریں۔
 - (i) ست تیلے کا حملہ گندم کی فصل پر سب سے پہلے گلو یوں کی شکل میں ہوتا ہے۔ لہذا کسان اپنی فصل کا باقاعدگی سے معائنہ کرتے رہیں۔ جیسے ہی حملہ نظر آئے متاثرہ کھیت کے حصوں میں پودوں کو رستی سے ہلا کر تیلے کو نیچے گرا دیں۔
 - (ii) کھالوں اور کھیت کے ارد گرد اُگی ہوئی جڑی بوٹیاں بھی ستیلے کی افزائش میں مدد کرتی ہیں۔ ان کی تلخی اشد ضروری ہے۔ اس کے لیے آلات کھاورڈی کا استعمال کر کے ان کی تلخی بھینٹی ہٹائیں۔ مزید برآں کیویائی زہر Glyphosate بھی سفارش کردہ مقدار میں استعمال کیا جا سکتا ہے۔
 - (iii) تیلے کا حملہ شروع ہونے پر گندم کی فصل کو سادہ پانی سے پاور سپریر کے ساتھ پریشر سے وقفہ وقفہ سے پیرے کرتے رہیں۔
 - (iv) منفید کیڑے مثلاً لیڈی برڈ ٹیل، کرلی سوپا، بکڑی، سرفقہ فلائی اور ٹفلی کیڑے اس کی تعداد کو بڑھنے نہیں دیتے۔ ایسے کھیت جہاں پر منفید کیڑوں کی تعداد کم ہو وہاں پر دوسرے کھیتوں سے فائدہ مند کیڑے اکٹھے کر کے چھوڑیں تاکہ ان کھیتوں میں تیلے کا حملہ کنٹرول کیا جاسکے۔
 - (v) ان منفید کیڑوں کی پرورش محکمہ زراعت کی دہاڑی، پاکپتن، ساہیوال، اوکاڑہ، ٹوبہ ٹیک سنگھ اور فیصل آباد میں قائم کردہ بیالوجیکل لیبارٹریوں میں بھی کی جارہی ہے۔ یہاں منفید کیڑے کا شنکاروں کو ہفت فراہم کیے جاتے ہیں۔ کا شنکار اس سہولت سے فائدہ اٹھائیں۔
 - (vi) گندم کی فصل پر زرعی زہریں ہرگز استعمال نہ کریں کیونکہ ہماری خوراک پر ان کے بہت بڑے اثرات مرتب ہوتے ہیں۔ اس کے علاوہ ماحول کا آلودہ ہونا صحت کے مسائل اور منفید کیڑوں کا ختم ہونا اضافی مسائل ہیں۔
 - (vii) ست تیلے کے موثر کنٹرول کے لیے کچھ کا شنکار محکمہ زراعت کی سفارش کے مطابق گندم کے کھیت کے ایک طرف کنولہ کی چند قطاریں کاشت کرتے ہیں تاکہ ان پر حملہ آور تیلے کے خلاف دوست کیڑے پیدا ہوں۔ جس سے گندم پر حملہ کرنے والے ست تیلے کو ختم کیا جاسکے۔ دوسرے کا شنکار بھی تیلے کے موثر کنٹرول کے لیے اس طریقہ کار کو اپنائیں۔ زرعی تو سمی کارکنان ست تیلے کی پہچان، نقصانات اور اس کے موثر کنٹرول کے لیے کا شنکاروں کی بروقت راہنمائی کریں۔

Annex-3 ~ Frequently Asked Questions ~ Cotton

Table A: Land Preparation, Soil Analysis and Water Analysis

Sr. #	Frequently Asked Questions
1.	What is best method of land preparation for cotton crop?
2.	Do we need to get precision land leveling after every two years or so?
3.	What are most critical weeds of cotton crop?
4.	What is recommended quantity of sulfuric acid to be used for treating cotton seed?
5.	In case of But cotton it has been observed that weeds attack is less as 2compared to traditional cotton. Why?
6.	How can we control weeds?
7.	Is there any natural method to control weeds?
8.	Why land leveling is necessary?
9.	What is cost of soil analysis?
10.	What is cost of water analysis
11.	Why should we get soil analyzed?
12.	Why should we get water analyzed?
13.	At the stage of land preparation, can we take some proactive measures to prevent attack of insects and pests?
14.	When should be apply first irrigation in case of Bt-cotton sown on beds?
15.	What is recommended interval of irrigation for Bt cotton varieties in case of bed sowing?
16.	

Table B: Irrigation

17.	When should be apply first irrigation after sowing of Bt cotton in lines?
18.	What is recommended interval of irrigation for Bt cotton varieties in case of sowing in lines?
19.	What is recommended timing of last irrigation for But cotton sown in lines?
20.	When should be apply first irrigation in case non-Bt cotton sown through drills?
21.	What should be interval of irrigation for non-Bt cotton sown through drill?
22.	What is recommended timing of last irrigation for non-Bt cotton sown through drill?
23.	What is optimal timing of last irrigation for cotton sowing on beds?
24.	Why should we get soil water analyzed?
25.	From where we should get water analyzed?
26.	Should we take sample along with us when we plan to visit the lab?
27.	Any effects of over-irrigation?
28.	How can we reduce water use without effecting health of the crop?

Table C: Seed selection, seed treatment and sowing method/practices

29.	What service does Cotton Research Institute provide?
30.	Which variety should we select?
31.	Which variety? BT cotton or non- Bt cotton?

32.	Which Bt varieties of cotton are available in the market?
33.	When should be sow Bt cotton?
34.	Is there any effect of sowing crop before time?
35.	Yield of Bt cotton is relatively very high. Should not we stop cultivating non-Bt varieties?
36.	What is recommended distance between two lines of plants when drill is used for sowing?
37.	What is optimal seed germination rate?
38.	What should be the source of reliable seed?
39.	When should we treat seed with fungicide and when with pesticide?
40.	Merits and demerits of early sowing?
41.	Merits and demerits of seasonal sowing?
42.	When should we sow which variety?
43.	Which method of sowing? Bed sowing or flat sowing?
44.	What should be optimal plant to plant distance for a Bt cotton variety?
45.	What should be optimal plant to plant distance for a non-Bt cotton variety?
46.	What is importance of seed treatment?
47.	From where we can get seed of any cotton variety?
48.	What should be optimal distance from plant to plant?

Table D: Agronomic practices

49.	What is cost of leveling?
50.	Should time span for sowing and harvesting be standardized?
51.	When should be perform the activity of thinning?
52.	How thinning should be performed?

Table E: Plant Protection

53.	How to effectively control the insects?
54.	What are sucking pests?
55.	What is thrips?
56.	How to identify thrips attack?
57.	What are alternate host plants of thrips?
58.	What is magnitude of damage by thrips?
59.	How to identify mealybug?
60.	How to control mealybug?
61.	What are recommended chemicals and their doses for controlling mealybug attack?
62.	Is there non-chemical method of controlling mealybugs?

63.	What is a useful insect?
64.	What is American Sundi?
65.	And how to control American sundi (American bollworm)?
66.	What is aphid? (susttaila)
67.	When does susttaila attack cotton?
68.	How can we identify susttaila?
69.	How does sust taila (aphids) damage cotton plants?
70.	How can we identify whitefly?
71.	How does it cause damage to cotton plants?
72.	What are host plants of whitefly?
73.	What is magnitude of damage by whitefly?
74.	How can we control whitefly?
75.	What is chatkabri sundi (Spotted bollworm)?
76.	When does gulabi sundi (pink bollworm) attack?
77.	Is there any alternate host plant for gulabi sundi.(Pink bollworm) ?
78.	How can we control gulabi sundi. (Pink bollworm)?
79.	What is lashkari sundi and (army worm) how to control it?
80.	What are mites?
81.	What are the factors which lead to attack of mites?
82.	How do mites attack?
83.	Any advice for protecting the crop from attack of termites?
84.	What is sabztaila (Jassids)?
85.	Is there any alternate host plant for Sabztaila?
86.	Will CLCV affect the growth of variety?
87.	What are host plants of leaf curl virus?
88.	What weedicides should be used for controlling weeds in flat sowing?
89.	What weedicides should be used for controlling weeds in flat sowing?
90.	What weedicides should be used for controlling weeds in bed sowing?
91.	What is post-emergence weedicides and their recommended dose?
92.	Is there any stress on crop by these weedicides?
93.	Is there any special weedicides for Deela, (Purple nutsedge), Itsit (Horse purslane), and grasses. I
94.	At what stage, post-emergence weedicides be applied?
95.	Pest management in early crop to handle leaf curling?
96.	Why cotton turn black?
97.	Why cotton crop wilt suddenly?
98.	What are reasons of fruit shedding?
99.	Why old pesticides have become ineffective?
100.	Is there any new pesticide available for different pests?
101.	Is there any Bt variety which is resistant against all pests?
102.	Why thrips and mites are becoming regular pests?
103.	What are new plant protection products / new pesticides?
104.	What are recommended pre-emergence weedicides?
105.	What are recommended post-emergence weedicides?
106.	Is there any alternate non-chemical means of controlling pests?
107.	What is Integrated Pest Management (IPM)?
108.	What are benefits of IPM?

Table F: Nutrition Deficiency and Fertilizer Application

109.	Why soil sampling is necessary?
110.	What and how much fertilizer should be used at the time of sowing?
111.	From where soil can be analyzed?
112.	What procedure we can adopt for collecting soil samples? – Separate for Crops, problem soils and Orchards
113.	Who will take soil samples?
114.	What is cost of soil analysis?
115.	What is best time for taking sample?
116.	What is recommended dose of fertilizer for Bt cotton sown early (Mar-Apr)?
117.	What is recommended dose of fertilizer for Bt cotton sown in May?
118.	When should we apply Phosphorus and Potassium for Bt Cotton?
119.	When should we apply Nitrogen for Bt Cotton sown early?
120.	When should we apply Nitrogen for Bt Cotton sown in May?
121.	What is recommended dose of fertilizer for non-Bt cotton?
122.	When should we apply Phosphorus and Potassium for non-Bt Cotton?
123.	When should we apply Nitrogen for non-Bt Cotton?
124.	Is there any other method for improving fertility of soil?
125.	What is nutrition deficiency for cotton?
126.	What are effects of nutrition deficiency?
127.	What are symptoms of nutrition deficiency? How to know?
128.	What are symptoms of nitrogen deficiency for cotton crop?
129.	What are symptoms of phosphorus deficiency for cotton crop?
130.	What are symptoms of potassium deficiencies for cotton crop?
131.	What is role of micro-nutrients in enhancing crop yield?
132.	What are symptoms of magnesium deficiency for cotton crop?
133.	How can we cover magnesium deficiency?
134.	What are symptoms of zinc deficiency for cotton crop?
135.	How can we cover zinc deficiency?
136.	What are symptoms of iron deficiency for cotton crop?
137.	What are symptoms of boron deficiency for cotton crop?
138.	How can we cover boron deficiency?
139.	What is best time for application of NPK?
140.	What are critical stages of NPK application?
141.	What are causes of fruit shedding?
142.	What is effect of soil pH (hard soils/problem soil) on nutrients availability?
143.	What are critical stages of nutrients application of cotton?
144.	What is nutrients fixation in soil? [Which combination zinc + Fe... Zinc + Phos...]
145.	What is soil conditioner?
146.	What is benefit of soil conditioner?
147.	What is antagonistic effect of nutrition on crop?
148.	Which fertilizer should be selected for sandy soil?
149.	In high pH soil, what kind of fertilizers should be used?
150.	Can we flood commercial Sulfuric Acid (H ₂ SO ₄) in standing crop?
151.	What is best method of fertilizer application?

152.	Can we apply PK fertilizer at later stages of crop?
153.	What is best timing of fertilizer application in relay cropping?
154.	Can we apply Potash and Zinc together?
155.	How can we deal with problem of high cost of fertilizers?
156.	What is use of humic acid?
157.	What is benefit of the use of potassium in foliar application?
158.	How many foliar sprays are required to get optimal yield?
159.	What is benefit of foliar application?
160.	What is benefit of the application of Farm Yard Manure (FYM)?
161.	How to get maximum benefit out of the use of FYM, GFYM and compost?
162.	Is there any negative effect of the application of Farm Yard Manure (FYM)?
163.	Does the use of fertilizer help in minimizing effect of insects/pests?

Table G: Picking, storage and marketing practices

164.	When should we start cotton picking?
165.	Do we need to observe any timing for cotton picking?
166.	Any other recommendation for cotton picking?
167.	Can we do picking in cloudy or rainy weather?
168.	What is recommended interval between two cotton pickings.
169.	Why cotton clothes are necessary for picking and transportation of cotton?
170.	Can we use Polypropylene or patsan (jute) bags for packing cotton?
171.	What should be level of moisture in the room where cotton is stocked?
172.	Can we keep Bt and non-Bt cotton together?
173.	Can cotton obtained in last picking be mixed with cotton obtained through earlier pickings?
174.	What is market rate of seed cotton?
175.	How can we store cotton for longer period of time?
176.	Why the market rates of seed cotton are is not stable?
177.	How to sell produce?
178.	What should we do with leftover bolls on the cotton sticks?
179.	If deep plough or Rotavator is not run, is there any negative effect?
180.	Is there any deadline before which cotton sticks should be removed?
181.	If cotton sticks are not used as fuel, then what should be done?

Table H: Others

182.	From where we can get cheap loans?
183.	From where we can get fertilizer on timely basis?
184.	How to deal with middlemen?
185.	From where we can get reliable weather forecasts?
186.	Please suggest recommendations for boosting yield.

Annex 3 ~ Frequently Asked Questions ~ Wheat

Table A: Land Preparation, Soil Analysis and Water Analysis

Sr. #	Frequently Asked Questions
1.	What is cost of soil analysis?
2.	What is cost of water analysis?
3.	Why should we get soil and water analyzed?
4.	Why land leveling is necessary?
5.	What is the cost of soil analysis?
6.	What is the cost of water analysis
7.	Why should we get soil analyzed?
8.	Why should we get water analyzed?
9.	At the stage of land preparation, can we take some proactive measures to prevent growth of weeds?
10.	Some people say land preparation is less important for wheat. Is it so? If yes why?
11.	What are benefits of Rotavation of cotton sticks?
12.	Which techniques of seedbed preparation should be used?
13.	How many ploughings we should apply?
14.	Why do we need land leveling?
15.	Why zero tillage should be practiced?

Table B: Irrigation

16.	Why should we get underground water analyzed?
17.	How should be take samples of underground water?
18.	What is criterion of fitness of water?
19.	From where we should get water analyzed?
20.	Is there any variety of wheat which requires less water to avoid shortage of water?
21.	Is there any negative effect of over-irrigation?
22.	Level of underground water (water table) is falling? How to deal with problem?
23.	How should we adjust time of first irrigation according to type of previous crop and time of sowing?
24.	How many number of irrigations should be apply to a wheat crop?
25.	Does number of required irrigations vary with type of previous crop and time of sowing?
26.	What is optimal time for last irrigation? Does it depend upon weather and sowing time?
27.	What are critical stages of irrigation for wheat crop?
28.	What are the benefits irrigation at crown root development stage?
29.	What are the benefits of irrigation at tillering stage?
30.	What the advantages of irrigation at booting stage?
31.	Should we irrigate at milky stage?

Table C: Seed selection, seed treatment and sowing method/practices

32.	Which variety of wheat should we select?
33.	What is yield potential of the recommended variety?
34.	What will be seed rate of the recommended variety of wheat?
35.	What will be benefits of seed treatment? What is importance of seed treatment?
36.	Which chemicals should we use for treating wheat seed?
37.	What should be the dose of treatment?
38.	Is there any seed treatment for controlling diseases in wheat?
39.	Is there any specific method of treatment of the wheat seed?
40.	Should we go for early sowing or late sowing?
41.	What are advantages and disadvantages of early sowing?
42.	What are advantages and disadvantages of late sowing?
43.	Which varieties more resistant to diseases?
44.	Does sowing time differ from variety to variety?
45.	If sowing time differs from variety to variety, then what are the recommendations?
46.	How should we maintain quality of seed?
47.	Should we get certified seed?
48.	Quantity of seed rate according to sowing time?
49.	What is reliable source of quality seed?
50.	Which fungicide should be used?
51.	What dose of fungicide should we apply?
52.	What is recommended method of applying fungicides?
53.	What is recommended method of sowing?
54.	What is a basal fertilizer?
55.	Why should we apply basal fertilizer?
56.	How should we apply basal fertilizer?
57.	Which variety has less lodging?

Table D: Agronomic practices

58.	What is cost of leveling of land?
59.	Should time span for sowing and harvesting be standardized?

Table E: Plant Protection

60.	What is a weed?
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61.	What are types of weeds in wheat crop?
62.	What is the magnitude of damages caused by weeds to wheat crop?
63.	Which weeds are more lethal for the wheat crop?
64.	What are different methods of weed control?
65.	What is weed scouting?
66.	When to apply weedicide?
67.	What is pest management?
68.	Does aphid cause any damage to wheat crop?
69.	Are there any beneficial insects for wheat crop?
70.	How to promote beneficial insects?
71.	Which are the important diseases of wheat crop?
72.	What are symptoms of diseases?
73.	What are preventive measures for wheat diseases?
74.	Is there any effect of fungicide on disease control?
75.	Which weedicides should be used to control weeds of narrow leaf and broad leaf wheat?
76.	What are benefits of fumigation?
77.	What are damages caused by termites and rats?
78.	How to control termites and rats attack?

Table G: Harvesting, threshing, storage and marketing practices

79.	What is market rate of wheat?
80.	How to sell produce to get maximum returns?
81.	Where should we sell our wheat produce?
82.	How to deal with marketing problems?
83.	Where can we get bardana (bags) from?
84.	How to deal with storage grain pests?
85.	Which pests attack at storage stage?
86.	Is there any effect of moisture contents on the quality of wheat grains?
87.	What is fumigation?
88.	How to control attack of rats on wheat stored in the building?
89.	Which types of pesticides are used for stored grain pests? (rat proofing)

Table H: Others

90.	From where we can get cheaper loans?
91.	From where we can get fertilizer on timely basis?
92.	How can we identify fake fertilizers?
93.	How can we identify fake weedicides?
94.	Where to report cases of suspicious/faked fertilizers?
95.	Where to report cases of suspicious/fake weedicides and other products?
96.	How to deal with problems created by middlemen?
97.	From where can we get reliable weather forecasts?

Annex 3 ~ Frequently Asked Questions ~ Citrus

Frequently Asked Questions Citrus

Table A: Nursery Management

Sr. #	Frequently Asked Questions
1.	Where are good citrus nursery plants available?
2.	What is rate (price) for nursery plants?
3.	Are less-seeded (or seed free) nursery plants available?
4.	Where is a disease free citrus nursery available?
5.	Is it necessary to treat the seed with fungicides for preparation of a nursery?
6.	In what conditions and how is a nursery raised in a pot/ media or soil?
7.	Whether mother plants are available at the nursery owner's farm or not?
8.	What is a certified nursery?
9.	Where are the certified nurseries?
10.	Why should I purchase nursery plants from certified nursery?
11.	What are the benefits of getting nursery from the certified nurseries?
12.	What is a dwarf root stock of kinnow (a type of Mandarin, main citrus fruit of Pakistan)?
13.	Is dwarf root stock for high density plantation available?
14.	Why should a proper timing for plantation of nursery plants be followed?
15.	What is recommended timing of plantation of nursery plants?
16.	Why should bed be prepared for nursery plantation?
17.	What measures should we take, at the stage of transplantation, to protect citrus plants from fungal attack?
18.	Why should we dip tap root of nursery plants in anti-fungal liquid before transplantation?
19.	Which variety or cultivar of citrus should we select?

Table B: Land preparation / Layout

20.	What is best time of land preparation for citrus orchard?
21.	What types of implements are required for preparation of land for orchards?
22.	What is best type of soil for citrus?
23.	Why should we get soil analyzed?
24.	From where we can get soil analyzed to know whether soil is suitable or not?
25.	What assistance can be available from extension department in land preparation?
26.	What will be cost of nursery plants / acre?
27.	Which layout of orchard is ideal?
28.	Is there any technical help available to layout the orchard?
29.	What is suitable time for preparation and laying out the orchard?
30.	How many pits should we have in an acre of an orchard?
31.	What will be the expenditure for pits preparation in one acre?
32.	What should be size of a pit?
33.	What is the appropriate plant to plant distance?

Table C: Transplantation

34.	What material should be used for filling the pit?
35.	What is best timing of transplantation?
36.	How can we take care of plants after transplantation?
37.	What is normal/acceptable mortality rate?
38.	How can we transplant nursery plants with minimized damages?
39.	How can mortality rate be reduced?

Table D: Water Analysis

40.	Can we use tube well water for citrus?
41.	Why is it necessary to get underground water samples analyzed?
42.	Where is the facility/lab available for water analysis/testing?
43.	How can we use tube well water for citrus?
44.	How can we improve the quality of ground water?
45.	What is the ideal time for first water application?
46.	How many water applications are required by a citrus orchard in a year?
47.	What are critical stages for water application in citrus orchards?
48.	How can we conserve water to reduce water losses?
49.	What is the importance of drip irrigation?

Table E: Fertilizer Application

50.	What is the significance of balanced use of fertilizers?
51.	Why is organic fertilizer important?
52.	What is suitable time for fertilizer application?
53.	Does soil type (Karwi ya mithi) matter in selection of fertilizer?
54.	What is the appropriate method of fertilizer application?
55.	Why should we use liquid fertilizer
56.	What is foliar spray?
57.	Why should foliar spray be used?
58.	What is importance of soil analysis for fertilizer application?
59.	How can we select fertilizer based on the soil analysis report?
60.	How can we reclaim soil using the information from soil analysis?
61.	What are symptoms of nutrient deficiency?
62.	Why should we get the leaves of citrus trees/plants analyzed?
63.	What is the cost of citrus leaves analysis?
64.	How can we decide upon the quantity of different nutrients required based on leaves analysis report?
65.	What is the importance of micro-nutrients for citrus plants/trees?
66.	What is the recommended dose of each fertilizer / nutrient for citrus orchards?
67.	When and how much FYM should we apply in orchards?
68.	When and how much green manuring should we apply in orchards?
69.	What is EM technology?
70.	Can we use EM technology in citrus orchards?

Table F: Grafting

71.	What factors should be considered when selecting a cultivar?
72.	What are drawbacks using kinnow root stock instead of lemon root stock?
73.	What factors should be considered when selecting a scion?
74.	What factors should be considered when selecting a root stock?
75.	What is the best time for grafting?
76.	What is the appropriate method of grafting?
77.	What is the importance of disease free and healthy grafting material?
78.	Why should we use anti-septic solutions?
79.	What is the recommended height (point on the plant stem) where the bud grafting should be done?

Table G: Plant Protection

80.	How can we protect our nursery from disease/pest attack? What should be done?
81.	Why leaves of my orchard are turning cup like / Curling? What should be done?
82.	Why are leaves dropping or getting yellow? What should be done?
83.	Why branches of my orchard plants/trees are dying back? What should be done?
84.	Why branches of my orchard plants are drying? What should be done?
85.	Plants of my orchards are dying back. What is the reason? What should be done?
86.	Plants of my orchards are quickly dying. What is the reason? What should be done?
87.	Plants of my orchards are slowly dying. What is the reason? What should be done?
88.	Brown dots (citrus canker) are emerging on the leaves of my orchard plants. What is the reason? What should be done?
89.	Brown dots (citrus canker) are emerging on fruits. What is the reason?
90.	Some fruits of my orchard remain green (greening / HLB). They do not gain true colour? What should be done?
91.	Leaves of my orchard plants are turning blackish. What is the reason? What should be done?
92.	Leaves of my orchard plants are turning blackish due to sucking insects. What should be done?
93.	Why my plants are infested with leaf-miners attack? What should be done?
94.	Some fruits are decaying and dropping (due to fruit fly) on the plants? What should be done?
95.	Some leaves are torn – look like someone has eaten some parts of leaves. What should be done?
96.	Gummosis (gum/goond) is oozing out of the stem and from branches? What should be done?
97.	How to control weeds in the orchards?
98.	Fruits have blemishes. Why? What should be done?
99.	What are the symptoms for scab and melanose disease?
100.	How can we control scab and melanose?
101.	Why and when should we prune/trim the plants/trees?

Table H: Harvesting / picking of fruits

102.	What are maturity indices?
103.	What is degreening of citrus fruits?
104.	How can we change color of fruits early (degreening of citrus)?
105.	What is recommended way of harvesting fruits?
106.	What is best time of harvesting of citrus fruits?
107.	What equipment should we use for harvesting of citrus fruits?
108.	How can we solve the problem of labour shortage?
109.	How can we minimize harvesting losses?
110.	How to solve the problem of capacity/training in picking / packing?
111.	Why do we need trained labour for picking?
112.	What are differences among A, B and C Grades of citrus fruits?
113.	Why should we go for initial grading / sorting?

114.	How can we appropriately handle the fruits after picking?
115.	What picking tools should be used?
116.	Where are such tools available?
117.	How can we de-contaminate buckets?

Table I: Post-harvest management

118.	How can we minimize losses while transportation?
119.	What is best means for transportation of citrus fruit?
120.	How early should we transport to factory?
121.	Why should sorting be done in the factory?
122.	Why and how should we treat fruits in the factory?
123.	Why washing should be done in factory?
124.	Why waxing is needed?
125.	How can shelf-life of fruits be improved?
126.	What material should we use in packing of citrus plants?
127.	Why chilling is needed after processing and packing before shifting to cold storages?
128.	Where is the cold storage facility available?
129.	How can we handle logistic problems?

Table J: Export management

130.	How can we export our produce ourselves?
131.	How to get an export firm registered?
132.	How to deal with custom clearance?
133.	What are the documents involved in the export?
134.	How can we prepare documents on timely basis?
135.	How can we quickly go through custom clearance at destination?
136.	How to deal with issues of pricing and recoveries?
137.	Why Global GAP Certification is needed? Why is it important for farmers?

Annex 3 ~ Frequently Asked Questions ~ Rice

Frequently Asked Questions Rice

Table A: Nursery management

Sr. #	Frequently Asked Questions
1.	What type of soil is suitable for rice nursery?
2.	Should we make any consideration for the previous crop grown in a field, before growing rice nursery there?
3.	What is suitable location (like shady tree) for growing rice nursery?
4.	What are recommended varieties of rice for our area?
5.	What is a suitable variety and time of sowing?
6.	What is the best method of sowing?
7.	Is it necessary to treat seed before sowing in field?
8.	What is the method of seed treatment?
9.	What is reliable source of good seed of rice for nursery?
10.	What are suitable fungicides for seed treatment?
11.	What are reliable sources of fungicides?
12.	What should be seed rate /marla (272 ft ²)?
13.	What is optimal germination rate?
14.	What is the magnitude of loss caused by the weeds in the nursery?
15.	What are the common weeds in rice nursery fields?
16.	What are methods of weed control in nursery?
17.	What is the appropriate time for weedicide application?
18.	Which weedicides should we apply?
19.	What is appropriate dose of weedicide?
20.	How to control grasshopper in the nursery fields?
21.	What are common diseases of rice nursery?
22.	What are methods to control diseases of nursery?
23.	What are symptoms of Zn deficiency in nursery? How to control Zn deficiency?
24.	What should be recommended age of rice nursery at the stage of transplantation?
25.	How does stem borer cause damage to rice nursery plants?
26.	How can we control stem borer in the nursery?
27.	How can we control the stem borer of rice nursery?
28.	What is foot rot (bakani) disease of rice nursery plants?
29.	What are symptoms of foot rot (bakani)?
30.	How can we control the foot rot of rice nursery plants?

Table B: Irrigation

31.	Is it useful to get underground water analyzed?
32.	What is correct method of water sample collection?
33.	What are the charges for water analysis?
34.	Why our irrigation water is pale in colour?
35.	By drilling bore sometimes beyond 400 ft, sometimes we find that land becomes hard.

	Why is it so?
36.	What should be ideal depth of bore in Sialkot?
37.	Why water of some area is considered as unfit?
38.	What are critical stages of irrigation in rice crop?
39.	When to give last irrigation to paddy?
40.	What is role of pucca (lined) watercourse?
41.	What is water harvesting?
42.	How can harvest water in different stages?

Table C: Soil Analysis and Fertilizer Application

43.	What is correct method of soil sampling?
44.	Why has the soil colour become pale?
45.	My soils do not responding to heavy dose of fertilizers?
46.	Can we get the fertilizers tested (fake or genuine) at district level labs? [at divisional level]
47.	Why is balanced use of fertilizer important for rice?
48.	Are soil reclamation measures successful?
49.	What are micro nutrients?
50.	Are micro-nutrients necessary for good production of rice?
51.	Salt-affected soils are common in Pasrur Tehsil. Why?
52.	Why do the leaves of rice crop go pale?
53.	What are benefits of Zn+Boron+Mn?
54.	What is recommended dose of Zn application? [10 kg (21%)/acre]
55.	What are symptoms indicating deficiency of Zn?
56.	What is the significance of iron, copper and sulphur for rice crop?
57.	Can we use visual methods to identify the nutrient deficiencies in crops?
58.	What is best combination of fertilizers for good production?
59.	What are symptoms of nutrition deficiencies?
60.	What are recommendations for the use of micronutrients?
61.	What is humic acid?
62.	Why should one use humic acid in rice fields?
63.	What is recommended dose of humic acid?
64.	From where can we get humic acid?
65.	What is recommended method of fertilizer application?
66.	What is ideal range of major nutrients in terms of ppm?
67.	What should be the colour of healthy rice leaves?
68.	Can we detect nutrition deficiency by examining colour of the rice leaves?
69.	Are organic fertilizers useful for rice production?
70.	What is role of organic matter (OM) in crop production?
71.	How can we improve OM in fields?
72.	Why do rice plants lodge near maturity?

Table D: Agronomic Practices

73.	How should we prepare land for rice production?
74.	What is optimum number of plants/acre?

Table E: Plant Protection

75.	What are the major insects which cause big damage to rice crop?
76.	How can the grasshopper be controlled in rice fields?
77.	What are major diseases of rice plants?
78.	What is phyto-toxicity?
79.	What are the symptoms of phyto-toxicity?
80.	How to control phyto-toxicity?
81.	What is Bacterial leaf blight (BLB)?
82.	What are symptoms of Bacterial leaf blight (BLB)?
83.	What is treatment of Bacterial leaf blight (BLB)?
84.	What are symptoms of Leaf folder / Leaf Roller?
85.	What is treatment for Leaf folder / Leaf Roller?
86.	What are symptoms of Brown plant hopper attack?
87.	How can we control attack of Brown plant hopper?
88.	What are symptoms of brown leaf spot?
89.	How can we control brown leaf spot?
90.	What are symptoms of rice borer?
91.	How can we control attack of rice borer?
92.	What are important weeds of rice crop?
93.	What is the magnitude of loss to rice crop caused by weeds?
94.	What are methods of weed control?
95.	Is cultural practice effective in leaf roller / folder?
96.	What is recommended quantity of water for spraying insecticide / fungicide rice crop?
97.	What is biological control of insects?
98.	How to control stem borer of rice?
99.	How to control moth (parwana) of leaf folder?
100.	What is difference between fungicide and insecticide?
101.	How can we control attack of rice moth?
102.	How can we control attack of rice beetle?
103.	How can we control attack of khapra beetle (cabinet beetle)?

Table F: Harvesting and marketing

104.	Any suggestions for harvesting rice crop?
105.	Is there any way of reducing the high cost of harvesting?
106.	How can we deal with problem of non-availability of labour?
107.	Farmers can't store produce for long time. However, rates offered to them remain quite low at harvesting stage. How can we deal with this problem?
108.	How can we better manage our finances? How can we deal with financial constraints?
109.	How can we deal with black marketing / shortage of inputs in the market?
110.	How can the influence of the middlemen be minimized?
111.	When and how should we fumigate?
112.	Sometimes fumigation does not work. Why?



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Annex-D Baseline Survey Report

Baseline Survey Report – Vehari, Sargodha & Sialkot

An interim output for ‘ICT based services for
Agriculture Extension’

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Contents

Executive Summary	4
Background	6
Rationale	6
Research Objectives	7
Research Design and Methodology	7
Instruments for Data Collection	7
Sampling Strategy.....	8
Sample Distribution Plan	10
Process of Data Collection	10
Data Processing and Analysis	11
Farmers Profile.....	12
Cotton Crop – Vehari District	18
Overview	18
Water and soil testing practices	18
Crop Related Information.....	19
Land Preparation	23
Pest Management.....	26
Fertilizer Application.....	28
Cotton Picking.....	28
General Views.....	29
Citrus Crop - Sargodha District	32
Water and Soil Testing Practices.....	32
Citrus Crop Related Information	34
Land Preparation	38
Nursery Plants	39
Pest Management and Weed Control.....	41
Harvesting.....	45
Rice Crop - Sialkot District	47
Water and Soil Tests.....	47
Rice Crop Related Information	47
Nursery Preparation.....	49
Transplantation of Nursery to Fields.....	50
Pest Management and Weed Control.....	51
Harvesting.....	52
Wheat - Vehari, Sialkot & Sargodha Districts	54
Wheat Related Information	54
Pest Management and Weed Control.....	62
Harvesting.....	63
Rural Women --- Some Insights.....	66
References	72

Table of Figures

Figure 1 Map of Punjab Province showing districts	9
Figure 2 Yield-wise distribution of farmers	19
Figure 3 Yield viz-a-viz farm size	20
Figure 4 Cost of production of cotton (PKR 48,413/acre)	22
Figure 5 Cost of production of cotton vs farm size	22
Figure 6 Yield comparison: Soil and water analysis done vs not done	33
Figure 7 Yield comparison: Citrus leaves analysis done vs not done	33
Figure 8 Size of farms	34
Figure 9 Yield of citrus vs size of farms	34
Figure 10 Yield comparison: number of crops in the orchard	35
Figure 11 Distribution of farms vs number of plants /acre	37
Figure 12 Sources of irrigation water for orchards	38
Figure 13 Average yield of citrus vs source of nursery plants	40
Figure 14 District-wise comparison of wheat yield	54
Figure 15 Distribution of farmers wrt wheat yield in Vehari	55
Figure 16 Average wheat yield for different farmers categories in Vehari	55
Figure 17 District-wise per acre cost of wheat production	56
Figure 18 Cost of production of wheat (PKR 24,027/acre) in Vehari	56
Figure 19 Cost of production of wheat (PKR 21,768/acre) in Sargodha	57
Figure 20 Cost of production of wheat (PKR 19,817/acre) in Sialkot	57
Figure 21 Average wheat cost of production for different farmers categories in Vehari	58
Figure 22 Time of wheat sowing followed by farmers in Vehari	60
Figure 23 Time of wheat sowing followed by farmers in Sargodha	60
Figure 24 Time of wheat sowing followed by farmers in Sialkot	61

Table of Tables

Table 1 Cell-phone statistics of three districts	13
Table 2 Age profile of the heads of households	13
Table 3 Education profile of the heads of households	13
Table 4 Tehsil-wise yield of cotton	20
Table 5 ANOVA – Tehsil-wise yield of cotton	20
Table 6 Correlation between yield/acre and the plant protection	21
Table 7 Per acre profit in cotton production	23
Table 8 Technical names of cotton weeds	26
Table 9 Does participation in extension workshops make any difference?	30
Table 10 Correlation between investment in cotton production and income/acre	30
Table 11 Correlation between knowledge of plant protection and degree of control over pests	31
Table 12 The practice of water and soil analysis, and the citrus yield	32
Table 13 Correlation between share of canal water in irrigation and citrus yield	38
Table 14 Knowledge of soil characteristics and citrus yield	39
Table 15 Source of nursery plants vs satisfaction with citrus production	41
Table 16 Correlation between incidence of diseases and the yield and farmer satisfaction	43
Table 17 Correlation between knowledge in pest management and pest control	44
Table 18 Correlation between knowledge in nutrition management and yield	45

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Executive Summary

This Baseline Survey Report is one of the activities of the project that aim to develop a sustainable knowledge management system to facilitate decision making in farming communities by making access to information easier and affordable through the use of Information Communication Technologies (ICTs).

Project area comprises three districts i.e. Vehari, Sargodha and Sialkot. The districts were strategically chosen to encompass the most well-known areas for growing particular crops (cotton & wheat in Vehari, citrus & wheat in Sargodha and rice & wheat in Sialkot).

The project is expected to reach 30% of farmers in the focal district Vehari of the target districts through helpline. The project will establish an MIS for Agriculture Extension, helpdesk and mobile applications for use of the farmers and extension providers. Secondly, FAQs will be developed and the ICT based system will disseminate about 400 SMS messages to 1200 farmers during a typical crop life cycle. Besides, about 360 Urdu Voice messages will also be developed and delivered to the farmers.

A baseline research was designed to document the profile of farmers, knowledge base, current agricultural practices of farming community and evaluate women's role in the rural matrix prior to implementation of the project. Total sample size for the study was 1200 small and medium farmers, with 400 farmers sample taken from each district.

Mobile accessibility was found to be fairly common in all the three districts with only 2% farmers in Sargodha, 5% in Vehari and 10% in Sialkot not having cell phones. The case of women was different in terms of accessibility to mobile phones is concerned, none of the women in Sargodha, 16% in Sialkot and 33% of women in Vehari were reported to have their personal cell phones.

The average age of the head of the household was 41-60 years for 41% families in Vehari and 49% households in Sargodha and Sialkot. More than 40% of heads of the household were illiterate, however, more than half of them were able to read and write.

The most commonly used source of information was established to be fellow farmers and model farmers in each region. Around 70% of farmers in Vehari and more than 80% of farmers in Sialkot and Sargodha spend between Rs. 300-1000 per month on cell phones. Most of the farmers were not able to segregate the number of calls specifically for agricultural purposes; the ones who responded reported their spending to be below Rs. 300.

The most commonly used source for seeking weather related information was television mentioned by 66% farmers in Vehari, 88% in Sialkot and 90% in Sargodha. Water and soil testing practices were almost non-existent, except in Sargodha where 6% farmers got the water tested. Moreover, 9% got the leaf curl test done for orchards and none of the rice farmers got the rice crop leaf test.

The data for cotton yield last year [2011-12] depicts an average of 44 maunds for tehsil Vehari, 38 maunds each for tehsil Burewala and Mailsi. The average income from cotton crop was registered as Rs. 45,105 for Vehari, Rs. 55,644 for Burewala and Rs. 40,666 for Mailsi. Almost all the cotton farmers, i.e. 97%, use raised bed manual method for sowing. Only 70 farmers also use drill for sowing purposes. Two-third of them purchases seed from seed dealers or nearby markets and 49% also use home kept seed alongside the purchased seed. A total of 305 farmers, i.e. 76% use BT cotton seed, whereas 276 farmers are using non-BT varieties as well. The exclusive BT users formed 26% of the sample and exclusive non-BT users were 24% of the farmers surveyed. Almost half of the farmers, i.e. 201, rely on both varieties of cotton for various reasons.

The farmers using chemicals for seed treatment formed 37% of the total sample. The farmers who switched to BT cotton cultivation and registered their response attributed this to higher yield expectations. Moreover, the scale of farmers' satisfaction from cultivating BT cotton was found to be

fairly pleasing. A high number of respondents, i.e. 98% mentioned that they store the cotton at some dry place before transferring it to their storage or directly selling it. A significant relationship, though not very strong ($r = 0.168$), was found between investment in cotton production and income per acre.

Pakistan is among the top ten citrus producing countries in the world. There were only 10% farmers who do not engage in inter-cropping by growing wheat and fodder in their orchards.

More than half, i.e. 55%, declared an income of Rs.100, 001 - 150, 000 per acre. A large number of farmers i.e. 87% mentioned that they have an average of 91-100 plants per acre in their orchards. Almost all the farmers, 98%, are using unregistered nurseries to buy plants for their orchards. The occurrence of disease in citrus orchards was informed as "considerable" by 64% farmers and 16% rate it as severe.

Rice is second major staple food crop in Pakistan after wheat, accounting for 4.9% of the value added in agriculture, 1 percent of GDP and about 10% of the export earnings of the country.

Average yield of rice in Sialkot comes to about 41 maunds (1.64 tonnes)/acre, with minimum of 10 maunds and maximum of 60 maunds. The farmers were able to generate an income of Rs. 40,001 – 60,000 per acre, as maintained by 77% farmers. The trend of raising own nursery is strongly entrenched in rice farmers, 95% of them do it for themselves. A total of 78% farmer use their own seed for their rice crop, 12% get it from their nearby market places or dealers.

The most popular variety of rice was observed as "Super Basmati" being used by 98.3%. Moreover, 21% farmers use "386", 5% grow "Supera" and 9 farmers rely on "Basmati 385". The maximum number of farmers sowing "Super Basmati" and "Basmati 385" use 8 kg of seed per acre. A total of 90% farmers transfer the nursery when it is at least 40 days old, a distance of 8-9 inches is maintained between the rice plants by 83% farmers.

Wheat is the staple diet of Pakistan; it contributes about 12.5% to the value added in agriculture and forms 2.6% of GDP. Vehari was the best performing district for wheat crop with an average yield of 40 maunds/acre in Vehari, 39 maunds/acre in Sialkot and 35.5 maunds/acre in Sargodha. The data shows that 94% farmers from Sialkot, 86% from Vehari and only 58% from Sargodha were able to make more than Rs. 30,000 per acre from their wheat crop. Almost all the farmers follow the method of wheat "Chatta" (broadcast) in dry land. The practice of using home kept seed is maintained by 88-89% people. It was quite astonishing to notice that none of the farmers in Sialkot and Sargodha and only 9 farmers from Vehari reported treatment of their wheat seed with chemicals. Manual harvesting was found to be still the more practiced method. The manual method was most prevalent in Vehari where 81% farmers follow this practice. Similar method was being used by 77% farmers in Sargodha and 63% in Sialkot. The problems faced by farmers were quite similar in every region; the most prominent common problems were unavailability of water, fertilizer issues and counterfeit products flooded in the market, high energy and input costs and unsatisfactory prices of their yields. Wheat farmers also face "Baardaana" (jute bags meant for storing wheat) issue.

Background

This Baseline Survey Report is one of the activities of the project that aim to develop a sustainable knowledge management system. This system is proposed to facilitate decision making in farming communities by making access to information easier and affordable through the use of Information Communication Technologies (ICTs). This project will nurture relationships among the partners of the project i.e., CABI, Punjab Agriculture Extension Department and Mobilink, a Mobile Network Operator, to attain the goals of improved outreach and monitoring of extension services.

Project area comprises three districts i.e. Vehari, Sargodha and Sialkot. The districts were strategically chosen to encompass the most well-known areas for growing particular crops (cotton & wheat in Vehari, citrus & wheat in Sargodha and rice & wheat in Sialkot) and to study the best practice in these high producing areas of these indispensable crops for Pakistan's economy. These four crops are of critical importance on account of their contribution to the economy of the country and livelihood of rural poor.

In order to benchmark the situation prior to the implementation of the project, a baseline study has been undertaken in the project area.

Rationale

Farmers work hard to grow their crops and manage their livestock to sustain their families, increase their income and improve their livelihoods. They are supported in their activities by extension services and agro input providers. This project aims to improve livelihoods for the farmers in target districts of Punjab Province (i.e. Vehari, Sargodha and Sialkot) by empowering them with critical information at critical stages of the major crops through an ICT based knowledge management system. The project targets to improve reach and monitoring of extension services to the farming community at a lower cost. It is expected that farmer helpline will reach 30% of farmers in target districts. Besides, it is also expected that Directorate General office of Agricultural Extension & Adaptive Research (AE&AR) will use the system to monitor extension service performance.

The project will establish an MIS for Agriculture Extension, helpdesk and mobile applications for use of the farmers and extension providers. Secondly, contents will be developed for the system. In this respect, FAQs will be developed for four major crops of the target districts i.e. rice, cotton, wheat and citrus. It is envisaged that ICT based system will disseminate about 400 SMS messages to 1200 farmers during a typical crop life cycle. Besides, about 360 Urdu Voice messages will also be developed and delivered to the farmers.

Another area of the intervention of the project is the training and capacity building of extension services. CABI will support the provision of one-to-one training to all staff of the extension department, who are responsible for dissemination of information among the farmers in the target districts.

Based on the success of the project, a robust model will be evolved for adoption of the service in other districts too.

The painstaking job of converting information into digestible/consumable and actionable formats, achieving maximum reach of this information in an affordable budget and finally assessing the absorption and adoption of information are the key elements of this project.

The project was planned in two phases. Concept testing of using technologies for dissemination of information was the main objective in phase I of this project. This next step aims at launching the model, developed in line with the inputs received in Phase I, through a pilot project in three districts of Punjab.

At the start of this phase of the programme it was necessary to assess the socio-economic patterns of the participating farmers, their current farming practices, evaluate their level of knowledge and assess the demand of use of complementary services delivered using mobile devices (*which provide access to actionable information and communication services with the aim of facilitating and informing farmers of critical information on existing technologies and of new technologies which could enhance their yields, and reap maximum value of their produce for improving livelihoods for the farmers in target districts*). This provides the baseline information about farmers and help in determining the performance indicators which would be evaluated after the launch of the project to assess the achievement index. Hence, a baseline study was undertaken in the target districts with the following objectives:

Farmers' groups and their support network were taken in the ambit of the research to assess the specific knowledge needs for integrating production, marketing and value addition activities.

Women form an integral part of the agriculture and ancillary activities. The role of women is generally undermined; however, they essentially play a major part from mainstream agricultural activities to livestock handling and involvement at various stages of crop management. Women generally participate in lighter agricultural activities. As such, they remain segregated from technical information related to fertiliser application, seed selection and the like. This was the information which needed validation to exactly probe the women role, their part in agricultural activities, gauging their empowerment index, access to various facilities including communication needs i.e. cell phones and so on. A baseline study of any rural set up would be incomplete without getting an input about women. Therefore, a qualitative part was built-in the research to get deeper insights in to various aspects of rural women in these districts.

Research Objectives

The research was designed to document the existing practices of the farmers. The broad based objectives are;

- To determine the profile of farmers in the project areas.
- To evaluate the infrastructure available to the rural areas in terms of road network, educational facilities, health network, access to various TV channels, landline and mobile phone coverage
- To gauge the existing knowledge base of farmers and sources thereof.
- To probe for a deep understanding of their current agricultural practices for each and every farming stage of major crops in the project region i.e. from land preparation; to seed selection; seed treatment; use of fertilizers, weedicides and pesticides; water management; harvesting; post harvesting, and so on.
- To evaluate the role of women in the household, level of financial empowerment, access to mobile phones and their familiarity with usage of various functions, participation in agricultural matters, financial gains from work, etc.

Research Design and Methodology

Instruments for Data Collection

In order to elicit data for the baseline study, four instruments were constructed. A guideline was developed for collecting information from women, while three separate structured Questionnaires were used to collect data from farmers. Assessment of the role of women in the existing rural matrix and their situation in rural system required a qualitative approach. Hence, a thematic guideline was used for thorough probing using a broader range of queries.

Questionnaires 2, 3 and 4 were meant for farmers. Each farmer questionnaire was for a particular district, having three sections. Section 1 contained questions related to major crop (cotton in case of

Vehari district, citrus in case of Sargodha district and rice in case of Sialkot district). Section 2 had questions on wheat crop (it is grown in all districts). The last section was meant to collect demographic and other information of the respondents including lifestyle, sources of information for agriculture, current practices of information gathering, attitude and behaviour towards modern agricultural practices, extent of technology uptake, existing familiarity and usage of mobile phones, etc.

Sampling Strategy

All three districts have different cropping pattern: cotton – wheat in Vehari, rice and wheat in Sialkot, while citrus and wheat in Sargodha. A district in Pakistan is divided into sub-administrative units which are called as tehsils (sometimes called as sub-divisions). There are three tehsils in Vehari district (Vehari, Mailsi and Burewala), six tehsils in Sargodha district (Sargodha, Bhalwal, Sahiwal, Kot Momin, Shahpur and Silanwali) and three in Sialkot (Sialkot, Daska, Pasrur and Sambrial). As discussed earlier, the idea underlying the selection of these districts was to represent the critical crops of Punjab to examine the current patterns of agricultural practices. Map showing all districts of the Punjab province is given at Figure 1. A brief profile of the districts taken up for the research is as follows:

- Sialkot is the smallest in size with total area of 3,016 square km¹. The district is divided into four tehsils (Sialkot, Pasrur, Daska, and Raya) with 106 union councils and 2,348 villages².
- Sargodha is the largest district in size with an area of 5,864 square km³. It is administratively divided into 6 tehsils (Sargodha, Bhalwal, KotMomin, Sahiwal, Shahpur and Silanwali) and 161 union councils.
- Vehari District is most recently created (1976) and is relatively larger than Sialkot District in size, with a total area of 4,364 km² (District Vehari, 2010). The district is administratively divided into three tehsils (Burewala, Mailsi and Vehari) and 89 union councils. The population of the district is 2,877,916 and population density is 659 persons per sq. km (District Vehari, 2010). Females account for 51% of the population (DCR, 1998). It is one of the poorest districts of the Punjab Province (Siddiqui, 2008). According to the District Census Report 98, about one third of the population lives in urban areas (DCR, 1998). Adult literacy rate in the District Vehari is 46% compared to 52% in the province (Government of Punjab, 2009a, p. v).

¹ DCS [District] (2012). History of Sialkot. Retrieved 11 December, 2012, from http://sialkot.dc.lhc.gov.pk/?page_id=1335

² DCS [District] (2012). History of Sialkot. Retrieved 11 December, 2012, from http://sialkot.dc.lhc.gov.pk/?page_id=1335

³ SP [Sialkot Police] (2012). The district at a glance. Retrieved 11 December, 2012, from <http://www.sargodhapolice.gov.pk/pages.php?id=56>



Figure 1 Map of Punjab Province showing districts

Targeted population for the baseline study comprised of small and medium farmers. Farmers are usually categorized as follows (Hassan, Tabasam, & Iqbal, 2005):

Less than 12.5 acres	Small farmers
12.5 – 25 acres	Medium farmers
25 acres and above	Large farmers

Since small and medium farmers account for largest proportion of the farming community, hence, it is easy to find them. In selected villages, they were randomly selected for interviews.

Since target group of this project is the small and medium farmers, hence, sample consisted of farmers of these categories. Total sample size for the study was 1200, with 400 farmers sample taken from each district. A sampling framework was developed for each district based on the number of tehsils falling in each district. Sample size of each district was equally distributed among all tehsils. A three-stage Random Sampling Technique was applied to select sampling units from each tehsil. The sample size of 1200 was equally divided among the three districts i.e. 400 sample size for each district. At stage 1, the sample of 400 was equally divided among the tehsils in each district. At second stage of sampling, 3 villages were randomly selected from each tehsil. It was ensured that selected villages are located at fairly large distance from each other to achieve as wide geographic coverage as possible. At stage 3, in each village a representative sample of the determined for each village was distributed among small and medium farmers. Detailed sample distribution plan is given below:

Sample Distribution Plan

District	Tehsil	Sample Size	Village-wise sample / tehsil			Category-wise Sample /village	
			V1	V2	V3	SF	MF
Sialkot	Sialkot	100	34	33	33	18/17	16
	Pasrur	100	34	33	33	18/17	16
	Daska	100	34	33	33	18/17	16
	Raya	100	34	33	33	18/17	16
	Total	400	136	132	132		
Sargodha	Sargodha	67	23	22	22	12/11	11
	Bhalwal	67	23	22	22	12/11	11
	KotMomin	67	23	22	22	12/11	11
	Sahiwal	67	23	22	22	12/11	11
	Shahpur	67	23	22	22	12/11	11
	Silanwali	67	23	22	22	12/11	11
	Total	402	138	132	132		
	Vehari	Vehari	133	45	44	44	23/22
	Burewala	133	45	44	44	23/22	22
	Mailsi	133	45	44	44	23/22	22
	Total	400	135	132	132		
Gross Total		1202	409	396	396		

SF = Small Farmers; and MF = Medium Farmers

In addition to the above 90 females were also interviewed.

Process of Data Collection

A team of social researchers and supervisors were given training on how to collect data by using these questionnaires. In order to ensure the quality of data collection, mock interviews were conducted. Work of each team was supervised by a more experienced team lead. Their main tasks were to make data collection work plan in the field (in line with the plan), assign work to team, provide them guidance as and when needed and monitor quality of data collection. The supervisors were briefed about the sampling design and geographical coverage. The supervisors ensured that all questionnaires were properly filled.

Qualitative data was collected from rural women in all the three districts using semi-structured questionnaire. This observational data collection was substantiated with an analysis based on their

lifestyle, body language and expression. The labour rates were also verified from various sources that include Pakistan Economic Survey 2011-12, agriculture extension personnel and local landlords hiring labour for various agricultural activities.

Data Processing and Analysis

Data were processed and analyzed in SPSS.

Farmers Profile

Number of household members

In all the three districts almost half of the farmers reported their family size as being between 6-8 members. However Sialkot had a higher percentage of large family size, with 27% of families reporting 9-11 members and 9% reporting 12-14 members.

Mobile ownership

Most respondents in all three districts reported that males in their household had access to mobile phones. Only about 2% of the farmers in Sargodha, 5% in Vehari and 10% farmers in Sialkot did not have a cell phone. It implies that cell phone concentration among farmers is higher in Sargodha than that in other two districts.

As far as access of women to the cell phones is concerned, almost all respondents of Sargodha district reported that women do not have access to mobile phones. However, in other two districts the situation is slightly better. About 16% of the respondents in Sialkot and around one-third of the respondents in Vehari reported that women in their households were having their separate or personal cell phones.

It was generally reported that the mobile phone of the head of the household was used as the family phone. Where women had access to mobile phones they were using them as means of communication with other family members.

The overall trend for mobile ownership represents the cultural norms and women empowerment indicators in each of the districts. Though Sargodha was ahead of other districts in mobile ownership among the farmers with 98% coverage, however, none of them reported their women to have cell phones. On the contrary, in Sialkot 90% farmers had cell phones and alongside 16% of their women also had access to their personal cell phones. The ratio of women having their mobiles was highest in Vehari with 33% women owning their sets, while 95% farmers reported to have mobiles. The women section of this report also explains that women in Sargodha rarely work as labour to make money, which keeps them economically dependent. This implies that economic empowerment of women is critical to their power of decision making and access to improved facilities.

Table 1 Cell-phone statistics of three districts

Facilities	Vehari		Sargodha		Sialkot	
	400		403		400	
	<i>n</i>	<i>%age</i>	<i>n</i>	<i>%age</i>	<i>N</i>	<i>%age</i>
Fixed line	16	4.0	14	3.5	18	4.5
Call phone owned by the Head of the household	378	94.5	382	94.8	338	84.5
Cell phone for joint family use	30	7.5	24	6.0	5	1.3
Women in the HH have cell phone/s	130	32.5	0	0.0	63	15.8

Demographics of head of the household

The average age of the head of the household was 41-60 years for 41% families in Vehari and 49% households in Sargodha and Sialkot. There was no household having female as its head. The other most prominent category was 26-40 years of age. The percentage of unmarried head of the household was relatively higher in Vehari with 13% people falling in that category (Table 2).

Table 2 Age profile of the heads of households

Age	Vehari		Sargodha		Sialkot	
	400		403		400	
	<i>n</i>	<i>%age</i>	<i>n</i>	<i>%age</i>	<i>N</i>	<i>%age</i>
Up to 25 years	38	9.5	11	2.7	10	2.5
26 - 40 years	148	37.0	158	39.2	149	37.3
41 - 60 years	164	41.0	196	48.6	195	48.8
Above 60 years	50	12.5	38	9.4	46	11.5
Total	400	100.0	403	100.0	400	100.0

More than 40% of heads of the household were illiterate and two-thirds reported themselves at being at the primary level (up to grade V) or below. Only 3-4% of farmers have completed their graduation / bachelor's degree (14 years of schooling). However, more than half of the head of the households were able to read and write.

Table 3 Education profile of the heads of households

	Vehari		Sargodha		Sialkot	
	400		403		400	
	<i>n</i>	<i>%age</i>	<i>n</i>	<i>%age</i>	<i>N</i>	<i>%age</i>
Illiterate	166	41.5	168	41.7	172	43.0
Primary Education	96	24	86	21.3	87	21.8
5 - 9 Class	61	15.25	75	18.6	73	18.3
Matriculation	42	10.5	27	6.7	43	10.8
Intermediate	23	5.75	31	7.7	15	3.8
Graduation	9	2.25	14	3.5	10	2.5
Post-Graduation	3	0.75	2	0.5	0	0.0
Total	400	100.0	403	100.0	400	100.0

The respondents reported the primary source of income as agriculture. There were very few cases, where agriculture was not listed as the prime profession of the head of the household. Other professions in the districts include small businesses (trade, transportation etc.) and jobs (government or private jobs). The number of people reporting primary professions other than agriculture was 6% in Vehari, 3% in Sargodha and 2% in Sialkot.

Assets of the Household

The farmers were asked about the assets in their household to assess their lifestyle and access to various essentials of life. Almost all the respondents had television sets at home in Sialkot, the ratio was quite high in Sargodha as well, with 89% having TVs. However, the trend in Vehari was different where only 60% had a television. Ownership of a car, jeep or pick up was rarely reported, but most had motorcycles or scooters as a mean of travelling.

A reasonable number of farmers, 40% in Vehari and 42% in Sargodha had their own tractors. However, this number was quite low for Sialkot with only 13% reporting to have their own tractors. Rotavators were available with 12-15% of the farmers in the three project districts. The farmers did not have easy access to other agricultural implements like cultivators, discs, harrow, ridger, drill, etc.

Spending on different heads in the last one year

The respondents were asked to document their expenses under various headings for the last year. The surveyors found it quite difficult to get realistic answers to this query and farmers were offended by deeper probing. They had a tendency to substantially under-report the details of their spending. However, we are presenting the data provided by the respondents.

Farmers in Vehari spend less than Rs.4000 in 90% cases for education and moreover, 70% of these do not allocate more than Rs.2000 for this purpose. A similar pattern was observed for spending on health, where 87% people do not spend beyond Rs. 2000 per year. This pattern was observed for clothes, religious occasions and social occasions, with little variation. Most of them reported spending less than Rs. 2000 per year under each of these headings. In Vehari, 19% of those farmers who answered the question (29%) on their level of spending on livestock and poultry reported spending more than Rs. 10,000 a year. Only 16% farmers reported their expenses on agricultural implements and 7% of these spent more than Rs. 10,000 per year.

The responses from Sargodha were similar to those of Vehari, on account of spending. More than 80% of the farmers from this district spend less than Rs. 4000 a year on each of health and education. The reported expenses on clothes were slightly higher than in Vehari, with 95% of farmers allocating up to Rs. 6000 for clothes per year. Only 24% farmers documented their spending on livestock and poultry, and of these 20% reported that they appropriate more than Rs. 10,000 for this expense.

Three-fourth of the farmers in Sialkot allocate less than Rs. 4000 for each of health and education. Of those farmers who responded to the query on spending for livestock and poultry (18% of total), 6% spent more than Rs. 10,000. Out of the 13% farmers who prioritised spend on agricultural implements, 5% earmarked more than Rs. 10,000 per year.

Loan/borrowing

Farmers were reluctant to share information about loan borrowing. Out of a total sample of 1202 farmers, only 6 disclosed that they had taken out a loan in the last year, which accounts for less than 0.5% of the farmers. It indicates that small and medium farmers have no access to or no preference of the loans.

Information sources for cotton crop

On reporting where they received information and advice on their crops, cotton farmers responded that they mainly relied on fellow farmers and role models around them. About 25% farmers consulted their

fellow farmers and 12% with the role models for advice on certain areas. Only about 14% farmers reported that they consulted the extension workers for seeking advice on cotton production. Electronic media was also not reported as a major source of information: only 9 farmers reported it as major source of information for them. There was negligible response for private extension workers, print media, zaraat naama (fortnightly magazine publishing by the Punjab Government) and the internet.

Information sources for citrus crop

Citrus farmers were dependent on their fellow farmers for getting information regarding their orchards. They extensively discussed with other farmers and prominent role models in their community. The farmers in Sargodha also exhibited a different trend by using electronic media (like TV) for getting information. One-fourth of the farmers ranked this medium as the top source of information (like TV). Internet, print media or zaraat naama were not ranked first by any citrus farmer. The role of private extension workers was more prominent than government extension staff.

Information sources for rice crop

The farmers involved in rice sowing also extensively consult each other for information sharing. Two-third of the farmers reported fellow farmers as the most frequently used source of information. The second most popular source was the model farmers who have been performing well. Model farms are progressive farms which are employing innovative / exemplary production technologies and agronomic practices. Such model farms are usually planned and managed with the technical collaboration of some organization like Extension Department or any Pesticide or fertilizer company. Government extension workers were not ranked as the top source of information and advice and private extension workers also had a little presence here. The rest of the sources were also essentially non-existent.

Information sources for wheat crop

Wheat farmers in Vehari were observed to show the least information seeking behaviour. Of the total number of farmers surveyed in Vehari 29% ranked their fellow farmers as the primary source of information and 12% consulted the model farmers around them. The other sources of information had an insignificant role in disseminating any information.

Farmers from Sargodha largely depend on each other to share information. Three quarters consulted fellow farmers and 18% adhered to the advice from their model farmers. The trend of not using other sources was present for wheat farmers in Sargodha also. There was almost a similar response in wheat farmers of Sialkot, with two-thirds of farmers using information gained from their peer group and 11% from the prominent farmers in the community to take advantage of their success stories.

Total monthly cell phone bills and expense on agriculture related calls

Around 70% of farmers in Vehari and more than 80% of farmers in Sialkot and Sargodha, spend between Rs. 300-1000 per month on cell phones. Almost half of the farmers from Sialkot and Sargodha and one third of the farmers in Vehari spend between Rs. 600 and 1000 per month for cell phone bills, in Some farmers allocated more than Rs.1000 for communication through mobiles; 14% from Vehari, 9% from Sargodha and 11% from Sialkot fall in that category.

When asked about the expenses on agricultural related calls, many farmers were not able to segregate the number of calls specifically for agricultural purposes. Of the farmers who responded to this query, almost all the farmers reported their spending to be below Rs. 300. There were only 6 farmers from Vehari and 4 from Sargodha who claimed to invest Rs. 300-600 for calls made for getting agricultural related information or discussing crop related matters.

Frequency of calls to get specific agriculture related information for their cotton, citrus and rice crops

The farmers from Vehari make calls to their fellow farmers, government extension workers and role model farmers for getting information. Half of them claimed that their calls are diverted towards their peer group, 31% call government extension staff and 23% contact the leading farmers in the area for cotton related information. They had an almost similar split for getting information about the wheat crop as well.

Sargodha presented a different scenario, more than half of the calls i.e. 57% were focused on getting information from other farmers regarding the citrus crop, 32% are diverted towards fertilizer dealers and 15% calls consult the best performing farmers in the community. The reliance on fellow farmers is greater in wheat crop where more than 70% farmers mentioned their role as a source of information. They also consume information from fertilizer dealers and role models; however, the role of extension workers was minimal for both the crops in Sargodha.

Sialkot farmers relied on their farmers' group for getting information about rice. Almost half of the calls i.e. 47% are made to other farmers and 34% are made to fertilizer dealers for various queries related to rice. The trend of respondents from Sialkot was quite similar for both rice and wheat. The frequency of calls to government extension workers was negligible.

Information sources for weather related information

Timely and accurate weather prediction is very critical for the production of cotton. Ali (2011a) suggests that farmers should look for weather forecasts before irrigating a cotton field, especially during monsoon season. Farmers referred to multiple sources for getting and verifying weather related information which is of prime concern for agriculture. However, the most commonly used source documented was television which was mentioned by 66% farmers in Vehari, 88% in Sialkot and 90% in Sargodha. The other two main sources were fellow farmers, being consulted by almost two-thirds of farmers in each district, and use of traditional methods to forecast weather (e.g. feeling air pressure). The weather information is not localized and gives a wider picture to the farmers; therefore, they have to further substantiate it with other sources to make a closer guess. The role of the government extension department was noticeable in Vehari where 14% farmers mentioned it. The office displays the weather updates for the next three days for the convenience of the farmers and they can even call to get weather information.

Information sources for pricing information about inputs and produce

The maximum number of farmers, 95% or more, consults their fellow farmers for information regarding seeds, fertilizers and pesticides, in Vehari. More than 80% further authenticated their information from nearby markets. Almost two-thirds of the farmers also use their farmer community networking in other places to get information about seeds; however, this source is not relevant in other cases. Seed information seems to be the most vital for farmers; therefore, 42% farmers in Vehari also call the dealers to verify pricing information. The same set of farmers only uses this source in 15% and 16% cases for fertilizers and pesticides, respectively. The trend for getting pricing information for the agriculture produce was totally different. The only major source was getting on the ground information from the local market. There was quite narrow response in other categories.

The farmers in Sargodha had quite a similar response for getting pricing information regarding seed, fertilizers, pesticides and agriculture produce. The two main source was fellow farmers being used by around 80% farmers in each category. However, in the case of the second most prominent source i.e. nearby markets there was some variation. An overwhelming majority i.e. 95% of the farmers were consulting these for seeds, 72% for fertilizers and 75% for the rest of the two categories i.e. pesticides and agriculture produce. Calls to dealers for getting information varied between 10-15% of farmers. Besides, television channels telecast feature programmes on various issues of the agricultural items market.

The response from Sialkot reported 95% of farmers visit their neighbouring marketplaces to check information about everything from seeds to fertilizers, pesticides and agricultural products. The other major source was the fellow farmers being used by around 72% farmers of this region. The dealers' role varied between 7-9% and television was even lower.

Agricultural practices and information needs of the farmers

Next four chapters discuss the existing agricultural practices, earnings, profitability and information needs of the farmers. This report documents the current state of agricultural practices, production, earning and profitability before introduction of the ICT-based availability of extension services. This information is used to inform the development of farmer advisory messages at this stage of the project. A possible post project study is planned to assess impact of the project on the earning capacity and livelihood of the farmers.

Cotton Crop – Vehari District

Overview

Agriculture accounts for 21 percent of GDP, generates employment for 45 percent of the labour force and provides livelihood to 60 percent of rural population of the country (Government of Pakistan, 2012, p. 17). Only three crops viz-a-viz cotton, wheat and rice contribute about 30 percent of the value added of agriculture (Government of Pakistan, 2012, p. 18).

Cotton is a strategic crop for the country. It accounts for 7.8 percent of the value added of agriculture and 1.6 percent of agriculture (Government of Pakistan, 2012, p. 19). During 2011-12, cotton was grown on an area of 2.84 million hectares, which produced 13 million bales cotton with yield of 815 kg/hectare (Government of Pakistan, 2012, p. 19).

Water and soil testing practices

Farming community in Punjab is facing acute shortage of canal water. Hence, in order to meet the deficiency of water, farmers are in practice of pumping out water (through tubewells and turbines) and use it for irrigation purpose. In Punjab, only 35% of cropped area is irrigated through canal water, while 41% of area is irrigated through canals and tube wells (Government of Punjab, 2011). However, ground water in most of the cases is not fit for irrigation purposes (Government of Punjab, 2011). Gap between demand and supply of irrigation water has increased over time, due to following factors (Government of Punjab, 2011):

- a. Increase in cropping intensity
- b. Increase in consumption of water in domestic and industrial sectors.

Excessive use of unfit groundwater for irrigation can damage quality of soil. Hence, farmers should get ground water tested before its use. Out of a total sample of 400 farmers in Vehari growing cotton, there were only 4 who claimed to have their water tested, forming a meager 1% of the respondents. Similar behavior was noticed for soil testing where 7 respondents gave an affirmative response.

Moreover, two of the four farmers who got their water tested did not use the results of the test. The other two became aware of the fact that ground water of their agricultural lands had excessive salts. The results for soil test, however, had a better uptake. The results identified a deficiency of potash and nitrogen in a couple of cases. At least, three respondents managed to lower / adjust the amount of urea and DAP in line with the requirements of their soil.

Secondly, it is also important to note that 40 to 50 per cent of canal water is wasted between the canal head works to the farm gate (Government of Punjab, 2011). It implies that there is significant potential for making additional canal water available for irrigation purpose.

Guidance for Farmer advisory messages:

- a. *Farmers should get groundwater and soil samples of their farm lands, tested from nearby lab to assess its fitness*
- b. *Farmers should adopt water conservation practices to improve water use efficiency*

Crop Related Information

Area under cultivation

Among the farmers interviewed during the research, 84% had their own land, 16% rented land for agricultural usage and another 15% opted for rented in addition to their self-owned to increase their area under cultivation. Therefore, a total of 124 farmers, i.e. 31% rely on rented land.

The breakup presents that 45% of the farmers in Vehari have less than 5 acres of own land under cultivation, another 22% own between 6-10 acres and 17% fall in the next bracket i.e. 11-15 acres of land. Of the surveyed farmers only 1.5% of the farmers had landholdings beyond 25 acres. However, the research was focused on small and medium farmers; therefore, the results are understandable in that context. A fairly noticeable number i.e. almost one-third of the total farmers chose to augment their agricultural activity by taking up rented land. The area breakup portrays that 75% farmers have rented in land a maximum of 10 acres (per farmer).

Yield of cotton

The data for cotton yield last year [2011-12] depicts more than half of the response falling in the average three brackets i.e. 55% having yield between 26-40 maunds per acre (1.04 – 1.60 tonnes/acre)⁴. However, it is healthy to notice that 29% farmers were able to fetch more than 40 maunds/acre. There were a negligible number of farmers, i.e. 4% who could not achieve beyond 20 maunds/acres and another 12% managed a mere 21-25 maunds/acre. Survey results show that average yield of cotton is about 37 maunds/acre in Vehari district. More than half (53 percent) of the farmers reported a yield less than average yield (i.e. 37 maunds/acre). Distribution of farmers according to yield brackets is given in Figure 2. . It means there is substantial room for improvement in the yield of cotton in the project area.

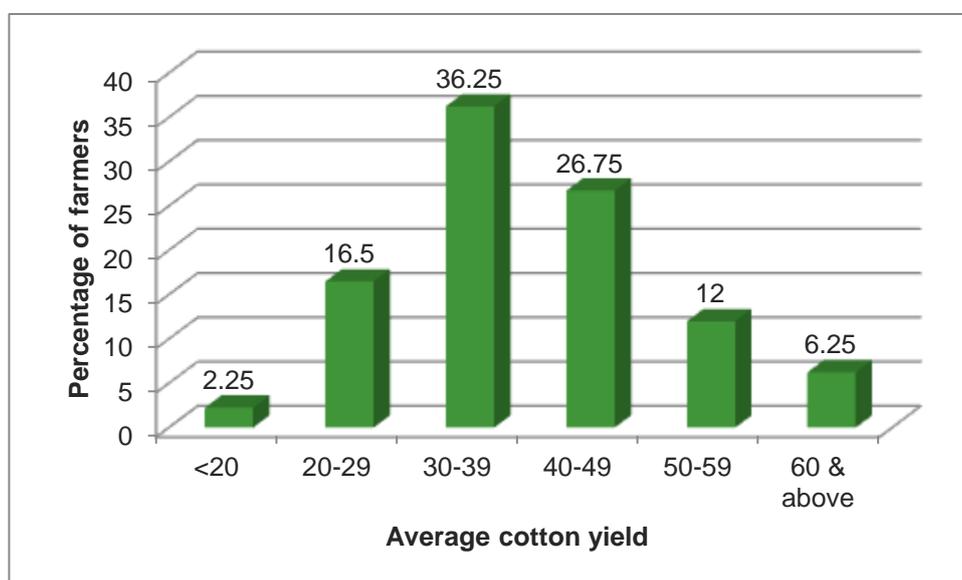


Figure 2 Yield-wise distribution of farmers

Guidance for Farmer advisory messages:

Figure 2 shows that there is significant potential for improvement in yield for most of the farmers. Just over 6 percent of the farmers achieved the yield of 60 maunds/acre, against average yield of 37 maunds/acre (1.48 tonnes / acre). This yield gap can be reduced through adaptation of improved technologies and practices.

⁴ One maund = 40 Kgs = 0.04 tonnes

Average yield of cotton is highest in tehsil Vehari, as compared to other two tehsils. However, variation in yield among high performing and low performing farmers is very high. ANOVA results show that difference in yield among tehsils is not statistically significant (**Table 4**). However, statistically, difference in yield among the three tehsils is insignificant, as shown in the **Table 5**. It is basically due to the fact that variation in the yield among farmers in tehsil Vehari is very high, as reflected in the value of Standard Deviations (**Table 4**).

Table 4 Tehsil-wise yield of cotton

TEHSIL	Mean	N	Std. Deviation
Vehari	43.87	115	64.189
Burewala	37.66	92	12.270
Mailsi	38.09	134	25.737

Table 5 ANOVA – Tehsil-wise yield of cotton

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2786.537	3	928.846	.543	.653
Within Groups	571038.898	334	1709.697		
Total	573825.435	337			

Small farmers have significantly lower yield (35.52 mauds /acre) as compared to large farmers (39.44 mauds /acre), as is shown in Figure 3. It shows that there is substantial potential for improvement in the yield of the small farmers.

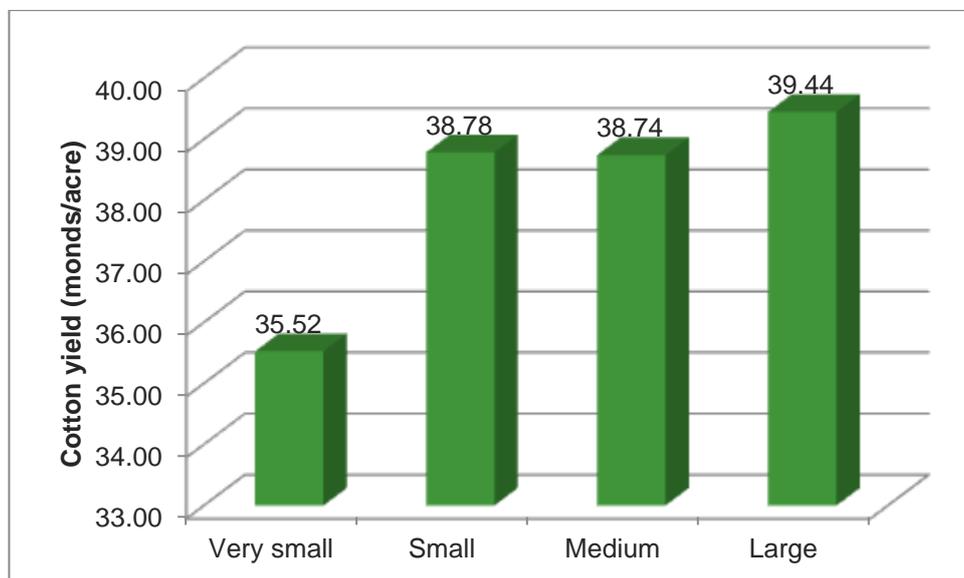


Figure 3 Yield viz-a-viz farm size

Table 6 shows that knowledge of the farmers positively and significantly correlated with yield/acre ($r = 0.183$, at $p = 0.000$ for knowledge). It implies that if knowledge of the farmers in plant protection is improved, it will lead to improvement in their per acre yield of cotton.

Table 6 Correlation between yield/acre and the plant protection

		CPPK	CPPC	Yield/acre
CPPK	Pearson Correlation	1	.786**	.183**
	Sig. (2-tailed)		.000	.000
	N	369	368	369
CPPC	Pearson Correlation	.786**	1	.127*
	Sig. (2-tailed)	.000		.015
	N	368	369	369
Yield/acre	Pearson Correlation	.183**	.127*	1
	Sig. (2-tailed)	.000	.015	
	N	369	369	400

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Guidance for Farmer advisory messages:

There is a significant correlation between farmers knowledge of plant protection and the cotton yield. It implies that farmers can enhance their cotton yield by improving their access to knowledge.

Cost of inputs per acre in cotton zone

The farmers were inquired about the cost of inputs towards their cotton growing area. The data presents picture of a positively skewed distribution, with 60% farmers spending between Rs.30,000 – 50,000 per acre⁵ towards their cotton crop. Only 7.5% allocate a budget less than Rs.30,000. Another noticeable expense slot lies between Rs.50,000 – 80,000 representing almost 28% of the respondents. There were 5% farmers who even spend beyond Rs. 80,000. Average cost of production comes to PKR 48,413/acre.

Leading cost items include cotton picking, fertilizers, irrigation, land rent, and plant protection (Figure 4). The analysis of the input costs reveals that rent of land is one of the most expensive cost items for those who take this option. Of 124 farmers who have rental land, 105 people spend between Rs.10,000 – 40,000 per acre as rent. The other most expensive inputs include cotton picking, followed by irrigation and fertilizers. About 65% farmers spend more than Rs. 9,000 per acre, on cotton picking, 74% farmers spend Rs.7,000 – Rs.20,000 on it and an overwhelming 96% spend between Rs.6,000- Rs. 20,000.

There is positive and significant correlation between expenditures /acre and the yield / acre, $r(400) = .225, p < .000$. It implies that investment in the cotton production is a major determinant of the yield.

⁵ One GBP = Pak Rs. 156

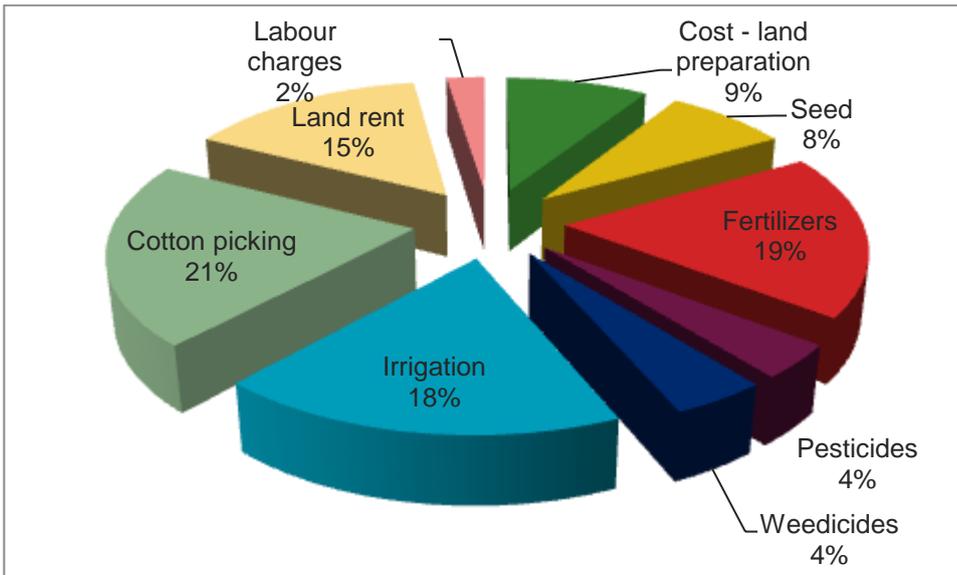


Figure 4 Cost of production of cotton (PKR 48,413/acre)

Cost of production in case of small farmers is less compared to the medium and large farmers (Figure 5), despite the fact that large farmers are expected to have benefits of economies of scale. It is due to the fact that medium and large farmers use more inputs.

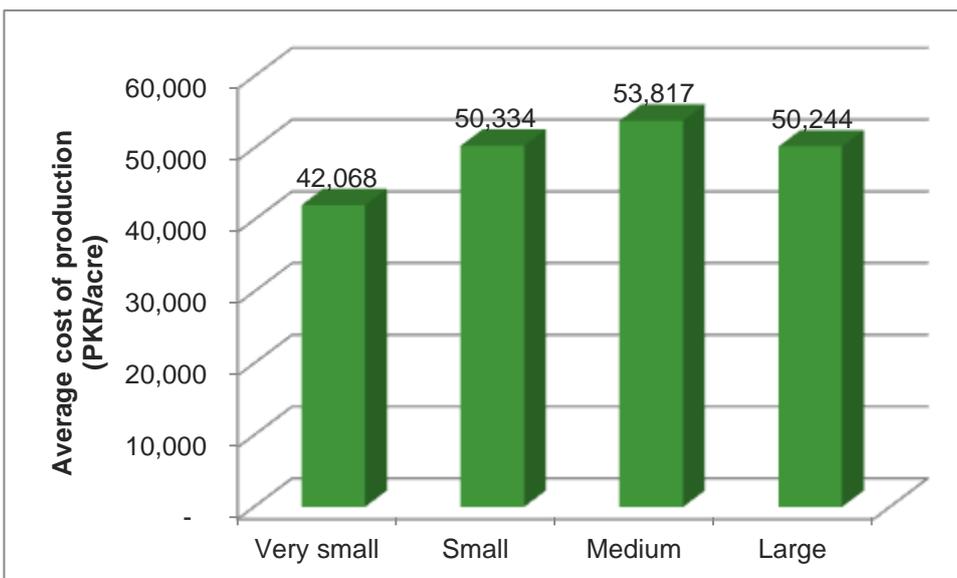


Figure 5 Cost of production of cotton vs farm size

Approximate Income from cotton

The income from cotton crop portrays that almost half of the farmers, i.e. 47%, earn between Rs.80,000 – Rs. 120,000 per acre after accounting for all the expenses on the cotton crop. These earnings have been calculated on last year's estimates which were based on a bumper cotton crop. Moreover, around 21% people were able to generate an income above Rs.120,000/acre (GBP 764).

Average profit earned from one acre production of cotton is about PKR 46,885 (GBP 299). Surprisingly, Burewala tehsil stands out among all tehsils of Vehari, in terms of per acre profit from cotton production. It is perhaps due to the fact that most of the farms are of medium size, which are usually more easily manageable and are more efficient. However, variation of profit among three tehsils is not statistically significant.

Table 7 Per acre profit in cotton production

TEHSIL	Mean	N	Std. Deviation
Vehari	45104.78	115	50966.87
Burewala	55643.48	92	83863.38
Mailsi	40666.05	134	38733.94
Total	46885.25	400	55010.44

Number of irrigation applied to cotton crop

The farmers use canal water along with tube well water for irrigating their cotton crop. The number of canal water irrigations had a wide range; most of the respondents use this water for as much as 8 irrigation cycles. There are rare cases that even use it beyond eight irrigations. However, it is amazing to note that there are only 1.25% farmers who use tube well water for less than 6 irrigation cycles. On the other hand 95% farmers rely on this expensive proposition for more than 7 times in their water management schedule. Underground water at most of the locations is brackish which is not good for citrus plant health and fruit quality.

Guidance for Farmer advisory messages:

There is need for improvement in the adoption of improved irrigation practices – particularly timings of the application of irrigation. Government of Punjab (2011) suggests that Increase in awareness level of farming community regarding the water quality for its efficient use offers an opportunity for increasing agriculture productivity.

Distance of fields from head of water course

Two-third of the cotton growing farmers reported a distance of 1-3 km. of their fields from head of water course. Out of the rest 12%, fields fall beyond 3 km. from head of water course. Farms at tail ends of water courses receive less quantity of water.

Land Preparation

Soil Rating and awareness regarding characteristics of soil under cotton cultivation

The cotton farmers expressed their satisfaction with the soil under cotton cultivation; two-third of them rated quality of their land as fertile and 30% think it is average. There were only two persons who showed disappointment with their soil. However, when inquired about their familiarity with the characteristics of soil under their usage, only 50 farmers registered their response (i.e. only 25%).

The farmers who claimed to be familiar with the soil under cultivation, pointed out the deficiencies as nitrogen, potash, calcium and phosphorous. Moreover, 44% of these also revealed a high concentration of sodium in their agricultural land.

Guidance for Farmer advisory messages:

Farmers need to improve their knowledge about the soil characteristics/conditions, and knowledge in how to improve and sustain fertility of their soils. Improper use of soil is posing serious threats to quality of their soils. Hence, proper management of soil is very critical to improving crop yields and to ensure sustainability of cropping system. Government of Punjab (2011) suggests that better management of land resources offers an opportunity for increasing agriculture productivity.

Laser aided land levelling

Out of the 400 farmers contacted during this research, 99 i.e. one-fourth had used laser aided land leveling for their agricultural land.

Guidance for Farmer advisory messages:

Uneven field account for significant amount of loss in irrigation water, poor distribution of water in the fields, inefficient use of fertilizers, poor health of crops. It is very critical for the farmers to increase their awareness on the proper management of lands and benefits of laser-aided land leveling.

Methods of sowing

In response to the query regarding the sowing methods being used by the cotton growers, there was an exorbitantly high value for raised bed manual method being used by 97% people. There were 70 farmers who also use drill for sowing purposes. This question had a multiple response as some of the farmers use more than one method of sowing. Only three farmers mentioned using tractor for raised beds and none of them indulged in broadcast method. The response clearly depicts a tendency towards labor intensive sowing practices while lesser number of farmers relying on mechanical methods. They still rely on ages old technologies for sowing. Manual sowing is not only time consuming but is also having some critical weaknesses. For example, distribution of seed is not uniform when sown manually while it is uniformly distributed when sown mechanically.

Guidance for Farmer advisory messages:

Farmers should develop greater awareness about innovative methods of sowing, so as to enhance their crop yields.

Seed Purchase

Source of seed also fetched multiple responses as the farmers use more than one variety for their cotton fields. Almost two-third of them purchases seed from seed dealers or nearby markets. Moreover, 49% also make use of home kept seed alongside the purchased seed. There were 14% farmers who rely on their fellow farmers for their seed requirements and only 3 of them mentioned contacting research institutes for the purpose.

Getting maximum yield is the foremost priority for 82% farmers while deciding the variety of seed to be purchased for their cotton crop. An “affordable price” is another factor in scale of importance for the farmers which was rated as “most important” by 9% and ‘important’ by 20% farmers. Risk of disease could not fetch its place as the most important decisive factor, however, a noticeable percentage i.e. 42.5% consider it important when deciding the variety of seed for their crop. It was discouraging to note that innovation and technical knowledge requirements (like treatment with chemicals, timings and method of sowing, agronomic practice before and after sowing etc.), were the least bothering constituents in their choice of seed for cotton.

Variety of Cotton Seed being used

An analysis of the data places the usage of BT cotton seed by a total of 305 farmers, i.e. 76%, whereas 276 farmers are using non-BT varieties as well. The exclusive BT users formed 26% of the sample and exclusive non-BT users were 24% of the farmers surveyed. Almost half of the farmers, i.e. 201, rely on both varieties of cotton for various reasons.

The most commonly used BT variety was MNH-886⁶, which was reportedly being used by 69% farmers. The other popular choices depicted through the data are Ali Akbar 703 and MNH 456 in BT cotton. There were small groups of farmers using a wide range of varieties in both categories.

⁶ MNH-886 is one of the four BT varieties (other three are TARZAN-1, NS-141, IR-NIBGE-3) which were approved by the Punjab Seed Council in Feb 2012 for one year for field performance/monitoring of the varieties (Pakistan Today, 2012).

Guidance for Farmer advisory messages:

Selection of a variety for sowing is very critical to the yield and returns. Over 80% of the farmers considered yield as the primary decision factor related with selection of cotton variety. On the other hand, reliability of the source did not figure out among their decision criteria. Farmers need to increase their knowledge about the quality and reliability of seed and seed sources.

Time of sowing cotton

Out of 400 farmers, 296 farmers reported that they were growing non-BT cotton. A reasonably high number of people i.e. 76% sow this kind of cotton in May. There was negligible response in other categories except 19% farmers who did not register their response. On the contrary, BT cotton is sown in February and January by 78% and 13% farmers, respectively.

There were 30 farmers who expressed their reservations with their time of sowing. Most of them attributed this delay to non-clearance of their fields and financial constraints.

Guidance for Farmer advisory messages:

Bt varieties are gaining increasing popularity in the cotton belt especially the Vehari District. Such varieties are different from the conventional varieties on many accounts like sowing time, selection of seed, agronomic practices etc. Hence, Farmers need complete package of the proper knowledge of such varieties for achieving optimal yield.

Average germination rate of the seeds

The average germination rate attained by the farmers has been quite satisfactory. The data portrays that 90% farmers were able to get germination in the range of 70-90% which is fair enough. Moreover, 5% claimed to have achieved more than 90% germination and none of the farmers reported below 60%.

Guidance on Farmer advisory messages:

By following technical advice of experts / extension workers, farmers can improve germination rate of seed.

Seed treatment practices and perception towards their benefits

The farmers using chemicals for seed treatment formed 37% of the total sample. Out of the 148 farmers using chemicals, Amedeo and Confidor (it has ingredients like Imidacloprid) were being used by 47% and 43% farmers, respectively. The quantity used was mentioned by 400 grams per maund by almost all those who responded to this inquiry.

The farmers using the chemicals for seed treatment retreated that they use this to improve the germination rate, protect their plants from fungus and insects. These responses were endorsed by 56%, 48% and 42% of the 148 farmers who reported to follow this practice.

Guidance for Farmer advisory messages:

Analysis suggests that farmers are not following standard practices of the seed treatment for sowing. Farmers can improve yield by following recommendations of the experts.

Perception regarding difference in requirements and methods of sowing for BT and non-BT cotton

Out of the farmers contacted for gathering baseline information, 81% perceive that there is a difference in the requirements and methods of sowing for BT and non-BT varieties of cotton. The

farmers who responded in affirmative were quite comfortable with their knowledge base regarding the difference in sowing both of these varieties. There was an overwhelming response towards their perception of fair or full knowledge towards the time of sowing. More than 90% were quite content with their information which is also reflected in the time followed for sowing BT cotton as against non-BT varieties. Moreover, more than three-fourth of them showed their adequate familiarity with the difference in irrigation needs for both kinds of cotton crop. Similarly 69% think they have ample knowledge about disease control mechanism for both kinds. If we add up people perceiving to have “reasonable knowledge” with these skill sets, the percentages would be even better off. More than two-third of the farmers also had fair or full knowledge regarding pesticides and fertilizer requirements for various varieties of cotton crop.

Area under cultivation for BT and non-BT cotton crop

Out of the 305 BT growers, almost three-fourth use an area less than 10 acres for cultivating this type of cotton. Moreover, 18% of BT users grow it on 11-20 acres of land. Among the 296 non-BT farmers, 70% use less than 10 acre and 7% allocated 11-20 acres of land for non-BT cultivation. A noticeable number, 23% farmers growing non-BT variety did not respond to this question.

Start of BT cotton cultivation

The BT growers registered their response about the pattern of converting to BT cotton cultivation. Only one of them started growing BT cotton before 2004, the ratio of people experimenting with BT cotton did not pick up till 2008 when it still stood at only 13 farmers. However, it took a sharp jump in 2009 reaching 73 and suddenly to 229 farmers in 2010. The data shows that cultivation of BT cotton has gained momentum after 2008 and is now widely cultivated by majority of farmers.

Reasons for shifting to BT cotton cultivation and level of satisfaction

The farmers who switched to BT cotton cultivation and registered their response attributed this to higher yield expectations. Moreover, the scale of farmers’ satisfaction from cultivating BT cotton was found to be fairly pleasing. Out of the 305 farmers engaged in BT cotton farming, 42% rate it as a great experience, another 17% consider it above satisfactory level and 38% place it as satisfactory enough to justify this shift. There were only 7 farmers who maintained a negative stance on this change.

Pest Management

Weed control methods

Important weeds of cotton include It-Sit, lumb, madhana ghass, jangli chulai, qulfa, tandla and deela (Haq, Islam, & Hussain, 2011). Besides, there are several other weeds of cotton crop too. List of all important weeds along with their common and technical names is given in **Table 8** Weeds cause damage to the crop directly as well as indirectly. Direct damage is usually through competition of weeds with crop in the use of available nutrition. As far as indirect damage is concerned, they prove to be hosts for leaf curl virus and whitefly. Hence, effective control of weeds is critical to higher yield.

Table 8 Technical names of cotton weeds

Local name	Common Name	Technical Name
Baru	Johnsongrass	<i>Sorghum halepense</i>
Bhakhra	Puncturevine	<i>Tribulus terrestris</i>
Chulai	Green amaranth	<i>Amaranthus viridis</i>
Deela	Purple nutsedge	<i>Cyperus rotundus</i>
Dhodak	Petty spurge	<i>Euphorbia prostrata</i>
Dhodak	Sun spurge	<i>Euphorbia helioscopia</i>
It-Sit	Horse purslane	<i>Trianthema monogyna</i>
Jangli Patsun	Wild jute	<i>Corchorus tridens</i>

Khabbal ghash	Bermuda grass	<i>Cynodon dactylon pers</i>
Kulfa	Common purslane	<i>Portulaca oleracea</i>
Lehli	Field bindweed	<i>Convolvulus arvensis</i>
Loomar ghash	Green foxtail	<i>Setaria viridis</i>
Swanki ghash	Jungle rice	<i>Echinochloa colonum</i>
Tandla	-	<i>Digeria muricata</i>

Source: Ali, Muhammad & Abid (2005).

Baseline survey results show that farmers are using many different methods for weed control simultaneously. A fairly large number of farmers, i.e. 71% use weedicides to fight against this menace. However, 62% also reported to use hoeing, 45% use manual method and 38% also use tractor driven hoeing to check the growth of weeds in their cotton crop. Each farmer is using multiple methods to control the weeds. Out of the 400 respondents, 32 told that they try crop rotation to keep the weeds under control and a couple of them also utilize bar harrow for this purpose.

After making use of these multiple methods for weed control, farmers appeared to be satisfied with their performance. The number of farmers recording complete control was 5.5% of the total, however, around 80% were able to control weeds up to 75% which seems to be acceptable by them. There were only 15% farmers who had a control less than 50% of weeds in their crops.

Perception regarding impact of killing beneficial insects

Use of pesticides also kills many beneficial insects while controlling the dangerous pests from the crop. The farmers were asked about their perception of their knowledge and views regarding this phenomenon. Two-thirds of the farmers expressed their unfamiliarity with this topic, however, the rest of the respondents were equally split between the ones who think it bears negative impact on the cotton crop and others who do not consider this an element impacting their crop.

Guidance on Farmer advisory messages:

Awareness of the farmers regarding beneficial insects is very critical to the effectiveness of plant protection measures. However, results suggest that two-third of farmers are totally unaware of such insects. By promoting their knowledge of such insects, effectiveness of plant protection can be improved and thus yield can be enhanced. Moreover, it will also lead to reduction in cost of plant protection.

Precautionary measures followed while spraying pesticides

Precautionary measures are taken by 93% of the farmers while spraying pesticides. Two-third of the farmers expressed their knowledge about wearing of a mask during pesticide sprays; half of them also properly cover the body while spraying pesticide and also keep the pesticides at a safe place. One-third of the respondents were also watchful about the direction of wind during the spray. However, the precautions about keeping these away from children and food were not highlighted much by the farmers.

The farmers mostly observe morning time for spraying; 64% do it before noon of which 32% spray at early morning hours. Moreover, 29% spray pesticides just before the evening. Ali (2011a) suggests that farmers should undertake pest scouting twice a week.

Knowledge and level of control for various pests

The knowledge about various pests and insects was perceived to be fairly reasonable by the farmers. They knew about all the pests mentioned and claimed to have fair and in many cases expert knowledge about each one of these. Similarly, they observed acceptable control over these pests; the ratio of complete control varied between 17 – 26% respondents and more than 60% claimed fair control. The number of people complaining about unacceptable control, including somewhat or little

control, was less than 15% in each category of pest. Common harmful insects of cotton include thrips, sabz taila (jassids), safaid makhi (whitefly), mites, sust taila (aphids) and mealy bugs. (Ahmed, Haq, Hussain & Salim, 2011)

Fertilizer Application

Quantity of fertilizers per acre

The cotton growers stressed on the need for fertilizers especially as the requirements for BT cotton are different. Farm yard manure is used by a very insignificant number of farmers, only 13 out of a sample of 400 farmers reported to use it before the sowing stage, another 5 mentioned using it before flower development stage and only one of them use it at 30-45 days after watering stage. Use of Potash also maintained a similar pattern with a negligible number of growers utilizing this fertilizer. The total number of users of potash at various stages amounted to only 23 in Vehari.

The data reveals that DAP and urea are rated as unavoidable expenses and a must for any crop; the need is accentuated in case of BT cotton cultivation. There were more than 90% farmers who use 1-2 maunds (40-80 kgs) of both these fertilizers before seed sowing stage. The use of DAP is scanty at other stages, however, there were 6 farmers using DAP at first watering stage, the same 6 using 30-45 days after watering stage and a couple of them even use before flowering stage. The case of urea was different, more than 70% of the farmers repeat 1-2 maunds of urea at first watering stage and around 60% maintain this usage 30-45 days after the watering stage as well. A reasonable number of farmers, i.e. around a one-third, apply urea for the fourth time before flower development stage. Therefore, the usage of urea was repeated at four stages by at least one third of the respondents, and a significant number maintains three cycles of its application.

Guidance for Farmer advisory messages:

Survey findings suggest that farmers apply fertilizer without properly assessing the needs of the nutrients deficiency. Eventually, effectiveness of fertilizers remains low. There are many areas in which farmers need more awareness to make appropriate decisions related with timing, type and quantity of fertilizers

Cotton Picking

Usual time of picking cotton

The peak time for picking cotton starts at 8 - 9 am as communicated by 88% farmers during their interviews for the baseline. There was negligible response in other categories where only 9 people mentioned sunrise as the time for cotton picking and 37 farmers mentioned around 10 am. Choosing early morning to start cotton picking usually aims at taking benefit of the dew, which adds weight to the cotton produce. However, this practice negatively affects quality of cotton.

Usual place of stocking cotton before transferring to storage / selling

A high number of respondents, i.e. 98% mentioned that they store the cotton at some dry place before transferring it to their storage or directly selling it. There were only 7 farmers who committed to keep the cotton in some humid place like watercourses before the storage. This is their documented response as they told the survey team. Why do farmers keep stock of cotton in the humid place? Actually, main intension is to increase weight of their produce to generate more revenue from it.

Guidance for Farmer advisory messages:

Farmers should be given greater awareness on the importance of the quality of cotton produce.

Seed Selection

Decision for seed selection falls in the domain of farmer, maximum weight is given to personal consideration of the farmer himself, followed by advice from fellow farmers. There is less reliance on agriculture extension staff as 69% farmers never consult them for seed selection, only 14% people maintained that they take advice from extension staff frequently or definitely. Around 15% people take in to account guidance from the role models around them.

Disease control and plant protection

Farmers maintained a reserved attitude towards consultation for disease control and plant protection. They hardly take assistance from any agriculture department or even pesticide company's representatives. Some of them mentioned their farmer network that they utilize for discussing disease related issues.

Fertilizer Application

Agriculture extension department provide consultation to 16% farmers for quantity and timings for fertilizer application. Moreover, 14% farmers get guidance from fellow farmers and 10% also take advice from fertilizer dealers.

Irrigation and soil related advice

The overall trend of seeking advice has shown minimal results in most categories; however, in this case it seems to be virtually non-existent. There was hardly any response for getting advice from any source.

General Views

Level of satisfaction with cotton output

An incredible number of farmers i.e. 81% showed their satisfaction with their cotton output. The response for absolute disapproval was only recorded by 9 farmers and the rest 17% also showed their inclination towards satisfaction. Therefore, the numbers are quite encouraging in terms of their perception towards performance. (However, this becomes a negative element where the farmers cease to invest in innovations to improve their crop.)

Most significant complications being faced for cotton crop

The most alarming issues facing the cotton growing farmers were reported as "electricity and water" problems, lack of availability of genuine fertilizer and availability of parallel counterfeit fertilizers; and issues pertaining to harvesting of cotton. High prices of input were also raised in different phrases. There were only 4% farmers who complained of not having enough information which becomes an impediment in their growth.

Visit to extension office for advice

Two-third of the respondents either not responded or had never been to the extension office. There were 21% people who had a chance to go to the office once or a couple of times. There is a very limited number of farmers who frequently go to seek advice from agriculture extension office.

Guidance for Farmer advisory messages:

Results show that there is a weak coordination between farmers and the extension office. Either farmers lack trust in extension workers or there is issue of accessibility. An improved access to the extension services can help the farmers in meeting their information needs.

Whether attended any workshop arranged by extension department

Almost half of the farmers had a chance to attend an event or a workshop arranged by the extension staff.

Table 9 shows that average cotton yield of the farmers who attended Extension workshops (39.37 maunds/acre i.e. 1.57 tonnes) was higher than that by the farmers who did not attend (35.93 maunds/acre i.e. 1.42 tonnes). In other words, participation in the extension workshops leads to increase in the yield by about 2.4 maunds/acre (about 10 percent).

Table 9 Does participation in extension workshops make any difference?

Participated in extension workshops	N	Mean	Std. Deviation	Std. Error Mean
Yield/acre Yes	197	39.37	11.955	.852
No	203	35.93	11.221	.788
Knowledge in PP* Yes	186	4.2457	.56464	.04140
No	183	3.9918	.62317	.04607
Control over PP Yes	187	4.0984	.53021	.03877
No	182	3.9632	.54744	.04058

* PP = Plant Protection

Correlation between investment in cotton production and income

We have found a positive and a significant relationship between investment in cotton production and income per acre (**Table 10**). But relationship is not very strong ($r = 0.168$). It implies that although, investment in cotton production matters a lot in the income of the cotton producers, however, there are some other factors too which affect income. Such factors may include technical knowledge and managerial of farmers and environmental factors etc. In other words, if capacity of farmers is developed, their income may be improved.

Table 10 Correlation between investment in cotton production and income/acre

		Total Cost/Acre	Income/acre
Total Cost/Acre	Pearson Correlation	1	.168**
	Sig. (2-tailed)		.001
	N	400	400
Income/acre	Pearson Correlation	.168**	1
	Sig. (2-tailed)	.001	
	N	400	400

** . Correlation is significant at the 0.01 level (2-tailed).

Correlation between Knowledge in plant protection and control over pests

We find that there is quite a significant, positive and strong relationship between knowledge of plant protection and control over pests ($r = 0.786$ at $p = 0.000$). Mean value of the knowledge in plant protection has been rated by them at about 4.1 and control over pests at about 4.0. Although, the

values are encouraging, however, knowledge of individual farmers and control over pests by individual farmers significantly varies from 1 to 5.

Table 11 Correlation between knowledge of plant protection and degree of control over pests

		CPP Know	CPP Control
CPPKnow	Pearson Correlation	1	.786**
	Sig. (2-tailed)		.000
	N	369	368
CPPControl	Pearson Correlation	.786**	1
	Sig. (2-tailed)	.000	
	N	368	369

** . Correlation is significant at the 0.01 level (2-tailed).

Citrus Crop - Sargodha District

Pakistan is among the top ten citrus producing countries in the world (Khan, 2010). Pakistan is very famous for Kinnow production. . Kinnow belongs to the family *Rutaceae*. Sargodha is the center of kinnow production in Pakistan.

TRTA Pakistan (2012) states that “*At this point Sargodha is the main citrus producing district, with about 23 per cent of Pakistan’s total citrus plantings, producing around 650,000 metric tons of fruit each year.*” Kinnow is a very tasty fruit and is widely liked. Besides, it can retain its freshness, if kept in storage Khan (2010) says, “*Kinnow is very delicious in taste and if treated with proper fungicide and wax and careful handling and storing of Kinnow at about 4 Degree Centigrade can retain it’s freshness until 2 months*”. It is very rich in juice contents. Average juice in kinnow is 50%. Average weight of a fruit is 210 grams. Average yield plant is 1000-1500 (Khan, ud).

Water and Soil Testing Practices

The response to water and soil test from the farmers in citrus orchid area present a relatively better practice for water testing, however, soil test is a totally ignored domain. Water test had been reported by 23 farmers, i.e. 5.7% of the total sample of 403 respondents whereas there was only one farmer who claimed to have had his soil tested. When probed for his awareness about the laboratory results, the farmer with soil testing did not register his response; however, the water test revealed that it is not suitable for orchards. Moreover, the laboratory results also pointed out excessive salts and lack of calcium in the water.

Table 12 shows that farmers who had the practice of getting water analyzed, had 9 percent more yield than those farmers having no such practice. In case of soil analysis, similar results are evident (Figure 6).

Table 12 The practice of water and soil analysis, and the citrus yield

Done?	Water Analysis			Soil Analysis		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation
Yes	177.17	23	49.055	180.00	1	-
No	161.88	380	51.232	162.71	402	51.231
Total	162.76	403	51.175	Total	203	51.175

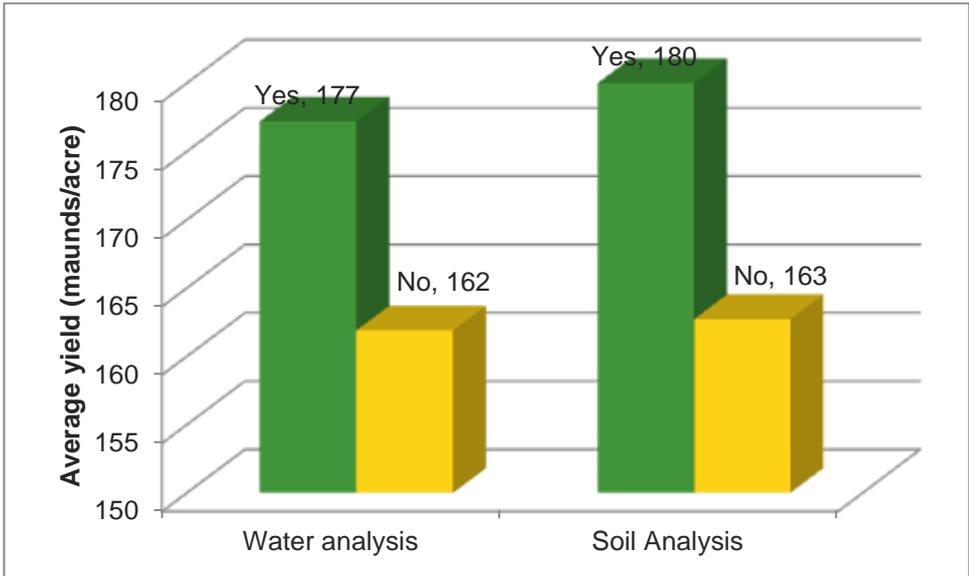


Figure 6 Yield comparison: Soil and water analysis done vs not done

Guidance for Farmer advisory messages:

Underground water in most parts of Sargodha District is unfit for irrigation purpose. Canal water is not available in adequate quantity and at most of the critical stages of the crop. Use of brackish water badly affects growth and quality of fruits. Farmers need proper knowledge in dealing with such situations.

Analysis of citrus leaves

The farmers were also inquired about analysis of citrus leaves for nutrient deficiency. A total of 37 farmers, i.e. 9%, had performed this test for their orchards. Figure 7 shows that farmers who had the practice of getting leaves analysis done, had about 10 percent more yield than the other farmers.

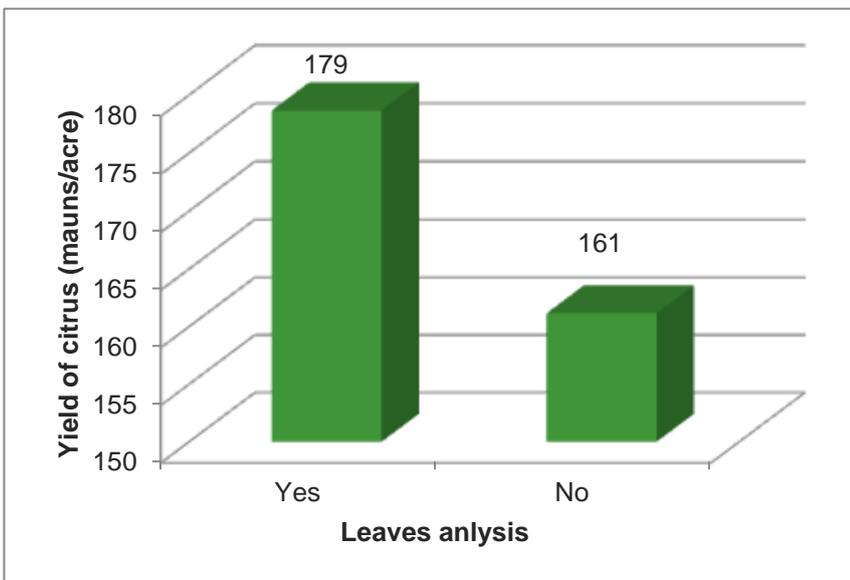


Figure 7 Yield comparison: Citrus leaves analysis done vs not done

Guidance for Farmer advisory messages:

Citrus leaves provide very useful and critical information on the attack of pests and deficiency of nutrients. Farmers need to learn how to read colour, shape and size of the citrus plants.

Citrus Crop Related Information

Total area under cultivation of citrus orchards

The data for area under citrus orchards reveals that more than one third of these fall below 5 acres of land; 26% between 6-10 acres and another 28% have been raised on 11-15 acres of land. There were 10% farmers who have allocated more than 15 acres of land for their orchards. However, this data pertains to small and medium farmers whose total area falls within 25 acres of land. Almost half of the farms had a size ranging between 5-11 acres (Figure 8). Therefore, the data is quite understandable.

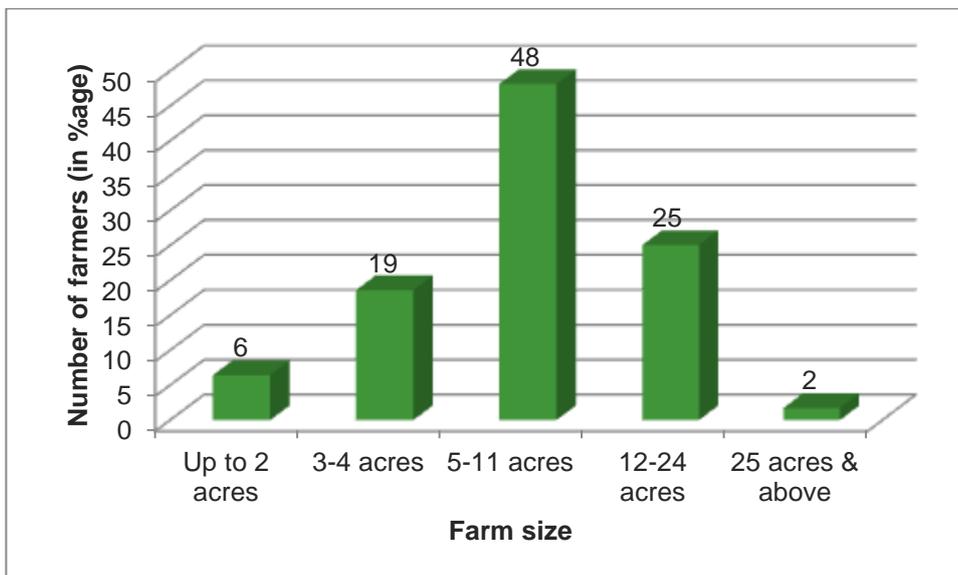


Figure 8 Size of farms

It appears that medium size farms are more efficient than large and small farms (Figure 9).

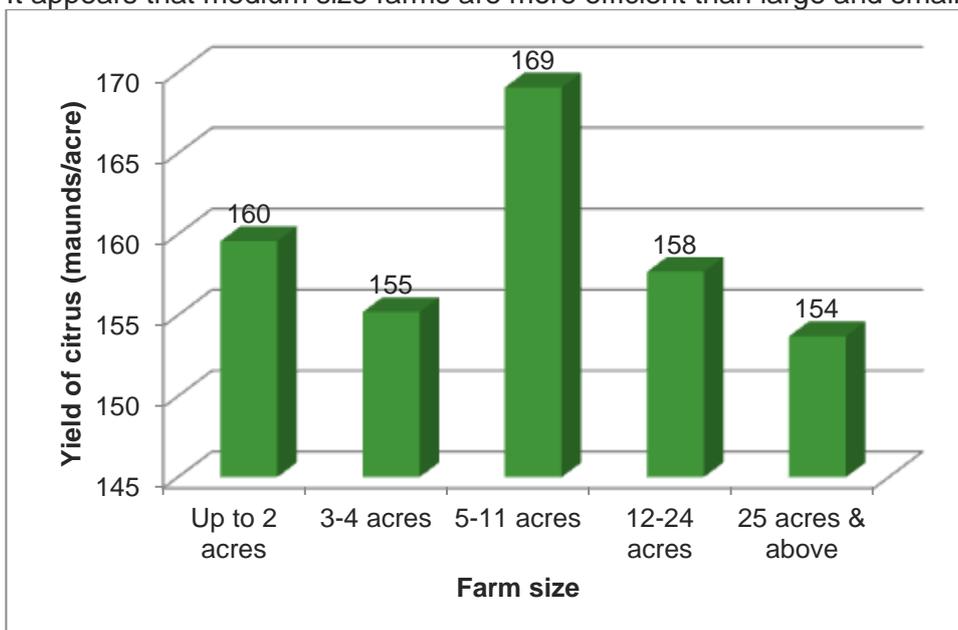


Figure 9 Yield of citrus vs size of farms

Number of crops in citrus orchards in a year

There were around 10% farmers who do not engage in inter-cropping and keep the orchards only for citrus production. However, a large number of farmers, i.e. 88%, inter-crop their orchards with one additional crop and the rest 2% even use the area for two more crops other than the citrus.

The farmers involved in intercropping grow wheat and fodder in their orchards. These crops are being grown by 66% and 59% farmers for wheat and fodder respectively. These are grown for their livestock needs and to raise additional income from their land.

The extension department strongly recommends that no crop should be sown in the orchards for obtaining higher yield of citrus. As discussed above, a large number of farmers are in the practice of growing at least one additional crop on their orchards. Citrus yield comparison is given in Figure 10. It shows that farmers who are growing two crops have significantly lower yield of citrus. However, in case of single crop, there is no substantial difference.

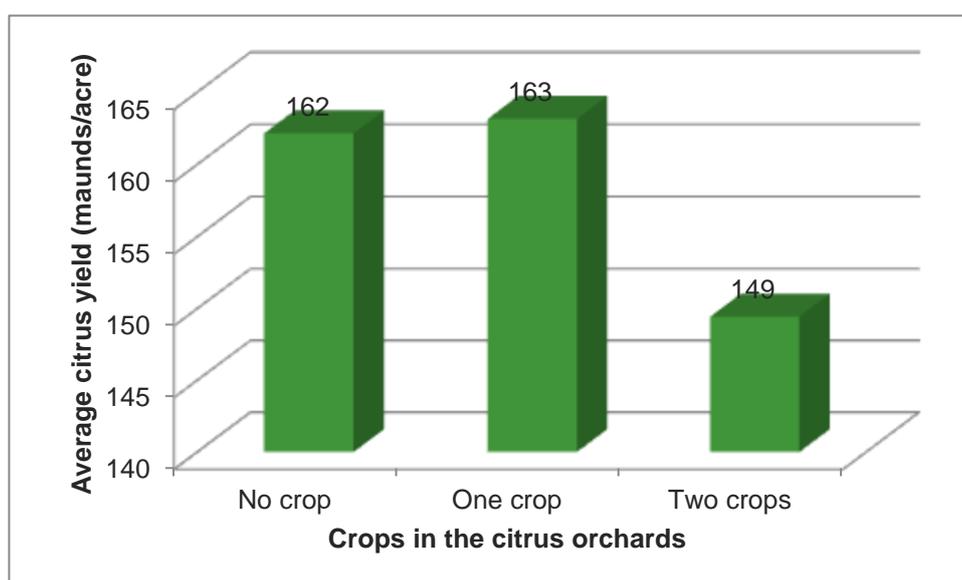


Figure 10 Yield comparison: number of crops in the orchard

Tractor ploughing practice in orchards

It is alarming to note that a high percentage of farmers i.e. 95.6% engage in 3-7 cycles of ploughing their orchards in a year. There were only 3% people who restrain from ploughing through tractor to avoid risking damage to their citrus plants. The data presents that ploughing by tractor is a fairly common practice in orchards.

Guidance for Farmer advisory messages:

It is a very common practice among the farmers to follow intercropping. About two third of the farmers are involved in such practices. A large number of farmers are growing two additional crops also. Intercropping creates several issues. Timings and quantity of irrigation needs of citrus plants significantly differ from other crops that are intercropped with citrus in the surveyed area. Hence, improper timing badly affects quality and quantity of fruits. Secondly, ploughing the fields for the crops may cause damages to the roots of citrus plants. Farmers need proper awareness / education on sensitivity of such issues.

Age of citrus orchards

There were 519 different orchards of different ages that were documented through the contacted farmers. The ages of 55.5% of these fall in the age bracket of 11-20 years. The other major slot fall in age category of 6-10 years comprising of 18.3% orchards and another 10.3% are even younger i.e. less than 5 years. The rest of the 15.8% are more than 21 years old, however, there was only one orchards aged more than 31 years which was the oldest in the whole lot of orchards under research.

The average yield per acre falls in the bracket of 50-200 maunds (2-8 tonnes) in most cases. For younger orchards, which were less than 5 years old, the maximum response came for 50-100 maunds yield per acre in 76% cases, 20% were managing between 101-200 maunds (4- 8 tonnes) and the rest 4% were only producing less than 50 maunds. For orchards between the age of 6-10, about 80% of the farmers recorded their yield falling within 100-200 maunds/acre. The rest, i.e. 19% were producing 50-100 maunds per acre in this age category. The reported yield for 11-15 year older orchards was quite in line with this previous category, bringing in 101-200 maunds in 83% cases, and 50-100 maunds in 10% orchards. However, there were some orchards that are producing amazing quantities, a couple of them even claimed more than 600 maunds/acre and 6 orchards have a produce of 201-300 maunds/acre. The data portrays an average of 101-200 maunds in orchards beyond 5 years of age, however, with more mature orchards the number of them producing more fruit increases. Therefore, though the average of 101-200 maunds maintained for around 81% orchards; there were 11 of them producing 201-300 maunds, and one each in consequent brackets of 301-400 maunds and 401-500 maunds and another getting more than 600 maunds yield. Similarly, for more aged orchards in the next categories i.e. 21-25 years and 26-30 years had more percentage in higher yield brackets. The only orchard aged 31-35 years was getting 101-200 maunds.

The overall results for yield present 82% orchards producing 101-200 maunds, 9% getting 50-100 maunds fruit and 7% falling in 201-300 maunds yield category.

Guidance for Farmer advisory messages:

Managing citrus plants of different ages require different type care and management. Proper care and management of the citrus plants can help in enhancing their life.

Total cost and income from orchards

The farmers were asked about the total cost they incur on their orchards. The maximum number of farmers, 56.3%, reported an expense of Rs. 30,001 – 40,000 per acre. Moreover, 30% people spend Rs.20, 001 - 30, 000 for the same purpose. There was negligible response in rest of the categories. The respondents were also inquired about approximate income from their last year's crop. More than half, i.e. 55%, declared an income of Rs.100, 001 - 150, 000 per acre, and 28.5% told between Rs.50, 001 – 100,000. There was a total of 7 farmers who claimed to earn more than Rs.200, 000 per acre from their orchards.

Guidance for Farmer advisory messages:

The advisory messages should cater to the income levels of the farmers. Advice that is too expensive to implement is ignored/implemented partially by the farmers.

Distance of plants and average number of plant per acre

A large number of farmers i.e. 87% mentioned that they have an average of 91-100 plants per acre in their orchards. Moreover, out of the rest everyone has 71-90 plants except one farmer who has managed to grow more than 100 plants in the same area. A large majority of the orchards had 90-100 plants / acre (Figure 11). Nasir, Aziz, Mohar, Ahmad & Rehman (2006) found that plant to plant distance of 7x 7m produced juice concentration of 43 percent. Nawaz, Ahmed, & Jiskani (2008)

recommend that plant to plant distance should be 22 X 22 ft or 20 X 22 ft resulting in 90 and 99 citrus plants per acre.

In line with the response about the average number of plants in the orchards, there was almost unanimous response that the distance between the plants is maintained within 16-20 feet, substantiated by 98% farmers. Average number of plants/acre in Sargodha is about 92.

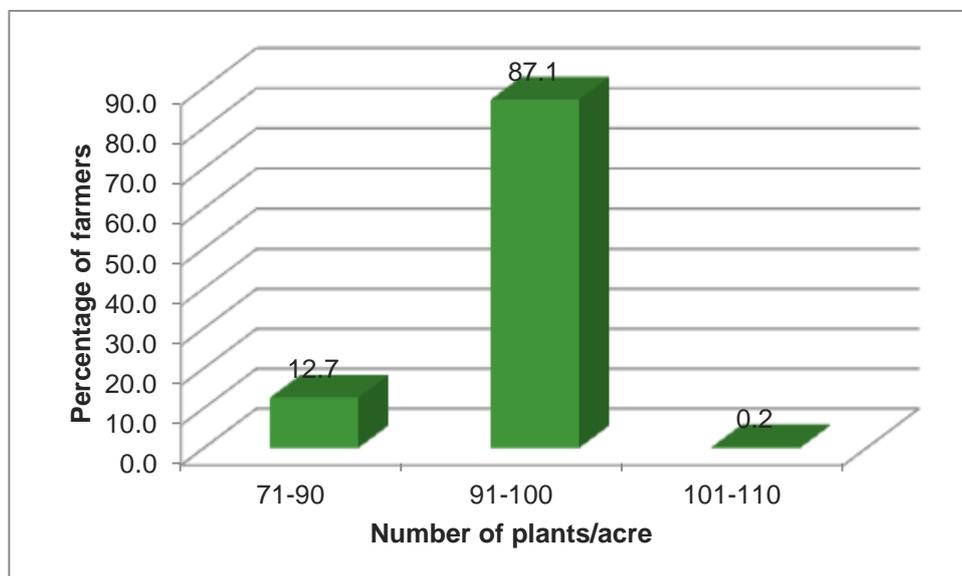


Figure 11 Distribution of farms vs number of plants /acre

Guidance for Farmer advisory messages:

Proper distance from plant to plant is very critical to the health of the orchards and production. Most of the farmers keep larger distances in between the plants only for creating adequate space for growing crops. Farmers can enhance their income by managing recommended plant to plant distance.

Ratio of canal and tube well water

The ratio of canal and tube well water is also quite promising, all the farmers receive at least half of the water required for their orchards from canals. About, half of the farmers use 70% of canal water and the rest 30% through tube wells. Another 34% manage to get between 60-70% canal water and more than 10% were fortunate enough to get more than 80% of canal water.

Share of canal water in the irrigation of citrus orchards is averaged at 67 percent (Figure 12). There is a significant correlation between the share of canal water in irrigation and the average yield of citrus (Table 13).

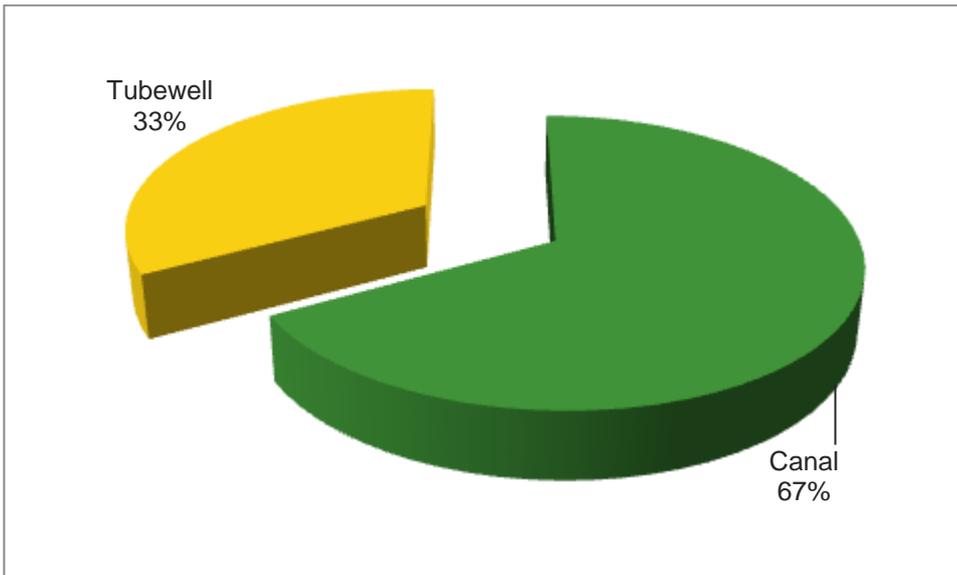


Figure 12 Sources of irrigation water for orchards

Table 13 Correlation between share of canal water in irrigation and citrus yield

		Total yield (maunds/acre)	Share of canal in irrigation (%)
Total yield (maunds/acre)	Pearson Correlation	1	.267**
	Sig. (2-tailed)		.000
	N	403	403
Share of canal in irrigation (%)	Pearson Correlation	.267**	1
	Sig. (2-tailed)	.000	
	N	403	403

** . Correlation is significant at the 0.01 level (2-tailed).

Distance of citrus orchards from head of water course

More than half of the orchards are placed within 1-2 km from head of water course. Moreover, 28% were found to be lying within a distance of 2-3 km from the source of water.

Land Preparation

Soil characteristics

The farmers were probed about their knowledge about the soil under citrus cultivation. However, 69% declined to have any such information. Of the 31% who claimed to know their soil, 77% perceive that their soil is deficient in Potash which is very essential especially for fruits. There is no evidence of laboratory analysis so this data is essentially based on perceptions and experience of the farmers. They judged their soil to be deficient in phosphorous and nitrogen. Moreover, high concentration of sodium salts was also reported by a reasonable number of farmers.

Farmers having knowledge about soil characteristics reported more yield than those having no such knowledge Table 14).

Table 14 Knowledge of soil characteristics and citrus yield

Knowledge about soil characteristics	Average yield (maunds/acre)	N	Std. Deviation
Yes	165.16	125	60.839
No	161.68	278	46.259
Total	162.76	403	51.175

Guidance for Farmer advisory messages:

Farmers who had knowledge of their soil characteristics reported more yield than those having no such knowledge. Hence, farmers' improved knowledge about the soil characteristics and the nutrition requirements, can boost their citrus yield.

Rating of the soil

Despite the perceived deficiencies in the soil being used for citrus cultivation, overall rating for the soil was above average. A large number of farmers, i.e. 68% consider it fertile and 30% rate it at "medium". There were only two framers who think their soil is very poor. However, their assessment is not based on any scientific knowledge. Fact is land degradation is becoming a serious threat to sustainable agriculture in Pakistan. According to Shah & Arshad (2006) about 61 percent of the agricultural land in Pakistan is worst affected. This shows that farmers seriously lack basic understanding of the quality of the soil and are mostly not aware of the significance of the issue.

Balanced use of fertilizers

The farmers consider themselves aware of the balanced use of fertilizers for their land. There were only 13 people who acknowledged lack of knowledge on this extremely important component of their agricultural practices.

Nursery Plants

Source of nursery purchase

The farmers are using unregistered nurseries to buy plants for their orchards. This response was received from 98% of them. There were only 7 farmers who grow their own nursery and only one farmer cared to buy from an approved registered nursery. None of them contact any citrus research institute for purchasing plants. Figure 13 shows that farmers who obtained nursery plants from certified nurseries had 62 percent more yield of citrus than those who purchased nursery plants from certified nurseries.

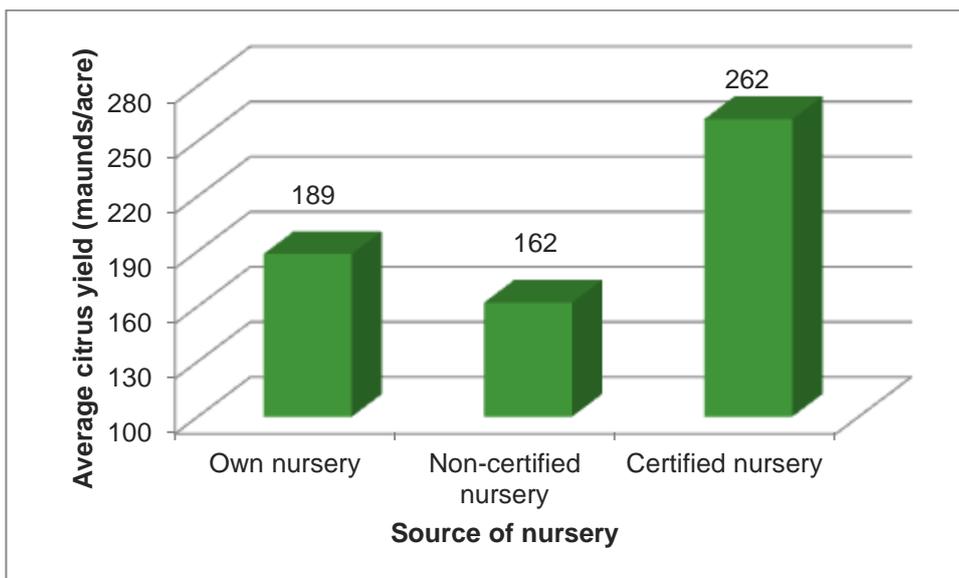


Figure 13 Average yield of citrus vs source of nursery plants

Important factors in nursery purchase decision

Yield was singled out as the most important factor that farmers take in to account when buying the nursery plants. Affordable prices and risk of disease are the other two elements considered before reaching the decision. Registered nursery was not acknowledged as an important factor and neither market returns influence the decision of the farmers. Perhaps, high quality fruit is considered for high end markets and is not considered as an attractive proposition for small and medium farmers as they can make the same amounts by offloading more quantities of lesser quality in the local and nearby markets.

Guidance for Farmer advisory messages:

Analysis suggests that large number of farmers obtain nursery plants from non-certified sources, whereas, results show that nursery plants obtained from certified sources give significantly higher yield. It implies that they need to be educated to purchase nursery plants only from certified sources.

Variety of citrus being used and yields

This area has a predominant concentration of “Kinnow” being grown by 98% farmers. Moreover, 38 farmers were also growing “Mousami” (a form of sweet orange; technically known as *C. sinensis*) and only 7 were engaged in cultivation of “Feutrells” (Mandarines). This query had a multiple response where a few growers are using more than one variety; however, the data shows Kinnow as the variety of choice.

The data reveals that there is no significant relation of variety on the yield. The results are very similar and therefore, one can safely assume that all the three varieties are producing matching yields.

Survival rate of plants in Citrus orchards

The survival rate of plants presents quite stable results; in 96% cases farmers reported 80% endurance in their orchards. The remaining 4% maintain that more than 70% of their plants are able to survive.

Guidance for Farmer advisory messages:

High mortality rate among the citrus plants is a serious source of concern for the farmers, which results in substantial loss for them. They need technical advice how to handle such problem.

Difference in requirements and sowing methods for different varieties

In case of citrus only 2% growers answered in affirmative, the rest 98% are not aware of any difference in requirements or sowing methods for various varieties of citrus.

The eight farmers, who maintained that the requirements differ with respect to various varieties, expressed their fair command on the subject. They perceive the degree of their knowledge regarding irrigation and nutrient requirements, disease control and pesticide application requirements for different varieties as fairly reasonable.

Satisfaction level with citrus production

The satisfaction index of the citrus growers bore average results; 72% rate the crop as “satisfactory”, 14% consider it “above satisfactory” and only 3% people marked it as a great experience. Out of a total of 403 farmers, 45 were displeased with their output, of which 5 farmers reported it as a disaster.

Table 15 shows that citrus growers who obtained nursery plants from certified nurseries are significantly more satisfied than other citrus growers.

Table 15 Source of nursery plants vs satisfaction with citrus production

Satisfaction level	Mean	N	Std. Deviation
Own nursery	2.8571	7	.69007
Non-certified nursery	3.0709	395	.62522
Certified nursery	4.0000	1	.
Total	3.0695	403	.62703

Type of rootstock to be used and methods of propagation

Only 30% of the farmers responded to this query; of these 28.5% take advice from common nursery growers. There were only 5 farmers who consider registered nursery growers to be authentic advisors in this regard.

None of the farmers responded towards methods of propagation used.

Guidance for Farmer advisory messages:

Selection of rootstock is also a critical decision for the farmers. Results reveal that the practice of obtaining guidance / information from rights sources like extension workers or experts is quite rare. In other words, empowering farmers with easy access to authentic and reliable source of guidance can help in improving quality and sale value of their fruits.

Pest Management and Weed Control

Weed control methods

A very high proportion of farmers, i.e. 88%, use tractor driven hoeing to get rid of weeds in their orchards. Moreover, 68% growers also use weedicides alongside other methods to fight this hazard to their production. There were only 7% people manually controlling the weeds and 15% mentioned hoeing to control the weeds.

Pruning of orchards

The frequency of pruning was observed to be once every 2-3 years. This pattern was being followed by more than three-fourth of the respondents. There were 23% farmers who believed in doing it more frequently and prune their orchards every year.

Guidance for Farmer advisory messages:

Pruning and trimming of citrus trees are important for maintaining their strength, vigour and health. Moreover such practices also affect the yield and quality of fruits. Timing, method and intensity of such practices are also very critical decisions.

Impact of killing beneficial insects on citrus

Three-fourth of the orchard farmers expressed that killing of beneficial insects bring an adverse impact on citrus. Only 7% of them do not consider this a negative element and the rest 17% showed their lack of knowledge about this phenomenon.

Guidance for Farmer advisory messages:

Farmers should learn how to promote the growth of beneficial insects .

Precautionary measures during pesticide spray

There was an almost absolute positive response to taking precautionary measures when spraying pesticides. Only one farmer denied using any precautions. A very high section of them, i.e. 92%, wear masks and around half of them cover their body. One-third of the farmers take note of the wind directions when spraying and keep it away from food products.

The time of pesticide spray was observed to be before noon by 61% people and another 27.5% also spray just before evening.

Incidence of disease attack and Canker in citrus orchards

The occurrence of disease in citrus orchards was informed as “considerable” by 64% farmers and 16% rate it as severe. There were only 20% respondents who rate the incidence of disease attack as low.

Moreover, they were inquired about attack of canker. It also brought similar response, where 62% think it is considerable and the category of severe lie at 24% which is one-fourth of the total sample. Ali (2007) believes canker to be the most threatening disease for citrus especially for Kinnow. Ali describes canker disease as follows,

“Citrus canker is characterized by appearance of lesions on fruit, foliage, and young stems of susceptible cultivars of citrus. On leaves, first appearance is as oily looking, 2–10 mm, similarly sized, circular spots, usually on the abaxial surface. On leaves, stems, thorns and fruit, circular lesions become raised and blister-like, growing into white or yellow spongy pustules. These pustules then darken and thicken into a light tan to brown corky canker, which is rough to the touch...”

Canker is a bacterial disease and is caused by bacterium known as *Xanthomonas axonopodis*.

It is apparent from the Table 16 that there is negative and significant relationship between the incidence of diseases and the average yield of citrus, as well as between incidence of diseases and farmers satisfaction with citrus production business. It implies that gaining greater control on the diseases, yield can be significantly enhanced.

Table 16 Correlation between incidence of diseases and the yield and farmer satisfaction

		Average yield (maunds/acre)	Farmer Satisfaction	Incidence of disease on scale of 5
Average yield (maunds/acre)	Pearson Correlation	1	.389**	-.397**
	Sig. (2-tailed)		.000	.000
	N	403	403	403
Farmer Satisfaction	Pearson Correlation	.389**	1	-.342**
	Sig. (2-tailed)	.000		.000
	N	403	403	403
Incidence of disease on scale of 5	Pearson Correlation	-.397**	-.342**	1
	Sig. (2-tailed)	.000	.000	
	N	403	403	403

** . Correlation is significant at the 0.01 level (2-tailed).

Guidance for Farmer advisory messages:

Canker is a serious threat for the citrus fruits. It lowers down sale value of the fruits. Farmers need to know how to handle such situation.

Level of knowledge and control of pests

The respondents were content with their level of knowledge about various pests and insects of citrus, however, there were inhibitions regarding the level of control they managed to achieve. They had reservations on the level of control especially in case of citrus root nematode (*Tylenchulus semipentans*)⁷, Canker⁸ and citrus wither-tip disease⁹. The rest of the pests had a fair control as perceived by the farmers during their interface for this research.

Average level of knowledge of farmers in pest management in mere 2.64 on scale of 5, i.e. below satisfactory. Similarly, degree of control achieved over pests is also very low i.e. 1.73 on scale of 5.00.

Table 17 shows that there is positive and very significant relationship between knowledge in pest management and the pest control. Table 17 also indicates that there is strong relationship between pest control and average yield. It implies that pests can be effectively managed through enhancing knowledge of the farmers in how to manage pests, which in turn would help in enhancing yield.

⁷ It results in gradual decline in yield and quality of citrus produce

⁸ Citrus canker (technically known as *Xanthomonas compestris. pv. citri*) badly affects the citrus plants health and their fruit quality (Burhan et al., 2007)

⁹ It causes twigs and affects branches, which appear like have been scorched with fire

Table 17 Correlation between knowledge in pest management and pest control

		Pest Control	Pest Knowledge	Total yield (maunds/acre)
Pest Control	Pearson Correlation	1	.560**	.170**
	Sig. (2-tailed)		.000	.001
	N	365	364	365
Pest Knowledge	Pearson Correlation	.560**	1	.106*
	Sig. (2-tailed)	.000		.043
	N	364	364	364
Total yield (maunds/acre)	Pearson Correlation	.170**	.106*	1
	Sig. (2-tailed)	.001	.043	
	N	365	364	403

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Knowledge regarding deficiency of nutrients

More than half of the farmers surveyed claimed to have complete or fair knowledge about Zinc and potash. Moreover, almost one-third of the farmers were found to be knowledgeable about nitrogen and phosphorous, whereas almost a quarter of the farmers contacted had knowledge of copper and manganese. About 60% of the farmers were familiar with Boron and Zinc as well.

The use of nutrients for improving yields observes the highest emphasis on zinc which was applied by 53% of the total sample of 403 farmers. The number of farmers using magnesium was found to be 29 which form around 7% of the total. There was even less response in rest of the categories.

Average of knowledge in application of major nutrients i.e. NPK is 3.35 on scale of 5.00, slightly above satisfactory level, while that for micro nutrients is 3.19. Moreover, results indicate that average citrus yield is positively and significantly correlated with knowledge in nutrients management (Table 18).

Table 18 Correlation between knowledge in nutrition management and yield

		Total yield (maunds/acre)	Knowledge in application of NPK	Knowledge in Micro Nutrients
Total yield (maunds/acre)	Pearson Correlation	1	.209**	.168**
	Sig. (2-tailed)		.000	.001
	N	403	403	403
Knowledge in application of NPK	Pearson Correlation	.209**	1	.892**
	Sig. (2-tailed)	.000		.000
	N	403	403	403
Knowledge in Micro Nutrients	Pearson Correlation	.168**	.892**	1
	Sig. (2-tailed)	.001	.000	
	N	403	403	403

** . Correlation is significant at the 0.01 level (2-tailed).

Guidance for Farmer advisory messages:

Farmers not only need information on the selection and application of fertilizers at appropriate times but also need information on availability and prices of fertilizers in the market.

Harvesting

Place of stocking citrus before shifting to storage

Only 16% farmers submitted their response to the query regarding place of stocking citrus before transferring it to storage. Most of the farmers place the fruit under shady places to avoid exposure to direct sunlight.

Grading of fruit

None of the farmers engage in mechanical grading of the fruit. These responses have been collected from small and medium farmers and many have not even registered their opinion for this question.

Cost of inputs per acre

Almost two-third of the farmers engaged in citrus cultivation, spend Rs.30,000-40,000 per acre. Moreover, 34% of these allocate Rs.20,000 -30,000 for the same purpose. The response was mainly split between these two categories and there was insubstantial numbers in other brackets of expenditures.

The major chunk of expenses for citrus farmers is diverted towards fertilizers followed by irrigation and land preparation cost. None of the farmers quoted expenses for grading, waxing and packing.

Problems faced during Citrus cultivation

The major inhibiting factors in citrus crop were explained as water issue. This was mentioned by 39% of the farmers. Moreover, the farmers further explained that tube well water is not suitable for orchards. The other issue pertains to fertilizers which were reported to be not available when required, it was also reported that markets are flooded with counterfeit and prices are too high. The citrus

growers also complained about the rates of their citrus produce. They cannot fetch appropriate prices for their produce which discourages them to invest heavily on their crop.

Guidance for Farmer advisory messages:

- 1. Farmers need to adopt water conservation strategies to minimize the use of ground water for irrigation purpose. They should consult the extension department for adoption of innovative technologies in conservation of water*
- 2. They should get groundwater samples tested from the laboratories available at the district level*
- 3. They should consult the experts of the Agricultural Marketing Department for making adjustments in the timing of the supply of their produce.*

Rice Crop - Sialkot District

Rice is second major staple food crop in Pakistan after wheat. It accounts for 4.9% of the value added in agriculture, 1 percent of GDP (Government of Pakistan, 2012, p. 21) and about 10% of the export earnings of the country.

Water and Soil Tests

The farmers' survey did not show any evidence of the water and soil testing. The results are rather discouraging. Though the number of farmers who got their water and soil tested is also low in the other districts, the problem in Sialkot was found to be rather alarming where there was not even a single positive response to these questions-

Guidance for Farmer advisory messages:

Information on soil and water testing is important for the farmers to improve their yields.

Rice crop leaf test

The farmers were inquired about the rice crop leaf test; however, none of them had done this test as well.

Rice Crop Related Information

Total area under cultivation of rice crop

The research was focused on small and medium farmers, therefore, the sample comprise of farmers below 25 acres of land. The landholdings are generally small 395 out of 400 farmers - cultivated rice on their own land. Moreover, 41 farmers also acquired additional land on rent to augment their production..Out of the self-owned land, almost half fell below 5 acres of land, whereas 29% farmers had employed 6-10 acres of land for rice cultivation and 14% in the category of 11-15 acres. Out of the farmers engaged in renting land¹⁰, 39% land fell in 6-10 acres and 11-15 acres categories each. Six of the farmers rented less than 5 acres for rice cultivation.

Rice yield per acre

Rice yield for last year crop ranged between 31-50 maunds per acre for 93% farmers. The farmers securing 31-40 maunds per acre were 57.3%, whereas 35.5% were able to fetch 41-50 maunds per acre. Twelve of the farmers contacted during the baseline research had a rice yield between 51-60 maunds per acre. On the contrary, 14 farmers could not push their yield beyond 20 maunds mark. Average yield of rice in Sialkot come to about 41 maunds (1.64 tonnes)/acre, with minimum of 10 maunds and maximum of 60 maunds.

Cost of inputs per acre

The farmers gave a detailed breakup of their expenses incurred on each acre of rice cultivation. Nursery costs them below Rs. 2000 per acre, and 59% even spend less than Rs. 1000 under this head. Land preparation costs vary between Rs. 3000 – 6000 for 95% of the farmers. The maximum number spend between Rs. 4000 – 5000. This amount was quoted by 46% of the farmers. Nursery transplant costs Rs. 2000 – 3000 for 95% respondents. Expense on fertilizers was noted as Rs. 5000 – 6000 by 85% rice cultivators, another 8.5% spend between Rs.6001-8000 and 4% mentioned Rs. 4000-5000.

¹⁰ It includes both categories of farmers i.e. those who have their own land too and rent in additional land for rice cultivation, and those farmers who only rely on the rented lands.

The farmers reportedly spent below Rs.1000 on pesticides for each acre of their rice crop, a similar pattern was quoted for weedicides. The expenses have been quite uniform in most of the categories yielding very similar response for almost all the farmers. However, in case of irrigation expense farmers observed different patterns. Out of 400 farmers, 40% claimed to allocate Rs. 7001-8000, 17% mentioned Rs. 9001-10,000 and 16% spend even more than Rs.10,000 for irrigation purposes. This varies with the ratio of availability of canal water. The harvesting cost was reported between Rs.1000 – 3000 by 98% farmers.

Data on land rental was not properly reported by the farmers. Similarly, there were very few people who explained the expense on hired labor. The total costs per acre were calculated between Rs. 20,000 – 30,000 by more than two-third of the farmers, i.e. 68.5%. The other major category was observed as Rs. 30,001 – 40,000, which was being spent by 25% people cultivating rice. It should be noted that average wage rate in Lahore (provincial headquarter located near Sialkot) is Rs. 390/day (Government of Pakistan, 2012). This implies that per acre labour required in Sialkot ranged between 77 – 103 man-days.

Income from rice crop

The farmers were able to generate Rs. 40,001 – 60,000, as maintained by 77% farmers. Of these, 40.5% reported an income of Rs. 50,001 – 60,000 per acre of land under rice cultivation. Moreover, 8.6% farmers raise between Rs.60, 001 – 80,000 and 3% make even more than that. There were only 5.5% farmers who do not manage to get more than Rs.20,000 per acre from their land.

No of Canal and Tube well water

The farmers from Sialkot were complainant about access and availability of canal water. Most of this district lacks canal network especially the ancillary drains for agricultural purposes. They, therefore, have to largely rely on tube well for their rice crop. An overwhelming number of 88% farmers reported to use tube well water for 26-40 irrigation cycles. There were only 6% farmers who responded towards usage of canal water.

Distance of crop from head of water course

Unfortunately 88.5% farmers did not register their response towards this query as most of them do not have access to canal water. However, the maximum number of farmers reported a distance within 1-3 km. from the source of water.

Characteristics of soil under rice cultivation

Most of the farmers, i.e. 94%, denied any information regarding the characteristics of soil under rice cultivation. The 23 farmers, who perceive a familiarity with their soil, think that it is deficient in nitrogen, calcium and potash. These results are based on their personal judgment and are not backed by any scientific knowledge.

Guidance for Farmer advisory messages:

Only a small percentage of farmers know some characteristics of soil. Without such knowledge, many decisions like application of fertilizer etc cannot be made properly and hence the yield cannot be optimized. Moreover, farmers also need to learn symptoms of the deficiency of different types of nutrients. They also need to know when organic fertilizer should be applied and what other practices should be adopted like use of leguminous crops.

Rating of Soil

A majority of farmers in Sialkot district, known for its rice cultivation, consider the soil to be fertile. This satisfaction was expressed by 78% people, of which 7% rate it very fertile. Out of the remaining, 21%

consider the soil to be of average category and there were hardly 5 farmers who were displeased with the quality of the soil.

Laser aided land leveling

It is encouraging to notice that 30% farmers had performed laser aided land leveling in the recent past for their land.

Guidance for Farmer advisory messages:

Rice production involves the use of intensive water application. Studies (Tran, et al) suggest that one kg production of rice requires 4000-5000 liter of irrigation water. Requirement of water increase if land is not properly leveled. In order to conserve water and improve water use efficiency, farmers need information related with laser land leveling.

Nursery Preparation

Sources of nursery

The trend of raising own nursery is strongly entrenched in rice farmers, 95% of them do it for themselves and 5% get it from their fellow farmers. Only 3 farmers reported to use registered seed for their nursery.

Source of seed purchase

The pattern of using home kept seed is very strong in Sialkot district. A total of 78% farmer use their own seed for their rice crop, 12% get it from their nearby market places or dealers. Farmers also rely on each other for their seed requirement; therefore, 10.5% also get it from fellow farmers. None of the farmers contact any research institute for buying seeds.

Guidance for Farmer advisory messages:

Farmers need proper information and guidance on the selection of varieties and nursery plants. Only recommended variety should be sown. There are some varieties which are not recommended by the government e.g. 386, Super Fine, Kashmiri, Malta, Hero etc. Such information is needed to be provided to the farmers prior to the sowing time.

Methods of sowing

The response was extremely inclined towards one response and i.e. "Kaddu method"¹¹ being used by 94.5%. The remaining farmers use "dry method" or "Daab method" for sowing rice.

Factors important in deciding the variety of seed

The most prominent reasons for selecting a particular variety of seed for rice cultivation were reported as maximum yield and affordable prices. These factors impact the decision, however, the third element taken in to account is the risk of disease.

¹¹ According to Kaddu Method, prepare a solution by mixing 450 grams salt (sodium chloride) in 18 liter water. Then add and soak rice seed in it. Light-weight seed will rise to the surface of water. Simply remove all such seed. Take out remaining seed, wash it with water to wash away salts. Then soak it in simple water for 24 hours. Now take out soaked seed and keep it in a dry place in piles (each of 15-20 kg). Cover the piles with wet bags. Keep sprinkling water thrice a day to protect it from heat. It will be ready for sowing after 36 hours in plots each measuring not more than 10 marlas where water is standing there for last three days. Sow the seed by using broadcast method. It should be done in evening time. Next evening drain out the water from the plots and re-irrigate it in the following morning. This process should be repeated for one week.

Variety of rice being used

The most popular variety of rice was observed as “Super Basmati” being used by 98.3%. Moreover, 21% farmers use “386”, 5% grow “Supera” and 9 farmers rely on “Basmati 385”.

Time of sowing

The time of sowing ranged between May to July for various varieties. Super Basmati was found to be largely sown in July, endorsed by 97% growers of this variety. Basmati 385 was being grown in June by two-third of the respondents who reported to use this variety. June and May were the months for sowing “386” by 82% and 17% respondent, respectively. “Supera” was being sown in June 2012 by all the farmers.

Quantity of seed used per acre

The quantity of seed used per acre differed for various varieties. The maximum number of farmers sowing “Super Basmati” and “Basmati 385” use 8 kg of seed per acre. However, there was varied response for “386” and “Supera”, where the quantity ranges between 4 to more than 8 Kg. for “386” and mainly 5-7 kg for “Supera”. The recommended seed rate is about 5-6 kg for basmati varieties and 8-10 kg for coarse varieties.

Yield per acre for different varieties

The yield per acre was quite in line with the overall yields as discussed above. A noticeable relationship cannot be established between the kind of variety sown and yield; almost all the varieties had quite similar response.

Use of chemicals for seed treatment

None of the farmers in the rice region use any chemical treatment for their seeds.

Time for sowing seed for nursery

There was conformity on time of sowing for the rice farmers, 98% sow the seed for nursery between 1-19 May.

Guidance for Farmer advisory messages:

There is need for preparation of crop calendars for rice crop production in Sialkot, so that farmers are provided with critical information at the critical stages of the crop.

Transplantation of Nursery to Fields

Age of nursery at transplant stage

The farmers were inquired about the age of nursery at transplant stage, there was again quite uniform response reported for this. A total of 90% farmers transfer the nursery when it is at least 40 days old, however, 10% of them prefer to shift them during 35-39 days after sowing. Most of the farmers, i.e. 94% showed their satisfaction with timely shifting of nurseries. The remaining farmers attributed this delay mainly to labor problems and in a few cases financial constraints barred them from following the anticipated timelines.

Distance of plants in rice fields

An extensive response was received for 8-9 inches distance between the rice plants endorsed by 83% farmers. Another 11% maintain 10-11 inches between their plants and response in other categories was too meager to be meaningful.

Average germination rate

Farmers in Sialkot region are also able to get an outstanding germination rate; almost all the farmers manage to get more than 80% germination from their seeds. Moreover, two-third of these even get more than 90% success rate which is quite exceptional.

Average number of plants in rice fields

The farmers expressed their lack of knowledge about the number of rice plants per acre in their rice fields. There were only few who responded to this query; 9% think that there are approximately 50,000 – 70,000 plants per acre whereas 2.5% perceive them to be less than 50,000 on average.

Difference in requirements and sowing methods for different varieties

There were only 50 farmers who think that various varieties of rice require different handling in terms of requirements and sowing methods, especially in terms of irrigation and pesticide application requirements. They mainly stressed on difference in these two aspects of rice cultivation.

Guidance for Farmer advisory messages:

Farmers need proper awareness related with agronomic and other requirements of each variety for optimal results.

Pest Management and Weed Control

Weed control methods and success achieved

The rice farmers mainly rely on weedicides, crop rotation and simultaneous usage of both the techniques to fight against the weeds. The number of farmers using weedicides alone was 46%, whereas 32% used both the methods and 22% find crop rotation sufficient in dealing with the weeds. Out of the 400 farmers contacted during the research, 29% managed to have complete control over the weeds, however, the rest of the 70% reported only 51-75% success in fighting this hazard to the crop.

Guidance for Farmer advisory messages:

Weeds cause colossal loss to the rice crop in the form of reduction in yield from 25% to even 50% (Ahmed & Akhtar, 2011).

Perception regarding adverse impact of killing beneficial insects

Only 17% farmers agreed with the statement that killing the beneficial insects, during efforts to control other pests, bears a negative impact on the rice crop. More than half, i.e. 56%, people were not aware of this happening and 27% disagreed with the query or the statement?.

Precautionary measures while spraying pesticides

Precautionary measures are taken by nearly all the farmers when spraying pesticides. A fairly large number of them, 82% in rice region, wear masks and almost half of them were aware of properly covering their body before spraying the pesticides. The farmers also reported their awareness about keeping these away from children's access and food. However, there were only a few farmers in Sialkot who considered wind direction when spraying.

The farmers prefer to spray before noon, as reported by 83% of the respondents. There were 9% of them who spray afternoon and response in other categories was negligible. Usually experts recommend that spray should be done in early hours of morning for greater effectiveness.

Level of knowledge about pests and control thereof

The farmers were quite satisfied with their knowledge about various pests of their rice crop. They rated their level of knowledge as at least fairly reasonable and in many cases, farmers thought they had an expert knowledge of these pests. There was absolutely no response denying knowledge in this respect.

As far the level of control is concerned, more than two-third of the farmer maintained a fair control over all the pests. The rest of the response was split between complete control and somewhat control however, the number of farmers falling in the former category was lesser and 25-35% farmers reported as having only somewhat control over the pests

Guidance for Farmer advisory messages:

Plant protection is an area, where farmers frequently need information on how to identify symptoms of various diseases and on how to handle disease. Farmers need timely proper advice/guidance on how to control weeds.

Similarly, farmers also need proper guidance in how to control important diseases of the rice crop (foot rot / bakanae, paddy blast, bacterial leaf blight, brown leaf spot, and stem rot). Effective measures taken on timely basis can help in gaining control over the diseases.

Harvesting

Harvesting time

The usual time for harvesting the rice crop ranges between 8 – 10 am. Almost half of the farmers start harvesting at 9 am and the remaining were equally split between 8 am and 10 am.

Methods for harvesting

Manual method for harvesting is still being used by 46% farmers, 14% engage in harvesting through tractors and the remaining 40% make use of both the methods for harvesting their rice crop.

Almost all the farmers, i.e. 96%, were satisfied with timely harvesting of their crop.

Methods for clearing the roots of rice crop

A fairly high percentage of farmers, i.e. 70%, burn these roots and 58.5% also use deep ploughing method to clear off the roots from the rice field.

Advice for managing rice crop

The mechanism of consultation was found to be completely missing in farmers of rice region. The other regions were also deficient on building in a process of taking advice; however, there was absolutely no response in any category. The only source being used by some of the farmers is their fellow farmer network where they discuss issues related to seed selection, fertilizer application, disease control, plant protection, irrigation and soil related problems.

Level of satisfaction with rice crop

There was an average reaction towards this query. The number of satisfied farmers was 60%, further augmented with 4.5% highly satisfied ones. Therefore, two-third of the farmers fall in the contented class. There were 14% respondents who were quite displeased with their performance in the fields and 23% explained their response as “somewhat satisfied” which clearly depicts they would like to accomplish better yields.

Problems faced during rice cultivation

The problems being faced by farmers appear to be quite similar in every region and for every crop. The farmers from Sialkot also complained about “lack of canal water”, “unavailability and counterfeit fertilizers” and “unsatisfactory prices of their yields” as the major problems being faced by them.

Visits to extension office and workshops arranged

There were very few farmers who recorded their liaison with agricultural extension office for seeking their advice. Only 13.3 respondents have visited this office once or twice. However, 21.5% farmers acknowledged to have attended events or workshops arranged by the extension department.

Wheat - Vehari, Sialkot & Sargodha Districts

Wheat Related Information

Wheat is technically known as *Triticum aestivum L.* Wheat is the staple diet of most of the Pakistanis and hence it is very important crop in Pakistan from the perspective of food security. Besides, it contributes about 12.5% to the value added in agriculture and 2.6% of GDP (Government of Pakistan, 2012, p. 21). It is grown in almost all parts of the country, hence, livelihood of the rural poor. During 2011-12, it was grown on an area of about 8.67 million hectares and production exceeded 23 million tonnes with average yield of about 2.7 tonnes/hectare (Government of Pakistan, 2012, pp. 21-22). Total consumption of wheat in Pakistan hovers around 21 million tonnes.

Total area under wheat cultivation

The data reveals similar trends in Sialkot and Vehari where 78% of the farmers have used less than 10 acres of land for wheat cultivation in case of self- owned land, however, 83% of the rented land also fall in the same category in Vehari whereas farmers have largely rented 11-15 acres for wheat crop in Sialkot. In Sargodha, 99% of the self-owned and 100% of the rented land being used for wheat cultivation does not exceed 10 acres.

There is one more observation which needs to be reviewed. In Vehari and Sialkot, farmers' total land exceeds the land being utilized for wheat cultivation which reflects the usage of land for other crops as well. On the contrary in Sargodha, almost all of the total land is used for wheat crop. Wheat is grown even in the orchards. Such pattern of farming is called as intercropping.

Yield of wheat

A comparison of yield between the three districts clearly shows that Vehari was the best performing district for wheat crop. Average yield of wheat was about 40.20 maunds/acre in Vehari, 39.22 maunds/acre in Sialkot and 35.49 maunds/acre in Sargodha (Figure 14). The number of farmers producing 41-50 maunds/acre of wheat per acre form 33% of Vehari farmers, 21% of Sialkot and 15% of farmers from Sargodha district. Moreover, Sialkot was ahead of other districts in 31-40 maunds/acre category where 72.5% of its farmers had yields within this range. Out of the contacted farmers, 53% from Vehari and 41% from Sargodha had a yield between 31-40 maunds per acre.

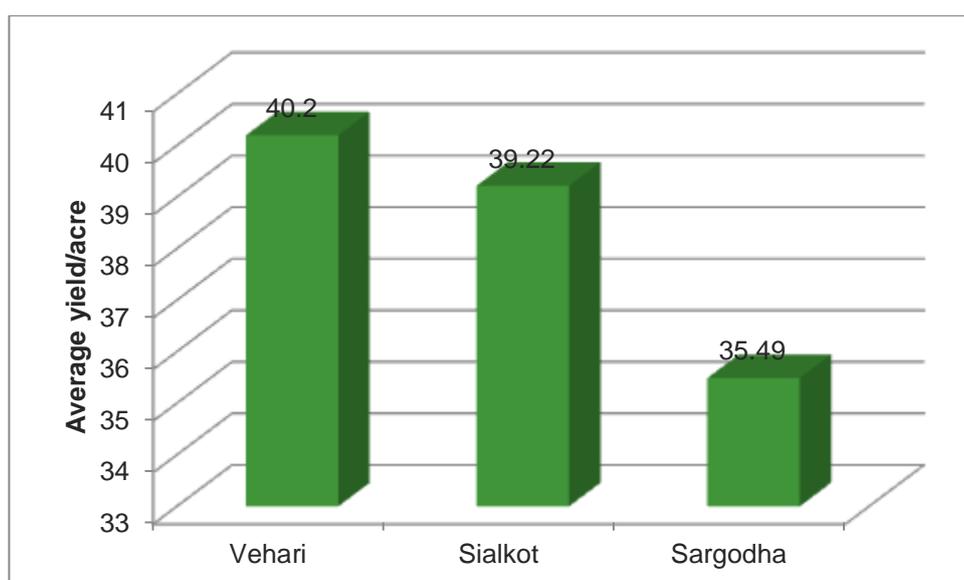


Figure 14 District-wise comparison of wheat yield

Yield-wise distribution of farmers of Vehari is shown in Figure 15

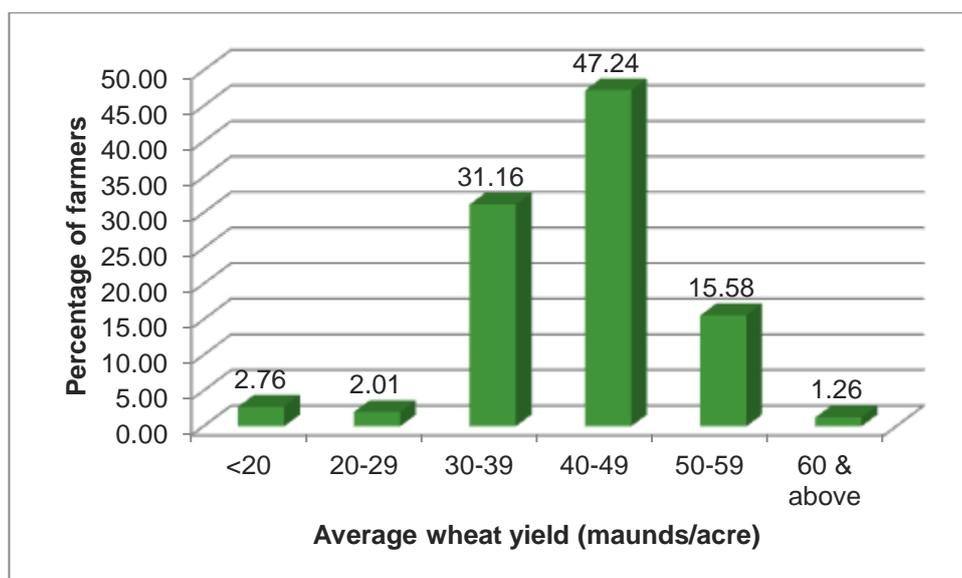


Figure 15 Distribution of farmers wrt wheat yield in Vehari

However, average wheat yield of small farmers in Vehari District is significantly lower than that of the large farmers. It means there is considerable potential for improvement in the yield of small farmers.

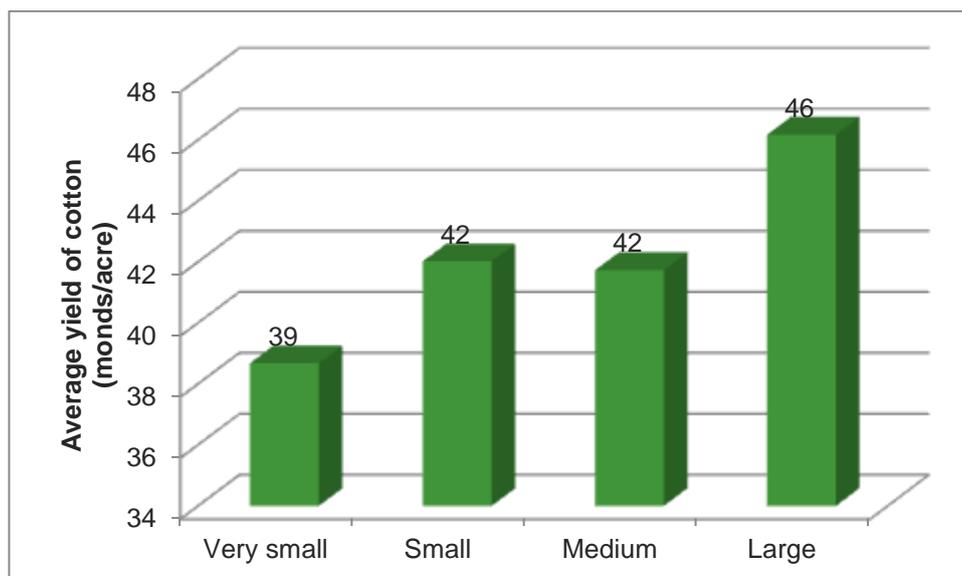


Figure 16 Average wheat yield for different farmers categories in Vehari

In a similar set of sample, 13 farmers from Sialkot and 18 farmers from Vehari could not exceed 25 maund yield mark, whereas in Sargodha 76 farmers had a yield below 25 maunds. Sargodha, therefore, remains the worst performing among the project districts for wheat crop.

Total cost of inputs for wheat

The data portrays that farmers in Sargodha and Vehari were spending relatively more on inputs than the farmers in Sialkot. The farmers spending Rs. 20,000 – 30,000 per acre towards inputs form 71% of total sample in Sargodha, 67% in Vehari and 41% in Sialkot. However, the percentage of farmers quoting an expense between Rs.10, 000 – 20,000 was observed to be 58%, 29% and 24% for Sialkot, Sargodha and Vehari, respectively. Therefore, a greater number of respondents from Sialkot fall in the lower expense bracket for inputs. There were few farmers who were allocating more funds towards inputs; most of them belong to Vehari region.

However, average cost of wheat production in Vehari is significantly higher than that in other districts (Figure 17). This pattern appears to be in conflict with above trend where farmers spending between Rs. 20000 – 30000 were slightly higher in Sargodha than in Vehari. This paradox is explained by the fact that in Sargodha, spending is slightly more skewed towards lower side.

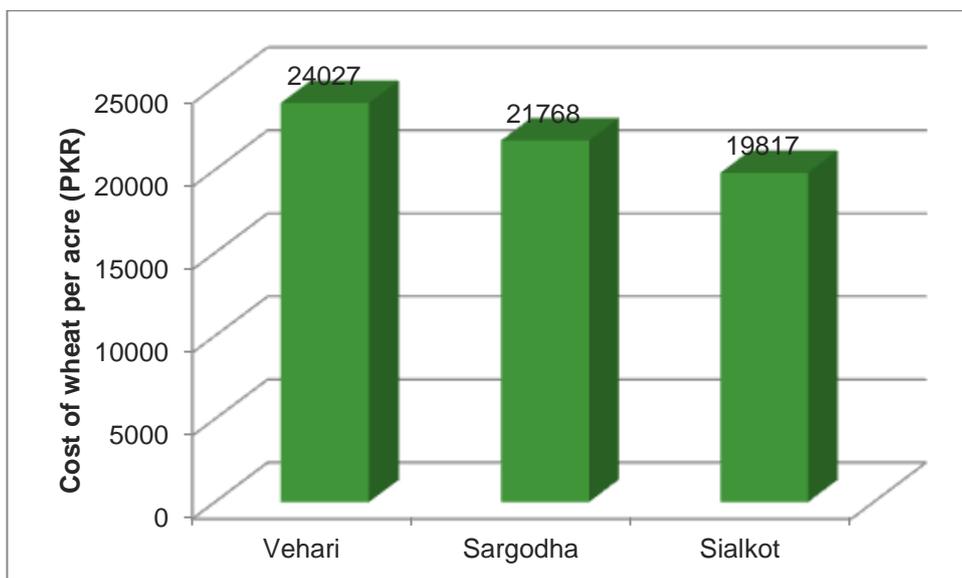


Figure 17 District-wise per acre cost of wheat production

Distribution of expenses on inputs

The graph below shows the distribution of expenses by farmers of Vehari on various inputs. Fertilizer is the major cost item in wheat production (31 percent), followed by land preparation and irrigation (each with 15 percent) and threshing (10 percent), as shown in Figure 18,

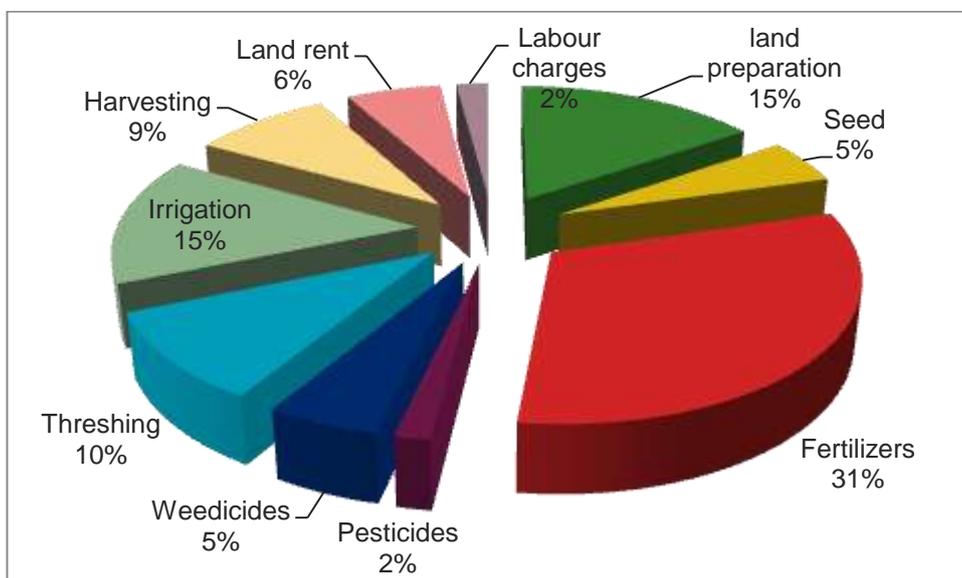


Figure 18 Cost of production of wheat (PKR 24,027/acre) in Vehari

In Sargodha too, fertilizer is the major cost item, rather with slightly higher share, in wheat production (34 percent), followed by land preparation (17 percent), irrigation (15 percent) and threshing (10 percent), as shown in Figure 19,

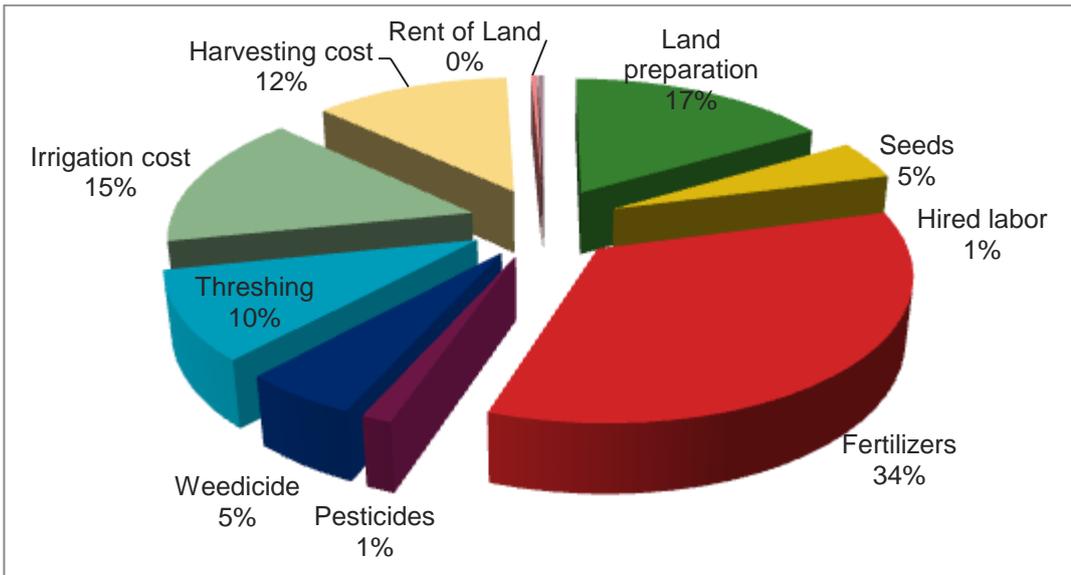


Figure 19 Cost of production of wheat (PKR 21,768/acre) in Sargodha

Fertilizer remained the major cost item for Sialkot, however, with slightly lesser share, in wheat production (30 percent), followed by land preparation and irrigation (each with 17 percent) and threshing (11 percent), as shown in Figure 20.

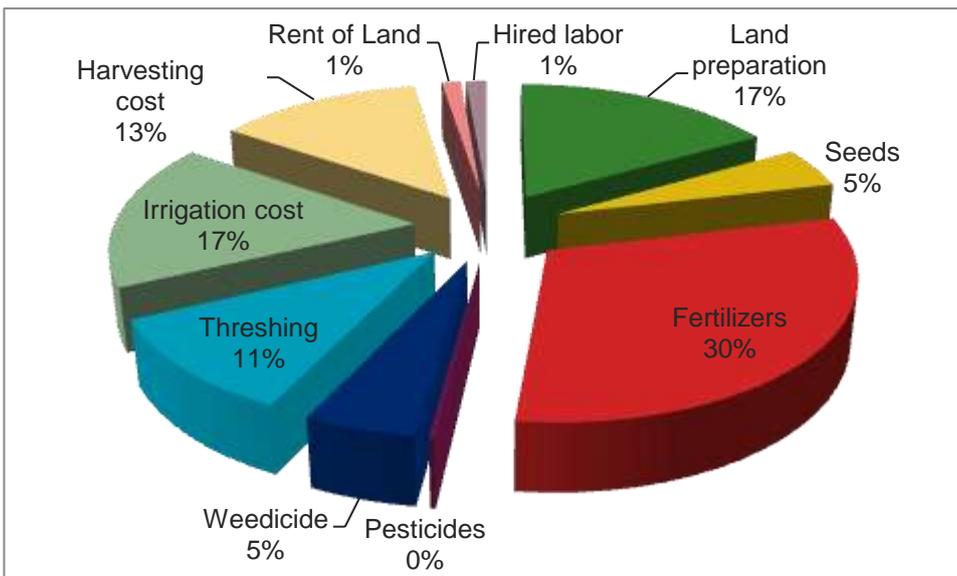


Figure 20 Cost of production of wheat (PKR 19,817/acre) in Sialkot

In Vehari District, cost of production of one acre is significantly lower in case of small farmers as compared to large farmers (Figure 21). Obviously, larger investment in wheat production results in increase in yield (Figure 16).

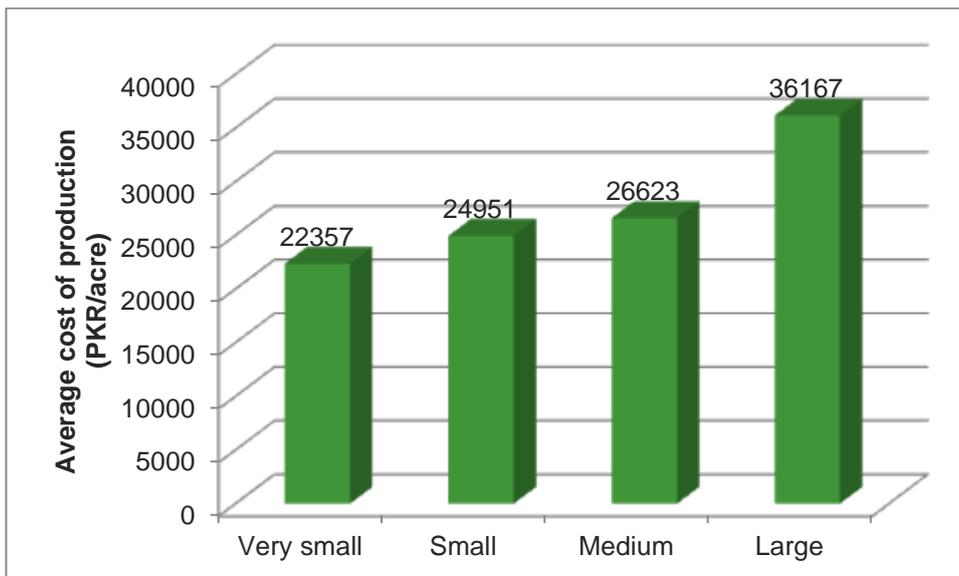


Figure 21 Average wheat cost of production for different farmers categories in Vehari

Income from wheat crop

The income from wheat crop presents that farmers from Vehari and Sialkot were able to fetch better income from their land. The data shows that 94% farmers from Sialkot, 86% from Vehari and only 58% from Sargodha were able to make more than Rs. 30,000 per acre from their wheat crop. A fairly large portion of the total sample, i.e.40% only makes Rs. 20,000 – 30,000 in Sargodha. Perhaps, it is due to the fact that cost of production in Sialkot is relatively on lower side.

Method of Sowing

There was no difference of practice regarding method of sowing adopted in all the three project districts. Almost all the farmers follow the method of wheat “Chatta” in dry land. There were 3 farmers in Vehari only who used drill to sow wheat.

Source of seed for wheat crop

The response to source of wheat seed brought similar practices in the project districts. The practice of using home kept seed is equally entrenched, 88-89% people using this source. Some of the farmers, however, also buy the shortfall from nearby dealers or fellow farmers.

Guidance for Farmer advisory messages:

Farmers remain concerned about the reliability of the source of seed. They need to be informed that certified seed is available with reliable sources like Punjab Seed Corporation.

Guidance for Farmer advisory messages:

Proper land preparation is essential for many purposes like water conservation, growth of seed, elimination of weeds, and maintenance of fertility and so on. Farmers always need guidance on this area.

Factors important in deciding the variety of seed

“Maximum yield” was the most important factor in deciding the variety of seed for their wheat crop in all the three districts. “Risk of disease” was the second most important factor followed by affordable prices in Vehari. “Affordable price” was more important for farmers in Sargodha and Sialkot than “risk of disease” as a deciding factors.

Varieties of wheat used

Varieties of wheat recommended by the government for the irrigated area include “Auqaab 2000”, Punjnad-1, Manthar 2003, Ufq 2002, Sahar 2006, Shafaq 2006, Farid 2006, Pasban 90, Inqalab 91, Mairaj 2008, Lasani 2008, Faisalabad 2008, Bhakar 2002, Aas 2011, Milat 2011, and Punjab 2011 (Ali, 2011b).

The farmers in Vehari preferred “Sehar”, “Watan” and “Inqalaab 91” used by 70%, 27% and 11% farmers, respectively. There was negligible response in rest of the categories of wheat. However, the popular varieties in Sargodha were found to be “Faisalabad”, “Bhakar”, “Inqalaab 91” and “Sahar”, being sown by 34%, 24%, 16% and 12% respondents, respectively. The reported varieties differ in all the three districts. The respondents from Sialkot claimed to use “Inqalaab 91”, “Sahar”, “Punjab 96”, “Auqaab 2000”, “Chenab 2000” and ‘Paras 2009’. The first two varieties were being used by 39% and 17% respondents; however, the remaining varieties were being used by 8-9% farmers in each category. The Extension Department suggests that varieties of Sahar 2006, Aqaab 2000, Inqalaab 91, and Bhakkar 2002 should be grown on very limited scale, as these varieties are infested with diseases.

Guidance for Farmer advisory messages:

Each zone has different recommended varieties of wheat crop. Yield potential for each crop is different. Hence, some farmers quite often remain in search of high yielding varieties. They need easy and quick access to some reliable sources for guidance.

Varieties like Sahar 2006, Aqaab 2000, Inqalaab 91, and Bhakkar 2002 should be grown on very limited scale, as these varieties are infested with diseases.

Quantity of seed used

The farmers in Vehari predominantly use 50 Kg. per acre for all the popular varieties being used in this district. The ratio of seed used was quite similar in Sialkot, where most of the farmers put 50 Kg. seed for each acre of land especially the farmers using “Sahar”. However, almost 40% of the farmers opting for “Inqalaab 91” and “Bhakar” also mentioned relatively lesser seed quantities ranging between 40-50 kg per acre. The seed per acre usage varied in Sargodha, it ranges between 40-50 kg. for “Sahar”, “Watan”, “Inqilaab” and “Faisalabad”. However, in case of “Bhakar” 21% farmers reported using only 35 kg for each acre of their land.

Guidance for Farmer advisory messages:

Quantity of seed requirement varies with respect to variety and timing of sowing. It is usually a complex decision. Farmers need proper guidance and timely information in this respect.

Time of sowing wheat

The farmers from Sialkot region were found to be most diligent in timely sowing of wheat crop; 26% of them were able to conclude their sowing by mid-November and 70% make it by the end of this month. Most of the farmers finish this exercise by mid-December, with 39% achieving the target of mid-November, another 31% by end of November and 27% completing it by mid-December. The most delayed sowing was noticed in Vehari where only 18% were able to hit the target of mid-November, and one-fourth of them even surpass mid-December as well.

More than 90% people in all the three districts were satisfied with the time of sowing they maintain, the farmers of Sargodha were the most satisfied with 97% people endorsing their level of contentment with the time of sowing.

The few farmers who expressed their displeasure with the time of sowing pointed out financial constraints and unclear fields for delay in sowing wherever applicable.

It is recommended that wheat sowing should be completed by the mid of November (Ali, 2011b). Delay in sowing of wheat after mid-November leads to decline in the potential yield of wheat by about 15 kg per day. However, Figure 22 shows that only 18 percent of the farmers could complete showing within the recommended time. Similarly, Figure 23 shows that about 60 percent of the farmers in Sargodha could not complete sowing of wheat in time. However, Figure 24 shows almost all farmers in Sialkot completed sowing well in time. It implies that there is substantial potential for improvement in Vehari and Sargodha districts.

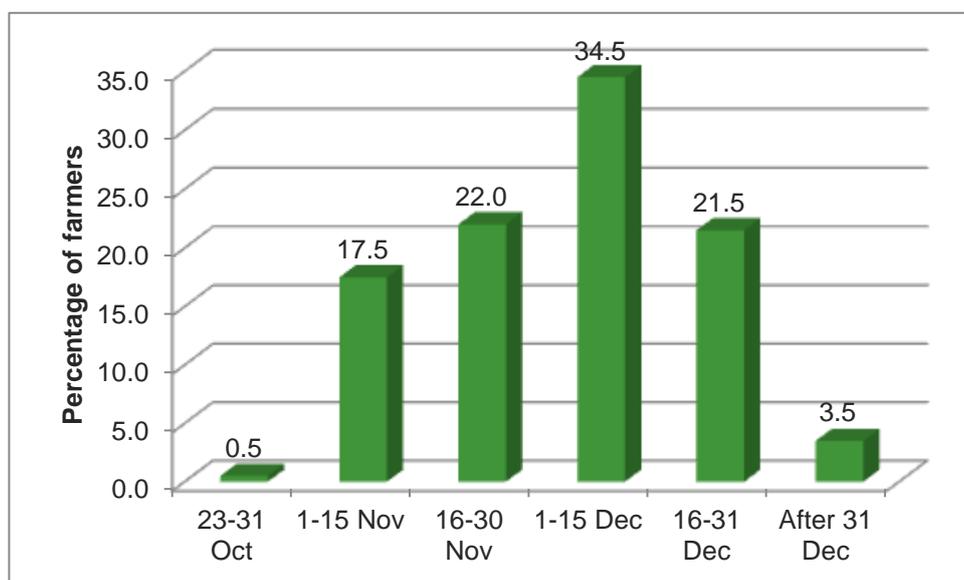


Figure 22 Time of wheat sowing followed by farmers in Vehari

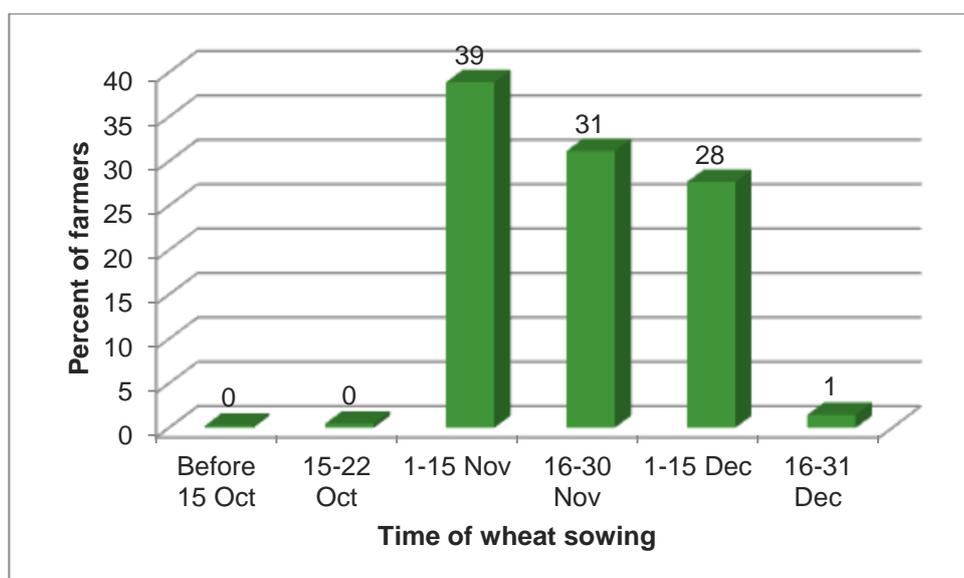


Figure 23 Time of wheat sowing followed by farmers in Sargodha

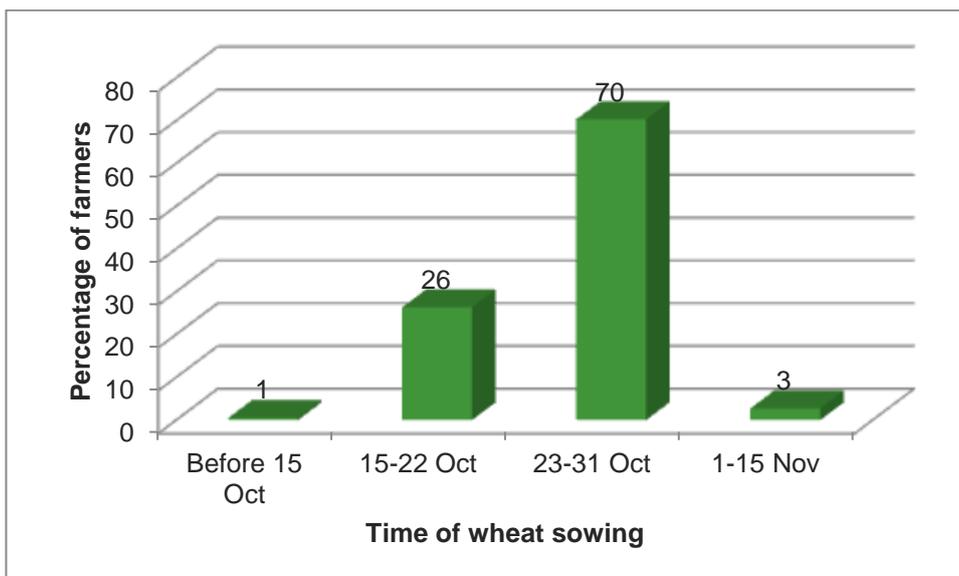


Figure 24 Time of wheat sowing followed by farmers in Sialkot

Guidance for Farmer advisory messages:

Mid November is the critical threshold on account of sowing of wheat. Each day delay in sowing of wheat crop, thereafter, causes decline in the yield by 15 kg. However, in practice large number of farmers is not aware of the criticality of such timings.

Average germination rate

The results for average germination yielded best results from Sialkot district where 94% farmers reported to achieve a germination rate of more than 80%. The similar milestone was achieved by 84% farmers in Sargodha and 66% from Vehari. In Vehari, 30% farmers record 70-80% germination rate for their wheat crop.

Seed grading practices

Seed grading practices differed between Vehari and the other two districts. This practice was being followed by approximately half of the farmers whereas in Sialkot and Sargodha only one-fourth farmers perform seed grading.

Seed treatment

It was quite astonishing to notice that none of the farmers in Sialkot and Sargodha reported treatment of their wheat seed with chemicals. There were only 9 farmers from Vehari who use chemicals for treating their wheat seed. The 9 farmers, who treat their seeds, use “Confidor” (imidacloprid), “Python” and “Amedeo” for this purpose. The farmers who recorded their response for the quantity of chemical used, mentioned 400 grams for 40 kg of seeds as an appropriate dosage for seed treatment. Two of the farmers, however, only use 100 grams for the same quantity.

The farmers who treat the seeds, were able to explain that this practice protects the plant from fungus attack and improve the germination rate of the seeds.

Guidance for Farmer advisory messages:

In order to improve germination rate, farmers can adopt multiple measures like selection of healthy and clean seed, seed grading, treatment of seed with fungicides etc.

Difference in requirements and sowing methods for different varieties

Most of the farmers disagree with any difference in requirements and sowing methods for different varieties. There were only 20 farmers from a total sample of 1203 who think that different varieties require different treatment with respect to sowing methods and other requirements.

The farmers who believe in differing requirements of varieties of wheat think that the difference lies in irrigation requirements and nutrients requirements.

Use of water at tillering stage

The crop of wheat attains maturity in about 160 days. During this period, the crop passes through some critical stages, irrigation at these stages plays vital role in determination of yield. Such stages include tillering, boot stage, grain formation and dough stages (Gill, 2012).

Tillering stage is a critical stage in wheat production. At this stage, application of irrigation is strongly recommended. The practice of irrigation at tillering stage was not found to be followed by many of the farmers. The maximum response came from Vehari where 30% respondents use water at this point in time. However, the data revealed merely 17% and 9% farmers involved in this practice in Sargodha and Sialkot, respectively.

Grain formation stage

The practice of water application at grain formation stage was found to be followed very rigorously in all the three districts. The ratio of farmers validating this practice was 99% in Vehari, 98% in Sargodha and 93% in Sialkot.

Guidance for Farmer advisory messages:

Irrigation of wheat crop at critical stages has a profound impact on the yield. Such stages include tillering stage, grain formation and dough stage.

Pest Management and Weed Control

Methods of weed control, their efficacy and damage caused by weeds

Weeds cause decline in wheat yield by 14-42 percent. They don't only cause damage to existing crop but also badly affect the quality of seed obtained through the current crop (Gill & Sattar, 2011). The farmers extensively rely on use of weedicides to combat weeds from their crops. The use was fairly common in all the three districts, substantiated by 86% usage in Vehari followed by 77% each in both Sialkot and Sargodha. The second most common practice to control weeds was reported as crop rotation, mentioned by 31% people in Sargodha, 30% from Sialkot and 25% from Vehari. Tractor driven hoeing was only being used in Sargodha to control weeds by 10% wheat farmers. Manual method was not found to be popular in this respect; the maximum response came from Vehari where 7% farmers use manual method in conjunction with other methods for weed control.

Despite the usage of all these different techniques for weed control, complete control is attained by only 10% farmers in Vehari, 9% in Sialkot and a mere 1% in Sargodha. Almost all the remaining farmers were able to achieve 51-75% control over weeds. The number of farmers reporting less than 50% control was highest in Vehari where 44 farmers fall in this category. However, there were only 7 such farmers in Sargodha and 4 in Sialkot.

All the farmers were aware of the fact that weeds reduce their yield of crop. Moreover, 41% farmers from Sialkot, 30% from Sargodha and 11% from Vehari also mentioned that weeds become breeding places for harmful insects and therefore, uncontrolled weeds aggravate the incidence of pest attack.

There were few farmers who mentioned that weeds also become a shareholder in all the nutrients, water, air and sunlight essentially required for the crop.

Guidance for Farmer advisory messages:

Weeds cause significant loss to the crop. Timely control is necessary. Similarly, farmers also need information related with gaining control on diseases like karnal bunt of wheat¹², smut etc., which can be proactively controlled through treatment of seed with recommended chemicals.

Perception regarding adverse impact of killing beneficial insects

Most of the farmers appear to be unfamiliar with the adverse effect of killing of beneficial insects along with pests when pesticides are used. Two-third of the farmers in Vehari, 59% from Sialkot and 45% from Sargodha mentioned their unawareness with the topic under discussion. This belief was not found to be very popular among the farmers in Vehari where only 6% think it impacts their crop and the rest 27% do not believe in this. Moreover, the response in Sargodha was equally split between the believers of adverse impact and otherwise, endorsed by 27% farmers in each category. In Sialkot, 18% farmers recorded their concern over the killing of these insects which eventually has a negative effect on wheat crop.

Number of pest scouting for wheat crop

Pest scouting was generally done once during the wheat cultivation last year. This response was substantiated by 66% respondents from Vehari, 71% from Sialkot and 77% from Sargodha. The farmers who did not indulge in this practice formed 16% of the sample in Vehari, 13% in Sargodha and 24% in Sialkot. However, a number of more vigilant farmers was observed in Vehari, where 14% people scout their fields for pests every month and there were 15 more farmers who reported pest scouting even more frequently.

Level of knowledge and control for pests

The farmers in all three districts believed they had very good knowledge of the common pests confronting their wheat crop. They were very comfortable with the degree of knowledge and there were hardly 2-3% farmers in all the districts who claimed to not having or having very little familiarity with these pests.

Pest control figures are closely aligned with the farmer's judgment about their level of knowledge. Therefore, very few farmers expressed their disappointment with their degree of control over these pests. Most of them think they were able to fairly control all of these pests, some opined to have "somewhat control" and there was a noticeable presence of farmers registering complete control, especially in case of Vehari.

Usage of Boron and Zinc

The number of farmers using Boron and Zinc was insubstantial, only 7 farmers reported it. The farmers who used these nutrients applied them after sowing and the quantity used was 3-4 kg per acre. The response was too meager to use the results to determine trends in quantity of use.

Harvesting

Methods of harvesting

Manual harvesting was found to be still the more practiced method. The manual method was most prevalent in Vehari where 81% farmers follow this practice. Similar method was being used by 77% farmers in Sargodha and 63% in Sialkot. Use of tractor for harvesting was more extensive in Sialkot

¹² Karnal bunt of wheat is caused by the smut fungus *Tilletia indica*. It is spread by spores.

than the other districts, with 42% farmers relying on this. There were only 22-23% farmers in the other two districts who use tractors for harvesting wheat.

Satisfaction level with wheat output

The data shows that around two-third of the respondents expressed their satisfaction with their output of wheat, in all the three districts. However, the satisfaction level was slightly higher in Vehari 72% were satisfied and another 7% rated themselves to be highly satisfied. The range of farmers who were “somewhat satisfied” fell between 20% in Vehari to 23% in Sargodha and 27% in Sialkot.

Problems faced during wheat cultivation

As pointed out for other crops, farmers cultivating wheat in Vehari also complained of water issues, fertilizer unavailability and counterfeit products flooded in the market, and problems in getting “Baardaana” (jute bags meant for storing wheat). Almost similar set of problems was registered from farmers in Sialkot who criticized about lack of canal water, high prices of inputs and difficulty in obtaining “Baardaana”. However, interestingly the farmers from Sargodha maintained a different stance and the most frequent problem related to “lack of information” which they think is the biggest impediment during wheat cultivation. Moreover, they also raised fertilizer issues, unavailability and counterfeit pesticides??, and “Baardaana” issues.

Visits to extension office and workshops

There were very few farmers who reported visits to extension office; 17% farmers in Vehari had been to agriculture office once or twice. The ratio was even lower for the other two project districts; 4% in Sargodha and 7% in Sialkot. This presents the facts for farmer’s reliance on agricultural department for seeking advice. The reach for events and workshop arranged by the extension department was slightly better, with 17-19% farmers admitting to have attended any of the events from all the three districts.

Conclusion: Guidance for Farmer advisory messages:

Farming has increasingly become a very technical enterprise. Farmers have to take decisions which must be right and be taken at right time. In other words, farmers need to shift to informed decision making from conventional mode of decision making. However, farmers lack easy and quick access to critical information / guidance needed at critical stages of crops.

Critical stages for each crop are different. However, some critical areas are common among all four major crops of the target districts:

- How to prepare land?*
- Selection of a variety*
- Selection of seed*
- Timings of irrigation*
- Weeds control – proactive and reactive measures*
- Plant protection – proactive and reactive measures*
- Purchase of fertilizers / nutrients*
- Care of fruit*
- Harvesting*
- Marketing of produce*

In short, if farmers are empowered with easy and quick access to much needed information at critical stages of the crops, they can easily and substantially improve their earning and earning capacity.

Rural Women --- Some Insights

During the baseline survey it was found that women's participation and knowledge about agriculture varied among three districts. The women were found to be working at the lower end of the workforce. Hence most of the women could not respond to the questions in the baseline survey. Therefore a different strategy using a qualitative approach was designed to understand the role of women. The following feedback will help in understanding the role and status of rural women in the project area.

Education of the respondent and Head of the household

Most of the respondents from Vehari had never attended school. Most of the heads of the households (male) had less education, only a few had passed matriculation examination.

Education trends were not very progressive in Sargodha, women were not educated but neither were the men. There was hardly any respondent who reported that their men attended school for a few classes.

However, education of the respondents and head of the household revealed relatively better trends in Sialkot. There were quite a few respondents who were able to read and write to some extent and their head of the households were matriculate (having 10 years schooling). In a few cases, the household women were having bachelor degrees.

Children's education

The children (both boys and girls) in Vehari in general attended school. There were very few cases where the children did not attend school. This was a healthy sign that at least people in this area were aware of the importance of educating their children. However, it was noticed that children usually drop out when they reach teenage and do not achieve further education. Children start work after fifteen years of age and none of the respondents reported children studying in grade 8 or beyond.

The trends in schooling were not very healthy for children in Sargodha. Some of them were going to school but the dropout rate was very high. The financial pressure on children to start earning does not let them complete the middle school.

Children of the respondents in Sialkot did attend schools. There was a drop out trend in Sialkot but it was relatively better than the other project districts. There were very few respondents who were not sending their children for schooling.

Occupation of Head of the Household

In 90% cases, the male head of the household in Vehari worked as daily paid labour, mostly in agriculture sector. Some of them either own landholdings, usually small in size, or have rented land or work for other landlords. A few respondents reported that their head of the household work in some other districts for better remunerations and one of them was running a small retail outlet.

The occupation of head of the household in Sargodha was mainly as labourer in agriculture sector. They were involved in all kinds of agricultural labour.

Men in Sialkot district were actively engaged in factory jobs due to industrial activity in this region. There were quite a few women also who mentioned that they were working in factories which are longer term/permanent work compared to shorter term and non-permanent work in agriculture. They reported that agriculture labour is relatively under paid and tougher than factory jobs. The factory owners arrange for their transport to and from work. These facilities make these jobs more attractive and lucrative for them

Household responsibilities being shared by women

Women in Vehari cater to their household responsibilities on a sharing basis with other women in the household including daughters, mother, mother-in-law, sister(s)-in-law, sisters, and so on depending upon the family structure. Family type is generally a joint family system so there is sharing in every respect. They do the cleaning, cooking, washing, dropping off children to school, attending family festivities, and other related household chores. However, they cannot do tutor their kids which is understandable due to almost negligible literacy rate in this area.

Women in Sargodha also maintain their household responsibilities except their children's educational responsibilities where they lack the capabilities. They handle the rest of the household obligations.

Women in rural areas of Sialkot district take responsibility for all kind of household tasks other than tutoring the children. One of the reasons for this trend is their lack of education to guide their children for educational assistance.

Pattern of decision making

The decision making pattern in Vehari is heavily skewed in favour of women in the household. The response was almost unanimous for women holding the power to run the house and take major decisions of the household. The respondents maintained that they do discuss with their partners; however, they have dominance in deciding the household matters.

The women in Sargodha were relatively less resourceful and had limited decision making. They did not have opportunities to work, they wanted to work but the general pattern here was different than the rest of the areas. Therefore, they did not have any personal earnings and they did not have much say in their household decision making either.

The pattern of decision making lies with women in Sialkot for household activities and major decisions are taken after joint consultation.

The bigger landlords (i.e. big land owners) had their families settled in urban areas and their pattern of living and handling affairs was not in line with the typical rural women of the project districts. However, the focus of the research was mainly the women from relatively marginalized farmers, small and medium, actually residing in rural areas.

Financial handling

In line with the pattern of decision making in day to day household matters, women in Vehari asserted that irrespective of the financial kitty they have, they are the ones managing it. They complained about the resources and some of them took it as a negative point as they are forced to manage within a limited budget. They reported that whatever they earn, if they do, is spent towards household expenses.

Women in Sargodha were handling the daily finances for their households but their means were very limited. They find it very hard to manage the household expenses within the budget granted to them. However, they were in charge of the everyday financial management.

Women in Sialkot were handling the money matters for their daily affairs; however, the major financial decisions are taken by males in consultation with the women in the household. In joint families the mother-in-law generally leads the house. This pattern was so strongly rooted that where the mother (-in-law) handles the financial affairs, the sons who are the major earners of the household would also abide by the decisions taken at the highest level.

Knowledge about agriculture related matters

Women in all the three districts expressed their knowledge skills for land preparation, crop cycles, harvesting, manual weed controls, livestock management and the like. They were not very familiar with more technical aspects like seed varieties, fertilizer selection, pesticides, weedicides, financial management of the agricultural activity and marketing the produce.

Whether informed regarding agriculture related matters

The respondents from Vehari told that the males in the household share agricultural related matters with them in most cases. They admitted the fact that they only possess information regarding crop cycles, seed grading, seed treatments, land preparation, water management, harvesting, and the like, however, they lack knowledge related to fertilizers, pesticides, weedicides, where to buy seed, seed varieties, and other technical information. Therefore, the males only keep them in loop in most cases and take their advice in rare cases where they are not qualified enough to comment.

The respondents interviewed in Sargodha mostly belonged to households of small landholdings. The farmers with bigger landholdings maintained their family houses in nearby cities particularly for the education of their children and other facilities. Women from small landholdings worked alongside their male counterparts to avoid hiring outside help. Therefore, they are part of the agricultural activity themselves and are informed of all the developments.

The women in Sialkot also reported a similar response. Men involve women of the household where they expect valid input; however, in technical matters they take the decisions themselves. The women maintained that in most cases, their male counterparts keep them posted about the agricultural decisions taken.

Personal occupation other than agriculture

None of the women in Vehari was involved in any occupation other than agriculture related.

Some of the respondents from Sargodha reported that they work as domestic help but that is not a permanent job here and they are hired on an ad hoc basis. A few mentioned different activities like candle making and other crafts to raise some money. They also take care of livestock on commercial or sharing basis.

Sialkot is an industrial city and hence it provides options for varied jobs in factories. This is a relatively more affluent area and buying power is higher than other districts of the project. Some of the respondents were also working in factories which offer permanent jobs, as against seasonal trends in agriculture, transport and lighter work when compared with the rugged weather conditions in the fields.

Agriculture activities engaged in

The women in Vehari were engaged in light agricultural practices like harvesting, tobacco strings for drying, hoeing and rice transplant. Moreover, they were also responsible for livestock handling. Almost all the respondents had livestock, some of them had their own and others had these on a sharing basis. They further maintained that they do not get much opportunity to work and earn. They were not satisfied with the compensation they get in return which is very little to attract them to work.

The respondents from Sargodha who worked in the family owned fields were engaged in almost every step of the crop from land preparation, manual weed control, sowing, transplanting, harvesting, etc. They, however, do not get involved in water management, fertilizer and pesticide spraying. Women work in agriculture on their family land but there are not many options for women as hired labour in agriculture in Sargodha.

Women in the Sialkot region were mostly involved in vegetable picking, packing vegetables in sacks, land preparation, manual weed control, and other lighter activities related to crops. They were also managing livestock which is by far considered as women's domain of work.

Maintenance of livestock and its related work was the common factor in all the three districts. As discussed earlier, this is mainly considered as women's responsibility. They keep their own animals and do it on "sharing or caring basis" for others to raise additional resources and by products.

Compensation for work

The rates for cotton picking range from Rs.6 -10 per kg and it varies on the capacity of the worker and hours of work employed. There were women who made up to Rs.500 a day after eight hours of work. However, the women mostly reported earning between Rs.100 – 150 per day for cotton picking after working for 4-6 hours. Some of them claimed to make only Rs.40-50, but this is for shorter hours. However, in the last one year, situation slightly improved as cotton picking wage rate increased to Rs. 12/kg due to shortage of labour and production of a bumper crop.

The women involved in rice transplanting reported earnings of Rs. 250 per day and the ones engaged in tobacco drying make Rs.150 a day.

The women in Sargodha rarely work as hired labour for agriculture. The women who work as domestic help reported that they get compensated with Rs. 100 a day. A few women who were engaged in seed grading, fodder cutting, vegetables growing and manage livestock for others reported to make Rs.200-250 after doing a variety of jobs. Moreover, there were some of the respondents who make candles and other crafts. These women make around Rs.1500-2000 a month.

The women working in the factories get around Rs.5000-6000 per month and they consider it a permanent job where they get some additional facilities (like transportation etc.) as well. The ones working on the agriculture side reported to get Rs. 70 for one shift of 4 hours in the morning and Rs. 90 for evening shift of 4 hours again for vegetable picking. The rate increase per year is Rs.10. Moreover, one of the women in a supervisory position gets Rs. 90 for morning shift and Rs. 90 for the evening shift. The rate for hoeing range between Rs. 150-200 per day and for packing the vegetables (potatoes and corn) in sacks was Rs. 150 per day. The average earning was reported as Rs.2500-3000 depending on the number of working days employed.

Financial empowerment

There are no issues pertaining to financial empowerment, women take charge of the financial resources and manage these all by themselves. In most cases, women were handling day to day affairs of the household including the financial side. Men get involved in agricultural related issues and bigger matters where they jointly reach the decisions. However, agriculture is the only domain where men take the major lead and just keep the women in informed where necessary.

This pattern was prevalent in all the three districts, with lesser extent in Sargodha. However, the general behaviour presents women to be quite empowered financially.

Time spent on different activities

The working hours for women in Vehari appear to be fairly relaxed. The household chores are managed jointly with all the women in the household. The women working in the fields work for relatively shorter hours. Some of the women work on need basis i.e. whenever they are short on cash, they work for a few hours. Moreover, some of the women from lower socio-economic background work as domestic help on a temporary basis; this would be as and when required basis. The overall impression of the women in Vehari was lack of passion for laborious work. They clearly maintained that it was hard to work in the fields in hot weather and they choose to work only for three to four hours, and that too only a few days in a month. There were very few women who permanently work full time in Vehari district.

The respondents, however, do maintain the livestock. Some of them have their own livestock and the rest keep it on a sharing basis. The number of animal kept was also very limited in most cases.

The women in Sialkot were the most professional; some of them even work in the factories. The women involved in agriculture related work for their own fields or as labour for other landlords. These women work hard and mentioned two shifts of work, four hours each in the morning and evening. They were managing household responsibilities alongside their work.

Sargodha had a mixed trend; household tasks are a must for rural women though they generally do it on a sharing basis due to joint family structures. The women work on their family agricultural land to overcome the need for hired labour, however, they complained of not having work prospects to earn and add to their pool of funds. They work as domestic help but those are not permanent jobs in rural areas.

Phone facilities

Landline facility has declined in rural areas since mobile accessibility became more reachable. There was no availability of landline phones, in certain areas the national network closed its operations due to very low number of clients which become unfeasible for them to cater. Therefore, people in rural areas rely on mobile phones for their communication needs. Each household had at least one cell phone, mostly owned by the male members. There were hardly few cases where women had a shared cell phone at home for reaching out their male counterparts at work or else.

The pattern for telephone usage and ownership was quite similar in all the three districts.

Mobile ownership

Mobile ownership maintained a similar pattern in most rural areas where it is regarded as a man's prerogative to keep cell phones. There was a very clear trend that each household at least had one mobile, however, it was predominantly owned by the male members of the house. The women interviewed mostly were not literate and were not able to report any accessible cell number. The respondents who gave numbers had written down on a piece of paper or saved these in some relative's cell phone.

It is considered against the social norms for women to carry mobiles and they use the phone on need basis. The women residing in areas close to the city or landlords having their families in the urban areas had a different pattern. The women living around urban centres owned cell phones and had a totally different approach towards its usage. However, even the women belonging to affluent families in rural areas denied access to cell phones rather they reported it as a taboo for women. A wife of a big land owner in Sialkot said

***“Yahan mard kehtay hain aurtoon ko mobile ki kia zaroorat hay aur
aisi aurtoon ko theek nahi samajhtay”***

(Men in rural areas argue that why women need a cell phone and consider that the women (of the area) who possess one as having a loose character)

Another women who was a widow and used to work in a supervisory position for agricultural labour, said

***“Main beewa aurat hoon, main mobile kaissay rakh sakti hoon,
her koi meray kirdaar par unglian uthai ga”***

(I am a widow so how can I keep a cell phone? I will have to face character assassination if I keep one.)

An interesting observation came from women in Vehari, which was further verified from other sources. The respondents interviewed for this research included some younger girls in this district who had attained an age of 23-24 years or even crossed that but were still unmarried. They reported that lack of financial resources is the biggest impediment in their getting married. A few women admitted secretly keeping cell phones and some others who reported not to have access to mobiles were quite familiar with various functions of the cell phones. It seems like a common practice to secretly keep unreported cell phones, mostly used by the younger group of women in Vehari. Moreover, although the women in Vehari denied having cell phones many of them were holding mobile sets during the interview sessions which they claimed belonged to some other member of the family.

Frequency of mobile usage and number of calls

In absence of the landline facility in the rural areas, mobile use is fairly common in Vehari. Every household has at least one cell phone, mainly owned by the males. Women use these numbers whenever they need to get in touch with their family or relatives. They claimed a very low usage of cell phones, only a few calls in a week. The few women who claimed to have a family cell phone or personal phone, told that they use it for getting in touch with male members of the household.

Mobile ownership rests with males and women hardly use this facility in Sargodha. They use the phones of their head of the household to make any necessary calls. The frequency of calls was reported as only a few calls per week.

Sialkot follows the same trend however; it is different in areas closer to the urban centres where women were keeping separate cell phones and were well conversed with its usage despite their uneducated backgrounds. However, the rural women consider it a taboo to have cell phones. One of the respondents who were working at a supervisory level for agricultural labour; has to contact her fellow workers for arranging the required number of women in the fields. When asked about her ways to manage this, she explained that she maintains a list of contact numbers for these women and gives these to the farm manager / munshi who would let her use his mobile to reach these women. She was a widow and was very conscious about her reputation which according to her would be “shattered” if she carries a mobile phone. The cell phone usage was limited to a maximum of a couple of calls a day and that’s too on requirement basis.

Mobile usage awareness and knowledge (use of cell phone functions)

The elderly women in Vehari were only aware of how to take an incoming call; most of them were able to locate numbers from the phone books. This was despite the fact that none of the women was educated, but they tend to recognize numbers using some kind of symbols. The relatively younger group of women was also able to listen to music but none of them was able to use the message function as they were all uneducated. The younger women in Vehari were much more conversant with various functions than the rest of the two project districts.

The women in Sargodha were not much familiar with various functions of the cell phone. They were familiar with the green and red buttons to receive the call and end the call. The knowledge was limited on the same pattern as the mobile ownership itself.

Mobile usage awareness was limited to taking calls and number search in some cases in women from Sialkot. None of the women reported to use other functions like messaging, downloading or listening to music. This is more so as none of them owns a mobile and they use it only for socializing with the family on a limited scale.

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