"Impact Assessment of ICT – enabled Knowledge Sharing Agri-portals in Uttarakhand"

Thesis

Submitted to the

Govind Ballabh Pant University of Agriculture & Technology,
PANTNAGAR-263 145 (U.S. Nagar), Uttarakhand, INDIA

By

KIRAN YADAV

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

Doctor of Philosophy

(Agricultural Extension & Communication)

December, 2011

ACKNOWLEDGEMENT

I thank almighty for carrying me when I could not walk and helping me safe under his company of love, care and endless blessings without which this tedious and wearisome task could not be escorted.

At the outset of this epistle, I consider myself fortunate and greatly privileged to have worked under the supervision and guidance of Dr. Gyanendra Sharma sir, Professor, Department of Agricultural Communication, G.B.P.U.A & T, Pantnagar and chairman advisory committee. Words are inadequate to express my sincere and deepest feelings of gratitude originating from the innermost core of my heart for his benevolent guidance, meticulous supervision, whole hearted encouragement, critical appreciation in the execution of my work and for all the trust he had in my abilities, primarily responsible for the present accomplishment.

With stupendous ecstasy and profundity of complacency, I pronounce utmost of gratitude to members of my advisory committee, Dr. Neelam Bhardwaj, Professor and Head, Department of Agricultural Communication, Dr. Shamshul Hasan Professor, Department of Agricultural Communication and Dr. A. K. Shukla, Professor and Head, Department of Mathematics, Statistics and Computer Science and Dean College of Basic Science and Humanities. I am grateful to them for their salutary advice, kind co-operation and congenial discussion on an array of topics.

It is my proud privilege to unveil a hearty sense of indebtedness towards Dr. V. Balaji, Global Leader, Knowledge Sharing and Innovation (ICRISAT) for his keen interest, invaluable guidance, inspiration and constant encouragement extended at all time during the course of this investigation. The financial assistance and needed resources during the study from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru is thankfully acknowledged which in fact made me to accomplish this voyage successfully. I wish to place on record my appreciation and sincere thanks to ICRISAT staff specially Dr. N. T. Yaduraju sir, Principal scientist, NAIP for his scholarly guidance and motivation.

I express my utmost regards to Dr. S. K. Kashyap, Dr. Kamesvari, Dr. M.A. Ansari, Dr. Surya Rathore and Dr. Amardeep, Department of Agricultural Communication for their unstinted help, valuable advice and constructive suggestions. I wish to place on record my appreciation and sincere thanks to the office members of Agricultural Communication for extending their kind co-operation, love and motivation during the entire course of this study.

I feel elated and overwhelmed with rejoice to avail this opportunity to divulge my innate sense of gratitude and reverence to Dr. Manoj Kulshreshtha and Dr. Deepali Tewari Pandey for their *meticulous guidance, persistent encouragement, amicable attitude, soothing affection and above all emotional buttress at all junctures throughout my studies and in all shades my life.*

Friends always knew how to pep me during my bad days and how to celebrate when I used to achieve something. It is difficult to express the gratitude I owe to all my friends especially Dr. Aparna Rajput, Dr. Kamini Bisht, Manish Chandola, Dr. Gaurav Papnai, Dr. Ajay Raut, Divya, Sagar, V. Ram Naresh, Dr. G. Sreedhar, Niharika Lenka, Upender Reddy, B. Bhanu Prakash and S. Jyothi.

Words fail to express my indebtedness to my divine parents Shri Surya Deo Yadav and Smt. Dhanawati Yadav, whom I worship, for their blessings and all the pleasures they sacrificed for the sake of all of us in the family. I am grateful to my sister Smt. Pratibha, brothers Narendra and Santosh, Sister-in-law Smt. Shweta, nephews Rishi, Somansh, and niece Avani whose innocent love and unending encouragement cannot be appreciated in mere words. My special thanks go to my niece, Pragati for her strong emotional support, unconditional love and her joyful company without which the present expedition could not be completed.

Words can hardly be appropriate to flush out my esteemed sense of ecstatic feelings for my eldest brother Late Arun Bhaiya whose love and blessings will always be felt by me.

With God's grace and the timely help of many, I was able to complete the task in time and when I start to thank all, I fear, I may miss a few. So, I like to keep my sincere thanks to all in my heart rather than scribbling few words of formality.

Kiran Yadav

December, 2011 ***(Kiran Yadav)***

Pantnagar *Authoress*

Dr. Gyanendra Sharma

Professor

Dept. of Agricultural Communication,
College of Agriculture,
G. B. Pant University of Agriculture & Technology, Pantnagar – 263 145
Distt. - U. S. Nagar, (Uttarakhand),

CERTIFICATE

This is to certify that the thesis entitled **"Impact Assessment of ICT - enabled Knowledge Sharing Agri-portals in Uttarakhand"**, submitted in partial fulfillment of the requirements for the degree of **Doctor of Philosophy** with major in **Agricultural Extension and Communication**, and minor in **Social Science** of the college of Post Graduate Studies, G.B. Pant University of Agriculture and Technology, Pantnagar, is a record of bona fide research carried out by **Ms. Kiran Yadav, Id. No. 29223**, under my supervision, and no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been acknowledged.

29.12.20

Pantnagar **(Gyanendra Sharma)**
December, 2011 Chairman Advisory Committee

CERTIFICATE

We, the undersigned members of the Advisory Committee of **Ms. Kiran Yadav, Id. No. 29223**, a candidate for the degree of **Doctor of Philosophy** with major in **Agricultural Extension And Communication** and minor in **Social Science,** agree that the thesis entitled **"Impact Assessment of ICT - enabled Knowledge Sharing Agri-portals in Uttarakhand"**, may be submitted in partial fulfillment of the requirements for the degree.

(Gyanendra Sharma)
Chairman
Advisory Committee

(Neelam Bhardwaj)	**(Shamshul Hasan)**	**(A. K. Shukla)**
Member	Member	Member

(Head)
Ex-officio Member

C O N T E N T S

L I S T O F T A B L E S

17.	Distribution of farmers according to gender	
18.	Distribution of respondents according to family type	
19.	Distribution of respondents according to family size	
20.	Distribution of farmers according to type of house	
21.	Distribution of farmers on the basis of access point of selected Agri-portals	
22.	Distribution of farmers on the basis of communication media possession	
23.	Distribution of farmers on the basis of agricultural equipment possession	
24.	Distribution of farmers on the basis of household material possession	
25.	Distribution of farmers on the basis of type of electricity connection at home	
26.	Distribution of farmers on the basis of social participation	
27.	Distribution of farmers on the basis of reach of extension agency	
28.	Distribution of the farmers on the basis of interpersonal sources of communication	
29.	Distribution of farmers on the basis of access to modern technology	
30.	Distribution of farmers on the basis of farming experience	
31.	Distribution of farmers on the basis of land holding	
32.	Distribution of farmers on the basis of livestock possession	

33.	Distribution of farmers on the basis of crop wise cultivated area	
34.	Distribution of farmers on the basis of extent of awareness of selected Agri-portals	
35.	Distribution of farmers on the basis of time of awareness of selected Agri-portals	
36.	Distribution of farmers on the basis of sources of awareness of selected Agri-portals	
37.	Distribution of farmers on the basis of visits of selected Agri-portals	
38.	Distribution of farmers based on of purpose of visits of selected Agri-portals	
39.	Distribution of farmers based on of type of registration	
40.	Distribution of farmers on the basis of frequency of visits to selected Agri-portals	
41.	Distribution of farmers according to information sharing behavior about the selected Agri-portals	
42.	Distribution of farmers based on of number of persons shared about selected Agri-portals	
43.	Distribution of farmers based on nature of persons shared	
44.	Distribution of farmers on the basis of gratification of recommended practices of selected Agri-portals	
45.	Distribution of farmers based on gratification of overall services of selected Agri-portals	
46.	Distribution of farmers on the basis of immediacy of feedback	
47.	Distribution of farmers based on utilization of knowledge gained through selected Agri-portals	
48.	Distribution of farmers based on knowledge level	

	about selected Agri-portals	
49.	Distribution of farmers on the basis of opinion of content relevance	
50.	Distribution of farmers based on design features of selected Agri-portals (Agropedia)	
51.	Distribution of farmers based on design features of selected Agri-portals (aAQUA)	
52.	Distribution of farmers based on usability features of selected Agri-portals	
53.	Extent of adoption of practices recommended by Agropedia	
54.	Extent of adoption of practices recommended by aAQUA	
55.	Extent of economic change among the users of selected Agri-portals	
56.	Extent of economic change among the users of selected Agri-portals	
57.	Major constraints expressed by users of selected Agri-portals	
58.	Relationship with socio-personal and communication characteristics with dependent variables	
59.	Model for dependent and independent variables	
60.	Distribution of stakeholders on the basis of content relevance of selected Agri-portals	
61.	Distribution of stakeholders based on design features of selected Agri-portals	
62.	Inputs used in implementation of selected Agri-portals	
63.	Distribution of scientists on the basis of human resource involved	

L I S T O F F I G U R E S

L I S T O F P L A T E S

17.	KVK, Jeolikote (Nainital)	
18.	Interviewing KVK, functionary	
19.	KVK, Kashipur (U. S. Nagar)	
20	KVK, Dhakrani (Dehradun)	
21.	Primary school at Dharmawala, Dehradun	
22.	Water source at Dharmawala, Dehradun	
23,24	Researcher interviewing the farmers	
25,26	Researcher interviewing the farmer and farm women	
27,28	Researcher with farmer and farm women	
29	Researcher with KVK scientist and farm women	
30	Researcher with KVK scientist	

LIST OF ABBREVIATIONS

aAQUA	-	Almost All Questions Answered
KVK	-	Krishi Vigyan Kendra
GDP	-	Gross Domestic Product
ICT	-	Information and Communication Technology
TARI	-	Telecom Regulatory Authority of India
NPPF	-	National Policy for Farmers
ICAR	-	Indian Council of Agricultural Research
SPSS	-	Statistical Package for Social Service
VIC	-	Village Information Center
IIT	-	Indian Institute of Technology
IDI	-	ICT Development Index
ITU	-	International Telecommunication Unit
IT	-	Information Technology
ICT4AD	-	Information and Communication Technology for Agricultural Development
GBPUAT	-	Govind Ballabh Pant, University of Agriculture and Technology, Pantnagar, Uttarakhand
NAIP	-	National Agricultural Innovation Project
SMS	-	Short Message Service

Chapter1 INTRODUCTION

Agriculture is the most important sector of Indian economy, contributes 23 per cent to national GDP, accounts for eleven per cent of exports and 50 per cent of population depends on it. Increasingly India feeds sixteen per cent of World population with 2.4 per cent of global land.

In the last five decades, there has been a steady and spectacular transformation of Indian agriculture from the food deficit to food sufficient status. Diffusion and adoption of modern technologies, high yielding varieties, dedicated efforts of farmers, extension personnel and scientists and also programmatic support of Central and State Governments have all contributed significantly from 50 million tons in 1950-51 to land mark achievement of 230.67 million tons of food production in 2008-09.

Agricultural sector challenges

The challenges before Indian agriculture are immense. The sector needs to grow at a faster rate than the past to allow for higher per capita income and consumption. It is an accepted fact that the sound agricultural development is essential for the overall economic progress of India. Given the range of its agro-ecological setting and produces, Indian agriculture is faced with a great diversity of needs, opportunities and prospects. The water-scarce rain fed areas, which accounts for 63 per cent of the cultivated land, exhibit low and also unstable yield and technology transfer gaps are much wider as compared to those of un-irrigated areas

(Chatterjee and Prabhakar, 2009). The National seminar of agricultural extension 2009 background note states that sustaining growth rate and achieving the required food grain production of 320 million tons by 2025 would be a herculean task considering some of the challenges like non-expanding land, depleting soil and water resources, adverse impact of climate change, rising cost of production, diminishing agriculture labor availability and farmers' reduced interest in agriculture **(NSAE, 2009)**. If India is to respond successfully to these challenges and also to achieve accelerated growth there is needs to have greater use of modern information and communication technology among, researchers, extension personnel, farmers and other stakeholders. Further, the agricultural extension requires paradigm shift from top-down, blanket recommendation of technological packages towards providing producers with the knowledge and understanding with which they solve their own location specific problems. Continuous two-way interaction among the farmers, agricultural scientists and extension personnel is the most critical missing component of agricultural extension **(Chatterjee and Prabhakar, 2009).** To assist the farmers in these changing contexts, new strategies and innovative solutions are urgently required which in turn will require technological support.

Need for ICT in Agricultural Extension

1. **To accelerate agricultural growth**

Recommendations of the Planning Commission of India's working group on agricultural extension for XI five year plan (2007-2011) states that the agricultural growth is stagnating and sluggish. Hence, there is an emergent need of vibrant, dynamic and innovative approach to be adopted for agricultural extension in order to achieve targeted growth rate and serve the farmers better. Integration of ICT in agricultural extension will provide needed impetus to agricultural sector.

2. To expand knowledge resource

Land and water resources are almost reaching their limits; hence, achieving food security heavily relies on "Knowledge Resource". In this scenario, ICT can complement the traditional extension system for "Knowledge Resource" delivery to the millions of the farmers.

3. To facilitate better information access

Estimates indicated that 60 per cent of farmers do not access any source of information for advanced agricultural technologies resulting in huge adoption gap **(NSSO, 2005)**. In this context, it is expected that convergence of ICT with traditional extension system will improve the farmers' information access.

4. To supplement inadequate technical manpower

In India, there are about 120 million farm holdings and the number is growing year by year. It proposes to provide one village extension personnel for 800-1000 farm families than the requirement of field level extension worker is estimated to be about thirteen lakh to fifteen lakh, against which the present availability is only one lakh extension worker **(Planning Commission, GOI, 2007)**. In this scenario, inadequate technical manpower to be for some extent compensate by the extensive use of ICTs.

5. For stronger research-extension client system linkage

ICTs are required to facilitate stronger linkages with research-extension-client system. The feedback received through ICTs to be more accurate and faster.

6. To develop efficient feedback mechanism

Lack of efficient feedback mechanism in the research-extension linkage was identified as one of the weaknesses in the existing extension systems. Hence, it is believed that the media and ICTs will offer strong potential to improve linkage mechanism.

7. For cost-effective extension delivery

The ICT tools such as Internet and mobile networks have the potential to provide agro-information services that are affordable, relevant (timely and customized), up-to-date, high accessibility and farmer friendly.

8. To develop knowledge managers

The existence of rural centers shows that ICTs can help in enabling rural development workers to gather, store, retrieve, adapt, localized and disseminate a broad range of information needed by rural families. This in turn leads to the emergence of knowledge workers that will result in the realization of bottom-up, demand driven paradigm for technologies generation, assessment, refinement and adoption.

9. To ensure gender equity in technology transfer process

Traditional extension is widely criticized for not concentrating women cultivators. Research evidences shows that ICT enabled extension system offers equal opportunity to the farm women.

10. To empower small and marginal farmers

In India, 77 per cent of cultivators are marginal farmers. Land holding declined from 2.28 hectares to 1.41 hectares per family. Empowering small and marginal farmers with the right information at the right time and at right place is essential for improving efficiency and vitality of small and marginal holding **(National Policy for Farmers, 2007)**.

11. To serve the farm stakeholders beyond technology transfer role

There is a growing recognition that extension must go beyond transforming new food crop technology to farmers and focus on helping the rural poor by promoting agriculture diversification, increasing rural employment and helping farmer gain access to biotechnology and access to export markets and also environment awareness and rural health awareness. To perform this expanded role, extension systems should be equipped with ICTs.

ICT infrastructure scenario

Strategic reforms in telecommunication sector since 1990s, facilitates strong ICT infrastructure in India. As on May 2009, 452.91 million fixed land line telephones, 415.25 million wireless and 6.4 million broadcast subscribers were estimated by the Telecom Regulatory Authority of India **(TARI, 2009)**. The tele-density has reached 38.88 (number of telephone subscribers per 100 individuals). However, there is a huge gap between urban and rural tele-density, 64.48 and 9.03 respectively. Despite several policy initiatives to promote rural ICT penetration, growth in tele-density continues to be skewed in favor of urban India. Total internet users are 49.40 million. In rural India only 1.2 per cent people have internet access, whereas it is 12 per cent in urban India. The overall urban and rural mobile penetration remains 43.88 and 4.92 per cent respectively.

National Policy on ICT in Agricultural Extension

National Policy Framework for Agricultural Extension (2000) stated that information technology revolution is unfolding and has very high visibility. Harnessing information technology for agricultural extension will receive high point in the policy agenda. Extensive use of modern information technology will be promoted for communication between researchers, extension workers and their farmer clients to transfer technologies and information more cost effectively. Further, it emphasized IT application in marketing, wider use of electronic mass media for agricultural extension, farmer participation in IT programs and support to the state government for using IT in agricultural extension, promoting IT based information kiosks and capacity building for use of IT **(DoA&C, 2000)**.

National Policy for Farmers (2007) indicated that the potential of ICT would be harnessed by establishing Knowledge Centers in villages. Further, the Common Service Centers (CSCs) of the Department of Information Technology, Ministry of Communication and Information Technology, Government of India and those set up by the state governments and private initiative programs will be evolved for inclusive broad-based development. Last mile and last person connectivity would be facilitated with the help of technologies such as broadband internet, community radio or internet-mobile phone synergies **(NPFF, 2007)**.

Document of ICAR Framework for Technology Development and Delivery System in Agriculture (2008) outlined the need for the construction of Agri-India Knowledge Portal – A single electronic gateway to be developed through a peer review process with the help of fifteen content accreditation centers from fifteen agro-climatic regions of the country. Each accreditation centers will be coordinated with other Agricultural Universities and agricultural institutions in their region for development of content in regional language as well as in English and also do its validation, which will be collected in the central data warehouse integrated in the knowledge portal. The portal will also serve as a platform for facilitation of interaction among researchers and extension personnel in the KVKs through high speed server intranet **(ICAR-FFTDDSA, 2008)**.

ICT initiatives for agricultural development in India

There have been number of initiatives in India, using ICT for agricultural development. In most of these projects, agriculture is only a small component. Indian experiences with IT projects are:

- Information Village project of the M S Swaminathan Research Foundation (MSSRF) (Pondicherry); Digital Green, Virtual Academy for the Semi Arid Tropics (VASAT), *Gyandoot* project (Madhya Pradesh); *Warana* Wired Village project (Maharashtra); *iKisan* project of the Nagarjuna group of companies (Andhra Pradesh); Application of Satellite Communication for Training Field Extension Workers in Rural Areas (Indian Space Research Organization); Automated Milk Collection Centers of Amul Dairy Cooperatives (Gujarat); Land Record Computerization (*Bhoomi*) (Karnataka); Knowledge Network for Grass Root Innovations – Society for Research and Initiatives (SRISTI) (Gujarat).

In addition to the above, a few non-governmental organizations (NGOs) have initiated ICT projects such as: *Tarahaat*.com by Development Alternatives (Uttar Pradesh and Punjab); VOICES – Madhyam Communications (Karnataka); Centre for Alternative Agriculture Media (CAAM).

Some exclusive agricultural portals are also available, such as: *Haritgyan*.com, *Krishiworld*.net, *TOEHOLDINDIA.com*, *Agriwatch.com*, ITC's *Soyachoupal.com*, IFFCO Agri-portal, InDG – India Development Gateway Portal, *Acquachoupal.com*, *Plantersnet.com*, *Agmarknet.nic.in*, *ikisan.com*, *agrisurf.com*, *indiancommodity.com*, *aAQUA*, *Agropedia*

Need for analyzing ICT in agriculture

Keniston (2002) stated that "At least fifty grassroots projects are currently using modern ICT for development in India. Surprisingly, these projects have been studied. No comparison has been made between them. These are seldom in touch with each other. Lessons learned in one project are not transmitted to others. Appropriate technologies are rarely evaluated. Central questions of financial sustainability, scalability and cost recovery are hardly ever addressed. So, opportunities to learn from the diverse, creative Indian experience so far remain almost entirely wasted". Even after experimenting hundreds of ICT projects for rural development in the last one decade, observations mentioned above are still very much relevant; and also preliminary hypotheses on grassroots ICT projects in India by **Keniston (2002)** are yet to be fully tested. To our knowledge, so far there is no large survey data-based evidence on the impact of ICT on agricultural extension services delivery in remote hilly areas probably due to the lack of reliable data on outcome variables, as well as variations across extension and non-extension communities and between users and non-users in observable and unobservable factors **(Aker, 2010)**. There is an urgent need to explore the short term and long term impact of these ICT projects to understand its worth on the farming communities.

1.1 Statement of problem

It has been argued that Information and Communication Technologies (ICT) can lead to development in developing countries. The World Bank, the United Nations (UN) and other donor agencies are directly-indirectly implementing ambitious multi-million dollar Information and Communication Technologies (ICT) - supported agricultural projects in developing countries. These projects aim to unlock the potential of ICT to improve the quality of life for poor, often rural farming communities **(Harris 2005)**. **Heeks and Molla (2009)** found in their ICT evaluation compendium that ICT is not fully utilized in agriculture. Scaling up of delivery, monitoring and evaluation still remains at experimental stage. There is much hope for sustainable impact arising from development-oriented ICT interventions, especially in the field of agriculture in remote hilly areas **(Mbarika, Okoli, Byrd & Datta 2005; Meso, Datta & Mbarika 2006)**. In the past, emphasis has been placed on the supply side (for example, infrastructure building) rather than the demand side (for example, farmers' willingness and capacity to acquire/use services) **(Ashraf, Hanisch & Swatman 2007; Heeks 2002)**. Hence, the main focus of the interventions has been the implementation of ICT for agricultural development (ICT4AD) projects, rather than understanding the impact at farming community level. This lack of understanding has led to many failures of ICT4AD projects reported in the literature **(Heeks 2002)**. Rather than a top-down imposition of infrastructure approach, with little understanding for their ultimate consequences, we consider there is need to understand impact of ICT4AD projects at the local context, which can then inform the policy and strategic levels. But the methodologies used to evaluate the impact of ICT on stakeholders communities are still an open issue.

Uttarakhand is a newly carved state, progressing rapidly because of the high literacy rate. But the farmers have to face many hardships because of the lack of basic amenities, almost no connectivity with the outside world. Physical reach is very tough for information dissemination. Despite the huge potential to harness ICT for agricultural development, only a few isolated projects have been tried in Uttarakhand like e-*chaupal*, Rural Knowledge Centers, Agriculture Technology Information Center (ATIC), *Janadhar Soochna Kutir* (JSK), and Village Resource Center etc. Adding to the series of these projects National Agricultural Innovation Project (NAIP), Indian Council of Agricultural Research (ICAR) funded two Agri-portals viz. Agropedia and aAQUA were launched at country level and also widely implemented in Uttarakhand. These portals were specifically designed and developed to transmit the latest crop, location and language specific information to the Indian farmers in general and farmers of Uttarakhand in particular. **Barala and Kameswari (2006)** reported that most of the farmers felt that RKCs were highly reliable because *sanchalak* belonged to their own village where as the extension agent was not personally known to them. RKCs were easily accessible then extension agents because centers were established in the same village. Majority of the respondents expressed greater credibility in RKCs than traditional extension agencies because of the negative perception of the government services and lack of trust in them. They also reported that farmers found difficult to understand the information provided due to the scientific language used.

Ansari and Yogeshwar (2009) reported that a large majority (90%) of the farmers were satisfied with the *e-chaupal* services. Farmers also appreciated the convenience of services, ease of accessibility of e-*chaupal*, credibility and reliability of information provided by e-*chaupal*, immediacy of feedback, comprehensibility of message frequency of contact, capability and availability of e-*chaupal* facilitators in attending to their problem.

Richardson and Sirimanne (2001) revealed that the benefits of expanding ICT to major urban cities have been well documented. But their impact on rural stakeholder community is not analyzed. Unfortunately, very few attempts have been found in hill conditions to evaluate ICT projects. This is coupled with the fact that evaluation of ICT on farming communities is still an open issue in terms of the methodologies and impact.

Since, Agri-portals are in existence to provide agricultural information in local language for the first time. Thus, problems and prospects of Agri-portals need to be explored in Uttarakhand to identify its impact on target audience and for further recommendations. Since, ICT for agricultural development is new in India in general and in Uttarakhand in particular, any attempt to evaluate only the end results would be premature and it is too early to expect concrete and sound results from these projects. Hence, the present study is planned to measure process impact of the selected Agri-portals rather than end result impact. Some of the researchable questions relevant in this context are:

- What are the socio-economic and communication characteristics of users of Agri-portals of Uttarakhand?
- How are these Agri-portals utilized by the farmers?
- Is there any impact of services of Agri-portals services on users?
- What are the opinions of different stakeholders about selected Agri-portals?
- What are the constraints faced by the users to avail the information from selected Agri-portals?
- Is there any influence of background characteristics on impact indicators of Agri-portals?

To answer these research gaps, the present study entitled "**Impact Assessment of ICT - enabled Knowledge sharing Agri-portals in Uttarakhand**" was conducted with the following objectives:

1. To study the socio-economic and communication characteristics of farmers of Uttarakhand.

2. To study the impact of selected Agri-portals.
3. To find out the relationship between background variables and selected impact indicators.
4. To study the constraints faced by users of selected Agri-portals.
5. To seek opinion of stakeholders on content relevance and design features of selected Agri-portals.

1.2 Scope of the study

It is well known that ICT projects in agriculture are multiplying with a fast pace but its evaluation is still an open issue for the researchers. The present study is an effort to unravel some researchable questions of evaluating ICT in agriculture. Impact assessment index, developed for the present study will be a significant contribution which can be further used by the research community to develop a tool of this kind for evaluating other ICT projects. This study will help the project development agencies to understand by exploring the constraints being faced by the farmers which hinder the success of many such initiatives. Findings of the study will also help the portal managers to understand the worth of these Agri-portals and to help the SAU scientists to modify or change the content to make it user friendly.

It will be helpful in effective implementation of these Agri-portals by providing information on opinion of all the stakeholders. There is dearth of impact studies conducted on the performance of ICT in agriculture. An effort has been made to find out various dimensions of its impact by utilizing intensive impact assessment models. This model can be further replicated for conducting impact studies of similar projects. Findings of the study will also be relevant for various social science disciplines, development studies, communication science and information technology sector. Publication of research results dissertation in social science journals, conferences and seminars about indicators of impact assessment of ICT in agricultural project will explore new areas.

1.3 Limitations of the study

Limitations of the study are as follows:

1. The study was conducted in selected districts of Uttarakhand stateon selected progressive farmers; therefore, the findings can not be generalized for small and marginal farmers of other states and even to the other progressive farmers of the state. However, these can be considered for progressive farmers with infrastructure similar to locations selected for the study.

2. Since, findings of the study are based on expressed response of the respondents; the objectivity of study was limited to the frankness and fairness of respondents in furnishing the information.

3. The study was conducted in geographically tough locations with bare minimum transportation available, so reaching to each and every farmer to interview them was a hard-hitting job for researcher.

4. The study also had limitation of time and resources faced by single investigator.

5. Mailed questionnaire had a usual limitation of low response rate.

6. The study had limitation of contacting the portal managers from IITs, scientists of State Agriculture University and *Krishi Vigyan Kendras.*

1.4 Organization of the thesis

The study is presented in six chapters. The first chapter “Introduction” highlights the problem statement, objectives, scope and limitations of the study. The second chapter focuses on “Review of Literature” which would help in understanding the past studies and experiences. In “Conceptual Orientation” theoretical aspects of research topics are discussed and elaborated. “Research Methodology” gives details about locale, selection and sampling procedures, operationailzation of variables and their measurements, research design, tools and techniques of data collection and statistical analysis. The fifth chapter consists of “Results and Discussion”. Finally summary of findings and their implications have been reported in the sixth chapter “Summary and Conclusion”.

The literature consulted and cited in the body of presentation has been enlisted in the section under “Bibliography”. This is followed by relevant appendices.

Chapter 2 REVIEW OF LITERATURE

Review of literature assists in delineation of the problem area and provides a basis for interpretation of empirical perspective of research. It helps in providing basic knowledge and understanding of the research trends in the use of Information and Communication Technology in agriculture. With this fact in mind, modest effort has been made to review the researches, survey reports, books, journals, magazines, popular articles and other sources of information relevant to the study. The collected review has been categorized under the following heads:

2.1 Socio-economic and Communication characteristics of farmers

2.2 Impact assessment of ICT in agriculture

- **2.2.1** Information Communication Technology
- **2.2.2** Impact Assessment
- **2.2.3** Impact Assessment Index
- **2.2.4** Research methods of impact assessment of ICT
- **2.2.5** Impact Assessment of ICT initiatives in agriculture

2.3 Relationship between background variables and selected impact indicators

2.4 Content and design features of Agri-portals

2.5 Constraints faced by farmers in using ICT

2.6 Farmers' opinion and constraints on ICT use in agriculture

2.1 Socio-economic and Communication characteristics of farmers

Kandpal (1984) revealed mass media exposure of the farmers and found that they had high degree of exposure to radio, newspaper, print media and farm demonstrations in case of progressive village than that of non progressive village. However, the respondents had no exposure to films and exhibitions.

Selveraj (1985) revealed that farmers were mostly dependent on personal localite sources like friends, neighbors, progressive farmers and village extension workers. Among the personal cosmopolite agriculture extension sources, magazines, cooperative members and subject matter specialists were found to be least used by contact farmers, whereas the least used sources of information for non contact farmers village level worker meetings, demonstrations, campaigns, cooperative members, agriculture extension officers, and subject matter specialists.

Srivastava (1990) reported that media ownership was quite high but the frequency of utilization was limited among the farmers of Nainital district. Most of the respondents 'owned and listened to radio' and 'owned and viewed television'. One fourth of the respondents subscribe to newspapers and magazines.

Mukhopadhyay and Ramdurai (2001) reported that large farmers received highest amount (91 per cent) of farm information followed by small farmers (57 per cent) and marginal farmers (39 per cent) in decreasing order of information reception. Large farmers' access to different information channels was much higher in contrast to the other categories of farmers.

Saade (2008) reported that 48 individuals participated in the portal survey, 75 per cent of which were male, 35 per cent of respondents claimed to have access to two or more computers. Only one respondent reported that he had no access to computer.

Sasidhar (2008) reported that majority (63.51 per cent) of the registered farmers of the Backyard Poultry Farm School were middle aged, male (75.7 per cent), belonged to backward (47.3 per cent) and scheduled caste/tribes (31.1 per cent). Majority (66.2 per cent) of the participants' belonged to nuclear families and most of them (44.6 per cent) had occupation as agriculture followed by livestock (28.4 per cent) rearing. All of them were educated and majority (74.3 per cent) of them studied up in middle school and above.

Singh *et al.* (2008) reported that most of the farmers had education up to primary level (34 percent), 11 per cent farmers were illiterate and 25 per cent were able to read and write. The majority of the farmers of Varanasi and Mirzapur districts of Uttar Pradesh had small to medium land holdings (1 to 1.5 hectares).

Chauhan (2010) observed that 64 per cent of the internet facility expecting farmers were from the middle age group, with a high school and higher secondary level of education (45 per cent) and had joint family. 60 percent of the respondents belonged to a small category of farmers with mixed farming as a main occupation. In order to earn additional income along with farming about 46 per cent of them possessed two or more animals. More than half of the respondents were found to be the member of one or more organizations.

Michailidis *et al.* (2010) aimed at exploring farmers' use of ICTs and their views on preferred extension media drawn from a survey of 490 farmers in the region of Western Macedonia. Analysis showed the existence of three farmers' classes regarding the use of a range of ICTs: 'high' (10%), 'medium' (40%) and 'low tech' (50%) farmers. The first class, use mobile telephones, PCs, internet and e-mail very often while the third one rarely or never. Furthermore, the three classes were found to differ in terms of gender, marital status, farming mode (full or part-time farming), and income sources and estimated farm net worth. Further, ICTs adoption is significantly related to factors such as annual income, farmers' classification, familiarity with ICTs and education, with gender being a supporting factor.

2.2 Impact assessment of ICT initiatives

2.2.1 Impact Assessment

Gosling and Edwards (1995) explained that a successful impact assessment needs to explore the whole 'impact chain' and so investigate the linkages between inputs and activities, how these generate the outputs which then produce outcomes and finally impact. Originally, impact assessment have been single method, there has been move towards multi-method approaches. Method of assessments includes surveys, appraisals, observations, case studies and participatory learning.

Bird (2002) defined that impact assessment is a formal evaluation type of study that assess the extent of implementation and influence of a specific program or project on desired outcomes and data collected is used to measure the extent of desired changes in the targeted population.

Hailey and James (2003) reported that any impact assessment initiative entails the identification of units of assessment. These units of assessment which are sometimes viewed as levels of assessment include the individual, household, organization, community, development agency, institutions and any combination.

Higher Education Funding Council (2004) defined that impact study tends to focus on specific contexts and do not attempt to generalize beyond the case at hand. They often use a range of qualitative and quantitative tools but rarely use control or comparison groups and statistical methods to test specific hypotheses. To be more specific, the impact assessment aims at measuring not only outcome attainment but its level of success.

Rosenzweig *et al.* (2009) defined impact as the difference between what actually happened as a result of the implementation of a program, and what would have happened if the program had not been implemented.

Impact evaluation is the process of identifying and measuring the impact (positive or negative) caused by such an intervention. Impact often takes time to become apparent, and can be caused by many factors other than one specific program.

2.2.2 Impact Assessment Index

Saade (2008) included the items related to the participant's experience with the portal and in relation to the following constructs: satisfaction, portal quality, usability, usefulness, ease of use, reasons to access the portal, component based evaluation, attitudes, intimidation and anxiety.

Karthikeyan (2008) developed five indicators for the evaluation of *Kisan Call Centre* with respect to the logic model approach. The broad indicators were awareness about the *Kisan Call Center* which included users' level of awareness and source of awareness, participation of the users, adoption of the recommended practices, information sharing behavior of the users and gratification of the services of *Kisan Call Center*. These indicators were further subdivided.

Vaisla and Bisht (2010) conducted a study on "SWOT Analysis of e-Initiative in Uttarakhand". A scale on "Impact Assessment of e-Initiatives in Uttarakhand‟ had been prepared for the study. The questionnaire contained the feedback of different e-Initiatives of the state covering IT awareness, infrastructure issues, effectiveness, and necessity of the programs to the grass root levels. It was a five point scale and contained 28 statements. Out of these 28 statements 14 statements were positive and 14 were negative.

An individual score was interpreted on the basis of the scale prepared "The higher the score the more favorable is the perception of respondent towards the effectiveness of e-Initiatives and the lower the score the less favorable is the perception of respondent towards the effectiveness of e-Initiatives".

2.2.3 Impact Assessment of ICT initiatives in agriculture

Richardson (1997) based on evaluation on an Internet project *communication para el Desarrollo en America Latina* reported that the ICTs used were appropriate and cost effective. Farm families were the main beneficiaries of training and information activities, intermediaries and extension workers had acquired more knowledge, skills and experience to train farmers and provide them with technical information. All stakeholders had access to better communication tools to facilitate transfer of knowledge and skills to the wider community.

Balit (1998) evaluated an internet based project in *America Latina*. The project was about sharing knowledge and skills with small subsistence farmers. The project also trained critical masses of national staff in the production and use of various communication channels preferred by peasant farmers and semi-literate rural populations. The project proved very successful and soon spread throughout the region and beyond China, Indonesia and the Republic of Korea.

Lukeeram *et al.* (2000) found that the faculty of agriculture of the University of Mauritius has developed a computer based information system- the Potato Extension and Training Information System (PETIS). PETIS uses the internet and will test whether rural communities can use the web to access information.

The system, destined principally for the small-scale potato growers, is equipped with audio files that provide information in English. Illiterate users have an option to read the summary of the content in Creole and Bhojpuri and icons and pictures that enable most rural users to navigate easily the basic levels on the site. The system has been rated very successful and research team is now exploring touch screen.

Munyua (2000) pointed out that through the establishment of rural information centers, ICT can create employment opportunities in rural areas by engaging info-kiosk managers, subject matter specialists, translators and information technology technicians. Such centers help bridge the gap between urban and rural communities and reduce the urban migration problem. He further reported that in Uganda, the National Agricultural Research Organization (NARO) and CAB International (CABI) are implementing a project entitled "*Electronic Delivery of Agricultural Communication in Uganda*".

Leewis (2001) revealed that new information services to rural community over which farmers, as users, will have much greater control than over current information channels. Even if every farmer does not have a computer terminal, these would become readily available at local information resource centers, with computer carrying expert systems to help farmers to make decisions. However, it will not make extension workers redundant. Rather they will be able to concentrate on tasks and services where human interaction is essential in helping farmers individually and groups to diagnose problems to interpret data and to apply their meaning.

Radhakrishna (2003) stated that Karnataka's Bhoomi project has revolutionized the way people access information on land records. Several of the 7, 00,000 land records are available online for banks, judicial courts and hundreds of village kiosks all across the state. Bhoomi, a successful project, is the only one and premier e-governance project in India that has recovered 70 per cent of revenues of the total investment in the project, which is expected to generate more than Rs 10 crore every year.

Mathew (2005) revealed that the Akshaya project has facilitated creation of ICT access in every village in the district and 100 per cent awareness of how ICT can influence people's lives. The project "Market-led Agricultural Initiatives through IT-enabled Agri

Business Centres in Kerala" is positioned to provide content and services delivery platform to stakeholders in the farming sector. It is building a robust, replicable, scalable and sustainable ICT application in the agricultural sector to provide transaction services to farmers and input/output providers".

Krishnareddy and Ankaiah, (2005) reported that deploying e-Sagu prototype increased income of the farmers to the tune of INR. 3075 (63 USD) per hectare and also reduced the pesticide usage. Further, their rudimentary estimate of economic advantage indicated that if e-Sagu prototype used for 1000 farmers, overall net benefit with the proposed ICT based system is INR 100 million (USD 204800).

Balaji *et al.* (2007) reported that ICRISAT, Hyderabad, has initiated the Virtual Academy for the semi-Arid Tropics (VASAT) as a technology mediated extension and knowledge sharing program. As part of the VASAT activities, two field projects (one in India and another in Niger) involving the participation of rural community based organizations were launched in 2004. In *Adakkal* region (South Central India), the VASAT project involved a local community based organization, *Adarsha Mahila Samaikhya*. A module prepared by ICRISAT experts was rendered into local language and the info-mediaries were administered, which helped the volunteers to "refine" farmers' queries before passing them to the experts. The ISRO supported video-conferencing and online forums in support of the agriculture related question and answer processes and also GIS derived tools were successfully experimented for micro-level drought preparedness. Now, AMS is a large SHG of 8000 women, running an *Adarsha Restaurant and Adarsha Handloom* and giving rainfall data to the farmers of

Adakkal and nearby villages and employed almost all the village residents.

IIM, Ahmedabad (2007) prepared report on "Impact Assessment Study of E-governance Projects in India". The report concluded that users of e-Seva have reported a significant improvement over the manual system of dealing with individual agencies. The composite score has moved from 3.39 (slightly better than satisfactory) to 4.66 (close to very good). e-Seva has lowered the travel costs by Rs 9.3 per transaction for its users who are all urban. Waiting time in e-Seva Centers has been halved in comparison to agency counters from 32.9 minutes to 14.6 minutes. There has been a significant improvement of 0.79 points on a 5 point scale in the quality of governance. There has been a significant improvement of 0.94 points in service quality on a 5 point scale. 96.84 per cent of respondents preferred the e-Seva system over the departmental systems.

Aker (2008) examined the impact that the introduction of cell phones has had on grain trade throughout Niger. Using an original dataset that combines data on prices, transport costs, rainfall and grain production, she shows that cell phones reduce grain price dispersion across markets by a minimum of 6.5 per cent and reduce intra-annual price variation by 10 per cent. The primary mechanism by which cell phones affect market-level outcomes appears to be a reduction in search costs, as grain traders operating in market with cell phone coverage search over a greater number of markets and sell in more markets. The results suggest that cell phones improved consumer welfare during Niger's severe food crisis of 2005, perhaps averting an event worse outcome.

Gandhi *et al.* (2008) indicated that the Digital Green project increased the adoption of certain agricultural practices sevenfold over a classic extension approaches. The digital Green project was shown to be ten times more effective per dollar spent. Further, 85 per cent of adoption of improved technologies achieved as against 11 per cent of adoption by traditional extension methods. **Gandhi *et al.* (2009)** also reported positive social effects and other qualitative results of Digital Green project of participatory video for agricultural extension.

Sarvanan (2008) reported that the cost and time indicators comparing traditional extension system and e-Arik (e-agriculture) project, sixteen fold and three fold less time were required to the clientele availing and extension system delivering extension services, respectively. It was further reported that 3.4 fold economic benefit as compared to the expenditure of deploying e-agriculture prototype.

Karthikeyan (2008) reported in the study conducted on "Formative Evaluation of *Kisan Call Center* in Tamil Nadu" that almost cent per cent (99.62 per cent) of the calls were made by men followed by less than half per cent (0.38 per cent) of the calls made by women. It is well known that in our rural society, male had higher exposure to external situations than female. Even though female have more involvement in agriculture and allied fields still male always prefer to utilize new technologies and innovative approaches in transfer of technology due to their exposure to the outside world.

Saade (2008) reported that online portal survey with the respondents indicated that they were somewhat satisfied with the achieved portal outcomes; in meeting their expectations and that the components were favorable to their needs. However, they reported that they are not too happy at trying enough to use the portal. Most participants agree that the content is useful, clear, concise, and accurate but not complete or current. Also, most of them agreed that the portal interface is acceptable and readable with no complaints in terms of availabilities, loading speed, colors, organizations etc. Many expressed that the portal did not have adequate search facilities.

It was concluded by the users that discussion and white boards, content repository, book catalogue and distance learning were not well done and were found to be disadvantageous, worthless and useless.

Ansari and Yogeshwar (2009) reported that a large majority (90%) of the farmers was satisfied with the e-chaupal services. Farmers also appreciated the convenience of services, ease of accessibility of e-chaupal, credibility and reliability of information provided by e-chaupal, immediacy of feedback, comprehensibility of message frequency of contact, capability and availability of e-chaupal facilitators in attending to their problem.

NAIP Project Report (2010) reported that the delivered SMS had average impact (87.17 per cent) among the farmers, content was moderately relevant (58.97 per cent) followed by highly relevant (38.46 per cent). It was found that most (48.17 percent) of the farmers adopted the crop tips up to 33-66 per cent followed by 33.33 per cent farmers who adopted those tips more than 66 percent delivered via aAQUA. According to the report most of the queries were posed about cotton crop.

Goyal (2010) has carried out one of very few studies which attempt to quantify the impact of improved market information through IT technology – in her case, computer terminals. Her work demonstrated that in areas where there was much improved access to and dissemination of market price information (through the presence of e-chaupal), farmers obtain wholesale prices of between 1 to 5 per cent higher (with an average of 1.6 per cent) than in areas where market information was less transparent.

Mittal (2010) in a study on "Socio-economic Impact of Mobile Phones on Indian Agriculture" revealed that many of the small farmers said that they benefitted from greater convenience, the saving stemmed typically from avoiding local travel and could range from ₹100-200 per trip. A small minority said that they had derived greater benefits from the ability to make better decisions about where to sell their output after getting market prices for a variety of local and distant markets.

Vaisla and Bisht (2010) studied the strengths, weaknesses, opportunities and threats of social and technological aspects of information communication technology while analyzing the impact of e-Initiative in Uttarakhand. Result findings were:

Social aspects

Strengths	**Weaknesses**
• People eager to learn Internet • People eager to learn IT skills	• Basic education poor • Low literacy • Low IT literacy • Different Languages • Public acceptance of self service models
Opportunities	**Threats**
• Employment increases • Education system will improve • People get structural job • Cheap manpower will widely available	• Brain drain of IT skilled people after training • Influence of another culture • Resistance of people • Digital divide

• Promotion of internet	• Privacy

Technological Aspects

Strengths	Weaknesses
• Everything is new: no negative legacy • Leapfrogging possible • Good Telecom and Mobile users Internet as pull factor • Use of Open source software	• Shortage IT skills • High cost of internet • Heterogeneous data • Lack of IT standards • Software licenses
Opportunities	**Threats**
• 2nd hand hardware available • Use of PPP mode for technology outsourcing	• Dependency on technology

2.2.5 Research methods to reveal impact of ICT

Geethakutty (2008) conducted an evaluation study on Women in Agriculture programme area of Palakkad district, Kerala. From among the 750 farmwomen participants of the programme; 60 respondents were selected following stratified random sampling procedure (two groups each of 5 members from 6 blocks from the above district). From among 79 agricultural functionaries who were directly involved in the programs in its various implementation periods, 50 were randomly selected as respondents. Using pre-tested structured interview schedule relevant data were collected through personal interview from the farm women respondents. The agricultural extension functionaries were contacted through a mailed questionnaire. The data received from farm women and officers were compiled and analyzed using SPSS and Excel packages of statistical methods. Secondary data from the earlier evaluation studies about the programs were also utilized to draw the conclusions of the present study.

Saade (2008) adopted online questionnaire administration via LUMS (Lahore University Management Science, Pakistan) portal. The portal database included 280 members all of which were sent an email asking them to complete the questionnaire and with a link to it.

The potential participants to the questionnaire were asked to complete it on a voluntary basis with no motivation to do so. Their participation was to be motivated by their desire to give feedback on the portal with the aim that their feedback would be used to enhance the portal for their own better usage.

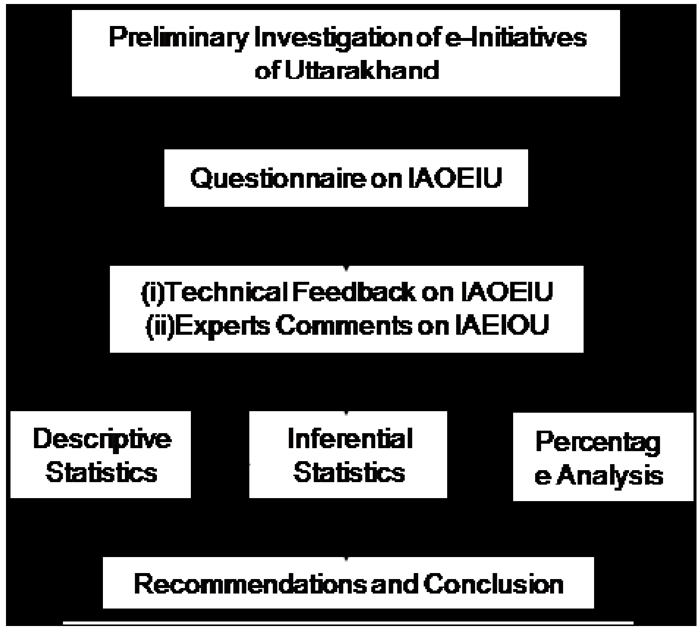
Sasidhar (2008) used a tool called 'Bennett's Hierarchy' (Bennett, 1976), which has been extensively used by extension practitioners for planning and evaluation. The Bennett's Hierarchy describes a series of staircase levels of evidence of program impacts, beginning at the bottom step with "inputs" i.e. allocation of resources to a program and progressing to the top, "end results" i.e., measuring impacts of a program on long-term goals or conditions. While this model is useful for assessing inputs, activities, outputs, reactions and knowledge, opinion, skill and attitude (KOSA) change (level 1-5).

The survey was conducted in eight villages from Bareilly district of Uttar Pradesh by employing a semi-structured interview schedule. The important variables were: radio listening behavior, reactions of participants, perception of participants on farm school sessions broadcasts, opinion, knowledge and attitude of participants, practice change, adoption level of the tips given by farm school etc.

Karthikeyan (2008) evaluated the performance of *Kisan Call Center* I Tamil Nadu at formative stage using Logic Approach Model. These are the tools for program planning, management and evaluation. This model typically depicts the inputs, process/activities, outputs and outcomes associated with an organization and its programs. The study area includes all the 30 districts of Tamil Nadu and two Union Territories namely Andaman and Nicobar Islands and Pondicherry in which the *Kisan Call Center* was operating.

Imas and Rist (2009) advocate a mixed-methods approach, which uses both quantitative and qualitative data, when an evaluator wants to deeply understand the context of why an intervention did or did not work. He states that mixed methods are also useful to validate information coming from different sources, or in the presence of resource constraints resulting in low sample sizes, such as a lack of adequate time or funding.

Vaisla and Bisht (2010) conducted "SWOT Analysis of e-Initiative in Uttarakhand" and adopted the following methodology, where IAOEIU stands for (Impact Assessment of e-Initiative in Uttarakhand)



2.3. Content and design features of Agri-portals

Murray and Costanzo (1999) concluded that although there is no agreed upon list of criteria outlining what usability includes, people generally agree that a usable website is accessible, appealing, consistent, clear, simple, navigable and forgiving of user mistakes.

Lazarus and Mora (2000) revealed unrelated graphics that do not enrich content but distract from important content and comprehension. For lower literacy audiences, it is critical that graphics directly relate "To Whom It May Concern" content. All illustrations; graphics or photos must be placed near the related text/content and when appropriate, be labeled and explained. The users become frustrated if multimedia components like audio, video, text and graphics do not function in synchronized manner. They found that about 11 words per line is good to reduce eye movement and keep the users attention and words familiar to users should be used. Keep sentences simple, specific, direct and written in active voice.

Nielsen (2001) reported that a sample website scored 58 per cent higher in measured usability when it was written concisely, 47 per cent higher when the text was scannable and 27 per cent higher when it was written in an objective style instead of the promotional style used in the control condition. Combining these three changes into a single site that was concise, scannable and objective at the same time resulted in 124 per cent higher measured usability. The design of the website should always reflect the need of its users. Usability is the combination of factors that affect the user's experience accessing a website.

Hofstede (2001) reported that color has been found to pose psychological effects on users that are different across cultures. Color can present opposite meanings such as yellow for cowardice in the United States and grace and nobility in Japan. Therefore, it is important to test colors with members of the intended audience during formative research.

Bernard *et al.* (2001) reported the optimal font size to be 14 or 12 points for online reading. Comparing four Sans Serif fonts (Arial, Comic Sans MS, Tahoma and Verdana) and four Serif fonts (Courier New, Georgia, Century Schoolbook, Times New Roman) at a resolution of 1024 × 768 revealed no difference in effective reading (font accuracy/speed of reading) between font types. They also reported that text in ALL CAPS is difficult to read. Regarding emphasis they found that italics and bold should draw attention to important words or phrases. Excessive use of these devices will clutter the site and distract the user. Whatever navigation is provided by the website should be consistent throughout, so that users do not get confused and perceive that they have entered another website.

Larose *et al.* (2001) concluded that the language in which text is presented on a website is an important consideration in India, where there are around 18 and 96 unscheduled languages.

Benigeri and Pluye (2003) reported difficulties in finding, understanding and using the information have been observed to be the most significant barriers preventing people from using web-based information. Finally, lack of access to the internet and its content, diminishes the effectiveness of the communication medium.

2.3 Relationship between background variables and selected impact indicators

Austin *et al.* (1998) incorporated psychological and social variables and found a positive impact of achievement in farming, production-oriented behavior and intelligence/openness in adoption of computers.

Warren *et al.* (2000) reported that although the adoption of ICT in horticultural production is recognized as a problem, researched that ICT adoption was very scarce. It was found that adoption of ICT was strongly associated with the education level of the farmer and farm size. The impact of age is not so clear. However, some researchers found a negative effect of age on ICT adoption.

Sasidhar (2008) indicated that no participants started backyard poultry farming after listening to farm school. Three fourth of them had no plans to start backyard poultry in the near future. However, 27 per cent of them were already rearing backyard poultry even before hearing the program. This clearly indicates that radio program can create awareness, knowledge and change attitudes but it is difficult to change the practice.

It was also revealed that half (50 per cent) of the participants gained medium knowledge followed by 25.68 per cent high knowledge and 24.32 per cent low knowledge. The corresponding knowledge levels for non-participants were 36.49 per cent, 24.32 per cent and 39.19 per cent respectively. The mean knowledge and range of scores of participants of farm school were more than the non-participants group and 't' value revealed significant ($P<0.01$) difference between them.

Akinyokun *et al.* (2010) in a study on factor analysis of performance indices of information communication and technology projects in Nigeria reported that correlation matrix of the performance indices generated shows that a correlation of 0.91 exists between the 'user involvement in planning' and 'user involvement in feasibility study'. A correlation of 0.94 exists between 'assessment of contribution to growth' and 'assessment of impact on productivity'. The implication is that 'user involvement in planning' is very likely to share the same factor with 'user involvement in the feasibility study'. On the other hand, 'assessment of contribution to growth' is likely to share the same factor with 'assessment of impact on productivity'.

2.4 Constraints faced by farmers in using ICT

Jaggi (2003) stated that there are some key issues affecting ICT initiatives i.e. connectivity in rural areas, literacy level, access cum user friendliness of ICT services, mechanism of content creation and sharing, mediating ICTs to the target groups and availability of funds, lack of awareness and lack of motivation to use information available on the internet.

Singh and Salooja (2004) argued that the impediments of effectiveness of ICT projects are: low computer literacy, non-availability of personal computers, problematic communication backbone, high telecom tariff rates and low bandwidth capabilities of internet service providers. The emphasis should be given to build a core ICT network infrastructure and services with emphasis on making them accessible to the poor e.g. through creation of network of rural knowledge centers.

Gelb (2005) in a study on ICT adoption in agriculture reported the major constraints faced by the farmers. In that inability of farmers to use ICT (12.5 per cent), unperceived economic or other benefits (21.4 per cent), lack of technological infrastructure (28.6 per cent), cost of technology (23.2 per cent), not enough time to spend on technology (23.2 per cent), do not understand the value of ICT (17.9 per cent) and lack of training (17.9 per cent) were found to be the major constraints.

Akpabio, *et al.* (2007) observed that ICT use in developing countries faced constraints relating to physical access, such as poor infrastructure and high costs, are quite common, aggravated by the lack of skills and the dissemination of inappropriate (i.e. provider-driven) information to farmers, including language barriers.

Mittal (2010) reported that in some cases, small farmers and fishermen found the lack of infrastructure, their lack of knowledge regarding the cultivation and marketing of non-traditional crops and their inability to access credit major hindrances to realizing the full benefits of mobile telephony.

Sarvanan (2010) reported that e-chaupal, the largest initiative among all internet based interventions in rural India, reached out to more than four million farmers in over 40,000 villages through 6450 kiosks across 8 states. The problem encountered while setting up and managing this e-chaupal are primarily of infrastructural inadequacy, including power supply, telecom connectivity and bandwidth, apart from the challenge of imparting skills to the first time internet users in remote and inaccessible areas of rural India.

2.5 Farmers' opinion and constraints on ICT use in agriculture

Malik and Bhardwaj (2001) conducted a study on "Perception of Farmers about Establishing Village Information Center in Uttarakhand" reported that majority (94.04 per cent) of farmers opined that VIC should be linked with agricultural universities followed by Krishi Vigyan Kendra (76.63 per cent), suggested opening time for VIC was 4:00 p.m to 9:00 pm by about half of the respondents followed by 4:00 pm to 9:00 pm and 5:00 pm to 8:00 pm.

Chauhan (2010) in the study on farmers' perception about ICT application in Gujarat indicated that 71 per cent of the farmers understood that internet is a rich source to collect world wide information on agriculture and its allied fields, while 72 per cent supported that 'Internet is fastest way to exchange information in shortest time', 65 per cent of the farmers completely or to a certain degree felt that internet is costly affair for the farmers. Internet is best mean to collect information on market prices of agricultural products mix opinion was observed for this aspect and was observed that 41 per cent of the farmers realized its use for agricultural marketing while 35 per cent partially realized it and nearly one fourth (24 per cent) of them did not realize this feature of the internet.

Majority (69 per cent) of the respondents agreed that internet can be a very useful mean to the farmers followed by majority (61 per cent) of the farmers who did not believe that use of internet is only time pass activity. It was reflected that 88 per cent of the farmers partially or absolutely realized that information available on the Internet is difficult to understand. It was observed by the majority (86 per cent) that development of Indian farmers is possible through the Internet. 81 per cent farmers had the opinion that farmers should make use of the internet.

To summarize, impact is the overall achievement of an intervention on the system and can be described by a variety of qualitative indicators such as 'improvements in the existing ICT enabled Agri-portals and other such initiatives in the field of agriculture. Impact is the end-point of an intervention involving input, process, output and outcome. Isolating the variable that caused the impact is problematic in any field of study. In the light of above comprehensive researches on the impact of ICT in agriculture done in the past, reveals that some changes are necessary in selecting methodology and impact indicators in agriculture. So, rather than continuing to implement ineffective evaluations for the sake of continuity, small modifications can be made to improve evaluation methods within the current system. Each quantitative approach should be augmented with more in depth qualitative data, and the way round to have a sufficient evidence base. Other reviewed studies provide qualitative evidence that ICT can impact on learning outcomes based on the opinions of the stakeholders. Thus, the present study will provide a more comprehensive methodology with indicators for every step of the program implementation which help in carrying out an in-depth study of Agri-portals.

Chapter 3 RESEARCH METHODOLOGY

A sound methodology is a pre-requisite for accurate results from any research investigation. It is the system explicit rules and procedures, upon which research is based and against which claims for knowledge are evaluated. This system is neither closed nor infallible. Rather the rules and procedures are constantly improved. According to **Kothari (2007), "**research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done systematically". Research methodology not only encompasses methods used for conducting research, but also the reasoning behind using these methods in research.

After reviewing the available literature related to the study, a scientific and systematic procedure was developed and adopted for conducting the investigation. This chapter has been discussed under the following heads:

3.1. Universe of the study

3.2. Description of locale

3.3 Sampling

Level-I

3.3.1 Selection of the Agri-portals

3.3.2 Selection of districts

3.3.3 Selection of KVKs

3.3.4 Selection of villages

3.3.5 Selection of the respondents

Level-II

3.3.6 Selection of portal managers

3.3.7 Selection of SAU’s scientists

3.3.8 Selection of KVK functionaries

3.4. Research design

3.5. Variables and their measurement

3.6. Tools and techniques of data collection

3.6.1 Tools preparation for impact assessment

3.6.1.1 Validity and reliability of the tool

3.6.2 Types of documentation

3.7. Hypotheses of the investigation

3.8. Analysis and interpretation of data

3.1 Universe of the study

The present study has been carried out in the state of *Uttarakhand*, which is the 27^{th} state of India, carved out of Uttar Pradesh, on November 9^{th} 2000. It lies in between 28^{0} 42’ and 31^{0} 28’ North latitude and 77^{0} 35’ to 81^{0} 50’ Eastern latitude.

Table 1: Uttarakhand at a glance

S. No.	Particulars	Statistics
1.	Total geographical area	53,483 sq. Km
2.	Area under forest	64.81%
3.	Gross cropped area	13.06 lakh ha
4.	Gross irrigated area	42.2%
5.	Area under food grain	987.8 lakh ha
6.	Fertilizer consumption	101.4 kg/ha
7.	Total population (a) Male population (b) Female population	84.8 lakh 43,16,401lakh 41,63,161lakh
8.	Population density per sq. Km.	159
9.	Literacy rate (a) Male (literacy) (b) Female (literacy)	72.28% 84.01% 60.26%
10.	No. of districts	13
11.	No. of tehsils	49
12.	No. of blocks	95
13.	No. of panchayats	673
14.	No. of villages	15669
15.	No. of towns	73
16.	Per capita land availability	0.86 ha.
17.	Number of Universities	04
18.	Per capita forest area	0.49
19.	Per capita Annual income	More than Rs, 12,000
20.	State capital	Dehradoon

Sources: Statistical Bulletin, Uttarakhand. 2001 - Uttaranchal Forest statistics, 2001 Forest Department, Uttaranchal http://envfor.delhi.nic.in/divisions/forprt/JFM/htm/area.htm

The state accounts for about 1.69 per cent of the total area of the country and are placed in 18th rank in all India level. The official language of the state is *Hindi* with *Kumauni* and *Garhwali* as local dialects. Population wise district *Nainital* is the biggest and the smallest one is *Champawat*. The main sources of income of the state are from tourism, forestry, horticulture medicinal plant, fodder, mushroom, fishery, silk wool and hydro electricity.

Map of Uttarakhand

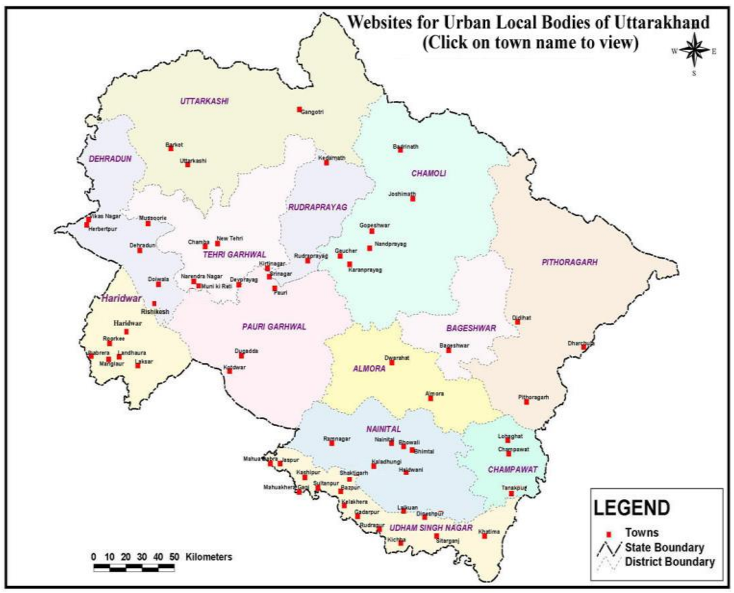


Fig-1 Source: http://210.212.78.58/index_town/

In the *Tarai* and *Bhabar* regions and *Shivalik* belt, thirteen per cent areas constitute rural settlement and 60 percent constitute urban settlement. The state demonstrates a wide range of intra regional diversity in respect of topography, climate, cropping pattern, soil texture, habitation, socio economic status, living style and development pattern. About 63 per cent area in the state is under forest. The net sown area is about eight lakh hectares. The population of the state is about eight million out of which 50.21 per cent are male and 49.79 per cent are female. The population consisted of 76 per cent of rural and 24 per cent of urban inhabitants. The literacy rate of the state is 72 per cent.

Seventy per cent of the population is directly and indirectly engaged in agriculture and allied activities.

Agriculture of Uttarakhand

Subsistence agriculture practiced on small terraced fields in Uttarakhand forms the primary source of livelihood for the majority of the state's population. About 80 per cent of the working population in remote hill villages is engaged in agriculture and animal husbandry **(Sati and Sati, 2000).** Due to harsh topography, climate and subsequent inaccessibility of the area, traditional mountain farming systems in Uttarakhand were self-sufficient, self-contained, closed systems, which did not require any outside input. Owing to limitations in the form of lack of irrigation, small and scattered land holdings, low soil-depth, high altitude, heavy rainfall and cold climatic conditions - agriculture in the mountains exhibits a lot of variations in crop diversity, crop composition and crop rotation (**Maikhuri *et al.* 2001).**

Moreover, it is also inextricably linked to animal husbandry and forests. Forest biomass fertilizes the fields in the form of organic manure via livestock and through humus coming directly from rainwater run-off from the forests **(Jain and Webster, 2001**).

Draught animals are the most economical and easily available source of energy for ploughing and post harvest activities. Manpower is also extensively used and sometimes ploughing is also done manually. Women play a key role in hill agriculture, particularly in the context of male workers migrating to the plains for employment. Interestingly, almost all hill women are engaged in agriculture as compared to only 59% men **(Chauhan *et al.*)**. Agricultural land is scarce and comprises of small terraced plots carved out of the hillside or cleared forestland. The majority of land area is under rainfed agriculture, and hence the communities are heavily dependent upon rain and snowfall.

Although the vast majority of the state's population is dependent upon agriculture, the land area available for cultivation is very limited. In terms of net sown area, agriculture occupies only 14.8 per cent of the total geographical area of the state and this includes areas in the districts of Haridwar and Udham Singh Nagar, which have a very high ratio of cultivated area of total land area. Excluding the figures for these two districts, only 10.7 per cent of the remaining land area of Uttarakhand is under cultivation.

The average size of landholdings in the state is also very small. There are an estimated number of ten lakh landholdings in Uttarakhand, 70 per cent of them are less than one hectare in size and the per capita area comes to only 0.8 hectares **(Rawat 2001).** However, in the Garhwal region alone, the amount of cultivated land per-capita comes to 0.2 ha **(Maikhuri *et al.* 2001**). According to **Semwal *et al.* (2001)** marginal farmers (landholdings between 0.02-1.0 ha) comprise more than 68 per cent, small farmers (landholdings between 1.0 ha to 4.0 ha) about 29 per cent and big farmers (landholdings between 4.0 and 10.0 ha) only three per cent of the farmers. District-wise, the average size of landholdings, in 1990, varied from 0.54 ha in *Pithoragarh* to 1.67 ha in *Nainital*. However, farmers in the plain districts of *Udham Singh Nagar* and *Haridwar* have much larger land holdings.

The crops and cropping patterns in the hills vary greatly with altitude due to varied climatic conditions, the nature of agricultural land and irrigation. There are two main cropping seasons i.e. *Kharif* and *Rabi*. *Kharif* season crops occupy about 63 per cent while Rabi season crops account for about 59 per cent of the gross cropped area of the region, with the cropping intensity of 159.29 per cent **(Swarup, 1993).**

Multi-cropping has been the dominant feature of traditional hill agriculture. It ensures that the multiple needs of the community are satisfied and, at the same time, the health of the agro ecosystem is also maintained. Upland cropping is highly diversified having various combinations of cereals, pulses, millets, oilseeds, pseudo-cereals, beans, vegetables, fruits and spices. The main *Kharif* season crops comprise: paddy, finger millet, barnyard millet, foxtail millet, maize and pulses. Wheat, barley, lentils, peas and mustard are the main *Rabi* season crops.

3.2. Description of locale

A brief description of district Nainital

In the state of Uttrakhand, district Nainital lies in the *Kumaun* division. It is located approximately in between 80°14' and 78 ° 80' east longitudes and 29°00' and 29°05' north latitude. The foothill area of the district is known as *Bhabhar*. The underground water level is very deep in this region. As per 1999 records, total average rainfall of the district was 1338.08 mm while total average rainfall up to August 2000 was 1602.69 mm.District Nainital has five tehsils viz. Nainital, Haldwani, Ramnagar, Dhani Kosiha, Katauli, and eleven developmental blocks namely Hawal bagh, Taluka, Bhikiashen, Haldwani, Ramnagar, Bhimtal, Ramgarh, Kotabagh, Betalghat, Dhari and Okhalkanda.

Table 2: District Nainital at a glance (2001 Census)

S.No.	Particulars	Area (Ha.)
1.	Total geographical area	53,448
2.	Total forest area	64.81%
3.	Cultivable barren land	8719
4.	Pasture land	1211
5.	Area under horticulture crops	16306
6.	Uncultivable land	26792
7.	Land used other than agriculture	3025
8.	Net sown area	49486
9.	Area sown more than once	32975
10.	Gross cropped area	82461

Source: Statistical Bulletin, Nainital district, Uttarakhand 2001

Table 3: Source wise irrigated area of district Nainital

S. No.	Source	Area (Ha.)	Total area (%)
1.	Canal	242034	80.24
2.	Tube well Government Private	 3366 1716	 11.16 5.69
3.	Other	878	2.91
	Total	30163	100

Source: Statistical Bulletin, Nainital district, Uttarakhand 2001

Table 4: Land holding pattern of farmers of district Nainital

S.No.	Category	Holding size	Landholding (%)
1.	Marginal	< 1 Ha.	60.2
2.	Small	1-2 Ha.	18.8
3.	Medium	2-4 Ha.	18.6
4.	Large	>4 Ha.	2.5

Source: Statistical Bulletin, District Nainital, Uttarakhand 2001

<u>Map of Nainital</u>

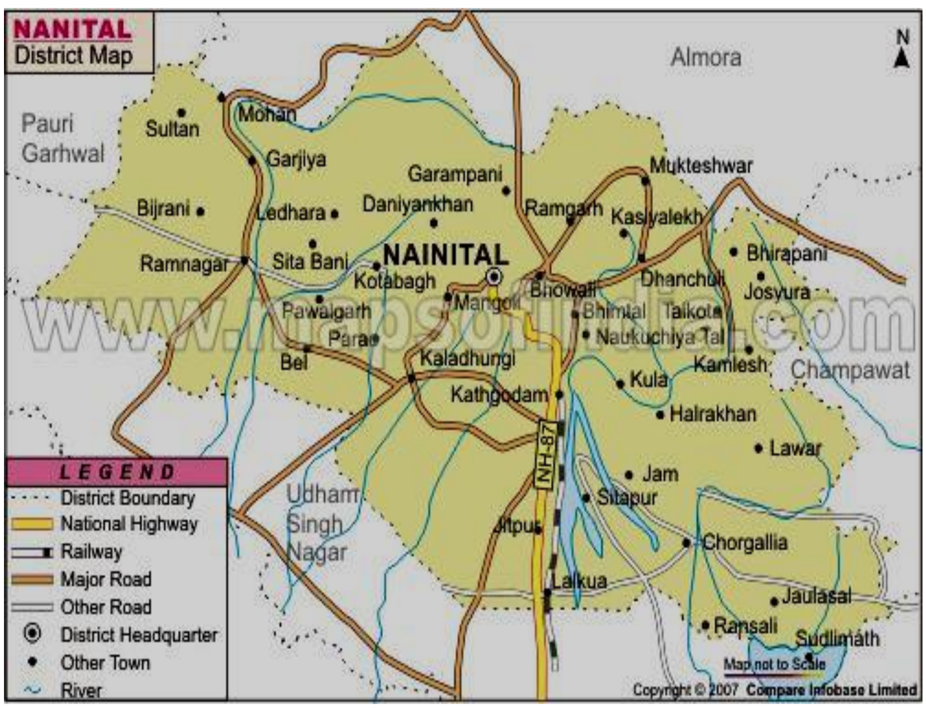


Fig-2

Source:http:/www.mapsofindia.com/maps/uttaranchal/district s/nainital.htm.

Brief description of Dehradun

Dehradun is capital of north India state: Uttarakhand, has six tehsils, namely Dehradun, Chakrata, Vikasnagar, Kalsi, Tyuni and Rishikesh. This district has six community development blocks, viz, Chakrata, Kalsi, Vikasnagar, Sahaspur, Raipur and Doiwala and seventeen cities, 764 populated villages, and 18 unpopulated villages.

The headquarters of many National Institutes and Organizations like ONGC, Survey Of India, Forest Research Institute, Indian Institute of Petroleum etc. are located in the city. Some of the premier educational and Training Institutes like Indian Miltary Academy, Rashtriya Indian Military College (RIMC), Indira Gandhi National Forest Academy (IGNFA), Lal Bahadur Shahstri National Academy of Administration (LBSNAA) etc. are also located in Dehradun. The city lies between 29 degrees 58' and 31 degrees 2' 30" north latitudes and 77 degrees 34' 45" and 78 degrees 18' 30" east longitudes. Altitude is 640 mts. (2100 ft) above mean sea level.

Table 5: District Dehradun at a glance (2001 census)

S.No.	Particulars	Area (Ha.)
1.	Total geographical area	3088.00 sq. Km
2.	Total forest area	2200.56 sq. Km
3.	Net sown area	550.57 sq. Km
4.	Net irrigated area	217.53 sq. Km
5.	Total population	16, 98,560

6.	Population density	332 people/sq. Km
7.	Total literates a. Total males b. Total females	85.24% 90.32% 79.61%
8.	Average size of operational holding	0.92 ha

Agriculture

Agriculture in the Doon Valley is practiced the same way as in the plains. The facilities for irrigation from canals and rivers are abundant but there is a great deficiency of manure. The hills, however, contain very little level ground thus, terraced cultivation is common. Intermittent cultivation consists of small patches of hill sides cleared of shrubs and grass usually by fire. In the district there are two harvests, the *kharif* sown in June or little earlier in the hills and reaped in September and October and the *rabi* sown in October-November and reaped in March in the plains and in April and May in the hills. Paddy is one of the most important *kharif* food crops in the district. Many kinds of rice are sown in the area. The district is famous for its basmati rice. Other important *kharif* crops are *maize, jhangora, sonk, urd, kulath, tor (arhar)* and *sugar* cane. Wheat is the principal crop of *rabi* and is grown in almost all parts of the district. Barley and mustard are other important *rabi* crops.

The important fruits grown in the district are the mango, guava, peach, grape, strawberry, pear, lemon and litchi. Among vegetables, potato is the most important crop. Potato cultivation in the Mussoorie hills is an old and established industry. Besides, catering to the needs of the town of the district, a considerable portion of the production of potato is exported to other districts of the state.

Map of Dehradun

Fig-3

Brief description of Udham Singh Nagar

Udham Singh Nagar is a district of Uttarakhand state with Rudrapur as its headquarters, is located in the Tarai region. It is bounded on the north by the Nainital district, on the northeast by the Champawat District, on the east of Nepal, and on the south and west of Uttar Pradesh state. The district was created in October 1995 out of Nainital District. G.B. Pant University of Agriculture and Technology. The district has six tehsils, namely Kashipur, Jaspur, Bajpur, Gadarpur, Rudrapur, Kichha, Sitarganj, and Khatima and 14 developmental blocks.

Table 6: District Udham Singh Nagar at a glance (2001 Census)

S. No.	Particulars	Statistics
1.	Total population	1,235,614
2.	Total Geographical Area	3,372
3.	District Type	Tarai
4.	Tehsils in UdhamSinghNagar	07
5.	Blocks in UdhamSinghNagar	07
6.	Nyaya Panchayats	27
7.	Number Of Villages	656
8.	Nagar Palika Parishads	08
9.	Nagar Panchayats	06

<u>Map of Udham Singh Nagar</u>

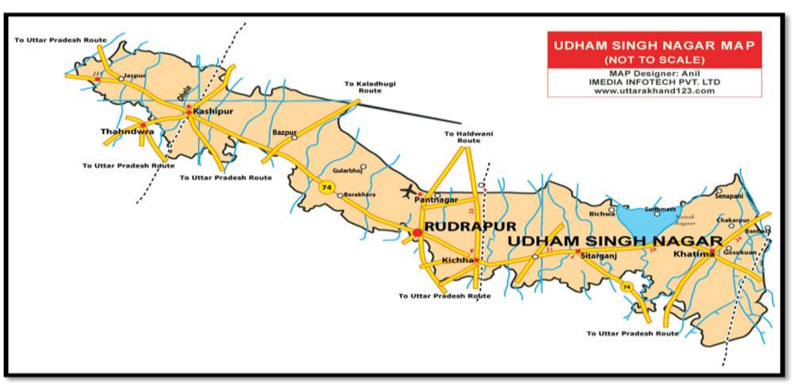


Fig- 4

3.3 Sampling

Level-I

3.3.1 Selection of the Agri-portals

In all, there are presently thirteen Agri-portals operating in India viz. *Haritgyan*.com, *Krishiworld*.net, TOEHOLDINDIA.com, Agriwatch.com, ITC's *Soyachoupal*.com, *Acquachoupal*.com, Plantersnet.com, Agmarknet.nic.in, ikisan.com, agrisurf.com, indiancommodity.com, aAQUA, Agropedia. Out of these, two Agri-portals viz. Agropedia and aAQUA have been launched in the country, operating at national level and have also been launched in Uttarakhand. These Agri-portals cater to the need based content on major aspects of agriculture desired initially by the progressive farmers and other stakeholder viz. Academia, extension functionaries etc. These Agri-portals are accessible through the network of KVKs across the state. Therefore, both these Agri-portals viz. aAQUA and Agropedia were selected for the present investigation.

Description of Agropedia and aAQUA:

1. **Agropedia**

Agropedia is a comprehensive, seamlessly integrated model of digital content organization in the agricultural domain. It aims to bring together a community of practice through an ICT mediated knowledge creating and organizing platform with an effort to leverage the existing agricultural extension system. Agropedia is envisioned to be a one stop shop for all kinds of information related to Indian agriculture. The practice of crop knowledge models has been defined and developed for the first time worldwide to create architecture for accumulating known codified and approved information about crops, with the support of Food and Agriculture Organization (FAO), Rome. These knowledge models are the structural representation of knowledge by using symbols to represent pieces of knowledge and relationships between them, which can be used to connect seamlessly to the knowledge base in Agropedia using semantic tools. Knowledge models have been represented using Concept Maps (C-Map) tools. Knowledge models have been designed at Agropedia with the intention of using them for indexing and browsing the content that we gather in the repository. A template for objects and relationships within the knowledge models as well as guidelines to develop knowledge models was formulated by the NAIP- KM team of IIT Kanpur with the assistance and support of FAO. Following this, the knowledge models of nine mandated crops of the project viz. Chickpea, Pigeon pea, Sorghum and Groundnut were developed at ICRISAT-Hyderabad, Wheat, Sugarcane, Litchi and Vegetable pea were developed at GBPUA&T-Pantnagar and Rice was developed in IIT-Kanpur.

2. aAQUA (Almost All Questions Answered)

Almost All Questions Answered or aAQUA is a Farmer Knowledge Exchange available at www.aaqua.org answering questions from progressive farmers in 4 languages in any one of 420 districts in India and some places abroad. Any farmer, agriculturist or hobbyist can register and post questions and a panel of Agriculture Experts answer questions based on the problem description and photos, if any. Contextual Information such as geographical location, weather, and season are retrieved automatically and made available to experts. Currently, questions may be asked in one of four languages - Hindi, Marathi, Kannada and English.

Originally developed in the Developmental Informatics Lab of IIT, Bombay, aqua uses relational database management systems and information retrieval techniques with query optimization, intermittent synchronization and multilingual support. aAQUA Mini the mobile version of aqua can help farmers get information to phone upload photos and get expert advice and SMS alerts directly to the farmers. Mobile phones are now affordable and there seems little doubt that cellular telephones will cover a large percentage of rural population in the country over the next few years. aAQUA was honored with the *Manthan* award for the best e-content in July, 2005.

3.3.2 Locale of the study

Uttarakhand is broadly divided into two regions namely *Kumaon* and *Garhwal*. The Kumaon region is further divided into two viz. Tarai and Hills. So, three representative districts (one from each region) namely Dehradun (*Garhwal*), Udham Singh Nagar (Tarai) and district Nainital (*Kumaon* hills) were purposely selected for the present study due to following reasons:

- Both Agri-portals have been initially launched in two representative districts of *Kumaon* and *Garhwal* i.e. in Dehradun and Udham Singh Nagar respectively. District Nainital was adopted later by the Directorate of Extension Education, GBPUAT, Pantnagar (one of the consortium partner of the NAIP project entitled "redesigning the farmer-extension-agricultural research/education continuum in India with ICT-mediated knowledge management" under which the selected Agri-portals were launched) as the additional one.

3.3.2 Selection of KVKs

The scope of these Agri-portals was limited to work with the extension system through KVKs of the selected regions of its implementation (KVK-*Dhakrani*, Dehradun and KVK-*Kashipur*, Udham Singh Nagar). These KVKs were considered as the principal channel of interaction with farmers and extension stakeholders. Because of this reason KVK-*Dhakrani* (Dehradun), KVK-*Kashipur* (Udham Singh Nagar) and KVK-*Jeolikote* (Nainital) were selected purposively.

3.3.4 Selection of villages

From the selected districts, seven villages namely *Jassowala, Dharmawal, Haripur, Line Jeevan garh, Enfield Tea State, Ambadi and Fatehpur* from Vikas Nagar Block, Dehradun, six villages viz. *Bajpur, Gadarpur, Kashipur, Brahm Nagar, Daroga Farm, Gopipura* from the *Kashipur* block, Udham Singh Nagar and one village namely *Gaanja* from the *Bhimtal* block, Nainital were selected purposively. The reason behind the selection of these villages was that the maximum number of beneficiary farmers who were trained by the concerned experts of selected Agri-portals belonged to these villages.

3.3.5 Selection of respondents: Selection of the respondents was done at two levels:

Level I

Four trainings along with the follow-up trainings on aAQUA and Agropedia have been conducted by Directorate of Extension Education, GBPUAT-*Pantnagar* along with IIT-*Bombay* and IIT-

Kanpur respectively. 30 progressive farmers from each district were identified by the respective KVKs who attended the trainings on Agropedia and aAQUA. So, all the farmer trainees were selected through census method for the present study. Therefore, at the first level of sampling, around 90 farmers were selected. Out of these 90 farmers 30 from *Dhakrani*, 28 from *Kashipur* and only 25 Farmers from *Jeolikote* were available at the time of interview. Thus, the selected sample was comprised of 83 farmers and farm women.

Level II

At this level the portal managers of Agropedia, IIT, *Kanpur* (Seventeen) and aAQUA, IIT, *Bombay* (Seven), scientists from State Agricultural University, GBPUA&T, *Pantnagar* (Thirteen), and extension functionaries of respective KVKs {KVK *Dhakrani*, Dehradoon; KVK *Kashipur*, and KVK, *Jeolikote* (six from each)} were selected for the present study. In all total 55 stakeholders were selected through census method. The responses of only 40 could be obtained via electronic mail. So, in all 129 farmers and experts were contacted to collect the data.

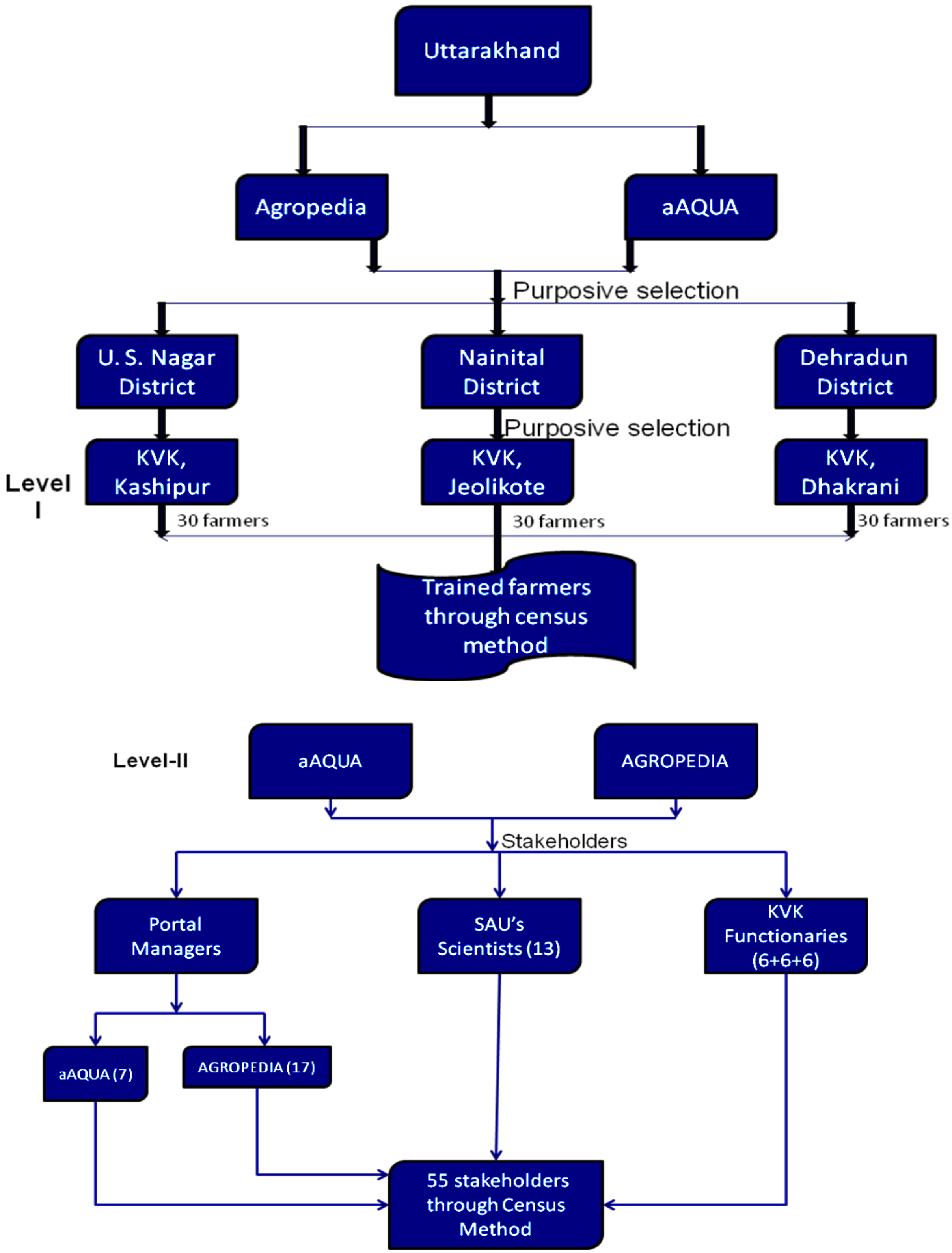


Fig. 5 & 6: Sampling at a glance

3.4 Research Design

Appropriate research design is the prime need of any research investigation. It is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with the economy in procedure.

In another view, “it is a plan, structure, strategy of investigation, conceived so as to obtain answers to research questions and to control variance” **(Kerlinger, 2009)**.

Depending upon the nature of study and to provide answers to selected research questions, analytical research design was used to assess the impact of selected Agri-portals launched in Uttarakhand during 2008-09. For measuring the impact of selected Agri-portals, the evaluation was focused more on process impact rather than on end result impact. Process impact examines the procedures and tasks involved in implementing a program. The purpose of process impact assessment is to assess whether the project is being conducted as planned or not. It monitors the program to ensure feedback during the course of the program. This type of impact studies, sometimes called “implementation evaluation,” may occur once or several times during the life of the program.

For measuring the impact of selected Agri-portals researcher reviewed several evaluation and impact assessment models viz. CIPP (Context, Input, Process, Product) evaluation model, Daniel Stufflebeam’s, CIRO (Context, Input, Reaction, Outcome), Scriven’s Goal-Free Evaluation Approach, Suchman’s Logic Approach Model, Heeks’ (2005) Information Chain Model, an Extended Framework for Investigating ICT Impact Towards Development, Social Impact Assessment (Vanclay, 2003), Measuring Impact model (NCVO, 2003), Program Action Logic model, Participatory Impact Pathways Analysis (PIPA, 2006), TOP (Targeting Outcomes of Programs) model (1995) and Bennett Hierarchy Seven Step Model of Planning and Evaluation.

Out of these, seven levels **Bennett Hierarchy Model of Planning and Evaluation (1976)** was found suitable for the present impact assessment study and was adopted with some modifications. The seven levels of a Bennett Hierarchy Model of Planning and Evaluation identified were: I - Input, II - Activities, III - output, IV - Reactions, V- Knowledge and Attitude change, VI - Practice change, and VII - Gratification of the services.

Bennett Hierarchy's Model of Planning and Evaluation (1976):

Bennett Hierarchy model of planning and evaluation (1976) has been extensively used by extension practitioners for planning and evaluation. The Bennett Hierarchy (**Table 7**) describes a series of staircase levels of evidence of program impacts, beginning at the bottom step with "inputs" i. e. allocation of resources to a program and progressing to the top, "end results" i. e. measuring impacts of the program on long term goals or conditions.

Table 7: Bennett's Hierarchy applied to the impact of Agri-portals

Evaluation Hierarchy	Measurement in the present study	Indicators
Level 7 (Gratification)	Level of satisfaction	Level of satisfaction
Level 6 (Practice change)	Change in behavior	Levels of adoption
Level 5 (Knowledge level)	Knowledge level of respondents	Knowledge level of respondents
Level 4 (Reactions)	Opinion of respondents	Opinion about design features, content relevance and usability features of selected Agri-portals
Level 3 (Outputs)	Activities completed and products developed	Activities performed by key stakeholders, number of participants, their profile, and products developed
Level 2 (Activities)	What Agri-portals offer or do	Assigned activities of key stakeholders
Level 1 (Inputs)	Resources used	Total money spent, Human resource involved, numbers of scientists, technical persons involved, number of registered participants

3.5 Variables and their measurement

3.5.1 Concept, Operational Definition and Measurement of Variables

A concept is an abstraction formed by generalization from particulars. An operational definition is the standardization of definitions for a particular research problem and that can be measured. It may also be conceptualized as the manipulated form of definition, which is meant for measuring the things in research. In measurement for further analysis of variable we assign some numerical value to some variable. It is empirical in nature. In the present study, various variables were conceptualized, operationally defined and measured as presented under:

Table 8: Variables and their measurement

S.No.	Variables	Scale/Techniques
A.	**Independent Variables**	
I.	Socio-Economic characteristics	Schedule developed
1.	Age	Chronological age
2.	Education	Modified scale of Mishra & Kaul (1999)
3.	Caste	Category
4.	Gender	Category
5.	Family Background	
a.	Family Type	Category
b.	Family Size	Category

6.	Occupation	Modified scale of Khandekar (1992)
7.	Annual income	Category
II.	**Communication Characteristics**	
8.	Interpersonal sources of communication	Category
9.	Mass media exposure	Modified scale of Gogoi (1984)
10.	Extension agency contact	Scale developed by Singh (1982)
III	**Farming characteristics**	
11.	Land Assets	National Commission on Agriculture, GOI (2000)
12.	Crop wise cultivated area	Category
13.	Farming experience	Scale developed by Padmaiah (1995)
14.	Livestock	Category
15.	Material possession	Category
16.	Agricultural equipment possession	Category
17.	Communication media possession	Category
18.	Household assets	Category
B	**Dependent Variable (Impact)**	
19.	Extent of awareness of Agri-portals	Impact Assessment Index
20.	Inputs	Impact Assessment Index

21.	Activities	Impact Assessment Index
22.	Outputs	Impact Assessment Index
23.	Knowledge level	Knowledge test
24.	Practice change	Impact Assessment Index
25.	Opinion of farmers and other stakeholders about Agri-portals	Opinionnaire
27.	Information sharing behavior of users of Agri-portals	Impact Assessment Index
28.	Gratification of the services of Agri-portals	Impact Assessment Index
29.	Immediacy of feedback	Impact Assessment Index

4.5.2 Independent variables

An independent variable is the presumed cause of dependent variable, or in other words, the variable expected to explain changes in dependent variable.

3.5.2.1 Socio-economic variables

The socio-economic characteristics of only the farmer respondents were studied here.

1. Age

It is the indicator of experience one has, maturity, role and status in the society. Age is a continuous variable that flows by ever increasing amounts from birth until death **(Bogue, 1969)**.

In the present study, it refers to the chronological age of the respondent in years, expressed in whole numbers, at the time of inquiry. The respondents were categorized in three categories on the basis of arithmetic mean and standard deviation as:

S. No.	**Category**	**Scores**
1.	Young (less than 20 years)	1
2.	Middle (between 20 to 48 years)	2
3.	Old (more than 48years)	3

2. Education

It refers to the level of education attained by the respondents at the time of inquiry. This was measured by a modified scale of **Mishra and Kaul (1999)**. The respondents were asked to tell the highest educational qualification. The score assigned to different categories was as follows:

S. No.	**Category**	**Score**
1.	Illiterate	1
2.	Primary level	2
3.	Middle level	3
4.	High school level	4
5.	Intermediate	5
6.	Graduate and above	6

3. Occupation

Occupation refers to farmers' main profession for a livelihood or source of income.

In the present investigation, occupation of a respondent represents the main and subsidiary sources of livelihood practiced by them and the respondents were categorized in the following manner:

S. No.	Category	Score
1.	Agriculture	1
2.	Animal husbandry	2
3.	Service	3
4.	Business	4
5.	Agriculture and service	5
6.	Agriculture and Business	6

4. Annual income

It refers to the total household earnings of the respondents' family per year through farm and non-farm sources at the time of inquiry i.e. Agriculture, dairy, business, service, labor and other sources pooled together to calculate the gross annual income of the family. Further, on the basis of mean value (₹ 385761.66) and standard deviation (₹ 363832) respondents were classified into the following categories:

S. No.	Category	Score
1.	Low income group (less than ₹ 20930)	1
2.	Medium income group (₹ 20930 - ₹ 7,50,594)	2
3.	High income group (more than₹ 7,50,594)	3

5. Caste

It refers to the hierarchical social status or the position of an individual either acquired by heredity or conferred upon by the society.

In this study, respondents were classified into the following categories on the basis of caste he/she belonged to.

S. No.	Category	Score
1.	General	3
2.	OBC	2
3.	SC/ST	1

Gender

It refers to the differences in man and woman in terms of role and status in society, values, attitude and other socio-psychological variables. It was categorized in two categories and scores of 2, 1 was given accordingly as under:

S. No.	Category	Score
1.	Male	1
2.	Female	2

6. Marital status

This refers to the marital status of the respondents and is classified as married or unmarried. It was categorized as follows:

S. No.	Category	Score
1.	Married	3
2.	Unmarried	2
3.	Other	1

7. Family Background

A. Family type

It refers to a group of two or more individuals residing together who are related with blood, marriage or adoption. A family has been defined and classified by several sociologists. However, for the present study two family types will be considered:

a. **Nuclear family**- It consists of husband, wife and their offsprings with or without other dependents.

b. **Joint family**- It consists of two or more units of the nuclear family living together under a common roof and sharing the same hearth. Family type was categorized as follows:

S. No.	Category	Score
1.	Nuclear	1
2.	Joint	2

B. Family size- *It has been operationalized as the number of people living together sharing a common hearth and a residence.*

For the present study it was considered as the total number of members residing in a household at the time of investigation and the respondents were categorized as below:

S. No.	Category	Score
1.	Small (less than 3 members)	1
2.	Medium (3-7 members)	2
3.	Large (more than 7 members)	3

House type

Type of house includes *the type of dwelling possessed by the family of the respondent.* The construction and management of house depict the social and economic status of family. Thus, the information regarding type of house was collected and categorized into three groups as follows:

S. No.	Category	Score
1.	Kachcha	1
2.	Semi-pucca	2
3.	Pucca	3

8. Material possession

It refers to the different physical assets possessed by the respondents for enhancing their status and improving standard of living. In present study agricultural equipments, communication media and selected household assets possessed by the family was used to access this aspect. To have a clearer picture of the facts, assets under sub categories were also computed separately. The overall material possession was computed on the following aspects:

a. Agriculture equipment possession

To study this aspect various farm implements and equipments available with farmer were taken into consideration and certain numerical values were assigned to each item. For relatively advanced tools the higher values were assigned. The scores assigned to various items were Tractor (01), Power tiller (02), Diesel/electric pump (03), Irrigation installation (04), Zero till ferti seed drill (05), Seeder (06), Sprayer (07), Combine harvester (08), Thresher (09), Bhusa reaper (10), Straw cutter (11), and Fodder chopper (12).

Based on the mean value (12.87) and standard deviation (3.98) of the total scores of the responses, following categories of the respondents were framed:

S. No.	Category	Score
1.	Low (less than 4)	1
2.	Medium (4-13)	2
3.	High (more than 13)	3

b. Communication media possession

It refers to the different communication media possessed by the respondents for various purposes of communication. To study this aspect, different media were taken into consideration and the numerical values were assigned to each of them. The scores assigned to various communication media were Landline (01), Mobile (02), Radio (03), TV (04) and Computer (05).

On the basis of the scores obtained by each respondent, they were categorized as follows, using mean value (9.86) and standard deviation (3.24).

S. No.	Category	Score
1.	Low (less than 7)	1
2.	Medium (7-13)	2
3.	High (more than 13)	3

9. Interpersonal sources of communication

In the present investigation it is operationalized as the *extent to which respondent approaches different localities sources of information*. It includes all the people to whom respondent contact to seek personal or scientific help. The frequency of contact was studied and the percentage was calculated to measure the interpersonal sources of communication of farmers.

S.No.	Infrastructure	Scores
1.	Friends	1
2.	Family/Relatives	2
3.	Neighbors	3
4.	Fellow farmers	4
5.	Progressive farmers	5
6.	Other (please specify)	6

10. Mass media exposure

It refers to the frequency of using different media for getting information about farming.

In this study it indicates participation in training programs, KVKs, Extension worker, TV, Radio, Newspaper, Farmers Fair, Internet, Government Demonstration, Information Kiosk, Input Dealer, Progressive farmers, and Private agencies by the farmers. The responses were assessed on the basis of several parameters viz. whether accessed or not, frequency of contact (codes given), type of information received, quality of information received, whether received information was tried or not, whether the recommended practice has been adopted or not, reasons for not adopting the recommended practices (codes given) and suggestions for improvement in extension services (codes given). Frequency and percentage were calculated to measure the overall mass media exposure of the respondents.

11. Social participation

In this study, it refers to the respondents' association and participation with any social organization, Panchayat, Panchayat Samiti, cooperative society, farmers' forum, Self Help Groups, Youth Clubs or any other organization etc. as a member or office bearer. The frequency was studied on three point continuum i. e. always, sometimes, never and the numerical value of 3, 2, and 1 were assigned respectively. Finally following categories were made on the basis of mean value and standard deviation.

S. No.	Category	Score
1.	Low (less than 9)	1
2.	Medium (9-13)	2
3.	High (more than 13)	3

12. Reach of Extension agency

It was defined as the degree of contact of the extension agencies in the area of investigation.

For the study it indicates degree of contact of Agriculture Department, Animal Husbandry Department, KVKs, Cooperatives, and any other source of information of Agri-portals with the respondents within a specified period of time. Respondents were inquired about the total number of visits per month to these agencies for getting information about selected Agri-portals.

Responses were measured by calculating the frequency and percentage.

S. No.	Category	Score
1.	Agriculture Department	1
2.	Animal Husbandry Department	2
3.	KVKs	3
4.	Cooperatives	4
5.	Any other	5

13. Livestock

It refers to the animal possessed by a family. In present study total numbers of animals were used as an indicator of livestock. It was classified as under:

S. No.	Category	Score
1.	No animal	1
2.	1-2 animals	2
3.	3-4 animals	3
4.	5-6 animals	4
5.	More than 5-6 animals	5

14. Land holding

It is the operational size of the farm which the farmer has actually put into cultivation. The data were collected by asking respondents about the area under irrigation, leased in land, leased out land and total operational holding. In the present study the criteria laid by the National Commission on Agriculture **(NCA)**, Government of India **(GOI)** were followed to classify the respondents in following categories:

S. No.	Category	Score
1.	Small farmers	2.51 to 5.0 acres
2.	Medium farmers	5.01 to 10 acres
3.	Large farmers	Above 10.01 acres

15. Farming Experience

It refers to the total number of years spent in farming by the respondent at the time of investigation.

The data were collected by asking the respondents to mention their farming experience in terms of completed years. Further, respondents were categorized into three groups as given by **Padmaiah (1995)** below:

S. No.	Category	Score
1.	Low (Less than10 years)	1
2.	Medium (10 to 20 years)	2
3.	High (More than 20 years)	3

16. Crops wise cultivated area

It refers to the type of crops grown in different agricultural seasons on a specified cultivable area by the respondents. For the present study three agricultural seasons viz. Kharif, Rabi and Zaid were taken into consideration. Total production during these seasons was also inquired. Further, respondents were classified as below:

S. No.	Category	Score
1.	Low (Less than 2 crops)	1
2.	Medium (2 to 3 crops)	2
3.	High (More than 3 crops)	3

B. Dependent variable (Impact of Agri-portals)

Dependent variable is one which a researcher wishes to explain. The independent variable is the antecedent and dependent variable is the consequent.

It refers to desirable changes in targeted populations. The central concerns of these Agri-portals are learning and achievement of perceptible behavioral change towards the use and application of ICT in agriculture. Changes brought out due to application of learning at work can be measured only after lapse of sometime after the implementation of selected Agri-portals. The impact of any ICT application helps in pinpointing the results and reporting them to all concerned.

In the present investigation these variables have been operationalized as under:

17. Extent of awareness of Agri-portals: It refers to the state of being aware about the existence and services of the Agri-portals. It will be measured in terms of sources of awareness and time of awareness of Agri-portals.

a. **Sources of awareness about Agri-portals:** The nature of sources through which the users had come to know about the selected Agri-portals was studied. The sources of awareness might be television, radio, newspaper, friends and relatives, neighbors, agricultural magazines, Krishi Vigyan Kendra (KVKs), farmers fair, university scientists etc. It was categorized as follows:

S. No.	Category	Score
1.	Radio	1
2.	Television	2
3.	Newspaper	3
4.	Agricultural Magazines	4
5.	Krishi Vigyan Kendra (KVKs)	5
6.	Farmers fair	6
7.	University Scientists	7

b. **Time of awareness of Agri-portals:** It refers to the exact time to get aware about the existence of selected Agri-portals by farmers at the time of interview. It was categorized on the basis of mean and standard deviation.

S. No.	Category	Score
1.	Less than one year	1
2.	One to two years	2
3.	More than two years	3

18. Inputs

It can be operationalized as total money spent in various phases of construction and implementation of selected Agri-portals.

For the present study, total money spent on selected Agri-portals, trainings, publicity, fees paid for installation of offline boxes at KVKs, transport charges, honorarium to the trainers, stalls in farmers' fair and publications released were collected through secondary sources under following subheads:

S.No.	Items	₹ /Number
a.	**Financial resources spent****	
i.	Fees paid to install offline boxes of Agri-portals	
ii.	Money spent for conducting trainings	
iii.	Honorarium for trainers	
iv.	Advertisements for popularization of Agri-portals	
v.	Transport charges	
vi.	Publications	
vii.	Stalls in farmers' fair	

****Excluding time value of human resources**

19. Activities and Outputs

This refers to the assigned activities of key stakeholders and activities performed by them. Total number of SAU scientists involved, number of portal managers involved, technical persons involved and total number of registered participants and their profile were calculated through secondary sources including the main NAIP project documents, research papers and articles. The necessary information was collected under the following subheads:

S. No.	Human resources involved	Particulars
i.	Number of agricultural scientists **a)** Scientists from GBPUAT, Pantnagar Uttarakhand. **b)** Scientists from UAS, Dharwad **c)** Scientists from ICRISAT, Hyderabad	
ii.	Number of portal managers from Indian Institutes of Technology. **a)** Portal managers from IIT, Kanpur **b)** Portal managers from IIT, Bombay	
iii.	Number of other technical personnel involved : **a)** Agropedia **b)** aAQUA	
iv.	Number of registered participants in Agropedia: **a)** Male **b)** Female Number of registered participants in aAQUA: **a)** Male **b)** Female	

20. Opinion of stakeholders about Agri-portals

An opinion is a subjective statement or thought about an issue or topic, and is the result of emotion or interpretation of facts. For the present study, the opinion of farmers and other stakeholders including portal managers, SAU scientists and KVK functionaries was taken on following aspects:

a. Opinion about content relevance

It indicates significance of the content being uploaded onto the selected Agri-portals i.e. Agropedia and aAQUA. For the present study opinion about content relevance (highly relevant, somewhat relevant, irrelevant), treatment of the message (high technical words, moderate technical words, and less technical words), adequacy of the content (adequate, somewhat adequate and inadequate), and usefulness of the content (highly useful, moderately useful and not useful) were measured on a three point continuum and the numerical value of 3, 2 and 1 was assigned respectively. Finally, following categories were made by giving rank order to various items on the basis of mean value **(Appendix III)**

b. Opinion about design features

It indicates the organization of information and the clarity provided by the background colors and graphics in reading the text presented on the selected Agri-portals (Agropedia and aAQUA). For measuring this aspect several statements were made and adopted and the responses were collected on five points continuum viz. strongly agree, agree, undecided, disagree and strongly disagree by giving scores of 5, 4, 3, 2, and 1 for positive statements and 1, 2, 3, 4, and 5 for negative statements. The respondents were then categorized by giving rank order to various items on the basis of mean value **(Appendix III)**.

c. Opinion of users about usability features of Agri-portals

It indicates the extent to which a system supports its users in getting the information efficiently, effectively and satisfactorily on the selected Agri-portals. It was measured by modified scale developed by **Chauhan (2010)**. The frequency was studied on three points continuum i. e. agree, partially agree and disagree and the numerical value of 3, 2 and one was assigned to the positive statements and 1, 2 and 3 was assigned to the negative statements. Finally, following categories were made by giving rank order to various items on the basis of mean value **(Appendix III)**.

21. Knowledge level of farmers

It can be operationalized as knowledge level of the farmers on various aspects of selected Agri-portals. For measuring the knowledge level of the farmers about selected Agri-portals a knowledge test on different aspects was prepared including registration onto these Agri-portals, access information, asking questions to the experts, downloading graphics and video, and provide feedback were measured through well prepared and pre-tested knowledge test. Further the respondents were classified on the basis of mean value (8.216) and standard deviation (2.87).

S. No.	Category	Score
1.	Low knowledge (less than 5)	1
2.	Medium knowledge (5-11)	2
3.	High knowledge (more than 11)	3

22. Practice change

It refers to the change of behavior of users of selected Agri-portals. In the present investigation it was measured through the extent of adoption of practices and services provided to the farmers through selected Agri-portals. An impact Assessment Index was developed to measure the extent of adoption of practices offered in land preparation, seed varieties, seed treatment, sowing time, sowing methods, spacing, weeding, plant protection, critical stages of irrigation, harvesting, storage and marketing and the responses were collected on four point viz. Practicing prior to exposure of Agri-portals, Began practicing after exposure to Agri-portals, Intend to practice in the future, No plans to adopt. Responses were measured by calculating frequency and percentage.

23. Gratification of services of Agri-portals: Gratification refers to the satisfaction of the users with regard to the results of adoption of recommended practices of Agri-portals and its overall services.

S. No.	Category	Score
1.	Satisfied	2
2.	Not satisfied	1

24. Immediacy of feedback

It is operationally defined as the length of time in days taken by the extension agency/ Agri-portals to respond to the queries of respondents. Immediacy of feedback was categorized as following:

S. No.	Category	Score
1.	Within a day	3
2.	Within a week	2
3.	More than a week	1

25. Information sharing behavior

Information sharing behavior of the farmers about Agri-portals and services rendered by the Agri-portals refers to the extent to which the users felt that the services provided by Agri-portals should be enjoyed by all the members of the society. The behavior would normally arise once the users were satisfied with the services of Agri-portals and felt their utility. Information sharing behavior was classified as follows:

S. No.	Category	Score
1.	Shared	2
2.	Not shared	1

3.6. Tools and techniques of data collection

Tool is the device used to collect the data. There are two sources of data collection-primary and secondary sources. Primary sources provide first hand information while secondary data are those already recorded for some other purpose but used in research.

Based on the understanding of facts and related reviews, a structured questionnaire was prepared to collect data. A semi-structured interview schedule was also developed to investigate in depth various dimensions of the study. Data collection tools were prepared by giving due consideration to various variables, objectives and respondents. Pre-testing was done on 30 teaching faculty of the College of Agriculture; who were not included in the final sample. Based on pre-testing, the necessary modifications and changes were made in the questionnaire and.

3.6.1 Interview schedule

The respondents were interviewed through structured interview schedule **(Annexure I)** prepared for the purpose. It was divided into three major sections. The first section consisted of questions regarding general profile of the respondents while the second section dealt with communication and related aspects. The third part consisted of total human resource involved, inputs used and the activities of key stakeholders of the Agri-portals and products developed during the project period. This information was collected through secondary sources.

Data collection

Data collection was done with the help of interview schedule, impact assessment index and opinionnaire from May, 2011 to July, 2011. All the farmer respondents were personally interviewed by the researcher in the study area. Portal managers (IIT, Kanpur and

IIT, Bombay), GBPUAT, scientists and the KVK functionaries were contacted through electronic mails.

Observation

In this study, observation technique was also used to enrich the data and verify the responses. An observation is the classic form of data collection in naturalistic or field research. Observational data is used to describe settings, activities and people; and such data can present this description from the perspective of the participants. Because observation provides knowledge of the context in which events occur, it can lead to deeper understandings that interviews alone. It was also contended that observations may enable the researcher to see things that the participants themselves are not aware of, or that they are unwilling to discuss. Relevant data about respondents' house, family type, material possession, annual income etc. were recorded on the basis of non-participatory observation. During this investigation the researcher frequently visited to the sampled villages and made several non-participant observations on various aspects under study. In order to collect some other information secondary sources were used.

3.6.2 Impact Assessment Index

In order to study extent of awareness of Agri-portals, inputs used, activities of key stakeholders, outputs of selected Agri-portals, knowledge and extent of adoption of the advices, opinion of stakeholders, practice change, information sharing behavior of farmers, gratification of the services of Agri-portals and immediacy of feedback by Agri-portals, following procedure was used to develop Impact Assessment Index:

3.6.2.1 Collection of items:

The tool in the present investigation consisted of twelve major areas related to the impact of selected Agri-portals. Each major area consisted of a number of sub-areas, under it. The major areas as well as their sub-areas were selected after thorough consultation with experts. Moreover, various literature, books and journals were also referred to select the areas.

3.6.2.2 Analysis of items:

After a preliminary selection and editing of items, twelve major areas and different sub areas delineated initially which were subjected to item analysis. The items were subjected to judgment by a panel of 20 judges. The judges were requested to go through the items and indicate their significance on a three point continuum as “Highly relevant”, “Relevant” and “Irrelevant” with corresponding scores of 3, 2, and 1 respectively. The relevance percentage of more than 75 was used as cutting point while screening and consideration for selection of the major areas and their sub areas.

3.6.2.3 Validity and reliability of the tool

Validity of the index

In the present investigation, validity of the index was examined for its content validity. Content validity is the representativeness or sampling adequacy of content, substance, matter and topics of a measuring instrument **(American Psychological Association, 1966)**. In developing ICT knowledge and skills index, the experts as judges were identified as those who had long experience of working with agriculture and ICT resources and produced materials using ICT applications by themselves. They were asked to judge the sampling adequacy of the contents. Thus, the judgment of the judges was taken into account before using the final index. The final index consisted of eleven major areas of ICT in agriculture, knowledge and skills.

3.6.2.4 Reliability of the index:

Reliability is the accuracy or precision of a measuring instrument **(Kerlinger, 2004)**. The split-half approach can be viewed as variation on the alternate-forms estimate of reliability. The items that comprise a given measure were split in half, and each half is treated as if it were an alternate form for the other, thereby obviating the need to construct two forms of the same measure. As with alternate - forms reliability estimates, scores on the two halves of the measures are correlated. This correlation however is based on measures that are half as long as the original one.

In order to estimate the reliability of a measure twice as long as each (i.e., the length of the original measure), split half correlations are traditionally stepped by the Spearman-Brown formula:

$$R_n = \frac{nr}{1} + (n-1)\ r$$

Where,

R_n = Reliability of the test n times

r = Coefficient of reliability obtained between the parts of the divided test

n = in the method of odd-even reliability, n is 2.

In the present study, the correlation between two halves of ICT knowledge and skills was found to be 0.69. Thus, the estimate of the reliability was 0.81 and the index was considered to be highly reliable.

Types of documentation

Diary method was used to document experiences and specific observations during visits to villages. Photographs were along taken for in depth analysis of the study area.

3.7. Hypotheses of the investigation

H_0 : There exists no relationship among socio-economic characteristics and knowledge level of the farmers about selected Agri-portals.

H_0 : There exists no relationship among communication characteristics and knowledge level of the farmers about selected Agri-portals.

H_0 : There exists no relationship among farming characteristics and knowledge level of the farmers about selected Agri-portals.

H_0 : There exists no relationship among socio-economic characteristics and adoption of the practices recommended by selected Agri-portals to the farmers.

H_0 : There exists no relationship among communication characteristics and adoption of the practices recommended by selected Agri-portals to the farmers.

H_0 : There exists no relationship among farming characteristics and adoption of the practices recommended by selected Agri-portals to the farmers.

Statistical Tools for analysis:

One of the most important aspects of research methodology is analysis and interpretation of data. These data were analyzed and interpreted according to the objectives of the study. The collected data were tabulated and analyzed using Statistical Package of Social Sciences (SPSS) with the help of following statistical methods.

Percentage

The percentage values were calculated to make a simple comparison. It was measured by dividing the frequency of particular cells by total number of sample/observation and multiplying it by 100.

$$\text{Percentage (\%)} = \frac{f}{n} = \frac{Frequency}{Total\ number\ of\ observation} \times 100$$

Mean

It is the average value of a series of observations. The mean score for each category was worked out separately from the formula:

$$Mean\ (\bar{x}) = \frac{\sum x}{n}$$

Where,

$\sum X$ = sum of each of the individual observation

N = Total number of respondents.

Standard Deviation

Standard Deviation is the measure of variability in a set of scores, computed for the purpose of analysis and further categorization of data. Standard Deviation was calculated by using the following formula:

$$\text{Standard deviation (S.D.)} = \sum \frac{(x - \bar{x})^2}{N}$$

Where,

The X = value of individual variables

$\bar{x}$ = mean value

N = Total number of items

Coefficient of variation (CV)

CV indicates the relative variation. The formula used for calculating CV is given below:

$$\text{CV} = \frac{\sigma}{\bar{x}} \times 100$$

Where,

σ = SD and

$\overline{X}$ = arithmetic mean

Multiple Regressions

$$\hat{Y} = a + b_1X_1 + b_2X_2 + \ldots\ldots.. + b_{17}X_{17}$$

Where,

$\hat{Y}$ = the variable to be predicted

a = the constant or intercept

b_1 = the slope of the first predictor

b_2 = the slope of the second predictor

X_1 = the score of the first predictor

X_2 = the score of the second predictor

ANOVA

1) Hypothesis $H_0 : \mu_1 = \mu_2 = \ldots\ldots\ldots = \mu_k$

H_1 : Not all means are equal

ANOVA Table

Source of variance	d_f	**SS**	**MS**	F_{cal}
Between samples	k-1	SS_B	MS_B	$\frac{MS_B}{MS_E}$
Error	n-k	SS_E	MS_E	
Total	n-1	SS_T		

Where,

K = number of samples

n_1, n_2 ,........, n_k = Sample sizes

n = $n_1 + n_2 + \ldots\ldots + n_k$

T_1, T_2 ,........, T_k = Sample totals

G = Grand Total = $\sum T_i$

Correction Factor (CF) = $\frac{G^2}{n}$

$SS_B = \sum \frac{T_i^2}{n_i} - \text{CF}$

SS_T = (Sum of squares of all observations - CF)

$SS_E = SS_T - SS_B$

$MS_B = \frac{SS_B}{K-1}$

$MS_E = \frac{SS_E}{(n-k)}$

Rejected H_0 , if $F_{cal} \geq$ F (K-1, n-k, α)

Testing significance of multiple regression

The t-test was used to test the significance of multiple regression. This test depicts whether the calculated multiple regression between the two variables is high enough to be considered as significant or not. If the r-values were found significant the correlation was considered as significant due to actual relation between the two variables otherwise it was attributed to chance or errors. The formula used for this is as follows:

$$t = \frac{r}{\sqrt{1-r^2}}\sqrt{N-2}$$

Where,

r = correlation coefficient

N = Number of respondents in a group

The calculated value was compared with the table value of ‘t’ at N–2 degree of freedom. If the calculated value of ‘t’ was higher than the observed value then correlation between two variables was significant otherwise not.

Theoretical understanding of the subject paves the way for formulating and understanding the research problems. Conceptual orientation is essential for getting entry into a subject matter. It gives a deeper insight into its magnitude. A concept expresses an abstraction formed by generalization from particulars **(Kerlinger, 2009).** This chapter discusses and elaborates the theoretical base and conceptual aspects of some of the intricate issues in the study under following headings:

4.1 Information and Communication Technology (ICT)

4.1.1 Use of ICT for Agricultural Development

4.2 Impact assessment

4.3 Impact assessment: Theories and Models

4.1 Information and Communication Technology (ICT)

The so-called traditional ICTs – radio, television and the print media – did play a major role during the Green Revolution in the 1970 and 1980s. In the past two decades South Asia has been a major hub for rural ICT experiments. Some commonly used ICT applications or tools include: telecenter, web portals, call centers, mobile phones, community radio, video and digital photography. GIS, e-mail, audio and video conferencing are also being used increasingly by researchers and development professionals.

There has been considerable growth in connectivity, content and capacity of the agriculture sectors of South Asia in the last decade **(Pradhan and Liyange, 2010).** However, the region's countries still lag behind developed countries in the ICT Development Index (IDI) published in 2010 by the International Telecommunication Unit (ITU), which is the UN agency for Information and Communication Technology. Of the 159 countries in the IDI, India ranks 117th position **(ITU, 2010)**.

ICTs generally refer to an expanding assembly of technologies that are used to handle information and aid communication. These include hardware, software, media for collection, storage, processing, transmission and presentation of information in any format (i. e. voice, data, text and image) through computers, the internet, CD-ROMs, email, telephone, radio, television, video, digital cameras etc. The advent of new ICT technologies in recent years has resulted in these now being regarded as traditional ICTs. The new ICTs are commonly referred to as "evolving applications" or technologies that rely on the Internet, telecommunication networks, mobile phones, personal computers and databases. When discussing ICTs in general, however, we also need to look at traditional ICT applications and the emerging convergence of many of these with the new ICTs **(Bisht, 2008)**.

Maneja (2002) revealed that ICT is the modern science of gathering, storing, manipulating, processing and communicating desired type of information in a specific environment. Computer technologies and communication technologies are the main supporting pillars and the impact of these two in the information storage and dissemination is vital.

Aneeja and Shenoy (2002) revealed that ICT is a powerful tool for the effective dissemination of information or knowledge gained across different areas. The basic function of the ICT is amalgamating local knowledge incubated by the communities with information existing in remote database and in public domain to herald formation of knowledge society.

According to **Chen and Kee (2005)** information and communication technologies are the backbone of the knowledge economy and in recent years have been recognized as an effective tool for promoting economic growth and sustainable development.

The role of ICTs is recognized in Millennium Development Goal 8 (MDG8), which emphasizes the benefits of new technologies, especially Information and Communication Technologies, in the fight against poverty. "With a 10 per cent increase in high-speed internet connections, economic growth increases by 1.3 per cent", observed a recent World Bank report on Information and Communication for Development **(World Bank, 2009).** The same report also observed that "Connectivity-whether the Internet or mobile phones – is increasingly bringing market information, financial services, health services to remote areas and is helping to change people's lives in unprecedented ways".

In the 1990s, at the height of the technology boom, rural ICTs was heralded as catalysts for "leapfrog development", 'information societies' and a host of other digital-age panacea for agricultural development. Now they have largely "fallen out of favor" **(Economist, 2005).**

Beardon (2005) argues that the impact of ICT-based projects has generally fallen well below the optimistic expectations generated by their protagonists, and consequently they have developed a bad reputation in development circles.

Researchers have now started to question the sustainability, scalability and the impact of such ICT pilots and experiments. **Jhunjunwala and Aiyar (2007)** observed that "only a few organizations in India have taken up ICT initiatives in any comprehensive manner and have tried to build services which can be scaled up and have a long term sustainable impact on the society. Reluctance to commercialize and scale these projects has led to their collapse as soon as the intervening agencies move out". In other words, many ICT projects in South Asia lack a self-sustaining capacity after the experimental phase, usually because they are funded by international agencies that cease funding over a period of time and user communities are poor to carry on with the projects **(Prasad, 2008).**

4.1.1 Use of ICT for Agricultural Development

i. ICTs are mostly used to disseminate information

Most of the ICT and Knowledge Management applications focus on disseminating information. Much of this information is generic and disseminated in a top-down fashion. For instance, most portals have the following sets of information: a package of practices for cultivation of a particular crop; eligibility requirements to benefit from a certain scheme; tips; crop calendars; information on input and planting material sources; weather updates; prices of outputs in major markets etc. Portals vary considerably in terms of user friendliness, use of visuals and regular updates. Although many of this portals/website used only English as the primary language earlier, they are now becoming multilingual and more recently, use the local language.

ii. Lack of local relevance of content, which is also not customized to the capacity of users

The value of information provided by ICT application greatly depends on its local relevance, whether it can be customized to a farmer's resource situation, as well as his/her capacity to use that information. Old ICTs, such as radio, television and print media, also suffer from the fact that they do not offer customized information, and what they do offer is through one-way transmission. However, with the rising trend of live or phone in programs and interactive portals, there are greater possibilities for interaction with experts.

Initiatives that use ICTs have also tended to focus on the issue of connectivity, with not enough attention paid to the generation of relevant content or efforts to build capacity. Packaging and adding value to information (downloading, simplifying, translating and adapting information into local languages) as well as documenting and uploading local information are all critical steps toward enhancing relevance and therefore, increasing user-friendliness of telecenter **(Gurumurthy, 2006).**

iii. ICTs for training farming communities

ICTs are used as tools to train rural communities in a few cases. One such initiative is the case of instructional videos by Digital Green in India. Digital Green produces videos that are instructional in nature – mainly recording of demonstrations that are made when an extension agent teaches farmers a new technique **(Sulaiman, 2011)**. One important feature of the company is that it tends to include local farmers in these instructional videos. The videos are also location-specific and feature local farmers who will be familiar to a particular audience, as opposed to experts in idealized conditions.

iv. ICTs in knowledge management

Knowledge management generally refers to the sharing of knowledge inside and from an organization to the outside. This involves generating, capturing and disseminating knowledge. Researchers have pointed out two kinds of knowledge: tacit (context-specific personal knowledge embedded in individual experiences and thus, difficult to share) and explicit (that can be easily articulated and transmitted). Explicit knowledge is easy to share or transmit; sharing tacit knowledge is comparatively difficult. Tacit knowledge plays an important role in providing meaning to explicit knowledge as well as contributing to the development of new knowledge. ICTs can support the transformation of tacit knowledge to explicit and vice-versa **(Sulaiman, 2011).**

Table 9: Technologies supporting Knowledge Transformation

Tacit to Tacit	**Tacit to Explicit**
E-meetings Synchronous collaboration (chat)	Answering questions Annotation
Explicit to Tacit	**Explicit to Explicit**
Visualization Browsable video/audio of presentation	Text search Document categorization

Source: Marwick (2001)

The most important tools deployed in knowledge management include organizational web pages and special portals created for specific commodities, sectors and enterprises or for specific activities such as e-commerce. Electronic databases, audio and video recordings, and multi-media presentations are also used widely to capture and disseminate knowledge.

Agropedia, is a current initiative that aspires to manage and organize the widespread knowledge in the Indian agricultural domain by building up an agriculture 'e-community' and strengthening the networks among different members of this community. It is a platform where both specialists in agricultural research and education as well as others interested in agriculture can make lasting contributions to a vast growing knowledge base (www.agropedia.net). A similar initiative, "*wikigoviya*" exists in Sri Lanka.

There has been a certain cache to the idea of using ICTs for knowledge management in development circles. This has sparked a mushrooming of websites and portals around a single commodity or enterprise, which indicates that there may be problems with sharing knowledge across various competing organizations in the same sector. A careful analysis of these websites and portals indicates that these are mostly used for disseminating generic information and there is very little contextualization to convert this to relevant knowledge that could be acted upon. Very few websites and portals have means for interaction in order to enable knowledge sharing or exchange **(Sulaiman, 2011)**.

Wherever these kinds of network or groups (farmers, self-help, common interest, commodity, use etc.) exist, communities are better placed to use information obtained through ICTs. The impact of ICTs, therefore, feels more in group context. The group context is, thus, a better forum for deploying ICTs if the new knowledge generated externally has to be applied and used.

Thus, Information and Communication Technologies are those technologies which can be used to interlink information technology devices (such as personal computers, digital camera, digital video camera and players, slide projectors and their telecommunication networks). The personal computer or laptop with e-mail and internet provides the best example. ICTs is said to be an assembly of technologies and tools that can be used to collect, store and share information between people using multiple devices and multiple media. It has been used in information dissemination in local language to the rural poor and farmers, playing a catalytic role in knowledge management, and in training the farming communities in better agricultural practices.

4.2 Impact Assessment

Impact evaluation is the systematic identification of the effects – positive or negative, intended or not – on individual households, institutions, and the environment caused by a given development activity such as a program or project. It is a type of evaluation which has received increasing attention in recent years. It is an important component of the armory of evaluation tools and approaches, albeit only one among a number.

Impact can be conceptualized as the difference between what happened with the project or program and the situation if the intervention had not been made, i.e., the counterfactual situation **(Singh *et al*, 2008)**.

Impact evaluation helps us better understand the extent to which activities reach the poor and magnitude of their effects on people's welfare. Impact evaluations can range from large scale sample surveys in which project populations and control groups are compared before and after, and possibly at several points during program intervention; to small-scale rapid assessment and participatory appraisals where, estimates of impact are obtained from combining group interviews, key informants, case studies and available secondary data **(World Bank, 2008)**. Many definitions of impact assessment have been developed, but a comprehensive definition presented by the **Joint Committee on Standards for Educational Evaluation (1994)** holds that impact assessment is "systematic investigation of the worth or merit of an object."

Current debate on impact assessment dictates that the purpose of impact assessment is to improve rather than prove impact **(Nadvi, 2004).** Impact could also be short term as well as long term. Referring to ICTs, **Menou (1998)** defines impact as the change in the ability of people to satisfy their needs brought about by the use of technology. Notwithstanding the clear need for impact assessment, little empirical evidence is available concerning the impact of ICT project on the lives of the beneficiaries **(Amariles, Paz, Russell & Johnson, 2006)**, particularly in the agricultural context.

It is understood that a successful impact assessment needs to explore the whole 'impact chain' and so investigate the linkages between inputs and activities, how these generate the outputs which then produce outcomes and finally impact. Although originally, impact assessments have been single method, there has been a move towards multi-method approaches. Method of assessments includes surveys, appraisals, observations, case studies, and participatory learning **(Saade, 2008)**.

FAO (2000) reported that *Impact* refers to the broad, long-term economic, social and environmental effects resulting from research. Such effects may be anticipated or unanticipated, and positive or negative, at the level of the individual or the organization. Such effects generally involve changes in both cognition and behavior.

The overall impact of an ICT4D project can be classified into one of the five following categories **(Heeks and Molla, 2009)**:

- ***Total failure***: the initiative was never implemented, was implemented but immediately abandoned, or was implemented but achieved none of its goals.
- ***Largely unsuccessful***: some goals were attained but most stakeholder groups did not attain their major goals and/or experienced significant undesirable outcomes.
- ***Partial success/partial failure***: some major goals for the initiative were attained but some were not and/or there were some significant undesirable outcomes
- ***Largely successful***: most stakeholder groups attained their major goals and did not experience significant undesirable outcomes.
- ***Total success***: all stakeholder groups attained their major goals and did not experience significant undesirable outcomes.

Major goals are the main objectives a group wanted to achieve with the ICT4D project (which might typically relate to outputs and/or outcomes and/or development impacts); undesirable outcomes are unexpected outcomes that a group did not want to happen but which did happen.

Impact assessment is done for several practical reasons **(FAO, 2009)**:

(1) **Accountability** – to evaluate how well we have done in the past, to report to stakeholders on the return of their investment, and to underpin political support for continued investment;

(2) **Improving program design and implementation** - to learn lessons from the past that can be applied in improving efficiency of research programs; and
(3) **Planning and prioritizing** - to assess likely future impacts of institutional actions and investment of resources, with results being used in resource allocation and prioritizing future programs and activities, and designing policies, programs and projects.

Impact assessment is viewed as a type of research evaluation. Research evaluation involves judging, appraising, or determining the worth, value or quality of research (proposed, ongoing or completed) and is done in terms of its relevance, effectiveness, efficiency and impact **(Horton *et al.* 1993)**. Impact assessment can be carried out at different levels of aggregation—individual research projects, specific research programs, or the research system as a whole—depending on the objectives and type of the exercise. There are several stages of research evaluation along a time continuum, and impact assessment can be viewed as occurring in the design and post-adoption stages at different levels of research system as depicted in Figure 1. Looking at the past, **ex post impact assessment** and evaluation of performance, achievements and impacts were mostly used. This is most suitable at the aggregate system level or a research program level.

During the present stage along the continuum, there are monitoring and evaluation of on-going research activities aimed at providing information to guide present activities and revision of ongoing projects. This is usually done at a research project level. Looking towards the future, there is **an ex ante impact assessment** of likely future environments and of the expected impacts of ongoing agricultural projects. **"Ex-Ante"** impact assessment is undertaken while the project is in process. They may occur at the midpoint of a project although they are very closely associated with the ongoing monitoring of the project. An Ex-Ante evaluation is an opportunity to pause and think about the direction of the project, making sure the project is on course for fulfilling its intended purpose, and redirecting if necessary **(infoDev, 2008)**.

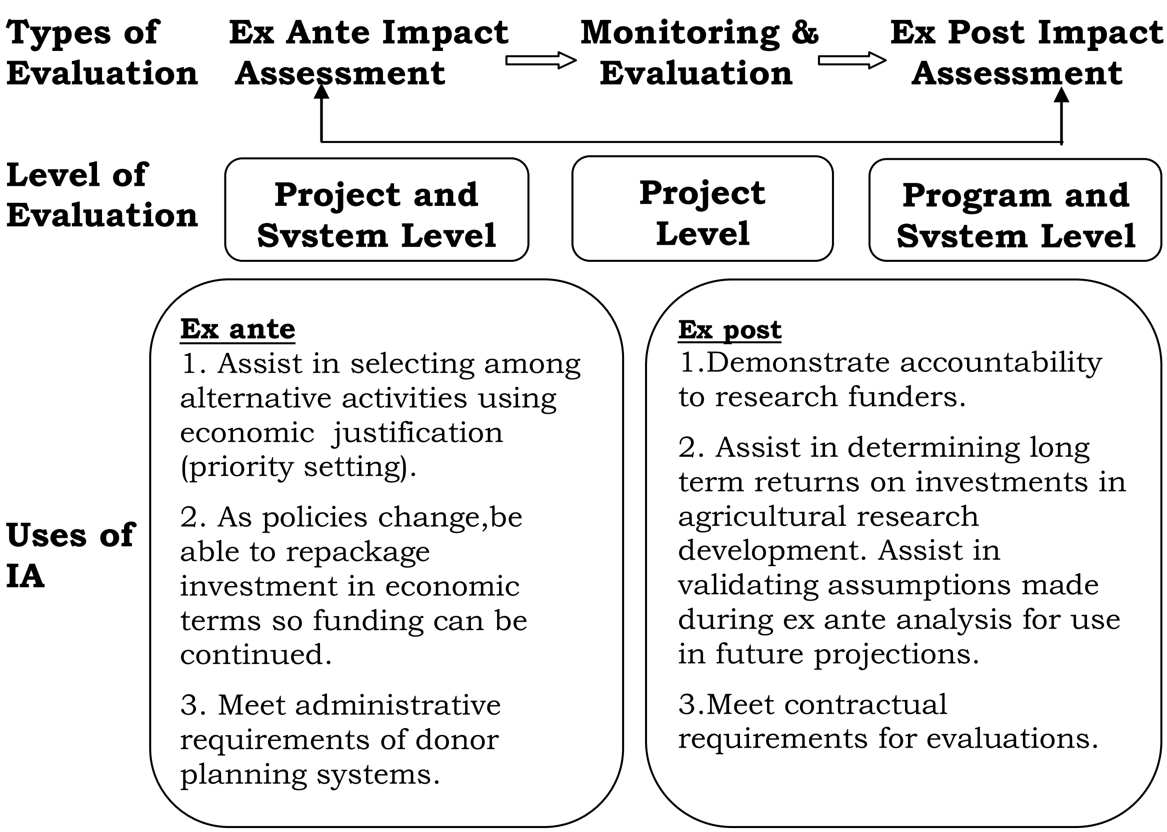


Plate 7: Types of Impact Evaluation (Foster et al, 1990)

Still, there are few factors which affect the type, intensity and focus of impact assessment. These factors can be best studied by a comprehensive model given by **FAO, 2000:**

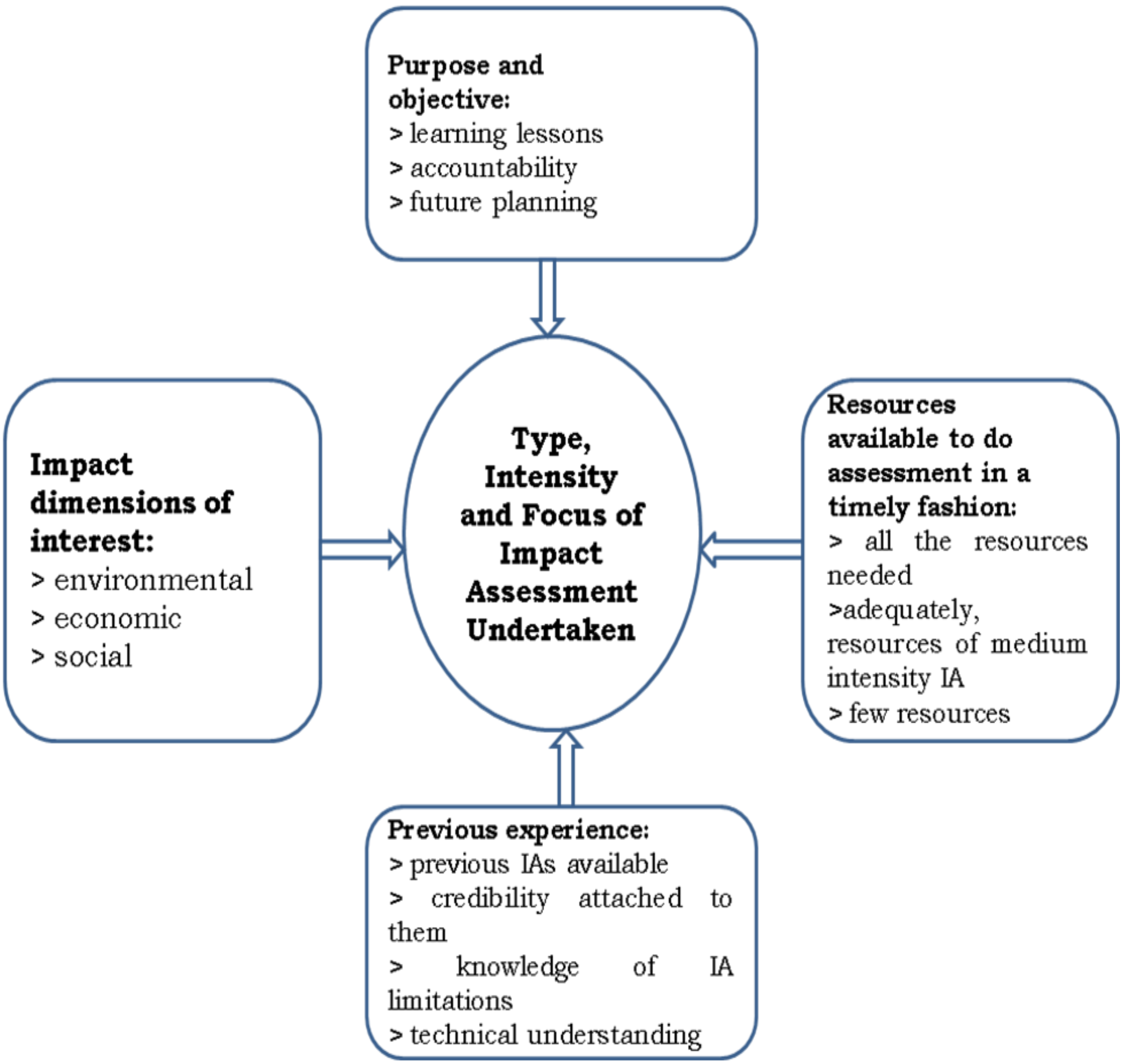


Plate 8: Factors Determining the Type, Intensity and Focus of Impact Assessment

Thus, it can be concluded that Impact is the totality of the effects of a development intervention, and also refers to effects in the long term or to effects on the scale of societies, communities, or systems. It can be classified in several categories on the basis of its success of failure. There are several reasons for which impact assessment can be conducted viz. accountability, project improvement and planning & prioritizing etc. Appropriate impact assessment design can be used based on the stages of the project implementation like ex-ante or ex-post impact assessment. But there are many factors which affect the intensity, focus and results of impact assessments, thus, impact assessment especially in agriculture needs a critical review and monitoring,

4.3 Impact Assessment: Models and Theories

According to **Menou (2004)**, “there is no single blueprint for impact assessment”. Instead, there is a continuum of more quantitative economic approaches to sociological and anthropological approaches **(Kirkpatrick and Lee, 2000)**. The present section of this chapter deals with few such models for impact assessment of ICT projects in agriculture. Although a number of ICT initiatives that tackle the digital divide have been analyzed, there is a paucity of frameworks that can be used to meaningfully assess the impact of ICT projects in agriculture. Therefore, an analysis of the relevant existing model has been done to find out a suitable framework for the present investigation.

1. Heeks’ (2005) Information Chain Model

Traditionally, ICT impact research towards development has been carried out in order to 1) understand the economic/social developmental impact **(Adam & Wood 1999)**, or 2) assess or measure the impact (impact assessment) considering different quantifiable indicators (ITU 2006). This research takes the former perspective of ICT impact research towards development. Literature on 'ICT and development' in developing countries emphasizes that local context and content are important while studying the impact of ICT towards development **(Conradie & Jacobs 2003; Krishna & Madon 2003; Roman & Colle 2003; Avgerou 2006).** Once the local context is identified, the next step is to identify the broad areas of development. Previous studies have demonstrated that ICT impacts can be applied in many ways, with various perspectives such as agriculture, economics, education, health, and so on.

Heeks' (2005) information chain model is a useful technique to understand ICT led developmental impact. Fig. 3 demonstrates how an individual processes data into information and as such acts upon it to achieve desired outcomes. In this model, data are used as the input which is then processed through assessment (assessing its relevance) and applying (applying assessed data to a specific decision); with information as the output. According to **Heeks (2005)**, the information chain model must be understood in its surrounding context of economic, social, data and action resources which assists human beings to transfer data to information.

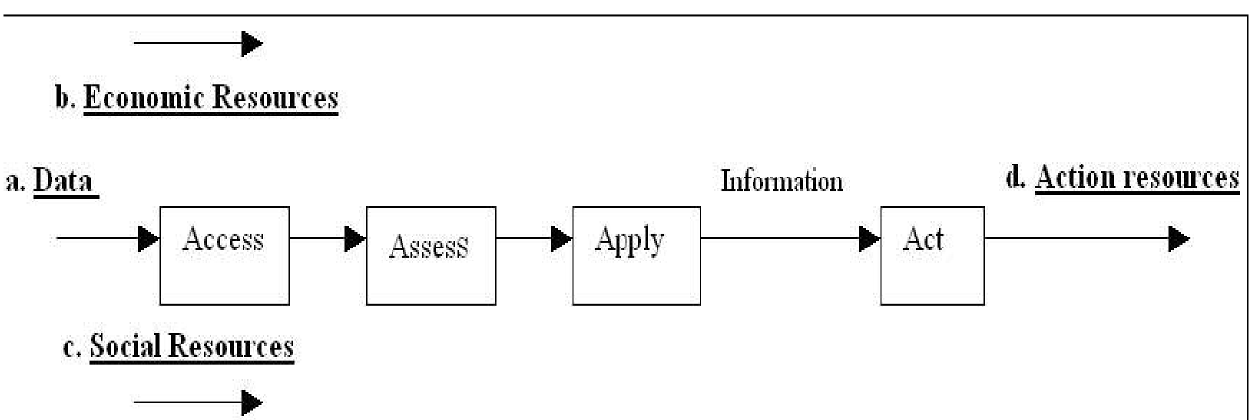


Plate 9: Heeks' (2005) information chain model

Supporting **Heeks (2005), Avergou (1998) and Gigler (2004)** argue that focusing on technological factors such as the rate of technology adoption; Internet hosting and computer ownership volume should not be the only solution towards ICT led development in developing countries. Access to information via the Internet or telecommunication is not a very difficult task. A greater challenge is the assessment and transformation of that data to meaningful knowledge, as well as the availability of the social resources. Hence, peoples' capabilities to access and assess data; and acquire and share knowledge need to be considered in ICT impact research in developing countries. This research views the issues through the lens of **Heeks' (2005)** information chain model as a foundation to improve understanding of the process of impact of ICT led development from the participants' perspectives.

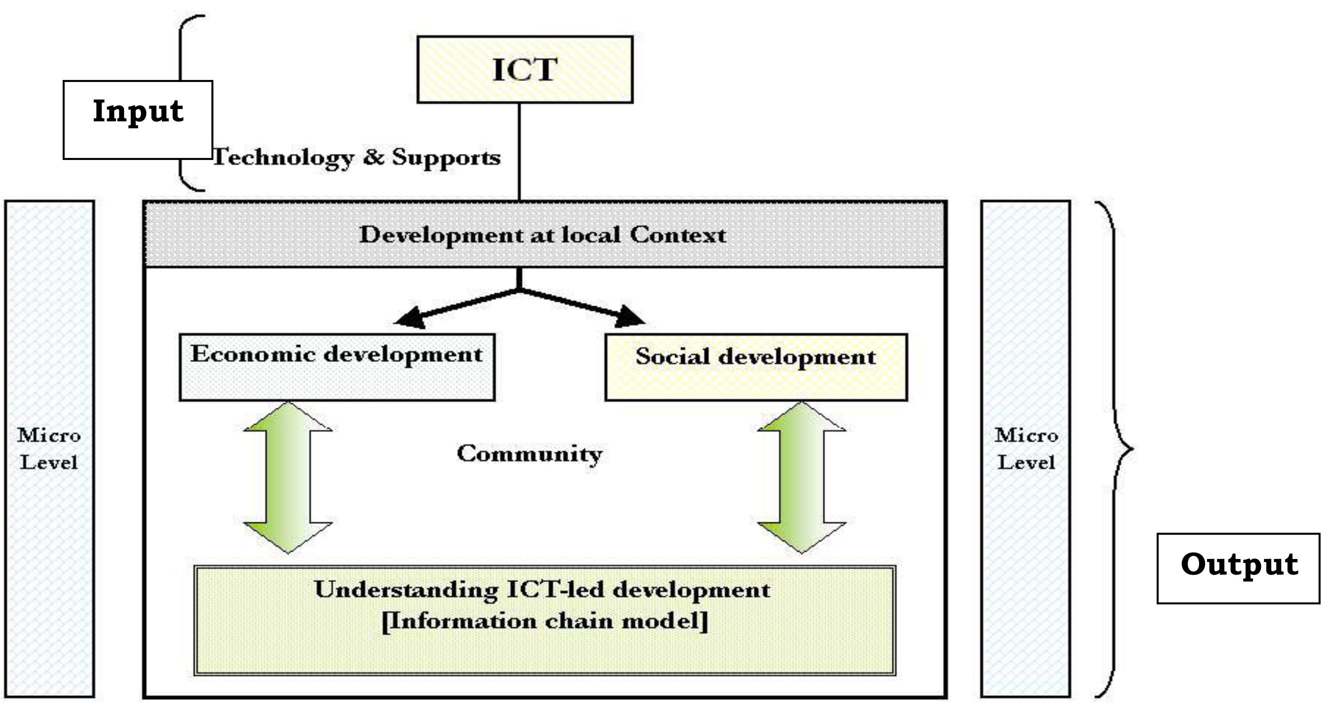


Plate 10: An extended framework for investigating ICT impact towards development

The information chain model is divided into two segments; **1)** *ICT*, act as input, where the aim is to provide technology and support in rural areas conducive to an improved standard of living, and **2)** *Development,* as the output, which is perceived and experienced by the participants due to the presence of ICT in their localities (rural/village areas). Hence, *input* is the term used for the program itself (ICT intervention's goal) and *output* impact is considered to be the results (actual impact) of that *input.* The two broad developmental facets provide some areas of development to view in general, and then, **Heeks' (2005)** model enables to understand the process of ICT led development from the participants' viewpoints.

2. **A refined framework to investigate ICT led development at community level, (Ashraf *et al.*, 2007)**

Heeks's (2005) uni-directional information chain model as a useful starting point for analyzing ICT-mediated intervention initiatives, but as not fully addressing the challenges of the ICT led development from the perspective of the target community. Hence, the refined framework, includes consideration of social constraints that hindered the ultimate process of development was developed by **Ashraf *et al.* (2007)**. In Fig. 3, the broad right-left arrow representing this interconnection. Addressing social barriers remains a challenge which, if successfully resolved, can then be linked with development. This interconnection is represented by the broad left right arrow.

Finally, the two broad developmental impacts (output) might usefully be compared with the initial statement of desired impact, finally in order to evaluate the program, and importantly if employed early, potentially to guide modifications to the intervention.

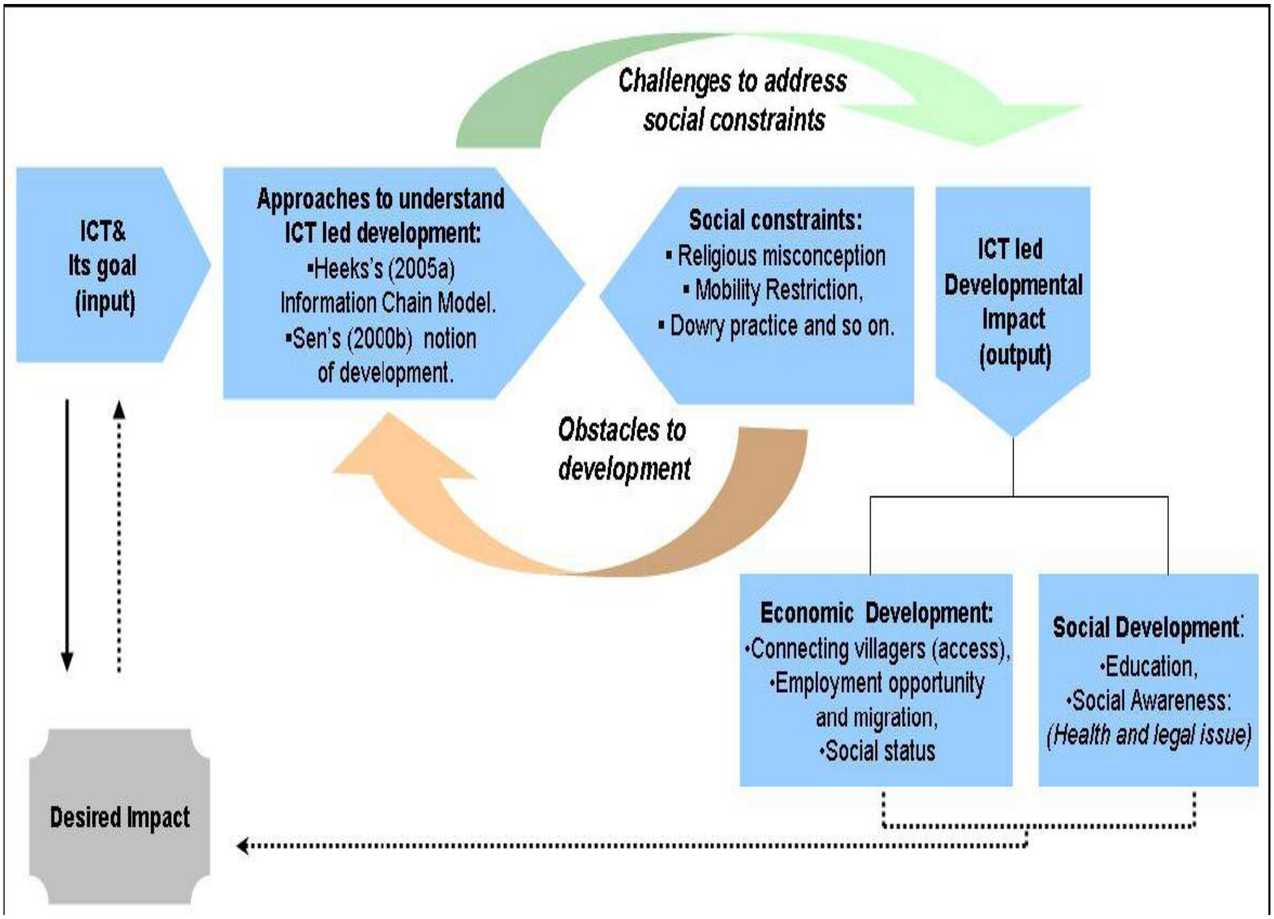


Plate 11: Refined framework to investigate ICT led development at community level (2007)

3. Social Impact Assessment (Vanclay, 2003)

The Social Impact Assessment framework says that social impact assessment analyses the intended and unintended social and cultural consequences of planned policies, programs and any social change invoked by ICT interventions in a farming community.

The model places an emphasis on social impacts; however, ICTs are expected to have an impact greater than social only. The framework is noted for issues that may impact the developing country's indigenous farming community.

4. Measuring Impact (NCVO, 2003)

It refers that impact assessment to be broader than performance measurement**.** It assesses the need and demand for the initiative, resources, activities, outputs (outcomes) and impact.

The relevant outcomes include quality of life; skills, confidence and self-esteem; access to learning and skills development; community development and social inclusion; participation in and effect on service provision; empowerment; employment and cultural activities, financial and public awareness. Relevant impacts include social inclusion, community development, local employment, improved health and well being, participation in local decision making and enhanced cultural life.

5. Logic Approach Model of Impact Assessment

A logic model given by Suchman, 1967; set out how an intervention (such as a project, a program, or a policy) is understood or intended to produce particular results **(Rogers, 2005).** Some versions of a logic model present it as four components in a linear sequence: inputs, activities, outputs, and outcomes. These represent the logical flow from:

1. Inputs (resources such as money, employees, and equipment) to

2. Work activities, programs or processes, to

3. The immediate outputs of the work that are delivered to customers or stakeholders, to

4. Outcomes or results that are the medium-term to long-term consequences of delivering outputs.

This is displayed in a diagram such as this:

INPUTS --> ACTIVITIES OR PROCESSES --> OUTPUTS --> OUTCOMES

Other versions of a logic model set out a series of intermediate outcomes or results, explaining in more detail the logic of how an intervention contributes to intended or observed results. Some logic models also include assumptions, which are beliefs the prospective grantees have about the program, the people involved, and the context and the way the prospective grantees think the program will work, and external factors, consisting of the environment in which the program exists, including a variety of external factors that interact with and influence the program action.

One of the key insights of the logic model is the importance of measuring final outcomes or results, because it is quite possible to waste time and money (inputs), "spin the wheels" on work activities, or produce outputs without achieving desired outcomes. It is these outcomes

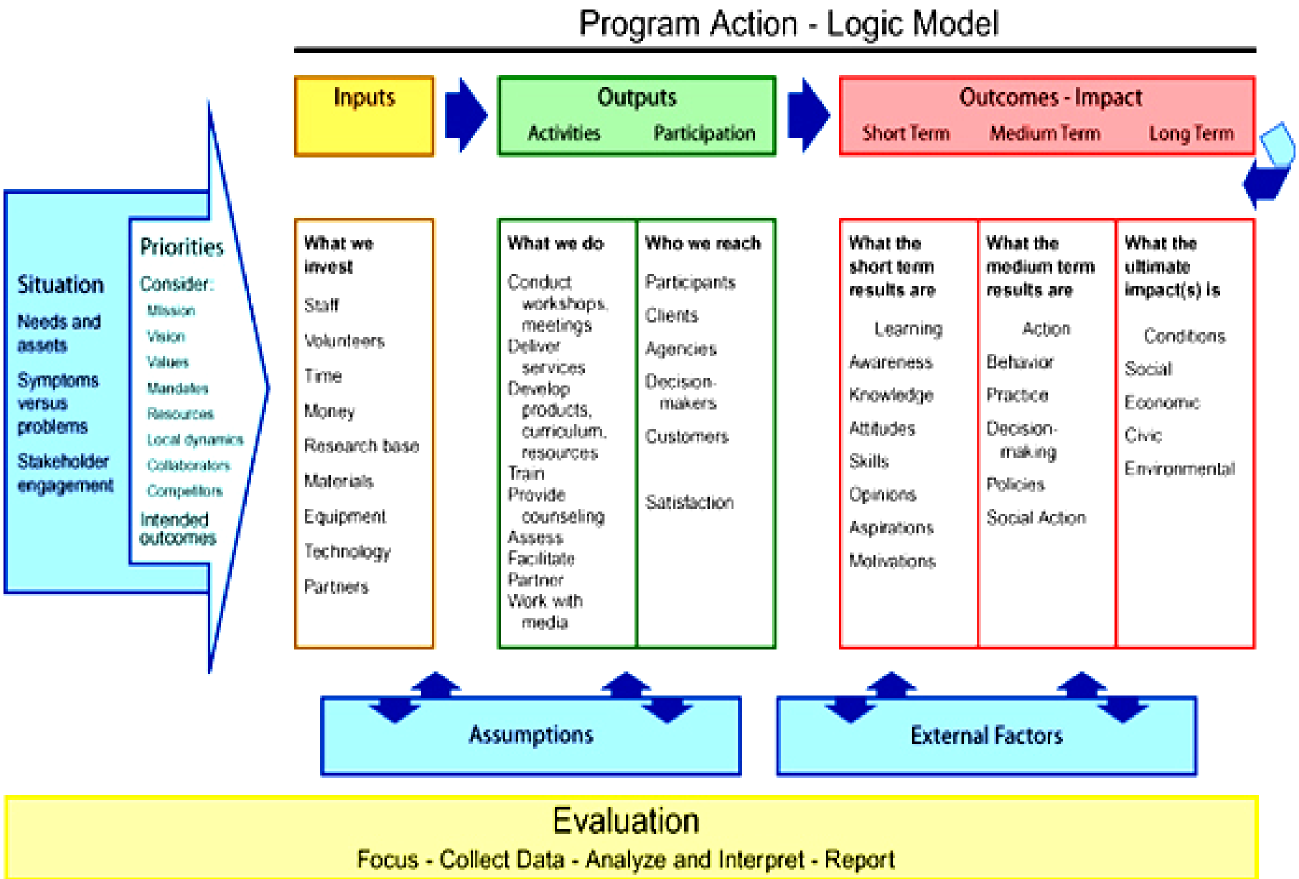


Plate 12: Logic Approach Model

(impact, long-term results) that are the only justification for doing the work in the first place. For commercial organizations, outcomes relate to profit. For not-for-profit or governmental organizations, outcomes relate to successful achievement of mission or program goals.

5. Program Action Logic Model

University Cooperative Extension Programs in the US have developed this more elaborate logic model, which includes six steps:

- Inputs (what we invest)
- Outputs:
    - Activities (the actual tasks we do)
    - Participation (who we serve; customers & stakeholders)
- Outcomes – Impacts
- Short Term (learning: awareness, knowledge, skills, motivations)
- Medium Term (action: behavior, practice, decisions, policies)
- Long Term (consequences: social, economic, environmental etc.)

In front of inputs, there is a description of a Situation and Priorities. These are the considerations that determine what inputs will be needed. The University of Wisconsin Extension offers a series of guidance documents on the use of logic models.

6. Participatory Impact Pathways Analysis (PIPA) Model (2006) It is a project management approach in which the participants in a project including project staff, key stakeholders and the ultimate beneficiaries, together co-construct their program theory **(Alvarez *et al.*, 2008)**.

The PIPA theory describes plausible impact pathways by which project outputs are used by others to achieve a chain of outcomes leading to a contribution to eventual impact on social, environmental or economic conditions. Impact pathways are a type of logic model, that is, they constitute a model that describes the logic of what the project will do, is doing, or what it did.

PIPA helps the projects' discuss and write down their assumptions and theories about how their project activities and outputs could eventually contribute to desired goals such as poverty reduction. The description of these assumptions and theories is a description of the projects (or program's) impact pathways. PIPA is helpful in:

- Clarify and communicate project's logic of intervention and its potential for achieving impact
- Understand other projects and identify areas for collaboration
- Generate a feeling of common purpose and better programmatic integration
- Produce an impact narrative describing the project's intervention logic
- Produce a framework for subsequent monitoring and evaluation

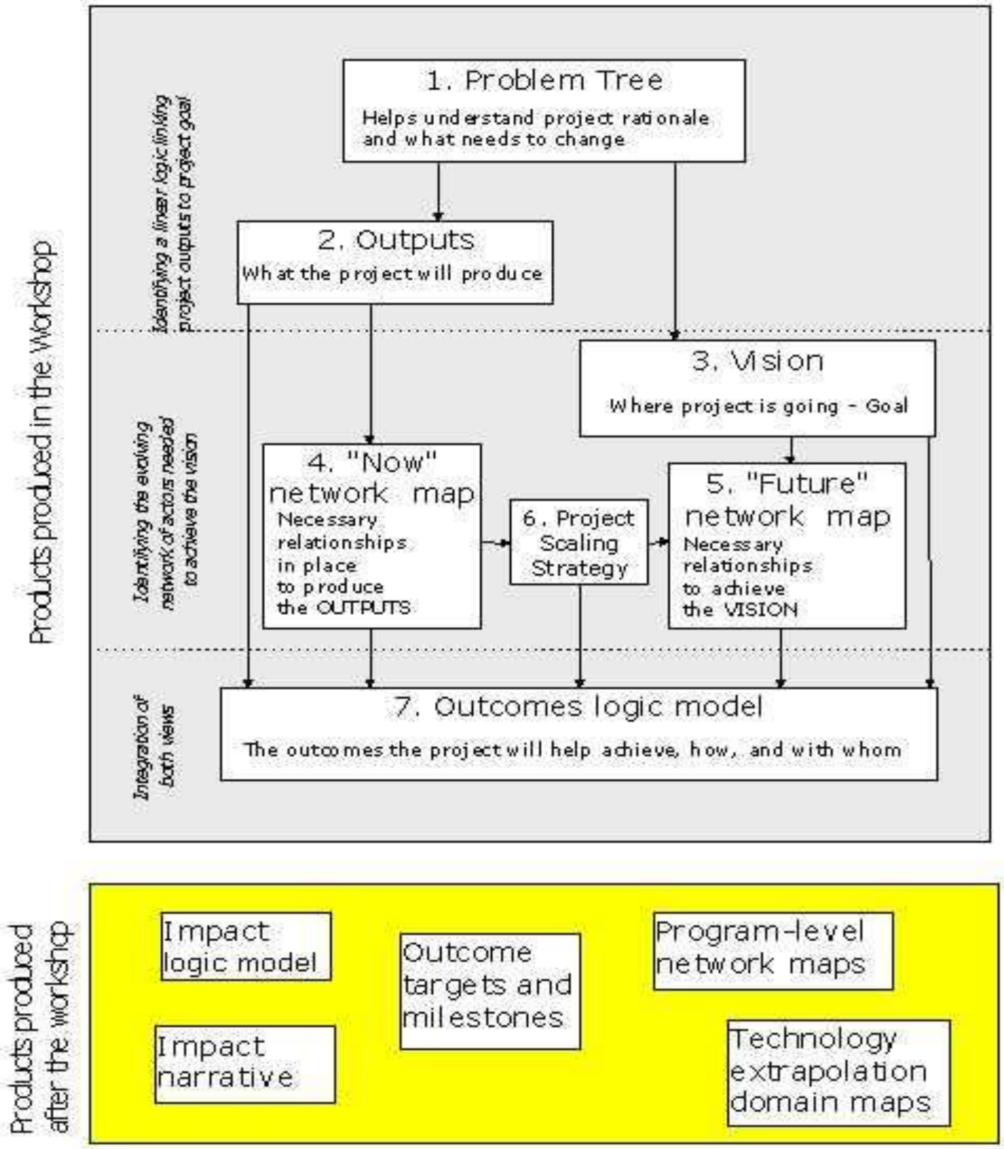


Plate 13: Participatory Impact Pathways Analysis (PIPA) Model (2006)

PIPA process

PIPA can be used at the beginning of a project, in the middle or at the end as a way of documenting and learning from the project. PIPA describes the project (or program) impact pathways in two ways: (i) causal chains of activities, outputs and outcomes through which a project is expected to achieve its purpose and goal; and (ii) networks of evolving relationships between project implementing organizations, stakeholders and ultimate beneficiaries that are necessary to achieve the goal. The workshop process, shown in the diagram, develops the two perspectives in turn and then integrates them.

7. **Bennett's hierarchy model of Planning and Evaluation (1979)**

Bennett's hierarchy has been used for almost 35 years in Cooperative Extension. Educators continue to relate well to this hierarchy in evaluating their Extension programs. Bennett's hierarchy contains seven sequential steps (input, activities, participation, reaction, knowledge, skills, opinions, aspirations-KASA, practice change, and end results/social, economic, environmental conditions-SEEC) (Plate 14). The first four steps focus around process evaluation, while the last three steps focus on outcome/impact evaluation. Modifications were made to the hierarchy by Bennett and Rockwell in1995 and in 2000 by adding a continuum linking program evaluation and program development (Plate 15). This revision helped educators understand that evaluation should be considered upfront in the design or planning phase of a program, not as an after-program activity.

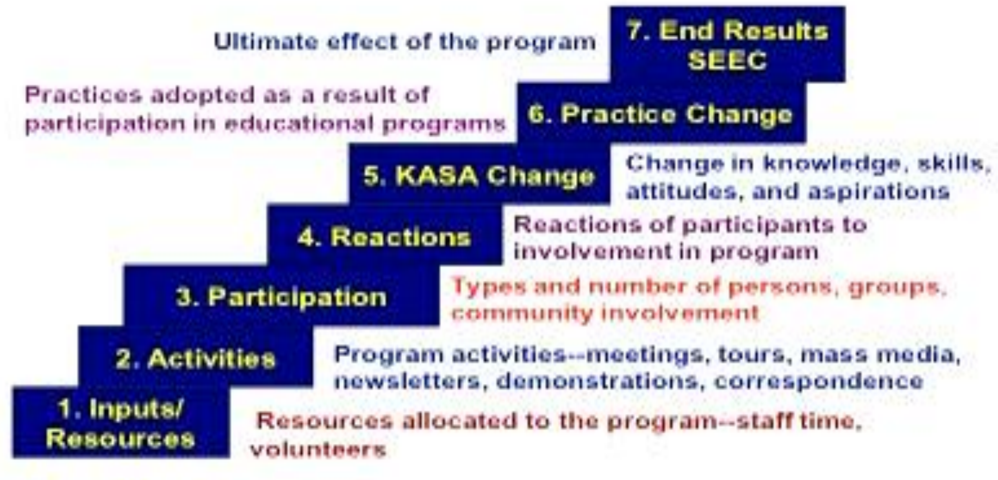


Plate 14: Bennett's Hierarchy Model of Planning and Evaluation (1979)

The model is hierarchical in two ways:

1. Each higher level provides stronger evidence of project accomplishments relative to identified desired conditions.

2. The difficulty and cost of obtaining evidence of project accomplishments generally increase as the hierarchy is ascended.

8. Targeting Outcomes of Programs (TOP) Model (1995)

Today, in a time of continued reduction in government funding, extension professionals are challenged more than ever before to document outcomes of programs and address stakeholder demands for accountability. This model provides a framework for linking Bennett's hierarchy to program outcomes and costs. Extension professionals could use this framework to link program outcomes and costs associated with such outcomes.

The TOP model is an outgrowth of **Bennett's hierarchy (Bennett, 1975 & Bennett, 1979)**. The hierarchy has been used principally by the Cooperative Extension to evaluate its programming in the U.S. and by extortionists in numerous other countries.

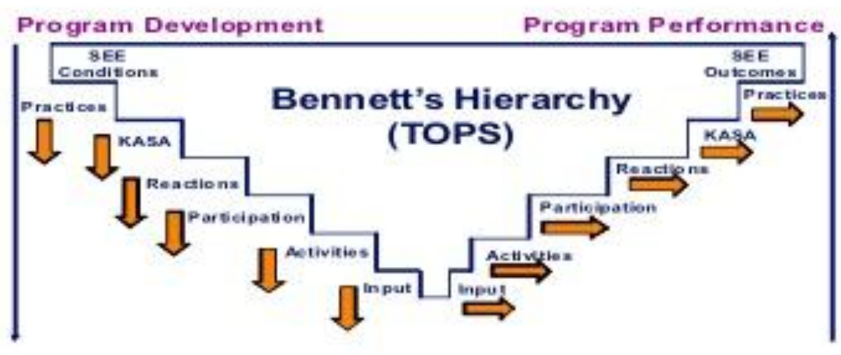


Plate 15: Targeting Outcomes of Programs (TOP) Model (1995)

Documenting program/project outcomes will continue to challenge program managers and educators, especially in the accountability era. Early identification of costs associated with documenting short, intermediate, and long-term outcomes will go a long way in assessing the costs and benefits associated with the evaluation of an extension program. Extension specialists and program managers should use these steps when they conduct training/workshops relative to costs and benefits associated with evaluating an extension program. In addition, the process of linking costs to program outcomes should be communicated to all educators who evaluate extension programs. Such communication will help link evaluation questions to outcomes and costs, and ultimately justify the value of extension programs to the public good.

TOP Includes a Two-Sided Hierarchy with Seven Levels

Level 1: SEE represents Social, Economic, and, Environmental conditions (or situations) that may need improvement. Social, Economic, and Environmental outcomes are the end results or benefits from programs targeted toward SEE conditions. These outcomes may represent public or private benefits. Social, Economic, and Environmental needs decrease as they are prevented, checked, reduced, or solved by the use of recommended practices (or behaviors).

Level 2: Practices are patterns of behaviors, procedures, or actions that influence SEE condition. Through educational programs, individuals, groups, organizations, and communities adopt practices and technologies that achieve needed SEE outcomes. These practices are adopted as program participants apply relevant knowledge, attitudes, skills, and aspirations (KASA).

Level 3: KASA refers to Knowledge, Attitude, Skills, and Aspirations that influence the adoption of selected practices and technologies to help achieve targeted social, economic, and environmental outcomes. Knowledge gain pertains to learned information or accepted advice; it also includes comprehending economic, social, and environmental principles, and comprehending individual and group decision-making processes. Attitudes focus on individuals' beliefs, opinions, feelings, or perspectives. Skills refer to individuals' mental and physical abilities to use new or alternative practices and Aspirations refer to ambitions, hopes, objectives, or desires. Changes in KASA can occur when people react positively to their involvement in program activities.

Level 4: Reactions reflect the participants' degree of positive or negative interest in topics addressed their acceptance of activity leaders, and their attraction to the educational methods. Delivering relevant, research-based subject matter can help hold clientele interest. People may obtain information, education, or assistance from different agencies or organizations at the same time.

Thus, the way they react to an activity sponsored by one organization may be influenced by complementary activities that are sponsored by other agencies or organizations.

Level 5: Program participants include individuals, families, groups, organizations, or communities. Participants must be sufficiently involved in program activities to acquire KASA and adopt practices needed to improve SEE conditions. Duration, continuity, frequency, and intensity of program participation all contribute to the amount of KASA change.

Level 6: Activities are the various educational strategies and events used to inform, educate, or train target audiences. They range from direct personal contacts to indirect technological or mass media approaches. Program activities are determined by requirements to obtain positive reactions from participants as well as other factors needed to achieve desired changes in KASA and practices. Program activities are supported by program resources.

Level 7: Resources are time, money, and staff (including volunteers) used to plan, promote, implement, and evaluate programs. Resources also include research-based educational materials, organizational maintenance, communication technologies, and transportation.

9. CIPP Model for Program Evaluation (Stufflebeam, 1987)

The CIPP model is based upon the *most important purpose of evaluation is to improve the function of the program*. The model is intended to help program leadership and personnel to systematically collect information about their program and to use that information as program are implemented and carried out.

CIPP refers to the four phases of evaluation:

1. **Context evaluation:** An evaluation of the extent to which the goals and objectives of the program match the assessed needs of the courts.

2. **Input evaluation:** An evaluation of the extent to which the activities, strategies and procedures of the program support the established goals and objectives.

3. **Process evaluation:** A process evaluation is a critical aspect of program implementation. Process evaluation is the continual assessment of the action plan developed; it is an ongoing and systematic monitoring of the program. A process evaluation provides information that can be used to guide the implementation of program strategies, procedures and activities as well as a means to identify successes and failures. Ultimately, a process evaluation will help refine the program's activities and ensures that program's activities are tied to both the needs of the court and the relevant community, as well as the desired outcome of the program.

4. **Product evaluation:** It is the evaluation of the impact and outcomes of the program.

The CIPP model is not intended to be applied in a linear or lockstep fashion. Rather, the CIPP model provides an organizing framework that underscores the importance of evaluating a program from its inception, through its development and implementation to its conclusion.

10. Theory of change with Iterative Theory of Action (Douthwaite et al., 2003)

This theory talks about how change will come, which is operationalized quite differently in specific situations in response to emerging needs and opportunities – that is to have a clear theory of change with an emergent theory of action. This theory comes from an agricultural research program that involves clear theories of horizontal scaling up (other villages use new agricultural methods) and vertical scaling up (involving different levels of government and other organizations). Iterative cycles of learning and adaptation in the middle of the process deal with the uncertainty around the wicked problem of agriculture.

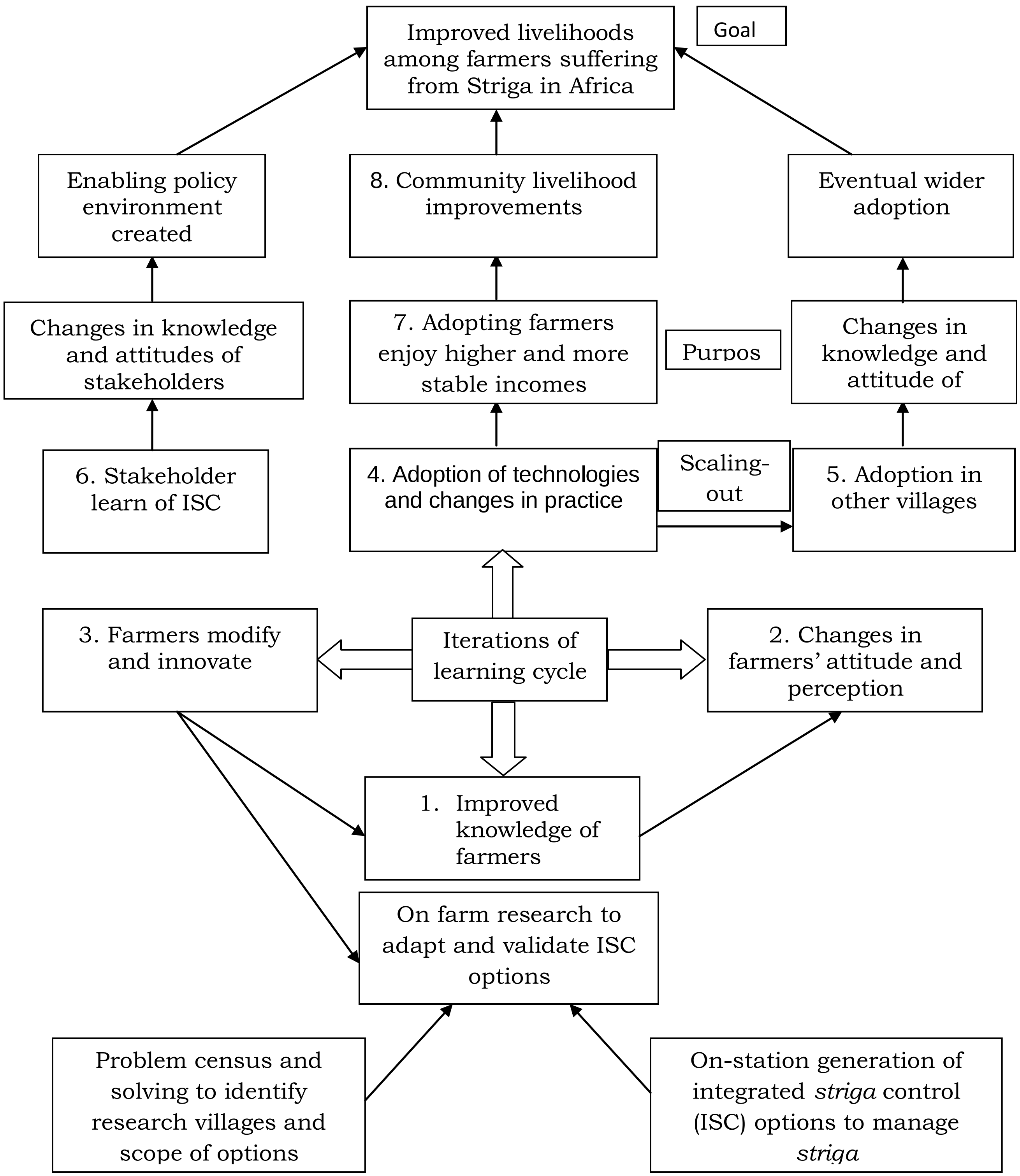


Plate 16: Theory of change with Iterative Theory of Action

As discussed above that there is no single blueprint for impact assessment of ICT projects in agriculture, so to find out indicators for the present impact assessment of the selected Agri-portals many models have been reviewed. Heeks' Information Chain Model emphasizes upon measuring the impact considering different quantifiable indicators. The information chain model is a foundation to improve understanding of the process of outcome/impact of ICT led development from the participants' perspectives. The Refined Framework Model includes considerations of social constraints that hindered the ultimate process of development. This model focuses on ICT project inputs-outputs and challenging the social barriers. The Social Impact Assessment model places emphasis on social impacts of ICT projects. Measuring Impact model of NCVO, 2003, assesses the need and demand for the initiative, resources, activities, outputs (outcomes) and impact. The Logic Approach Model represents the logical flow of inputs, work activities, immediate outputs and outcomes of a project/program. This is a comprehensive model being used for evaluating many projects. An extension of Logic Approach, Program Action Logic Model includes six steps: input, output, impact, short term, medium term, long term. Participatory Impact Pathway Analysis, theory describes plausible impact pathways by which project outputs are used by others to achieve a chain of outcomes leading to a contribution to eventual impact on social, environmental or economic conditions.

A widely used Bennett Hierarchy Model of Planning and Evaluation (1979) contains seven sequential steps (input, activities, participation, reaction, knowledge, skills, opinions, aspirations-KASA, practice change, and end results/social, economic, environmental conditions. The extension of this model is known as Targeting Outcomes of Program model is also based on the assessing the project impact on seven consecutive steps. CIPP model of planning and evaluation refers to the four phases of evaluation: Context, Input, Process and Product evaluation. After a thorough review of these models, Bennett Hierarchy Model of Planning and Evaluation (1979) was adapted for the present investigation.

If ICTs are to contribute meaningfully to innovation management, there has to be a fundamental rethinking of our approach to agriculture and rural development. Despite the initial hype around ICTs has since subdued, there is a need to shift the discussion around ICTs from one of more coverage to that of better and more meaningful use of ICTs for agricultural innovation management. Lack of empirical evidence on the contribution of ICTs – and the reluctance to report and learn from failures in ICT experiments – has led to disillusionment about the role of ICTs among the development community.

ICTs are clearly not a substitute for human intermediation and the limits of stand-alone ICT initiatives should be clearly understood. ICTs cannot solve the underlying institutional bottlenecks that constrain organizations from interacting with each other. Addressing these issues is important if the full potential of ICTs is to be realized. Information and knowledge alone is not enough to ensure behavioral change and there is always a need for opportunities, platform or networks for dialogues and sharing information and knowledge. Although the understanding of communication, innovation and extension has changed substantially in the past two decades, there is still a gap between theory and practice. This gap needs to be bridged if ICTs are to effectively contribute to putting new knowledge into use.

Chapter 5 RESULTS AND DISCUSSION

This chapter deals with research findings of the study together with relevant discussion on the facts. Findings of the study have been presented and inferences were drawn from them in relation to specific objectives of the study set forth. Findings of the study are presented under the following subheads:

SECTION - A

5.1. Socio-economic and communication characteristics of farmers

SECTION - B

5.2. Impact of selected Agri-portals in Uttarakhand

5.2.1 General information of farmers

5.2.2 Knowledge level of farmers

5.2.3 Extent of adoption of the recommended practices

5.2.4 Opinion of farmers about content relevance

5.2.5 Opinion of farmers about design features

5.2.6 Opinion of farmers about usability features

5.2.7 Extent of change among farmers

5.2.8 Inputs used and activities and output of stakeholders

SECTION - C

5.3. Constraints faced by users in the adoption of practices recommended

SECTION - D

5.4. Relationship between background characteristics of farmers and selected impact indicators

SECTION - E

5.5. Opinion of other stakeholders

5.5.1 Opinion of other stakeholders about content relevance

5.5.2 Opinion of other stakeholders about design features

SECTION - A

5.1. Socio-economic and communication characteristics of farmers

To study this aspect, factual information related to farmers were collected and analyzed. Two parameters namely socio-economic and communication characteristics were taken into consideration for this purpose. Socio-economic and communication characteristics of farmers were studied in terms of age, education, caste, gender, family background, occupation, annual income, interpersonal sources of communication, mass media exposure, extension agency contact, land assets, farming experience, livestock, agricultural equipment possession, communication media possession and household assets.

5.1.1 District wise distribution of respondents

Table 10: District wise distribution of farmers (N=83)

S.No.	District	No. of farmers	Percentage
1	Dehradun	30	36.14
2	Udham Singh Nagar	30	36.14
3	Nainital	23	27.71
	Total	**83**	**100**

Data regarding village wise distribution of the trainees has been presented in Table 10. From a perusal of table indicates that 83 progressive farmers (92.22 per cent) were interviewed to use selected Agri-portals viz Agropedia and aAQUA. From district Dehradun and district Udham Singh Nagar 30 farmers each, received trainings on use and application of Agropedia and aAQUA and all started using both the Agri-portals. 36.14 per cent progressive farmers were trained from Dehradun and Udham Singh Nagar each; from Nainital, 27.71 per cent progressive farmers were trained (Fig. 1). In spite of being educated and computer literate the possible reasons for not using the selected Agri-portals could be non-availability of computers and internet accessibility. District Nainital was not among the mandated area of implementation of these Agri-portals and comparatively less numbers of trainings were conducted on its use and application; might be the reasons of less participation of farmers.

Age

Table 11: Age wise distribution of farmers (N=83)

S.No.	Age Category	No. of farmers	Percentage
1	Young (less than 20 years)	19	22.89
2	Middle (20-48 years)	46	55.42
3	Old (above 48 years)	18	21.69
	Total	**83**	**100**

Mean = 34.16 SD = 14.16 CV = 41.45

A perusal of Table 11 reveals that the majority of the farmer respondents (55.42 per cent) were found to be in the middle age category (20-48 years) while 22.89 per cent belonged to the young age category (less than 20 years) and with only a little difference with 21.69 percent of respondents were in the older age category (above 48 years). After giving training to the progressive farmers the focus was rerouted to youths because youths are supposed to be more technology savvy and can make better use of selected Agri-portals for agricultural development. The SD (14.16) and CV (41.45) values further suggest that farmers were heterogeneous with respect to their age (Fig. 2). The findings of the study are in harmony with the observation of Chauhan (2010).

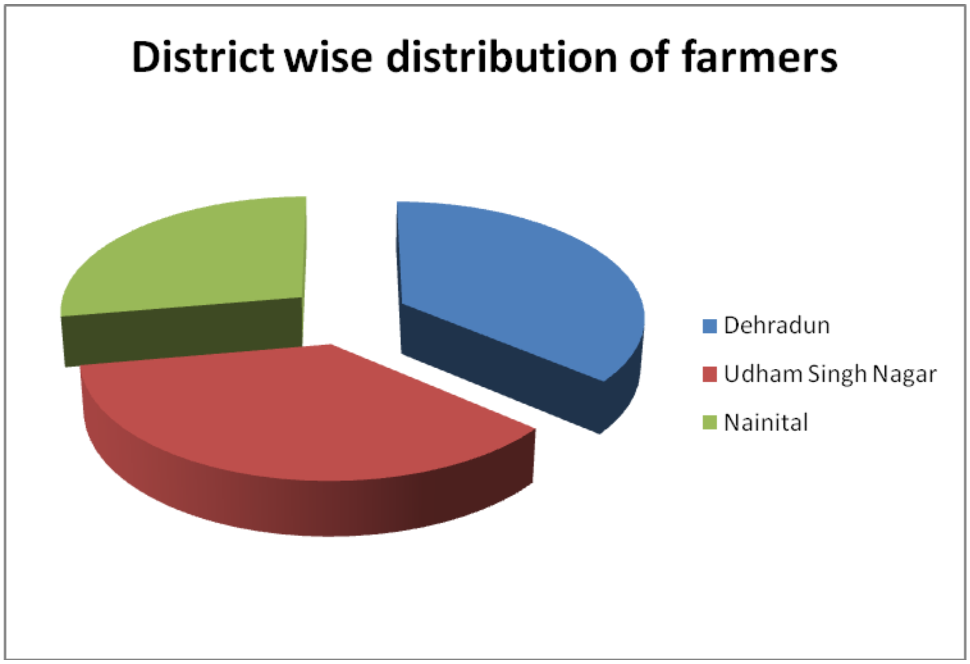


Fig. 1: District wise distribution of farmers

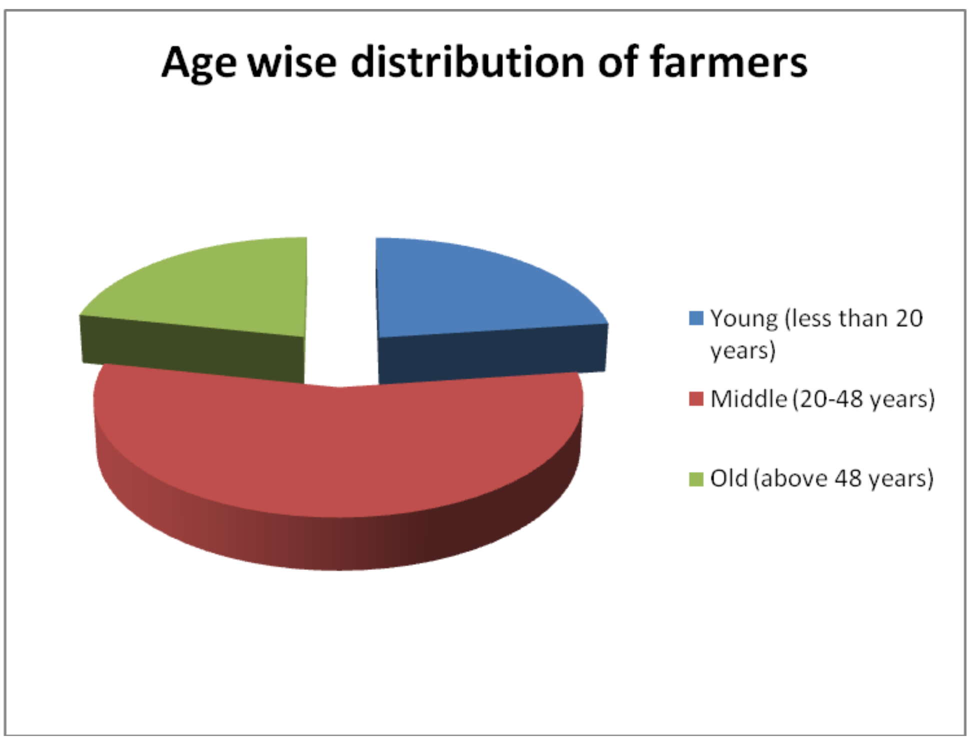


Fig. 2: Age wise distribution of farmers

Education

Table 12: Distribution of farmers according to educational status (N=83)

S.No.	Educational status	No. of farmers	Percentage
1	Primary	1	1.20
2	Middle school	3	3.61
3	High school	9	10.84
4	Intermediate	41	49.39
5	Above intermediate	29	34.93
	Total	**83**	**99.97**

Data regarding education level of farmers presented in Table 12 reveals that almost all farmer respondents were literate. About half of the farmers (49.39 per cent) were educated up to intermediate level. Table also evinces that 34.93 per cent farmers were educated to more than intermediate level followed by farmers educated up to High School (10.84 per cent), middle school (3.61 per cent). Very few farmers were educated up to primary level (1.20 per cent). This indicates that there existed a fair majority of the literate farming community (Fig. 3). Almost all the young farmers of district Nainital were also computer literate but the non availability of computers and internet restricted them to access the selected Agri-portals and being an active participant. The findings are in line with the findings of Sasidhar (2008) and Chauhan (2010). However, the findings vary with the observations of Singh (2008) where most

(34 per cent) of the farmers were educated up to primary levels or can only read and write.

Occupation

Table 13: Distribution of farmers according to occupation (N=83)

S.No.	Category	No. of farmers	Percentage
1	Agriculture	47	56.62
2	Service	3	3.61
3	Business	1	1.20
4	Agriculture with service	16	19.27
5	Agriculture and Business	16	19.27
	Total	**83**	**99.97**

As regards occupation, it is evident from Table 13 that majority (56.62 per cent) of the farmers' main occupation was agriculture followed by agriculture with service and agriculture with business like fishery, dairy etc. (19.27 per cent, 19.27 per cent respectively). Since, the study was focused on farmers having agriculture as their main occupation so very few respondents were service holder (3.61 per cent) and carried out business (1.20 per cent). The results are in conformity with the findings of Sasidhar (2008).

Caste

Table 14: Distribution of farmers according to caste (N=83)

S.No.	Caste category	No. of farmers	Percentage
1	General	40	48.19
2	OBC	24	28.91
3	SC/ST	19	22.89
	Total	**83**	99.99

Data regarding caste composition of trainees presented in table 14 reveals that nearly half (48.19 per cent) of the farmer respondents belonged to general caste followed by other backward caste (28.91 per cent). The representation of SC/ST families was lowest (22.89 per cent) among all the three districts. The findings of the study are in harmony with the results of Verma (2008).

Annual income

Table 15: Distribution of farmers according to annual income (N=83)

S.No.	Annual income	Number of farmers	Percentage
1	Low (less than ₹ 20930)	19	22.89
2	Medium (₹ 20930 - ₹ 7,50,594)	53	63.85
3	High (more than₹ 7,50,594)	11	13.25
	Total	**83**	**99.99**

Mean= 385761.66 SD= 363832

A household income from various sources was inquired and is presented in Table 15.

Data revealed that about three fourth of farmers had 'medium' family income followed by nearly one fourth i.e. 22.98 per cent farmers had 'low' family income and only 13.25 per cent had 'high' family income. This might be because only progressive farmers were selected for the present study. Thus, it can be concluded that majority of farmers' socio-economic status was good.

Marital status

This refers to the marital status of the respondents and is classified as married, unmarried or other.

Table 16: Distribution of farmers according to marital status (N=83)

S.No.	Category	Number of farmers	Percentage
1	Married	48	57.83
2	Unmarried	33	39.75
3	Other	2	2.40
	Total	**83**	**99.98**

Table 16 depicts that majority (57.83 per cent) of the progressive farmers were married followed by (39.75 per cent) unmarried and (2.40 per cent) others including widowers.

Gender

Table 17: Distribution of farmers according to gender (N=83)

S.No.	Category	Number of farmers	Percentage
1	Male	73	87.95
2	Female	10	12.04
	Total	**83**	**99.99**

The data regarding distribution of farmers on the basis of their gender is presented in Table.17. Table reveals that although In Uttarakhand almost all the agricultural operations are being performed by the women only; still majority (87.95) of farmer respondents were males. Findings indicates that farm women were very less (12.04 per cent) in number as compared to their male counterpart.

Results showed that unlike common Indian rural family, where male members dominate over females in arranging livelihood for their family; in Uttarakhand females play a major role in livelihood earnings. But surprisingly when it comes to go outside the veils they are always restricted. Still it is appreciable to note that in such families female members have also come forward to participate in use and application of modern technologies for agriculture and also contribute towards family economy and national income. Mishra (2008) and Verma (2008) reported similar findings.

Family type

Table 18: Distribution of respondents according to family type (N=83)

S.No.	Category	Number of respondents	Percentage
1	Nuclear	74	89.15
2	Joint	9	10.84
	Total	**83**	**99.99**

A perusal of the Table 18 shows that majority of the respondents (89.15 per cent) belonged to nuclear family followed by joint family (10.84 per cent).

It can be concluded from the data that most of the respondents had small and nuclear families. Table also evinces that in the rural areas too concept of joint family is no more in prevalence and people preferred the nuclear family system over joint family. This indicates the modernization of villages.

Family size

The respondents were classified into three different categories and it is presented in Table 19.

Table 19: Distribution of farmers according to family size (N=83)

S.No.	Category	Number of farmers	Percentage
1	Small (less than 3 members)	5	6.02
2	Medium (3-7 members)	68	81.92
3	Large (more than 7 members)	10	12.04
	Total	**83**	**99.98**

Mean= 5.36 SD= 1.85 CV = 34.51

Data regarding family size of the trainees has been presented in Table 19. It is clear from Table that vast majority (81.92 per cent) of farmers and farm women had medium size family followed by large family (12.04 per cent) and small size family (6.02 per cent). The SD (1.85) and CV (34.51) further suggest that farmers were heterogeneous with respect to their family size.

It can be concluded from the above data that in rural areas people are still not very conscious about the population problem of the nation. It was further reported by several villagers that their size of a family is the strength of family. They also believe that bigger the family size; more will be the earning hands.

Type of house

Table 20: Distribution of farmers according to type of house (N=83)

S.No.	Category	Number of farmers	Percentage
1	Semi-pucca	77	92.77
2	Pucca	6	7.23
	Total	**83**	**100**

Data regarding type of house is presented in Table 20. From perusal of the table it is clear that majority (92.77 %) of farmers in all three districts had semi-pucca houses and only 7.23 per cent farmers owned pucca houses.

Access point

Table 21: Distribution of farmers on the basis of access point of selected Agri-portals (N=83)

S.No.	Access Point	Number of farmers	Percentage
1	Cyber café	16	19.27

2	Krishi Vigyan Kendra	42	50.60
3	Home	22	26.50
4	Information kiosk	1	1.20
5	Any other	2	2.40
	Total	**83**	**99.97**

A perusal of Table 21 shows that half (50.60 per cent) of the farming community went to *Krishi Vigyan Kendra* to access to the selected Agri-portals. Fairly good percentage (26.50 per cent) of farmers accessed online information at their home followed by cyber café (19.27 per cent). Negligible number of farmers accesses these Agri-portals (Fig. 4) at information kiosks (1.20 per cent) and from other sources (2.40 per cent).

Unlike mobiles, internet penetrates slowly among the communities. But present findings of 26.50 per cent farming community owned and had access to internet at their home and used it to access latest agricultural information is quite appreciable. This shows that farmers are now aware about the power of knowledge and information. Table also evinces that *Krishi Vigyan Kendra* is quite popular among the farmers for authentic information.

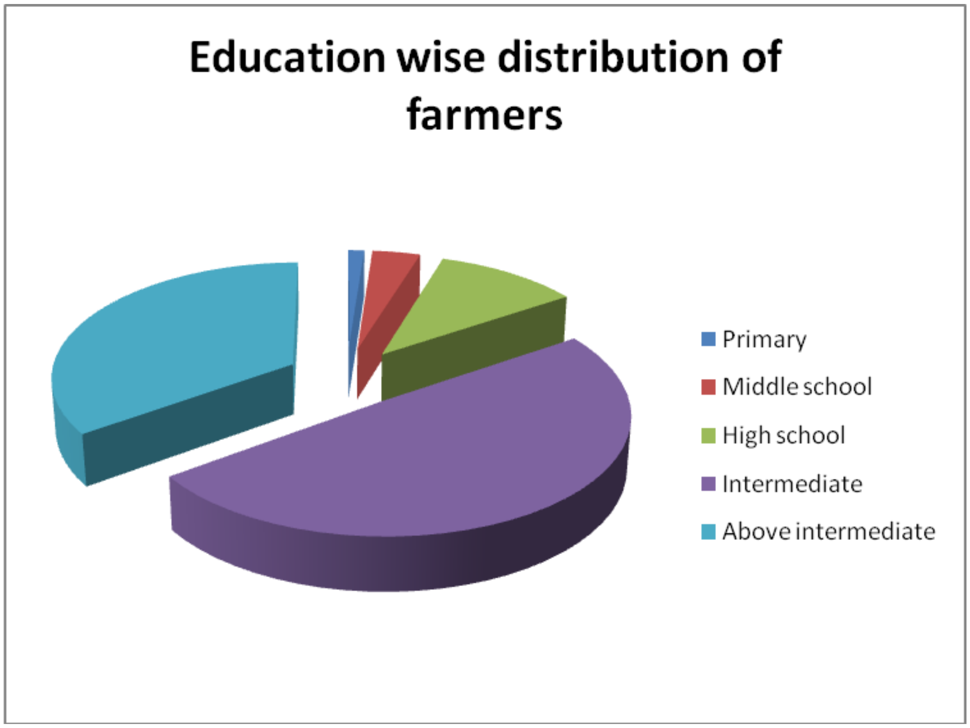


Fig. 3: Education wise distribution of farmers

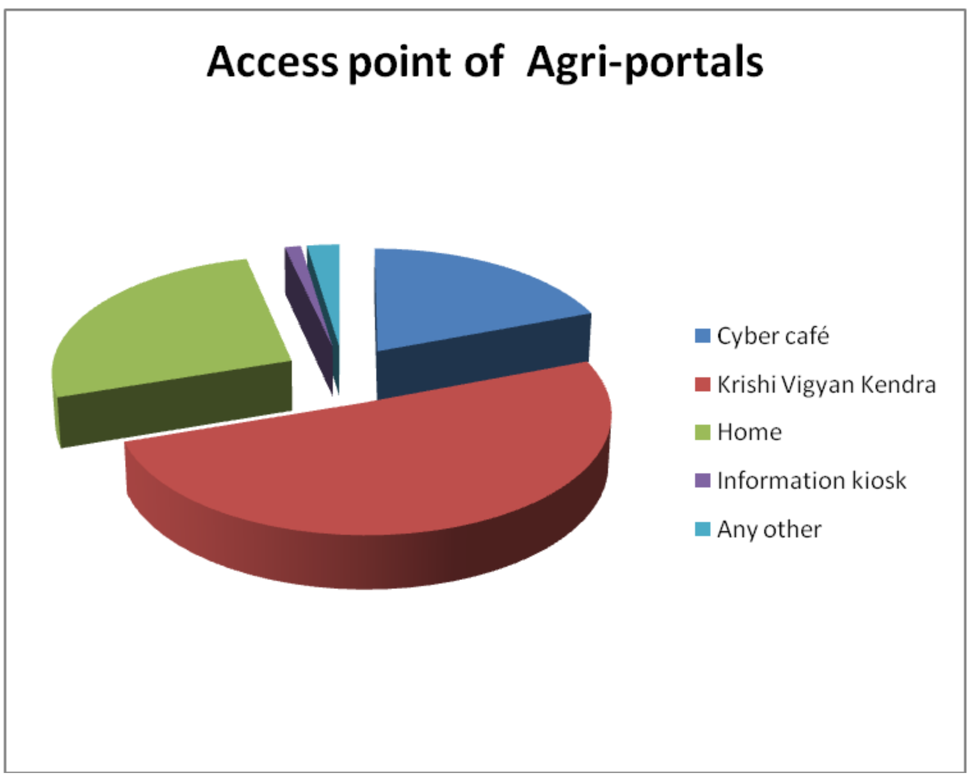


Fig. 4: Access point of Agri-portals

Material possession

As indicated earlier, the material possession in present study refers to the agricultural equipment, communication media and household items possessed by the farmers. In order to have a clearer picture, the status of possession of these items have been analyzed and discussed separately as below:

Communication media possession

It refers to different communication media possessed by the respondents for various purposes of communication.

Table 22: Distribution of farmers on the basis of communication media possession (N=83)

S.No.	Category	Number of farmers	Percentage
1	Low (less than 7)	7	8.43
2	Medium (7-13)	57	68.67
3	High (more than 13)	19	22.89
	Total	**83**	**99.99**

Mean= 9.86 SD= 3.24 CV = 32.86

Data regarding communication media possession is presented in Table 22 indicates that the majority (68.67 per cent) of farmers belonged to 'medium' level of communication media possession. It was observed that 22.89 per cent farmers possessed higher number of communication media followed by low communication media possession group (8.43 per cent). The SD (3.24) and CV (32.86) values further suggest that farmers were heterogeneous with respect to communication media possession.

It can be concluded that communication media now has reached people irrespective of caste, class, background, age etc. and are being used for information seeking and entertainment in rural areas.

Agricultural equipment possession

To study this aspect various farm implements and equipments available with farmer were taken into consideration and certain numerical values were assigned to each item.

Table 23: Distribution of farmers on the basis of agricultural equipment possession (N=83)

S.No.	Category	Number of farmers	Percentage
1	Low (less than 4)	30	36.14
2	Medium (4-13)	9	10.04
3	High (more than 13)	44	53.01
	Total	**83**	**99.19**

Mean= 12.87 SD= 3.98 CV = 30.92

Data regarding agricultural equipment possession has been presented in Table 23. From the perusal of Table it is clear that majority (53.01 per cent) of the farmers possessed 'high' level of agricultural equipment followed by 36.14 per cent of those who had 'low' level of agricultural equipments and very few farmers fall under 'medium' level of agricultural equipment possession. It is observed that little more than 50 per cent farmers had high agriculture equipment possession. The SD (3.98) and CV (30.92) further suggest that farmers were quiet heterogeneous with respect to agricultural possession.

Household material possession

Table 24: Distribution of farmers on the basis of household material possession (N=83)

S.No.	Category	Number of farmers	Percentage
1	Low (less than 9)	13	15.66
2	Medium (9-13)	37	44.57
3	High (more than 13)	33	39.75
	Total	**83**	**99.98**

Mean= 11 SD= 2.01 CV = 18.27

Data regarding household material possession of trainees presented in Table 24 indicate that, maximum percentage (44.57 per cent) of farmers possess 'medium' household material followed by those who had 'high' household material (39.75%) and 'low' household material (15.66 per cent). The SD (2.01 per cent) and CV (18.92) further suggest that farmers were homogenous with respect to agricultural possession. The findings are in harmony with the observations made by *Verma* (2008).

It is clear that overall household material possession of the farmers were good. This may be because they were progressive with high annual income.

Type of electricity connection

Table 25: Distribution of farmers on the basis of type of electricity connection at home (N=83)

S.No.	Category	Number of farmers	Percentage
1	Metered	82	98.79
2	Non-metered	1	1.20
	Total	**83**	**99.99**

A perusal of Table 25 shows that almost all (98.79 per cent) farmer respondents had metered electric connection at their home followed by negligible percentage (1.20 per cent) of respondents having non-metered connections. This indicates that all the selected villages were electrified thus; farmers can use selected Agri-portals as and when required as electricity was no more a constraint.

Social participation

Social participation means the voluntary sharing in person to person and in group to group relationship beyond the immediate household **(Pathak, 2002).**

Table 26: Distribution of farmers on the basis of social participation (N=83)

S.No.	Category	Number of farmers	Percentage
1	Low (less than 9)	13	15.66
2	Medium (9-13)	37	44.57
3	High (more than 13)	33	39.75
	Total	**83**	**99.98**

Mean= 5.61 SD= 3.12 CV = 55.61

It can be interpreted from Table 26 that maximum farmers (44.57 per cent) had a medium level of social participation followed by high social participation (39.75 per cent). Very few farmers (15.66 per cent) had a low level of interaction with the social organizations. The SD (3.12) and CV values (55.61) showed a high level of heterogeneity among the farmers with regard to their social participation. It can be concluded that a majority of respondents were progressive farmers, fairly good educational status, with cosmopolitan sources of communication. They either realized the importance of social participation or got opportunities of social participation. This may also be due to the fact that they might not have time for such activities and remain busy with their occupation.

Reach of extension agency

It is defined as the degree of contact of the extension agencies in the area of investigation.

As mentioned earlier reach of extension agency was measured in terms of contacting agriculture department, animal husbandry department, KVKs, cooperatives, and any other source of information about Agri-portals by the respondents in a specified period of time. Respondents inquired about the total number of visits per month to these agencies for getting information about selected Agri-portals.

Table 27: Distribution of farmers on the basis of reach of extension agency (N=83)

S.No.	Extension agency	Number of farmers	Percentage
1	Agriculture department	56	67.46
2	Animal husbandry	52	62.65
3	KVKs	83	100
4	Cooperatives	4	4.81

***Multiple responses were allowed, hence totals add up to more than 100 per cent**

Response of farmers on their frequency of contact with different extension agency and change agents has been presented in Table 27. It indicates that all the farmers contacted Krishi Vigyan Kendra (KVKs) for getting information about selected Agri-portals. Agriculture departments (67.46 per cent) and Animal husbandry departments (62.65 per cent) were among the next popular extension agencies contacted by them. Very few people contacted cooperatives for getting information about selected Agri-portals.

Interpersonal sources of communication

Table 28: Distribution of the farmers on the basis of interpersonal sources of communication (N=83)

S.No.	Category	Number of farmers	Percentage
1	Friends	75	90.36
2	Family/Relatives	69	83.13
3	Neighbors	57	68.67
4	Fellow farmers	80	96.38
5	Progressive farmers	49	59.03
6	Any other	33	39.75

***Multiple responses were allowed**

It is clear from Table 28 that among the interpersonal sources of communication fellow farmers were most popular and majority (96.38 per cent) of farmers contacted them to get agricultural information. This was followed by friends and about 90.36 per cent farmers contacted them for information followed by family members or relatives (83.13 per cent). 68.67 per cent farmers contacted with their neighbors followed by progressive farmers (59.03 per cent) and any other (39.75 per cent) sources of interpersonal communication.

It can be concluded that though the modern technology has invaded every walk of life but still interpersonal communication commands the supreme power. It is important to note here that relatively few farmers contacted progressive farmers for getting agricultural information, the finding is well supported by two step flow of communication theory as it says that information always flow in steps: first it goes to the progressive farmers they filter it and pass it to the lower level.

Access to modern technology

Table 29: Distribution of farmers on the basis of access to modern technology

S.No.	Category	Number of farmers	Percentage
1	Trainings	65	78.31
2	KVKs	78	93.97
3	Extension worker	32	38.55
4	Television	79	95.18
5	Radio	32	38.55
6	Newspaper	35	42.16
7	Farmers' fair	73	87.95
8	Internet	41	49.39
9	Government Demonstration	26	31.32
10	Information kiosk	2	2.40
11	Input dealer	12	14.45
12	Progressive farmers	40	48.19
13	Private agency	2	2.40

***Multiple responses were allowed**

A perusal of Table 29 reveals that among all the modern means of communication; farmers mostly accessed television (95.18 per cent) followed by KVKs (93.97 per cent). Farmer's fair (87.95 per cent) and trainings attended (78.31 per cent) were the next most popularly accessed media (Fig. 5). Internet was used by almost half (49.39 per cent) of the farmers to get agricultural information. Newspapers were also read by the 42.16 per cent farmers. A fair proportion of respondents also contacted the progressive farmers for latest updates of agriculture. It was interesting to note here that radio is still popular among the farmers and about 38.55 per cent farmers used it for agricultural updates, extension workers were also contacted by 38.55 per cent farmers. This is followed by government demonstration (31.32 per cent), input dealers (14.45 per cent) and information kiosks (2.40 per cent) and private agencies (2.40 per cent).

Though information kiosks are promoted most by the central and state government but still it was observed that least number of farmers accessed it. This may be because of differential treatment of the *sanchalaks* and in most cases computers were kept in one of the villager's house and the traditional village system does not allow everybody to enter to anybody's house. It can also be concluded that like mobile phones internet started penetrating in the society but with a slower pace.

Farming experience

It refers to the total number of years spent in farming by the respondent at the time of investigation.

Table 30: Distribution of farmers on the basis of farming experience (N=83)

S.No.	Category	Number of farmers	Percentage
1	Low (less than 10 years)	53	63.85
2	Medium (10-20 years)	17	20.48

3	High (more than 20 years)	13	15.66
	Total	**83**	**99.99**

Table 30 shows that majority of farmers had low (63.85 per cent) farming experience followed by medium (20.48 per cent) farming experience and high (15.66 per cent) farming experience. Thus, it can be concluded that most of the farmers had less than 10 years of farming experience and only few farmers had more than 20 years of farming experience. But in general farmers were fairly experienced. The findings are in confirmity with Prabhakar (2010).

Land holding

It is the operational size of farm which a farmer has actually put into cultivation. Data were collected by asking respondents about the area under irrigation, leased in land, leased out land and total operational holding.

Table 31: Distribution of farmers on the basis of land holding (N=83)

S.No.	Category	Number of farmers	Percentage
1	Small farmers (2.51 to 5 acres)	24	28.91
2	Medium farmers (5.0 to 10 acres)	29	34.93
3	Large farmers (above 10.01 acres)	30	36.14
	Total	**83**	**99.99**

Data regarding land holdings of trainees has been presented in Table 31. It is clear from table that maximum (36.14 per cent) numbers of respondents were large farmers followed by medium

(34.14 per cent) and small (28.91 per cent) farmers respectively. Since the respondents were progressive farmers so, it was quite obvious that they were resourceful with large land holdings. However, the findings vary with the observations made by *Singh* (2008) and *Chauhan* (2010).

Livestock possession

It refers to the animal possessed by a family. In present study total number of animals was used as an indicator of livestock.

Table 32: Distribution of farmers on the basis of livestock possession (N=83)

S.No.	Category	Number of farmers	Percentage
1	Low (less than 1)	30	36.14
2	Medium (1-7)	44	53.01
3	High (more than 7)	9	10.04
	Total	**83**	**99.19**

Mean= 3.94 SD= 2.96 CV = 75.92

Data regarding livestock possession by the farmers has been presented in Table 32. It is clear from Table that majority (53.01 per cent) of the farmers had 1-7 animals followed by 36.14 per cent of those who had 1 or less animals. Only nine per cent farmers had more than seven animals. SD (2.96) and CV (75.92 per cent) values showed that farmers were highly heterogeneous with regard to their livestock possession.

Crop wise cultivated area

Table 33: Distribution of farmers on the basis of crop wise cultivated area (N=83)

S.No.	Category	Number of farmers	Percentage
1	Low (less than 2 crops)	35	42.16
2	Medium (2-3 crops)	42	50.60
3	High (more than 3 crops)	6	7.22
	Total	**83**	**99.98**

A perusal of Table 33 shows that almost half of the farmers grow 2-3 crops on yearly basis. Around 42.16 per cent farmers grow less than two crops and only 7.22 per cent farmers grow more than three crops in a season. This is concluded that despite of being progressive farmers, they still followed the traditional cropping pattern and did not go for diversification and inter cropping.

SECTION – B

5.2. Impact of selected Agri-portals in Uttarakhand

5.2.1 General information of farmers

Extent of awareness

S. No.	Extent of awareness	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Aware	83	100	83	100
	Total	**83**	**100**	**83**	**100**

The extent of awareness about selected Agri-portals were studied in two dimensions viz. the extent of awareness about selected Agri-portals from the users of these Agri-portals and level of awareness of the users. Hence, with two different groups the awareness study had been conducted to know how far the farmers were aware of its existence.

Table 34: Distribution of farmers on the basis of extent of awareness of selected Agri-portals (N=83)

This analysis gives a broad picture about extent to which farmers were aware about the existence of selected Agri-portals. The response was obtained in the form of those who were 'aware' and 'not aware' about Agropedia and aAQUA. It is clear from Table 34 that all the farmers (100 per cent) were aware about the existence of selected Agri-portals viz Agropedia and aAQUA. The findings clearly indicate that selected Agri-portals were known to the farmers and also that ICT started penetrating in to farming community. This high level of awareness might be due to the high publicity made about the existence of selected Agri-portals in the villages where more farmers reside. The SAU experts and KVK scientists did play an important role in popularizing it among the farming communities.

Efforts need to be taken to promote awareness in such a way that it should reach teven to the small farmers. Proper selection of media for creating awareness is the deciding factor to have a better reach to the farmers living in remote areas. Although it is clear from the Table that efforts were appreciable to create awareness about selected Agri-portals among the progressive farmers but appropriate efforts should be taken to make it popularized among the small and marginal farmers too.

The extent of awareness of farmers was analyzed in terms of the time of awareness and sources of awareness of selected Agri-portals.

Time of awareness

Table 35: Distribution of farmers on the basis of time of awareness of selected Agri-portals (N=83)

S. No.	Time of awareness	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	More than 2 years	83	100	83	100
	Total	**83**	**100**	**83**	**100**

It refers to the approximate time to get aware about the existence of selected Agri-portals by farmers at the time of interview.

Table 35 implies that all the farmers (100 per cent) got aware long back i. e. during the initial stages of the launch of Agropedia and aAQUA. Thus, it can be concluded that farmers were associated with the very initiation of selected Agri-portals.

Sources of awareness

The nature of sources through which farmers had come to know about selected Agri-portals was studied. The sources of awareness might be friends and relatives, neighbor, KVK scientists, farmers' fair or *Pantnagar* University etc.

Table 36: Distribution of farmers on the basis of sources of awareness of selected Agri-portals (N=83)

S.No.	Sources of awareness	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Friends and relatives	4	4.81	4	4.81
2	Neighbor	1	1.20	1	1.20
3	KVK scientists	81	97.59	79	95.18
4	Farmers' fair	8	9.63	8	9.63
5	Pantnagar University	39	46.98	37	44.57

***Multiple responses were allowed**

From Table 36, it is clear that majority (97.59 per cent) of the respondents were aware of Agropedia through KVK scientists followed by scientists of Pantnagar University (46.98 per cent). 9.63 per cent farmers got aware through farmers' fair followed by friends and relatives (4.81 per cent). Negligible number (1.20 per cent) was aware through neighbors. In farmers fair advertisement about Agropedia and aAQUA had been given twice a year (in *Rabi* and *Kharif* season fair) where farmers from all India and even from neighboring countries came to visit.

With little difference in figures majority of the farmers got aware about aAQUA through KVK scientists (95.18 per cent) followed by scientists from Pantnagar University (44.57 per cent).

Like Agropedia; farmers fair (9.63 per cent), friends and relatives (4.81 per cent) had been the other important sources of information. Neighbors again played very little role to make farmers aware about the existence of aAQUA.

Thus, it can be concluded that KVKs and Pantnagar University has played a key role in spreading awareness among the farming community.

Visits to Agri-portals

Table 37: Distribution of farmers on the basis of visits to selected Agri-portals (N=83)

S. No.	Category	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Visited	42	50.60	81	97.59
2	Not visited	41	49.40	2	2.40
	Total	**83**	**100.00**	**83**	**99.99**

A perusal of Table 37 shows that out of 83 farmers exactly half of them (50.60 per cent) visited Agropedia portal during the period of investigation. This figure reached to its maximum in case of aAQUA where 97.59 per cent farmers visited the portal. This could be because aAQUA was started much earlier than Agropedia and farmers could get the agricultural and livestock information directly on their mobile handsets through text messages. Unlike aAQUA, Agropedia was initially launched for the academia and extension personnel etc. and each time a farmer wants to access the information from Agropedia he has to go to its website, which was difficult for them. Poor infrastructure and computer illiteracy also restrict them to access the information but still farmers were trained to use these Agri-portals. Whereas mobile penetration was fairly good even in the rural areas so most of them got intact with aAQUA more.

Purpose of visit

Table 38: Distribution of farmers based on purpose of visits selected Agri-portals (N=83)

S.No.	Purpose of visit	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Clicked by chance	NIL	NIL	1	1.20
2	Market price	5	6.02	19	22.89
3	Agricultural practice	80	96.38	72	86.74

***Multiple responses were allowed**

Farmers were asked about for what purpose they have visited the selected Agri-portals and the responses are presented in Table 38. Majority (96.38 per cent) of them visited Agropedia to get the agricultural information followed by getting latest market information (6.02 per cent). While in case of aAQUA 86.74 per cent farmers visited for agricultural practices and rest 22.89 per cent were interested in getting updated market information. Negligible number of farmers (1.20 per cent) clicked it by chance.

Thus, it can be concluded that farmers were well aware about that Agropedia provides comprehensive agricultural information while aAQUA deals with agricultural production, livestock and market rates of the selected commodities.

Type of registration

Table 39: Distribution of farmers based on of type of registration (N=83)

S.No.	Category	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Clicked on sign up	1	1.20	1	1.20
2	Through KVK scientists	2	2.40	2	2.40
3	In a training program	79	95.18	79	95.18
	Total	**82**	**98.78**	**82**	**98.78**

Table 39 shows that majority (95.18 per cent) of farmers themselves registered onto Agropedia and aAQUA in a training program conducted at Krishi Vigyan Kendra. Only 2.4 per cent farmers were registered through KVK scientists followed by 1.2 per cent farmers who got registered by themselves.

So, training on selected Agri-portals made them the registered members of these Agri-portals so that they can get every type of information of agriculture and livestock.

Frequency of visit

Table 40: Distribution of farmers on the basis of frequency of visits to selected Agri-portals (N=83)

S.No.	Frequency	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Daily	4	4.81	4	4.81
2	Weekly	4	4.81	4	4.81
3	Monthly	8	9.63	8	9.63
4	As per need	63	75.90	65	78.31
	Total	**79**	**95.14**	**81**	**97.55**

It can be seen from Table 40 that though the farmers attended the training programs and got themselves registered on to the selected Agri-portals but still they were not so frequent in visiting it. Majority (75.90 per cent) of farmers visited Agropedia and 78.31 per cent farmers visited aAQUA according to their needs. 9.63 per cent farmers visited both the Agri-portals monthly followed by weekly (4.81 per cent in both the cases) and a equal number of farmers (4.81 per cent for both the Agri-portals) daily.

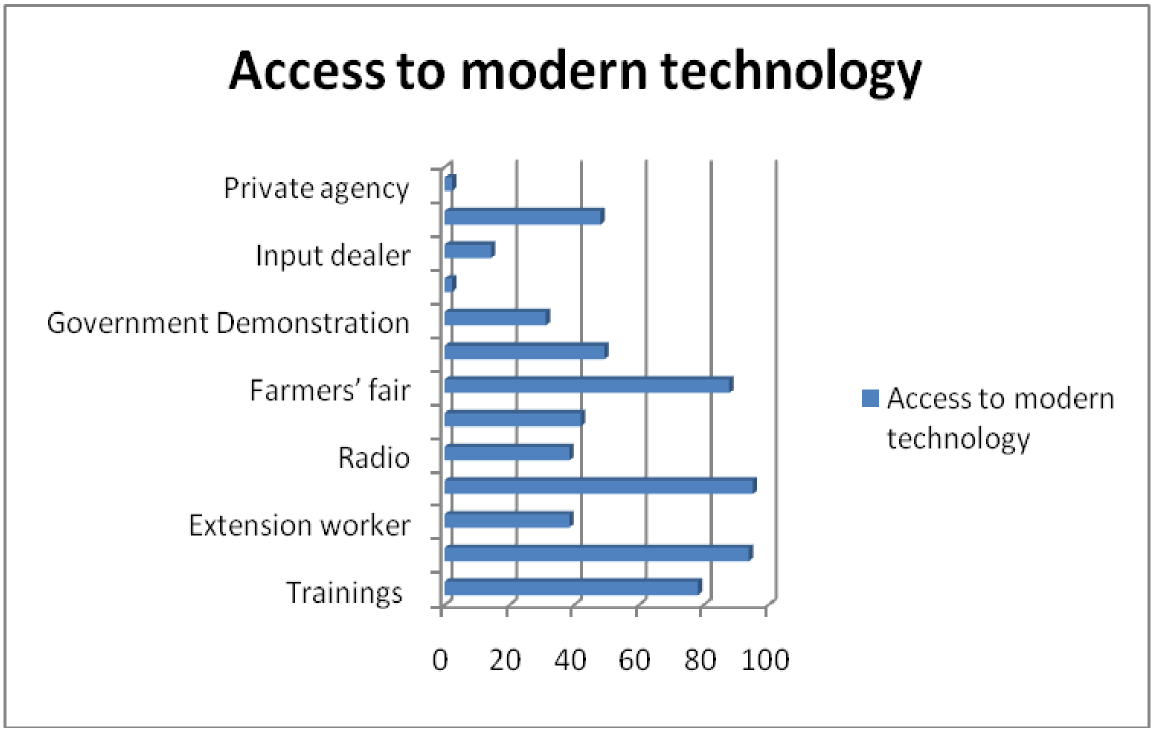


Fig. 5: Access to modern technology

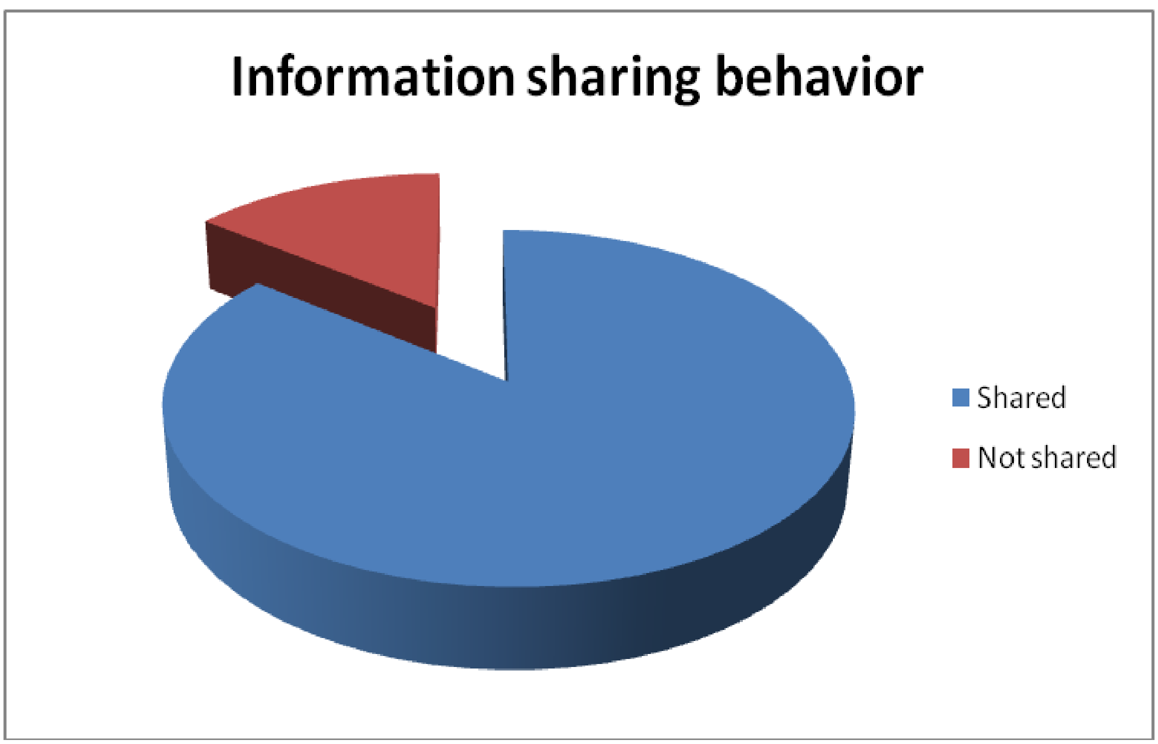


Fig. 6: Information sharing behavior of farmers about Agri-portals

Information sharing behavior

Information sharing behavior of the farmers using aAQUA and Agropedia and the practices recommended by these portals represents the extent to which the farmers felt that the services provided by the selected Agri-portals should be enjoyed by all the members of society (Fig. 6).

Table 41: Distribution of farmers according to information sharing behavior about the selected Agri-portals (N=83)

S.No.	Category	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Shared	68	81.92	71	85.54
2	Not shared	15	18.07	12	14.45
	Total	**83**	**99.99**	**83**	**99.99**

After getting aware of the selected Agri-portals, got registered and visited, the farmer would either get satisfied or dissatisfied with the kind of services provided. If the results were satisfactory, there would surely be sharing of information about the services and recommendations of selected Agri-portals. The information sharing behavior of farmers about selected Agri-portals are presented in Table 41.

The results of Table 41 show that majority (81.92 per cent) and (85.54 per cent) of farmers had shared the information provided through Agropedia and aAQUA respectively. It directly reflects upon the satisfaction farmer earned out of the services and recommendations given. Hence, necessary steps might be taken to provide best quality services and recommendations at their door steps.

It could also be observed that only few farmers 18.07 per cent and 14.45 per cent did not share the information and recommendations of Agropedia and aAQUA respectively. The studies are in harmony with the observations made by *Karthikeyan* (2008) where the farmers showed similar kind of information sharing behavior about Kisan Call Centers at Tamil Nadu.

Number of persons shared

Table 42: Distribution of farmers based on number of persons shared about selected Agri-portals (N=83)

S.No.	Category	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Less than 5	21	25.30	21	25.30
2	6 to 10	11	13.25	11	13.25
3	More than 10	36	43.37	36	43.37
	Total	**68**	**81.92**	**68**	**81.92**

It could be observed from Table 42 that maximum (43.37 per cent) number of farmers had shared the information about Agropedia and aAQUA with more than ten persons. Desire to promote awareness about selected Agri-portals might be one of the reasons for sharing the information to maximum number of farmers. Above all aAQUA offer free services to the farmers on their mobile phones and also both the Agri-portals offer free agro-advisories to them through computer. Hence, with a view to motivate peer groups to utilize free services, number of persons had been shared with the details of aAQUA and Agropedia's mobile services and agro-advisories respectively.

Maximum number of farmers were found to share the advices with more than ten persons on an average and more than one third (25.30 per cent) of the farmers shared the information of the selected Agri-portals with less than five persons. One fifth of the farmers had shared it between six to ten persons. Out of total 83 farmers being interviewed; only 68 had shared it with other persons and rest fifteen farmers had not carved up the information of the selected Agri-portals with anyone. This might be due to the dissatisfaction of users as a result of adoption of the recommendations provided by aAQUA and Agropedia.

Nature of persons shared

Table 43: Distribution of farmers based on nature of persons shared (N=83)

S.No.	Nature of persons	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Family members	50	60.24	50	60.24
2	Friends	48	57.83	48	57.83
3	Relatives	55	66.26	55	66.26
4	Fellow farmers	26	31.32	26	31.32
5	Neighbors	62	74.69	62	74.69

***Multiple responses were allowed**

Out of 81.92 per cent of the farmers who had shared the information about Agropedia and aAQUA, it was found that majority (74.69 per cent for both) of the farmers had shared it with neighbor followed by relatives (66.26 per cent each). This might be due to the frequent contact made by farmers with these groups and easy accessibility with them.

The analysis on nature of persons shared about the recommendations of selected Agri-portals determines the persons with whom the information and its results were being communicated. It could be observed that in case of both the Agri-portals, 60.24 per cent farmers shared the information with their family members followed by 57.83 per cent shared it with friends and 32.31 per cent shared this information with the fellow farmers.

The findings are well supported by the observations made by *Karthikeyan* (2008).

Gratification of services

Gratification refers to the satisfaction of farmers with regard to the results of adoption of recommended practices of agropedia and aAQUA and its overall services.

If the practices recommended by Agropedia and aAQUA were found suitable to the farmers' condition and if the results produced positive impact upon them, gratification would normally arise with them. When impractical and unsuitable information were provided by the experts and officials of the selected Agri-portals without probing much into the farmers' situations, the results might not fulfill the users' need and might end up with dissatisfaction (Fig. 7).

Table 44: Distribution of farmers on the basis of gratification of recommended practices of selected Agri-portals (N=83)

S. No.	Category	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Satisfied	50	60.24	64	77.10
2	Not satisfied	2	2.40	NIL	NIL
	Total	**52**	**62.64**	**64**	**77.10**

In order to know about the extent of suitability and satisfaction of the recommended practices of Agropedia and aAQUA among the farmers, the level of gratification was analyzed and results are expressed in Table 44. Farmers of the selected Agri-portals were categorized into ‘adopters’ and ‘non-adopters’ based on adoption of the recommended practices by Agropedia and aAQUA. From Table 44, it could be observed that, majority (60.24 per cent and 77.10 per cent in case of Agropedia and aAQUA respectively) of the farmers were satisfied with the recommendations of selected Agri-portals. The reason for this result might be due to the fact that, information provided by the experts and officials were suitable to the farmers at field level. Hence, it may be inferred that location specific, low-cost and quality services and recommendations need to be provided to make the farmers satisfied with the practices recommended. It is also observed that negligible number (2.40 per cent) of farmers was dissatisfied with the recommendations of Agropedia portal.

Gratification with the overall services of selected Agri-portals

The overall services of selected Agri-portals include, service timings, message delivery timing, recommendations and clarity in the delivery of messages. These are the overall services in which satisfaction was measured. Table 44 shows that majority of the respondents (74.69 per cent) were satisfied with overall services provided through Agropedia and in contrast only 4.81 per cent farmers were not satisfied with the overall services of Agropedia.

Like Agropedia, with little difference in percentage majority (84.33 per cent) farmers were satisfied and only 2.46 per cent were not satisfied with the overall services of aAQUA.

Table 45: Distribution of farmers based on gratification of overall services of selected Agri-portals (N=83)

S. No.	Category	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Satisfied	62	74.69	70	84.33
2	Not satisfied	4	4.81	2	2.46
	Total	**66**	**79.50**	**72**	**86.79**

It could be observed from Table 45 that maximum numbers of farmers were satisfied with the overall services of selected Agri-portals. The results are in harmony with similar studies undertaken by *Karthikeyan* (2008) on Formative evaluation of the Kisan Call Center in Tamil Nadu.

The extent of satisfaction, results in information sharing of selected Agri-portals and its advice to the fellow farmers. This normally ends up with wide popularity about Agropedia and aAQUA and more participation from the desired clients. The information sharing behavior was the indicator of the study and a medium term outcome of both the Agri-portals.

Immediacy of feedback

It is operationally defined as the length of time in days taken by the extension agency/Agri-portals to respond to the queries of respondents.

Table 46: Distribution of farmers on the basis of immediacy of feedback (N=83)

S.No.	Feedback	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Within the same day	4	4.81	10	12.05
2	Within a week	11	13.25	25	30.12
3	More than a week	22	26.50	36	43.37
	Total	**37**	**44.56**	**71**	**85.54**

A perusal of Table 46 shows that in response to the queries of registered farmers of Agropedia, most (26.50 per cent) of them got reply in more than one week followed by 13.25 per cent farmers who got the solution to their problem within a week. Very less (4.81 per cent) farmers reported to got it within the same day. On the other hand with somewhat more differential figures 43.37 per cent farmers got the reply from aAQUA in more than one week followed by 30.12 per cent who got the answers within a week. Again very few (12.05 per cent) farmers got the solution to their problems within the same day.

It can be concluded that online solutions are not immediately available to the farmers from both the Agri-portals. Hence, more concentration needs to be taken in educating the officials and experts about immediate reply and solution to their problems. This will increase the credentials of Agropedia and aAQUA among the farming communities. Because availability and accessibility of computer and internet is not very good in the rural areas so the farmers cannot go again and again just to check whether they got the reply or not. This will lower down the authenticity of the selected Agri-portals.

Utilization of knowledge gained

Table 47: Distribution of farmers based on utilization of knowledge gained through selected Agri-portals (N=83)

S. No.	Category	No. of farmers (Agropedia)	Percentage	No. of farmers (aAQUA)	Percentage
1	Utilized to fullest extent	3	3.61	9	10.80
2	Utilized to medium extent	39	46.98	57	68.62
3	Not utilized	30	36.14	14	16.86
	Total	**66**	**86.73**	**72**	**96.28**

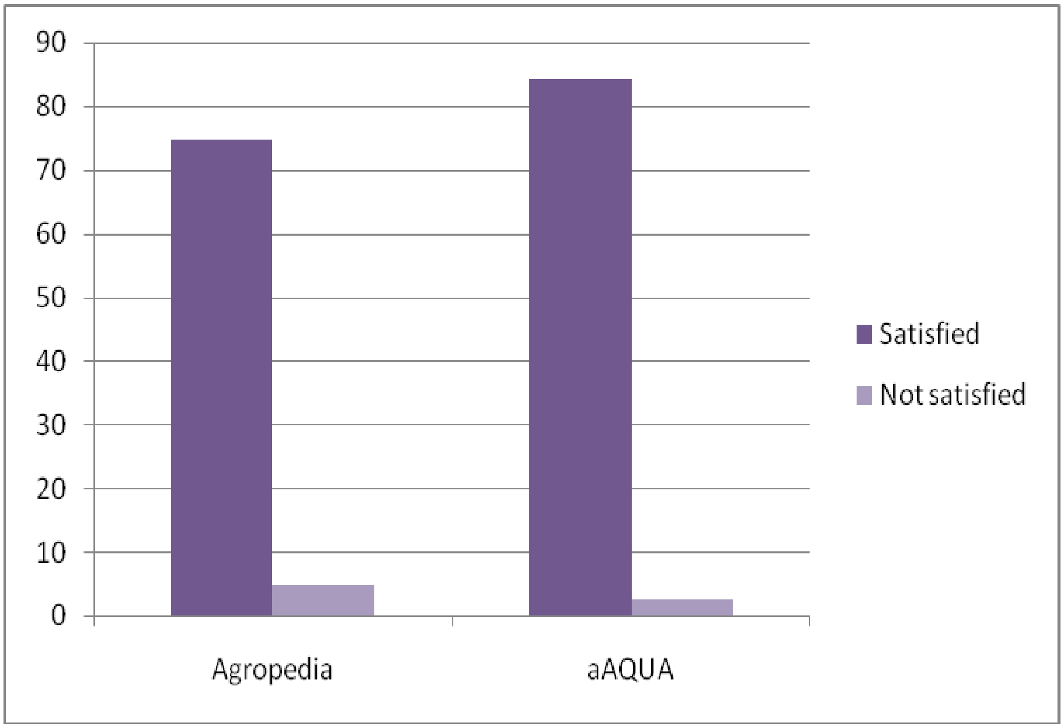


Fig. 7: Gratification of the services og Agri-portals

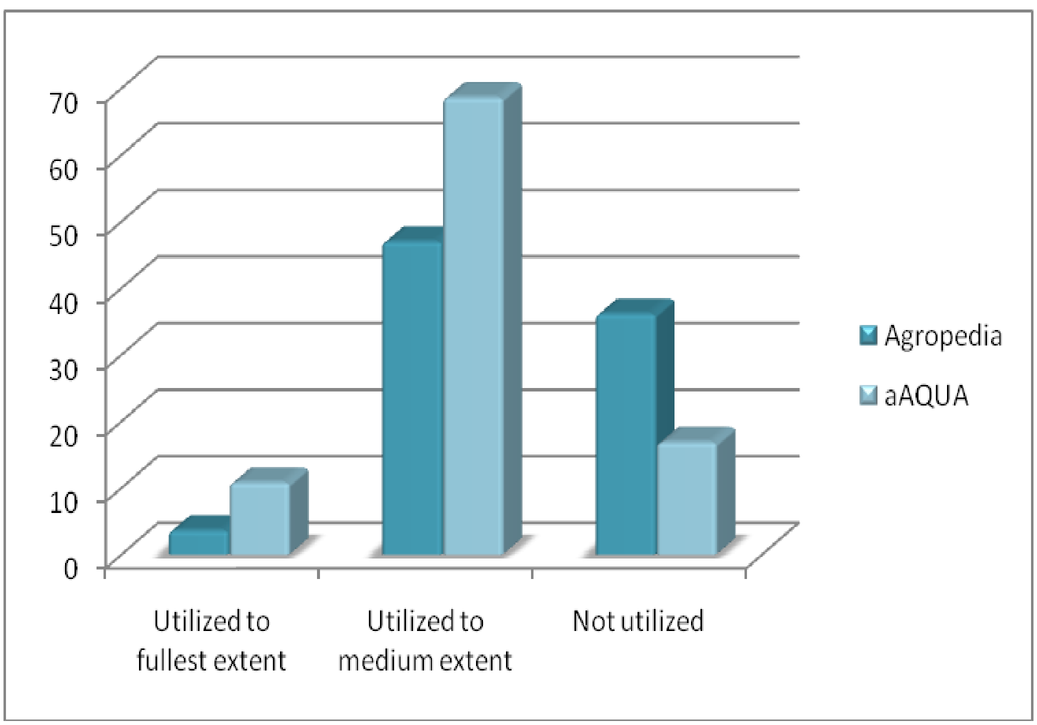


Fig. 8: Utilization of knowledge gained through selected Agri-portals

After being aware and satisfied with the information and knowledge gained through the selected Agri-portals, its utilization comes. It is clear from Table 47 that maximum number (46.98 per cent) of farmers utilized the agricultural knowledge gained to a medium extent through the Agropedia. 36.14 per cent farmers have not utilized the knowledge gained. Surprisingly very few farmers (3.61 per cent) utilized it to the fullest extent (Fig. 8). The reason could be that Agropedia was initially and especially designed to address the professionals, accordingly the message would have been treated like that. Therefore, it would be of less use to the farmers.

In case of aAQUA majority (68.62 per cent) of the farmers utilized the knowledge gained to the medium extent followed by 16.86 per cent farmers not utilized at all and 10.80 per cent, who utilized it to the fullest extent.

The possible reason could be that aAQUA was started much earlier and a very popular communication media i. e. Mobile phone was being used to send the agricultural information to the farmers. Therefore, the farmers need not to go to the cyber café and access the computer to get the information. Thus, aAQUA was quite popular among the farming community and hence, the utilization level reaches to satisfactory level.

Knowledge level

It can be operationalized as knowledge level of the farmers on various aspects of selected Agri-portals. For measuring the knowledge level of the farmers about selected Agri-portals a knowledge test on different aspects was prepared including registration onto these Agri-portals, information access, asking questions to the experts, downloading graphics and video, and provide feedback were measured through well prepared and pre-tested knowledge test. A score of one for each correct answer was assigned to categorize the respondents into low medium and high knowledge groups.

Table 48: Distribution of farmers based on knowledge level about selected Agri-portals (N=83)

S. No.	Category	No. of farmers	Percentage
1	Low knowledge (less than 5)	13	15.66
2	Medium knowledge (5-11)	57	68.67
3	High knowledge (more than 11)	13	15.66
	Total	**83**	**99.99**

Mean= 8.216 SD= 2.87 CV= 34.93

Perusal of data presented in Table 48 reveals that the majority (68.67 per cent) of the farmers gained medium knowledge level followed by similar numbers (15.66 per cent) of farmers gained high knowledge and low knowledge level. The SD (2.87 per cent) and CV (34.93) values further suggest that farmers were heterogeneous with respect to their knowledge level. The findings of the study are in harmony with the observation of *Sasidhar* (2008) and *Chauhan* (2010). Hence, it is concluded that farmers gained significant knowledge on various aspects of agriculture from Agropedia and aAQUA.

Opinion of farmers

It indicates the significance of the content being uploaded onto the selected Agri-portals i.e. Agropedia and aAQUA. For the present study opinion about content relevance, design features and usability features of farmers and other stakeholders were studied and analyzed.

d. Opinion about content relevance

It indicates the significance of content being uploaded onto selected Agri-portals i.e. Agropedia and aAQUA. For the present study opinion about content relevance (highly relevant, somewhat relevant, irrelevant), treatment of the message (high technical words, moderate technical words, and less technical words), adequacy of the content (adequate, somewhat adequate and inadequate), and usefulness of the content (highly useful, moderately useful and not useful) were measured on a three point continuum and the numerical value of 3, 2 and 1 was assigned respectively. Treatment of the message refers to the modification of the content into local language with less technical terms for better comprehension and convenience to the farmers. Adequacy of the content implies to the ability of the messages to provide all the necessary information. Usefulness of the content implies to the worth/value of the sessions.

Table 49: Distribution of farmers on the basis of opinion of content relevance (N=83)

S.No.	Category	Agropedia	aAQUA
1	**Content relevance**		
	Highly relevant	2 (2.40)	31 (37.30)
a.	Somewhat relevant	55 (66.26)	48 (57.80)
b.	Irrelevant	19 (22.89)	NIL
2	**Treatment of message**		
a.	High technical words	30 (36.14)	10 (12.04)
b.	Moderate technical words	36 (43.37)	27 (32.53)
c.	Less technical words	8 (9.63)	42 (50.60)
3	**Adequacy of content**		
a.	Adequate	3 (3.61)	33 (39.75)
b.	Somewhat adequate	61 (73.40)	45 (54.21)
c.	Inadequate	11 (13.25)	1 (1.20)
4	**Usefulness of content**		
1.	Highly useful	NIL	36 (43.37)
2.	Moderately useful	66 (79.51)	43 (51.80)
3.	Not useful	9 (10.84)	NIL

Mean = 15.67 SD = 4.45 CV=28. 39

Note: Figures in parenthesis indicate the percentage in the respective category

It is clear from Table 49 that opinion of farmers about content relevance of Agropedia was fairly good. Majority (66.26 per cent) of the farmers opined that the uploaded content of Agropedia was somewhat relevant followed by 22.89 per cent farmers reported that uploaded agricultural content was irrelevant. Very few (2.40 per cent) farmers reported the content as highly relevant. Though the agricultural information uploaded on Agropedia is in 28 languages worldwide but it primarily focused for agricultural professionals so, the information presented will be less useful for the farmers. Treatment of messages was reported as moderately technical by 43.37 per cent farmers. High and less technical words were reported by 36.14 per cent and 9.63 per cent farmers respectively. Somewhat adequacy of the uploaded agricultural content was reported by majority 73.40 per cent farmers. Inadequacy and adequacy of the content were reported by 13.25 per cent and 3.61 per cent farmers respectively. Majority (79.51 per cent) of the farmers experienced that content onto Agropedia was moderately useful followed by 10.84 per cent who reported the content as not useful.

Analysis of content relevance of aAQUA is presented in Table 49. It is clear from the Table that over half (57.80 per cent) of the farmers reported that content provided through aAQUA was moderately relevant and rest of the farmers (37.30 per cent) found it highly relevant. In contrast to Agropedia no farmer reported the aAQUA content as irrelevant. Half of the farmers (50.60 per cent) found the content as less technical followed by 32.53 per cent reported it as moderately technical. Unlike Agropedia very few (12.04 per cent) farmers found it technical. Over half (54.21 per cent) of the farmers reported that the content provided by aAQUA was somewhat adequate followed by negligible number (1.20 per cent) of farmers who found it as inadequate. So, it can be generalized that overall the content of aAQUA was fairly appreciated by the farmers in terms of relevance and message treatment. Nearly half (51.80 per cent) of the farmers found the aAQUA content as moderately useful followed by 43.37 per cent farmers reported as highly useful.

It can be concluded from the above findings that quality information increases understandability and comprehensiveness of the information. This will be reversed if the information given contains highly technical words. Therefore, before presenting any information, particularly to rural communities, it is necessary to treat or modify the message as per the local language or convenience of the target beneficiaries. As far as the adequacy and usefulness of the content are concerned, majority of the farmers tilted towards positive side. Messages which don't provide the complete information about a problem are not useful for the farmers. Therefore, information provided through Agropedia and aAQUA should provide crop, location and language specific agricultural information to the farmers. Comparatively lower SD (4.45) and CV (28.39) values further suggested that respondents were homogeneous in opinion.

Opinion about design features

It indicates the organization of information and the clarity provided by the background colors and graphics in reading the text presented on the selected Agri-portals (Agropedia and aAQUA).

Table 50: Distribution of farmers based on design features of selected Agri-portals (N=83)

S.No.	Statements	Agropedia	
		Mean value	Rank
1	Readability of the text is appropriate.	4.19	I
2	The graphics are integrated with the information presented.	4.00	II
3	Video uploaded is appropriate to the textual information.	3.83	III
4	The webpage is heavily loaded with information.	3.78	IV
5	Home page is simple, well organized and attractive.	3.75	V
6	All major parts of the Agri-portals are accessible from the home page.	3.59	VI
7	Synchronization is poor between the text uploaded and the visual icons.	3.55	VII
8	Advertizing on the home page is limited and non-obtrusive.	3.53	VIII
9	The information is not appropriately organized.	3.51	IX
10	Too many animations which distract the users.	3.33	X
11	The speed of uploading the graphics is poor.	2.81	XI
12	Use of too many colors made the Agri-portal very attractive.	2.60	XII

A perusal of Table 50 states that appropriateness of readability of text of Agropedia ranked as best (highest mean score=4. 91). The information presented was well supported with the appropriate graphics (mean score=4.00) followed by appropriate supporting videos with a mean score of 3.83. The information presented on web page was too much so farmers reported that the home page seems to be heavily loaded with the variety of information which leads to perplexity (mean score=3.78) simultaneously followed by the opinion that home page was simple, well organized and attractive. It was reported that all major parts of Agropedia could be accessed from the home page (mean score=3.59). So, the farmers need not to go to further links for information. Farmers responded that there was poor synchronization between the text uploaded and the visuals used to support the information (mean score=3.55). Advertizing on page is limited and non-obtrusive was ranked as eighth with a mean score of 3.53. The information is not appropriately organized ranked quite low according to farmers' opinion (mean score=3.51). Farmers also observed that bare minimum animations were used in Agropedia site to avoid the distraction (mean score=3. 33). The speed of uploading the graphics was poor and ranked as tenth which means that graphics could be uploaded very easily. Colors were carefully chosen to avoid the commotion and misunderstanding. In all the Agropedia portals was appreciated by almost all the farmers with somewhat changes.

Table 51: Distribution of farmers based on design features of selected Agri-portals (N=83)

S.No.	Statements	aAQUA	
		Mean value	**Rank**
1	Readability of the text is appropriate.	4.31	**I**
2	The home page is simple, well organized and attractive.	4.07	**II**
3	Graphics are integrated with the information presented.	4.02	**III**
4	All major parts of the Agri-portals are accessible from the home page.	3.75	**IV**
5	Advertizing on home page is limited and non-obtrusive.	3.61	**V**
6	Synchronization is poor between the text uploaded and the visual icons.	3.59	**VI**
7	The webpage is heavily loaded with information.	3.57	**VII**
8	Too many animations which distract the users.	3.36	**VIII**
9	Information is not appropriately organized.	3.36	**VIII**
10	Video uploaded is appropriate to the textual information.	3.26	**IX**
11	The speed of uploading the graphics is poor.	2.89	**X**
12	Use of too many colors made the Agri-portal very attractive.	2.63	**XI**

It is clear from Table 51 that like Agropedia most of the farmers reported that the readability of the text is appropriate with a highest mean score of 4.31 followed by the response that home page is simple, well organized and attractive (mean score=4. 07). Most of the farmers opined that graphics are integrated with the information provided and ranked third with a mean score of 4.02 followed by fairly good opinion that all major parts of the portal can be accessed from home page (mean score=3.75). Unlike Agropedia, farmers reported that comparatively more advertisements were there on home page of aAQUA (mean score=3.61). Table also revealed that synchronization is good between the text uploaded and the visual icons used (mean score=3.59) followed by the response that webpage is heavily loaded with the information (ranked lower in the hierarchy with a mean score of 3.57). Farmers opined that information was appropriately organized but fairly good animations were used which distract the user's attention (with a similar mean score of 3.36 each). According to farmers' opinion videos uploaded were not much appropriate to the context (mean score=3.26). Farmers reported that colors used were more in numbers which created a bend among the users.

To be concluded, it can be said that with more or less differences; farmers' opinion was sound about both the Agri-portals.

Opinion of farmers about usability features

Table 52: Distribution of farmers based on usability features of selected Agri-portals (N=83)

S.No.	Statements	Mean value	Rank
1	I wish that my children should make positive use of Agri-portals for farming.	2.97	**I**
2	It is the fastest way to exchange agricultural information in the shortest time.	2.95	**II**
3	Development of Indian farmers is possible through the selected Agri - portal.	2.91	**III**
4	It is a rich source to collect worldwide information on agriculture and allied fields	2.89	**IV**
5	I wish that farmers should make use of Agri-portals.	2.89	**IV**
6	It can be a very useful mean to the farmers during the present time	2.84	**V**
7	Using Agri-portal is nothing other than time pass activity	2.74	**VI**
8	It is best mean to collect information on market prices of agricultural product	2.65	**VII**
9	It is a costly affair for the farmers.	1.63	**VIII**
10	Information available on the Agri - portal is easy to understand	1.48	**IX**

The data presented in Table 52 indicated that internet is the best means to learn new things for young generation, thus, most of the farmers ranked it first with the highest mean score value of 2.97. They wished their children to make positive use of the Agri-portals like Agropedia and aAQUA. At the same time farmers with the second highest mean score value of 2.95 supported the statement that 'Internet is the fastest way to exchange information in shorter time'. It was really appreciable to note that majority of the farmers assumed that development of Indian farmers is possible through Internet and ranked it third with a mean score value of 2.91. Most of the farmers (mean score=2.89) understood that internet is a rich source to collect world wide information on agriculture and its allied fields, at the same time and exactly with the similar mean value (2.89) it was opined that farmers should make use of the internet. *Chauhan and Chauhan, (2006)* also reported the same results. The results pointed out that farmer agreed with the statement; "Internet can be a very useful mean to the farmers during present time" with a noticeable mean value of 2.84.

It was exciting to note that most of the farmers with little difference in mean score value (2.74) did not believe that use of internet is only time pass activity. It means that they opined it as a useful medium for farming community. Earlier farmers were not in a position to use online information for development of agriculture because whatever sites available for agriculture are mostly in English language but the selected Agri-portals changed the trend and started providing crop, location and language specific information.

Internet is best mean to collect information on market prices of agricultural products but as it is being a new system for our farmers, mix opinion was observed for this aspect and it was observed that farmers with a mean score value of 2.65 believed these portals as the best means to get market information. Looking at the present cost involved in this technology, it is not easy for the farmers to have this facility individually at his home, thus, with a mean score of 1.63 farmers completely or to a certain degree felt that the internet is a costly affair for them.

The low mean score (1.48) showed that farmers partially or absolutely realized that information available on the Internet is difficult to understand. This may be because that getting information in this way is quite new and farmers were not well-known for it. Findings of the present investigation are in harmony with the similar study conducted by *Chauhan* (2010).

Data presented in Table 53 shows that practices recommended by Agropedia has some impact on those farmers who began practicing the recommendations after exposure to Agropedia and on whom who have intensions to adopt these in future (Fig. 9). Most of the farmers reported that they started following practices regarding land preparation (20.48 per cent), seeds/varieties (28.91 per cent), seed treatment (36.14 per cent), sowing methods (28.91 per cent), spacing (24.09 per cent), weeding (27.71 per cent), and plant protection (24.09 per cent) after being exposed to Agropedia. On the other hand most of them intended to practice these in the near future. Very few farmers reported that they had no plans to adopt the recommendations of Agropedia. It can be concluded that despite the fact that the Agri-portal is very new to this kind still farmers appreciated and adopted its advisories.

Table 53: Extent of adoption of practices recommended by Agropedia

S. No.	Practices recommended	Practicing prior to exposure of Agropedia		Began practicing after exposure to Agropedia		Intend to practice in the future		No plans to adopt	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Land preparation	50	60.24	17	20.48	8	9.63	3	3.61
2	Seeds/varieties	24	28.91	24	28.91	23	27.71	10	12.04
3	Seed treatment	22	26.5	30	36.14	25	30.12	4	4.81
4	Sowing time	49	59.03	16	19.27	7	8.43	6	7.22
5	Sowing methods	16	19.27	24	28.91	33	39.75	7	8.43
6	Spacing	28	33.73	20	24.09	27	32.53	6	7.22
7	Weeding	2	2.40	23	27.71	47	56.62	5	6.02
8	Plant protection	2	2.40	20	24.09	29	34.93	6	7.22
9	Critical stages of irrigation	40	48.19	8	9.63	21	25.3	4	4.81
10	Harvesting	83	100	0	0	33	39.75	4	4.81
11	Storage	11	13.25	13	15.66	42	50.60	4	4.81
12	Marketing	11	13.25	4	4.81	76	91.56	0	0

***Multiple responses were allowed**

Table 54: Extent of adoption of practices recommended by aAQUA

S. No.	Practices recommended	Practicing prior to exposure of aAQUA		Began practicing after exposure to aAQUA		Intend to practice in the future		No plans to adopt	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Land preparation	50	60.24	18	21.68	8	9.63	3	3.61
2	Seeds/varieties	24	28.91	24	28.91	23	27.71	10	12.04
3	Seed treatment	22	26.5	30	36.14	25	30.12	4	4.81
4	Sowing time	49	59.03	17	20.48	7	8.43	6	7.22
5	Sowing methods	16	19.27	24	28.91	33	39.75	7	8.43
6	Spacing	28	33.73	20	24.09	27	32.53	6	7.22
7	Weeding	2	2.40	23	27.71	31	37.34	5	6.02
8	Plant protection	2	2.40	20	24.09	29	34.93	6	7.22
9	Critical stages of irrigation	40	48.19	8	9.63	21	25.3	4	4.81
10	Harvesting	83	100	0	0	33	39.75	4	4.81
11	Storage	11	13.25	13	15.66	42	50.60	4	4.81
12	Marketing	11	13.25	4	4.81	76	91.56	0	0

***Multiple responses were allowed**

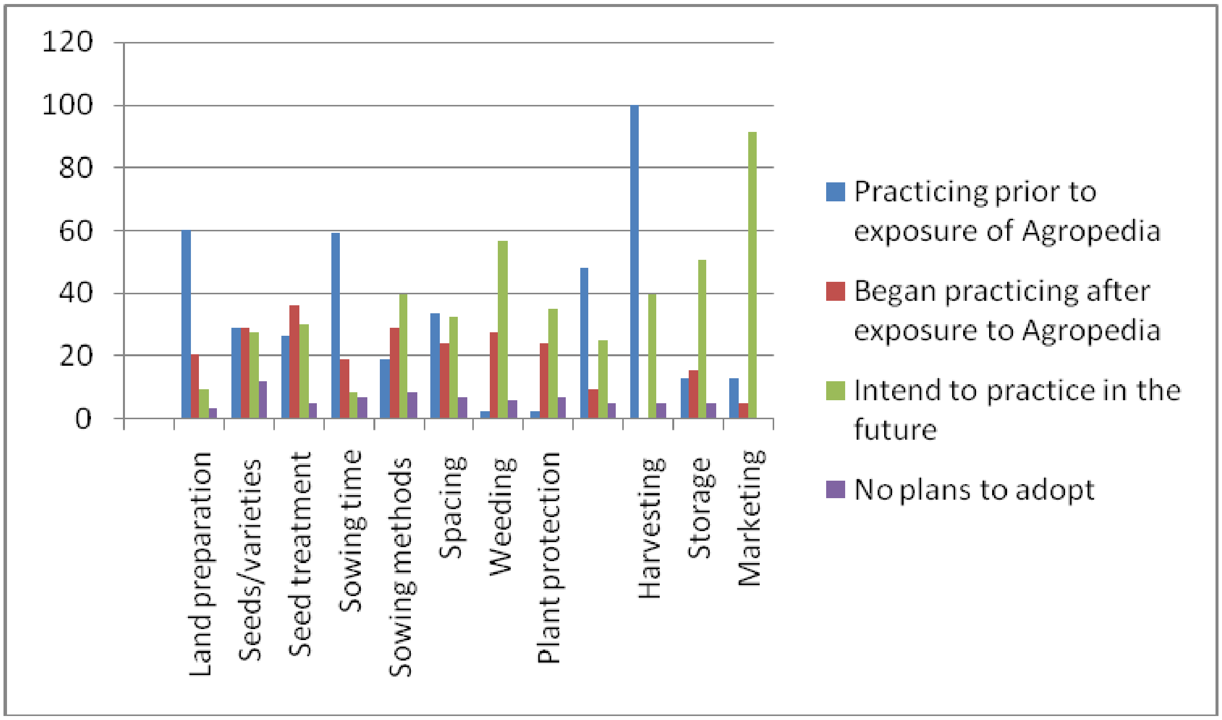


Fig. 9: Extent of adoption of practices recommended through Agropedia

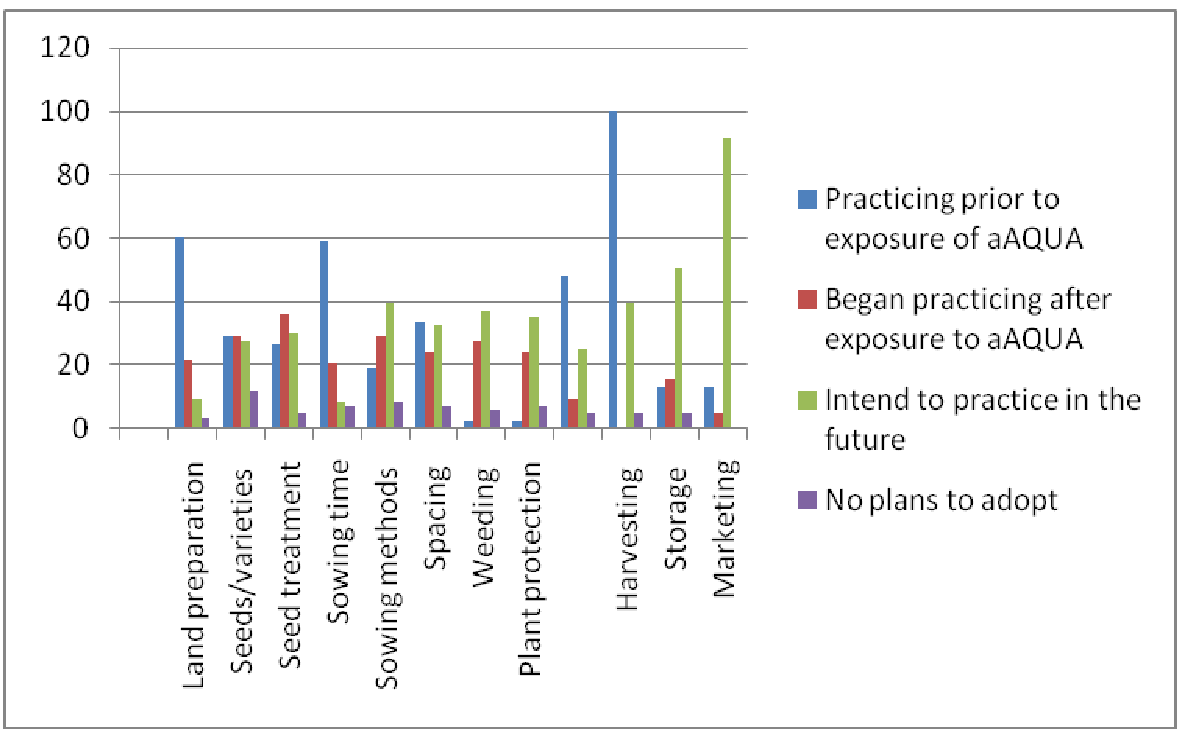


Fig. 10: Extent of adoption of practices recommended through aAQUA

A perusal of Table 54 revealed similar results with a more or less difference with Agropedia. Farmers reported that they started following practices related to land preparation (21.68 per cent), seeds and varieties (28.91 per cent), seed treatment (36.14 per cent), sowing time (20.48 per cent), sowing methods (28.91 per cent), spacing and weeding (24.09 per cent and 27.71 per cent respectively) and plant protection (24.09 per cent). Most of the farmers intend to practice these in the future (Fig. 10). Again very few farmers reported that they do not have any plans to adopt these practices even in future.

Table 55: Extent of economic change among the users of selected Agri-portals (N=83)

S. No.	Aspects	Agropedia	
		Frequency	**Percentage**
I.	**Increase in yield**		
1.	No change	42	50.62
2.	Up to some extent	38	45.78
3.	Up to large extent	0	0
II.	**Change in quality of produce**		
1.	No change	42	50.62
2.	Some change	37	44.58
3.	Significant change	01	1.12
III.	**Income level**		
1.	No change	63	75.90
2.	Up to some extent	19	22.89
3.	Up to large extent	00	00
IV.	**Number of crops grown on fields every year**		

1.	No change	69	83.13
2.	Up to some extent	11	13.25
3.	Up to large extent	02	2.41
V.	**Diversification of crops**		
1.	No change	71	85.54
2.	Shifted from traditional crops to cash crops	11	13.25
3.	Shifted from traditional varieties to hybrid varieties	00	00
VI.	**Disease control**		
1.	No change	47	56.62
2.	Up to some extent	27	32.53
3.	Up to large extent	6	7.23

The economic changes due to adoption of practices recommended by Agropedia and aAQUA were studied for six components. It is clear from Table 55 that practices recommended by selected Agri-portals tried to bring positive changes among the farming community like increase in yield, changes in the quality of produce, income level, number of crops grown every year, diversification of crops, disease control etc. But most of the changes tilted towards negative side like half (50.62 per cent) of the farmers reported that there was no change in increase in yield while a fair percentage (45.78 per cent) of farmers said that somewhat positive changes happened due to adoption of the practices recommended by Agropedia.

Again half (50.62 per cent) of the farmers experienced that there was no change in the quality of their farm produce followed by 44.58 per cent farmers who reported some changes in produce.

Only negligible (1.12 per cent) number of farmers reported significant changes in farm produce. 75.90 per cent farmers reported no change in income level while 22.89 per cent reported that income status changes up to some extent. The large majority (85.54 per cent) farmers did not shift towards the diversified cropping pattern and still stuck to the traditional system of cultivation. This is followed by 13.25 per cent farmers who changed to some extent and adopted the recommended diversified cropping system. 83.13 per cent farmers did not change the total number of crops grown in their fields every year followed by only few farmers (13.25 per cent) who changed to some extent while negligible (2.41 per cent) number of farmers changes up to a large extent. Majority (56.62 per cent) of farmers experienced no change in disease control followed by few farmers (32.53 per cent) who experienced some changes and relatively less farmers (7.23 per cent) experienced significant changes in disease control.

The reason might be that farmers could not access the information on a daily basis and for Agropedia they need to go to the cyber café and use the computers to access to the information, which is quite difficult for rural farmers. Lack of time, infrastructure, and computer illiteracy might be the hindering factors for farmers.

Table 56: Extent of economic change among the users of selected Agri-portals (N=83)

S. No.	Aspects	aAQUA	
		Frequency	**Percentage**
I.	**Increase in yield**		
1.	No change	38	45.78
2.	Up to some extent	42	50.62
3.	Up to large extent	03	3.61
II.	**Change in quality of produce**		
1.	No change	17	20.48
2.	Some change	63	75.90
3.	Significant change	03	3.61
III.	**Income level**		
1.	No change	35	42.17
2.	Up to some extent	43	51.81
3.	Up to large extent	05	6.02
IV.	**Number of crops grown on fields every year**		
1.	No change	52	62.65
2.	Up to some extent	20	24.09
3.	Up to large extent	11	13.25
V.	**Diversification of crops**		
1.	No change	52	62.65
2.	Shifted from traditional crops to cash crops	30	36.14
3.	Shifted from traditional varieties to hybrid varieties	01	1.12
VI.	**Disease control**		
1.	No change	21	25.30
2.	Up to some extent	34	40.96
3.	Up to large extent	27	32.53

Changes in increase in yield, changes in the quality of produce, economic changes, number of crops grown in every year, diversification of crops and disease control are presented in Table 56. It is clear from the table that unlike Agropedia majority of farmers reported that yield increased up to some extent due to the adoption of practices recommended by aAQUA. No changes in yield increase reported by 45.78 per cent followed by very few farmers who experienced yield increment up to a large extent. Large majority (75.90 per cent) of farmers experienced that quality of produce improved due to the adoption of recommended practices from aAQUA. In contrast 20.48 per cent farmers reported no changes taken place due to the recommendations of aAQUA. This may be because the recommendations were not crop and language specific for the farmers. A significant change in the quality of produce was reported by very few (3.61 per cent) farmers.

The economic change due to adoption of practices recommendation shows that majority (51.81 per cent) of the farmers who experienced an increase in income level up to some extent followed by 42.17 per cent number of farmers reported no changes in income level. Few farmers (6.02 per cent) reported significant changes in income level. This might be because some of the farmers were very progressive and had computer and internet facilities at their home so they need not to go and contact elsewhere for the information. The information was readily available to the farmers and they got the latest information at the right time.

Regarding the number of crops grown in every year on field majority (62.65 per cent) of farmers reported no changes. They are still carrying out the same practice followed from the years. The investigation also revealed that as much as 24.09 per cent farmers reported an increase in the number of crops grown in the field every year to some extent followed by 13.25 per cent farmers who reported significant changes in cropping pattern. This indicates that practices recommended were effective to some extent but still it needs to farmer friendly and location and language specific to be adopted by a number of farmers.

The majority of the farmers did not shift from traditional crops to cash crops and were still following the same cropping pattern. They did not adopt the diversification of crops; positive changes in crop diversification were reported by as many as 36.14 per cent farmers. Again very few farmers (1.12 per cent) shifted themselves from traditional crops to hybrid varieties. Thus, it can be concluded that it is very difficult for the rural farming communities to leave their indigenous practices that easily and adopt the latest practices, even if they are relatively advantageous over their existing one.

Regarding the disease control due to the advice from aAQUA, fairly good results can be seen. The maximum number of farmers reported that they succeeded in controlling the major crop diseases up to some extent. It is significant to note that as much as 32.53 per cent farmers controlled their crop disease up to a large extent, which is a positive change due to the recommendations to the farmers.

Thus, it can be concluded that on an average economic changes were satisfactory to some extent but still a large majority of farmers still did not experience the changes. The possible reason could be that any information generally takes some time to be penetrated into the society and takes relatively good time to be adopted. Since, the selected Agri-portals were not mature enough in this area so many changes could not be expected. While we look for some positive changes it can be suggested that necessary steps might be taken to provide quality advices to the farmers for better adoption.

SECTION - C

There are some factors which hamper the adoption of recommended practices by Agropedia and aAQUA for better agricultural outputs. In this investigation the trainees were asked to indicate various constraints faced by them to access and to adopt the recommendations of the selected Agri-portals. The constraints as perceived by the farmers that affected the adoption of improved agricultural practices were identified in the present investigation. Various constraints faced by the practicing (who adopted the practices recommended), farmers who discontinued after once they adopted and who did not adopt it; have been analyzed and discussed as follows.

Table 57: Major constraints expressed by users of selected Agri-portals (N=83)

S. No.	Constraints	Total score	Rank
1.	Less number of trainings on use and application of selected Agri-portals.	466	**I**
2.	Lack of follow-up trainings.	460	**II**
3.	Content is not crop and language specific to Uttarakhand region.	436	**III**
4.	Slow internet speed	402	**IV**
5.	Involves high technical skills.	396	**V**
6.	Involves too many steps to get information.	382	**VI**
7.	Lack of accessibility	365	**VII**
8.	Non-availability of computers	356	**VIII**
9.	Recommendations are not ready to use.	353	**IX**
10.	Lack of efforts by the extension personnel to establish proper linkage between portal managers and farmers.	346	**X**
11.	Difficulty in following as per the portals recommendation.	340	**XI**
12.	Erratic supply of electricity.	332	**XII**
13.	Computer illiteracy	272	**XIII**
14.	Content is not updated	256	**XIV**
15.	Delayed response for the queries of farmers	241	**XV**
16.	Lack of technical support from the extension personnel	220	**XVI**
17.	Lack of experienced trainers	216	**XVII**

Table 57 reveals that less number of trainings on the use and application of selected Agri-portals were the major problem faced by the farmers (mean score=466) followed by lack of trainings (mean score=460). The reason for being it as a major constraint could be that use of such platforms in the field of agriculture is relatively new and moreover Indian farmers are characterized by illiteracy, poverty and computer illiteracy which impeded them to use it. In that case number of trainings on use of these portals must be conducted for better understandings of all features of selected Agri-portals. Hands on sessions must be emphasized for better comprehension. The content of the selected agricultural crops was one of the constraint (mean score= 436). Agropedia and aAQUA are the nationalized portals and provide information on major crops grown in the country, but different agro climatic zones follow differential cropping pattern; so information were not so crop and location specific. However, the agricultural information provided for many important crops but farmers want agro-advisories for crops grown in hilly regions.

Slow internet speed (mean score=402) and the use of selected Agri-portals involves high technical knowledge (mean score=396) were reported to be other problems faced by farmers. Moreover, the portals were designed for the farmers so it could not be too technical but the farmers need to be trained accordingly to access the information from selected Agri-portals.

Getting information from the selected Agri-portals involves too many steps (means score=382), lack of accessibility (mean score=365) and non-availability of computers with mean score of 356 ranked sixth, seventh and eighth respectively. Among the farmers who adopted the recommended practices reported that most of the recommendations were not ready to use (mean score=353). In all the locations of Uttarakhand measuring unit of agricultural land is *Nali* but at national level Acre or Hectare is being used so, they need to change the fertilizers or pesticides doses accordingly which is quite difficult for the farmers. The extension personnel were not directly linked to the portal managers (mean score=346) which created a communication gap, otherwise the portals managers would have been known the needs of the farmers of Uttarakhand and could have provided the need based information. Electric supply is good in the state so power supply ranked low (mean score=332) and computer illiteracy ranked thirteenth (mean score=272). This might be because the respondents were progressive farmers with good educational background and most of them were computer literates.

Since, the portal managers regularly updating the content on the respective portals and it was also appreciated by the farmers by ranking it low among the constraints (mean score=256). Delayed response for the queries of farmers (ranked fifteenth, mean score=241), lack of technical support by the extension personnel (ranked sixteenth, mean score=220) and lastly the lack of experienced trainers (ranked seventeenth, mean score=216) were reported as least important constraints by the farmers. All the farmers were from the adopted villages of the *Krishi Vigyan Kendras*, so they are well supported and informed by the respective KVKs because of this reason it was considered as less important problem.

It can be concluded that if the farmers were trained properly, these Agri-portals will definitely make a difference in the agricultural scenario of the state and will unquestionably improve the feeble condition of Indian farmers and farming.

SECTION - D

5.4. Relationship between background characteristics of farmers and selected impact indicators

Table 58: Relationship with socio-personal and communication characteristics with dependent variables

	Overall knowledge level	Practicing prior to exposure of Agropedia	Practicing prior to exposure of aAQUA	Began practicing after exposure to Agropedia	Began practicing after exposure to aAQUA	Intend to practice the recommend-ations of Agropedia in future	Intend to practice the recommendat-ions of aAQUA in future	No plans to adopt the recommen-dation of Agropedia	No plans to adopt the recomme-ndation of aAQUA
Age	**0.160**	**-0.173**	**-0.181**	**0.048**	**0.029**	**-0.073**	**-0.071**	**0.143**	**0.143**
Education	**0.792****	**0.339**	**0.262***	**0.093**	**0.011**	**0.289****	**0.281***	**0.179**	**0.179**
Occupation	**-0.006**	**0.277**	**0.235***	**0.163**	**0.211**	**-0.086**	**-0.094**	**0.086**	**0.086**
Annual income	**0.021**	**-0.002**	**0.038**	**0.253***	**-0.124**	**-0.133**	**0.505****	**-0.103**	**-0.103**
Caste	**0.002**	**0.271***	**-0.268**	**-0.107**	**-0.108**	**0.135**	**0.337****	**0.127**	**0.127**
Marital status	**0.099**	**-0.205**	**0.256****	**0.450****	**-0.140**	**0.254***	**0.245***	**0.037**	**0.026**
Family type	**0.040**	**0.162**	**0.248***	**0.351****	**-0.005**	**-0.133**	**0.012**	**0.025**	**-0.026**
Family size	**-0.064**	**-0.056**	**-0.039**	**0.006**	**0.240***	**0.351****	**0.065**	**0.109**	**0.012**
Communication media possession	**0.335****	**0.108**	**0.036**	**0.007**	**-0.075**	**-0.104**	**0.012**	**0.089**	**0.089**

Agricultural equipment possession	**0.452****	**0.344****	**0.349****	**-0.001**	**0.027**	**0.231***	**0.221***	**0.034**	**0.034**
Farming experience	**0.246***	**0.001**	**0.027**	**0.799****	**0.238***	**0.244****	**0.256****	**0.049**	**0.042**
Land holding	**0.230***	**0.165**	**0.179**	**0.355****	**0.448****	**0.220***	**0.224***	**0.006**	**0.006**
Interpersonal sources of information	**0.009**	**0.031**	**0.023**	**-0.054**	**-0.054**	**0.224***	**0.224***	**-0.041**	**0.182**
Social participation	**0.248***	**-0.022**	**-0.159**	**-0.109**	**-0.154**	**-0.086**	**0.180**	**0.177**	**-0.020**
Access to modern technology	**0.227***	**0.246***	**0.262***	**0.100**	**0.071**	**0.141**	**0.141**	**-0.039**	**-0.039**

**= Correlation is significant at 0.001 levels 2-tailed)
*= Correlation is significant at 0.001 levels 2-tailed)

The results in Table 58 show that education, communication media possession and agricultural equipment possession have positive and highly significant relationship with overall knowledge level and social participation, farming experience, land holding and access to modern technology are positively and significantly correlated with overall knowledge gain (Fig. 11).

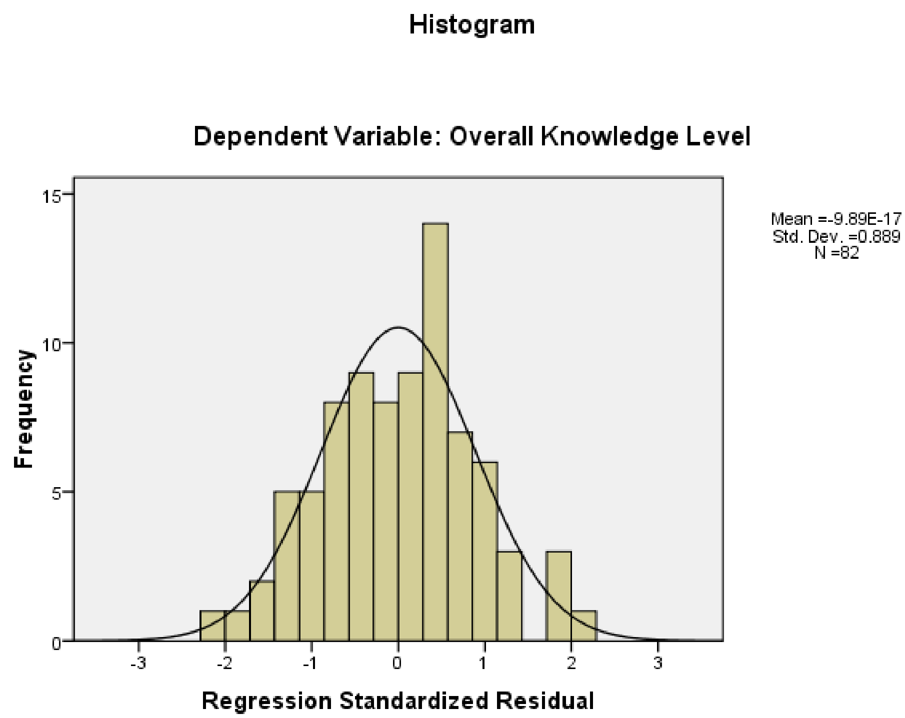


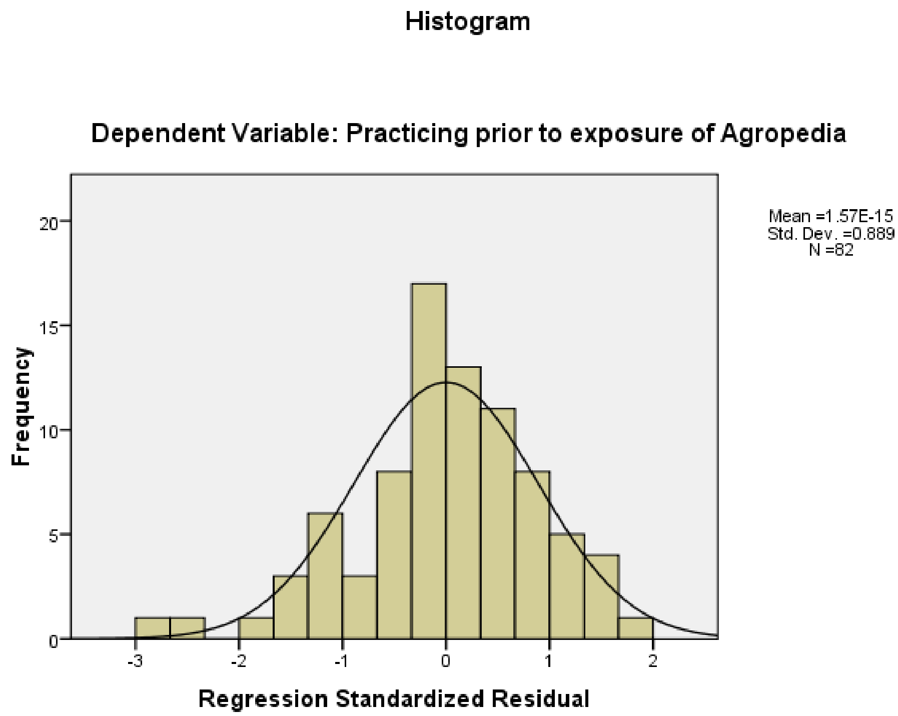
Fig .11

According to Table 59, multiple correlation coefficient (R^2) is 0.799 which means all the independent variables are highly correlated with overall knowledge level. R^2 value also shows that there is approximately 79 per cent changes are due to these independent variables and rest 21 per cent changes are due to other variables, not explained here.

Thus, the dependent variable, overall knowledge level (Y_1) depends on some socio-economic and communication characteristics and the regression coefficient is not equals to zero so, the null hypothesis is rejected.

A positive and highly significant correlation was observed between dependent variable; practicing prior to exposure of Agropedia (Y_2) and agricultural equipment possession (Fig. 12). Positive and significant relationship was observed between the dependent variable, caste and access to modern technology. The calculated value of multiple correlation coefficient (R^2) is 0.490 which indicates that all the independent variables are moderately correlated with practicing prior to exposure of Agropedia. R^2 shows that about 50.00 per cent changes are due to these independent variables and 50:00 per cent changes are because of the other variables, not mentioned here. Since, the dependent variable (Y_2) depends on some independent variables and is not equals to zero, so the null hypothesis is rejected and the alternative hypothesis is being accepted.

Education, occupation and access to modern technology are positively and significantly correlated while marital status, agricultural equipment possession and family type are positively and highly significant (Fig. 13) with the dependent variable practicing prior to exposure of aAQUA (Y_3). The multiple correlation value (0.481) indicates that around 48 per cent changes are due to above mentioned independent variables and rest 52 per cent changes are because of the interaction of other independent variables. Thus, the null hypothesis is rejected and the alternative hypothesis is accepted here.



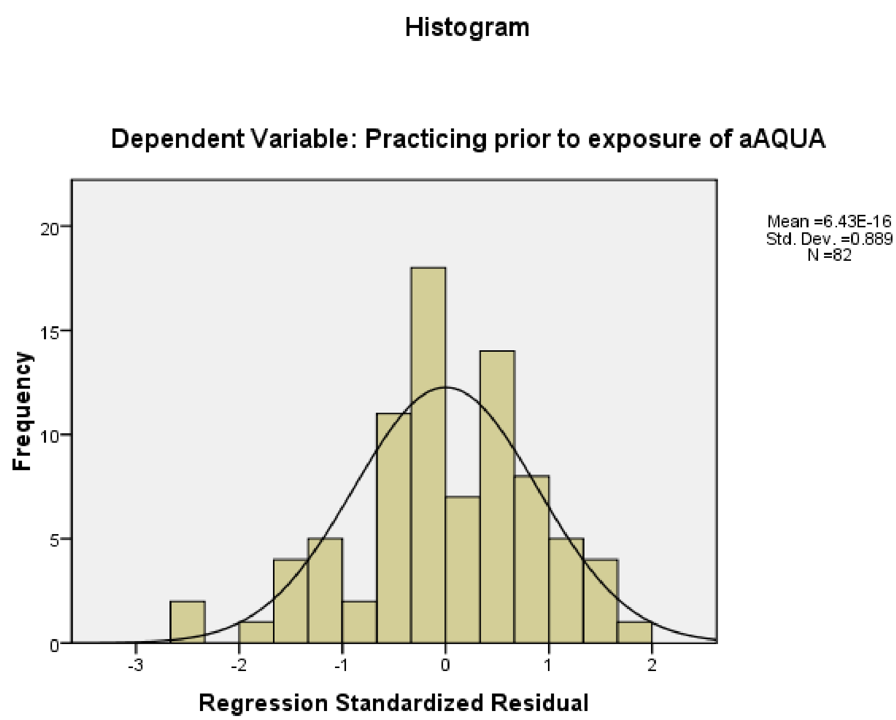
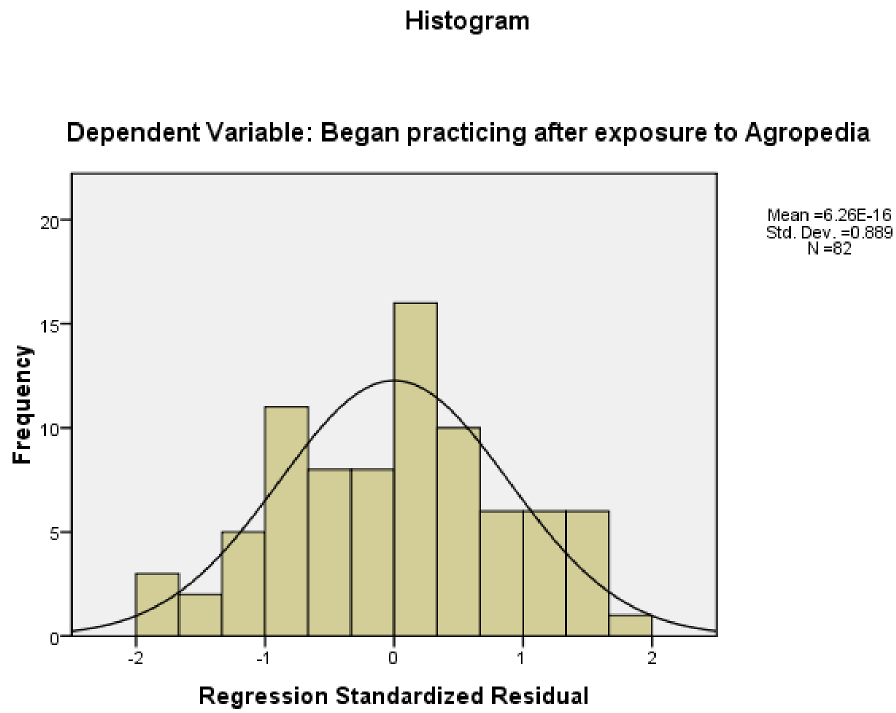


Fig. 12 and 13

Table also revealed that annual income is positively and significantly correlated while marital status, family type, farming experience, and land holding are positively and significantly correlated (Fig. 14) with the dependent variable began practicing after exposure to Agropedia (Y_4). Similarly, family size, farming experience are positively and significantly but land holding is positively and highly significant with the dependent variable, began practicing after exposure to aAQUA (Y_5). Multiple correlation coefficient 0.345 and 0.369 display overall weak correlation (Fig. 15) among the independent and dependent variable was due to the above mentioned variables and rest changes are because of rest of the variables. Thus, null hypothesis is rejected and alternative hypothesis have been accepted in both the cases.


Histogram
Dependent Variable: Began practicing after exposure to Agropedia
Mean =6.26E-16
Std. Dev. =0.889
N =82
Frequency
Regression Standardized Residual

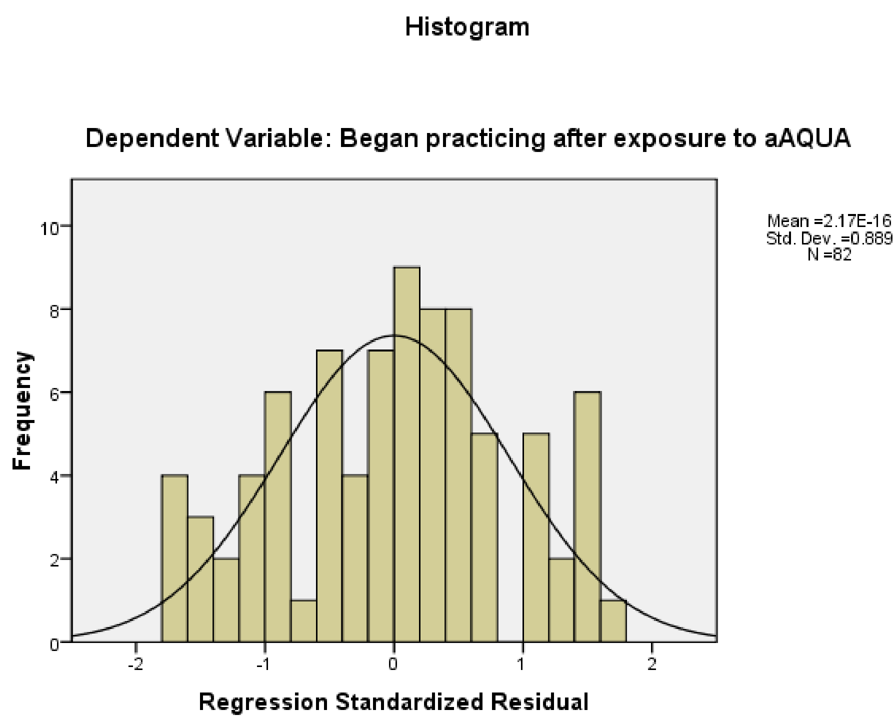

Histogram
Dependent Variable: Began practicing after exposure to aAQUA
Mean =2.17E-16
Std. Dev. =0.889
N =82
Frequency
Regression Standardized Residual

Fig. 14 and 15

Table 59: Model for dependent and independent variables

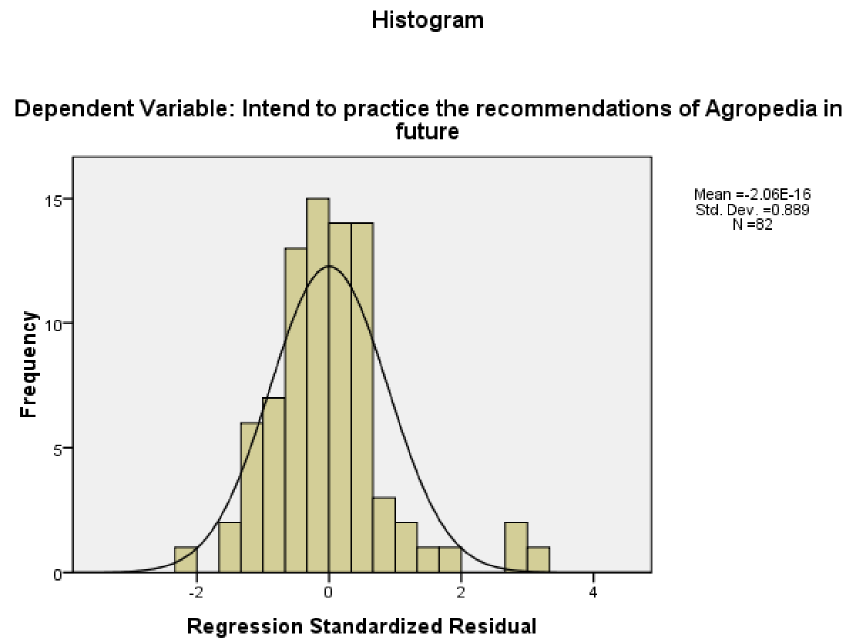
Model No.	Model Equation	R^2
1	$Y_1 = 3.041+(-0.010)x_1+(-0.194)x_2+(-0.049)x_3+(-1.376)x_4+(-0.885)x_5+(0.194)x_6+(1.114)x_7+(-0.929)x_8+(-0.010)x_9+(1.482)x_{10}+(0.118)x_{11}+(0.003)x_{12}+(0.008)x_{13}+(0.034)x_{14}+(0.019)x_{15}+(-0.140)x_{16}+(0.085)x_{17}$	0.799
2	$Y_2 = 7.431+(0.081)x_1+(0.591)x_2+(-0.390)x_3+(-2.265)x_4+(-0.710)x_5+(-0.456)x_6+(-0.460)x_7+(1.087)x_8+(-0.009)x_9+(-1.019)x_{10}+(0.258)x_{11}+(0.123)x_{12}+(-0.207)x_{13}+(0.013)x_{14}+(0.052)x_{15}+(-0.135)x_{16}+(-0.024)x_{17}$	0.490
3	$Y_3 = 10.914+(0.074)x_1+(0.272)x_2+(-0.259)x_3+(-1.331)x_4+(-0.362)x_5+(-1.009)x_6+(-1.059)x_7+(-1.331)x_8+(-0.171)x_9+(-1.527)x_{10}+(0.200)x_{11}+(0.115)x_{12}+(-0.198)x_{13}+(0.006)x_{14}+(0.025)x_{15}+(-0.048)x_{16}+(-0.045)x_{17}$	0.481
4	$Y_4 = 22.620+(0.023)x_1+(0.210)x_2+(0.126)x_3+(3.118)x_4+(-0.831)x_5+(0.366)x_6+(0.489)x_7+(-0.823)x_8+(0.030)x_9+(-6.107)x_{10}+(-0.049)x_{11}+(-0.053)x_{12}+(-0.069)x_{13}+(0.028)x_{14}+(-0.006)x_{15}+(-0.168)x_{16}+(0.033)x_{17}$	0.345
5	$Y_5 = 25.431+(-0.002)x_1+(-0.246)x_2+(0.266)x_3+(4.138)x_4+(-0.542)x_5+(0.136)x_6+(0.158)x_7+(0.744)x_8+(-0.023)x_9+(-6.437)x_{10}+(-0.091)x_{11}+(-0.054)x_{12}+(-0.060)x_{13}+(0.027)x_{14}+(0.003)x_{15}+(-0.086)x_{16}+(0.006)x_{17}$	0.369
6	$Y_6= 0.200+(-0.173)x_1+(-1.189)x_2+(-0.237)x_3+(1.685)x_4+(0.827)x_5+(0.607)x_6+(1.041)x_7+(-2.851)x_8+(0.156)x_9+(6.325)x_{10}+(0.045)x_{11}+(-0.055)x_{12}+(0.165)x_{13}+(-0.029)x_{14}+(-0.315)x_{15}+(0.134)x_{16}+(0.099)x_{17}$	0.367
7	$Y_7 = -0.031+(-0.160)x_1+(-1.103)x_2+(-0.260)x_3+(1.552)x_4+(0.782)x_5+(0.453)x_6+(0.986)x_7+(-3.058)x_8+(0.177)x_9+(6.364)x_{10}+(0.031)x_{11}+(-0.057)x_{12}+(0.154)x_{13}+(0.029)x_{14}+(-0.304)x_{15}+(0.139)x_{16}+(0.099)x_{17}$	0.363
8	$Y_8 = -13.395+(0.032)x_1+(1.419)x_2+(0.203)x_3+(-3.808)x_4+(0.175)x_5+(0.580)x_6+(-0.250)x_7+(-0.390)x_8+(0.048)x_9+(1.598)x_{10}+(-0.134)x_{11}+(-0.008)x_{12}+(0.179)x_{13}+(-0.006)x_{14}+(0.266)x_{15}+(-0.013)x_{16}+(0.66)x_{17}$	0.239
9	$Y_9 = -13.395+(0.032)x_1+(1.419)x_2+(0.203)x_3+(-3.808)x_4+(0.175)x_5+(0.580)x_6+(-0.250)x_7+(-0.390)x_8+(0.048)x_9+(1.598)x_{10}+(-0.134)x_{11}+(-0.008)x_{12}+(0.179)x_{13}+(-0.006)x_{14}+(0.266)x_{15}+(-0.013)x_{16}+(0.66)x_{17}$	0.239

A positive and significant correlation was found among marital status and interpersonal sources of communication while positive and highly significant correlation was observed among education, family size, agricultural equipment possession, farming experience, and land holding with dependent variable, intend to practice the recommendations of Agropedia in future (Y_6) (Fig.16).

The dependent variable, intend to practice the recommendations of aAQUA in future (Y_7) is positively and highly significant with annual income, caste and farming experience. The farmers with high agricultural experiences strongly intended to adapt the recommendations of the selected Agri-portals. Positive and significant correlation was found among education, marital status, land holding, agricultural equipment possession, and interpersonal sources of communication and dependent variable Y_7.The values of multiple correlation coefficient 0.367, 0.363 also verify the overall moderate association among these variables. Thus, the null hypothesis is rejected and alternative hypothesis has been accepted.

On the other hand dependent variable, no plans to adopt the recommendations of Agropedia and aAQUA in future did not show any association with any of the independent variables (Fig. 17, 18).

Though, ICT is gaining ground with a very fast pace even in the farming communities, but results of the present study shows that there are still some farming population exists who does not plans to adopt the recommendations of the selected Agri-portals (Y_8 and Y_9) even in future with a very small value of multiple correlation coefficient i. e. 0.239 and 0.239 respectively. So the null hypothesis accepted (Fig. 19).


Histogram
Dependent Variable: Intend to practice the recommendations of Agropedia in future
Mean =-2.06E-16
Std. Dev. =0.889
N =82
Frequency
Regression Standardized Residual

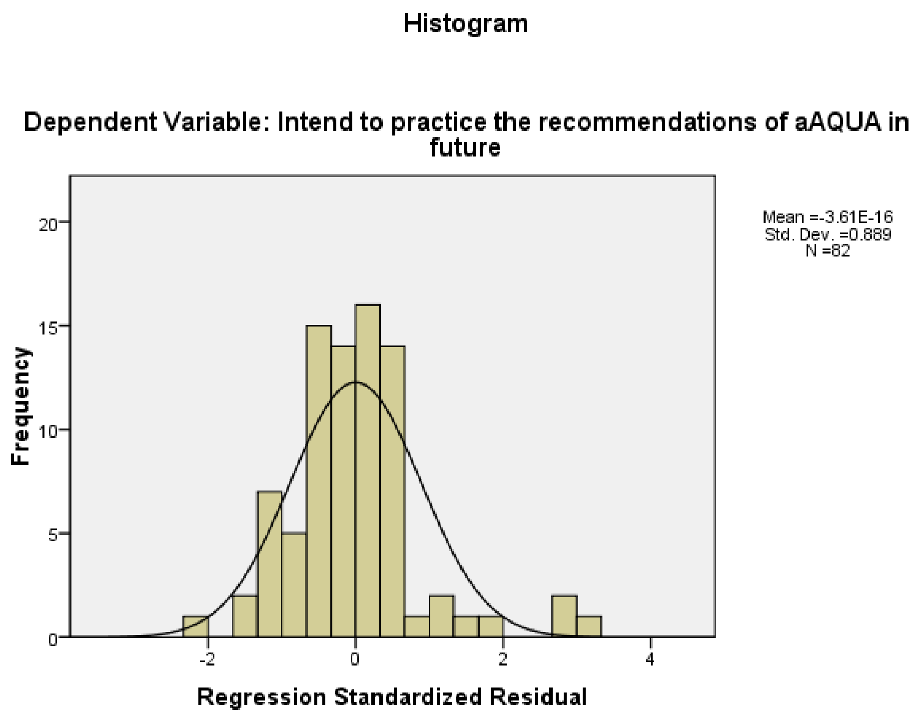
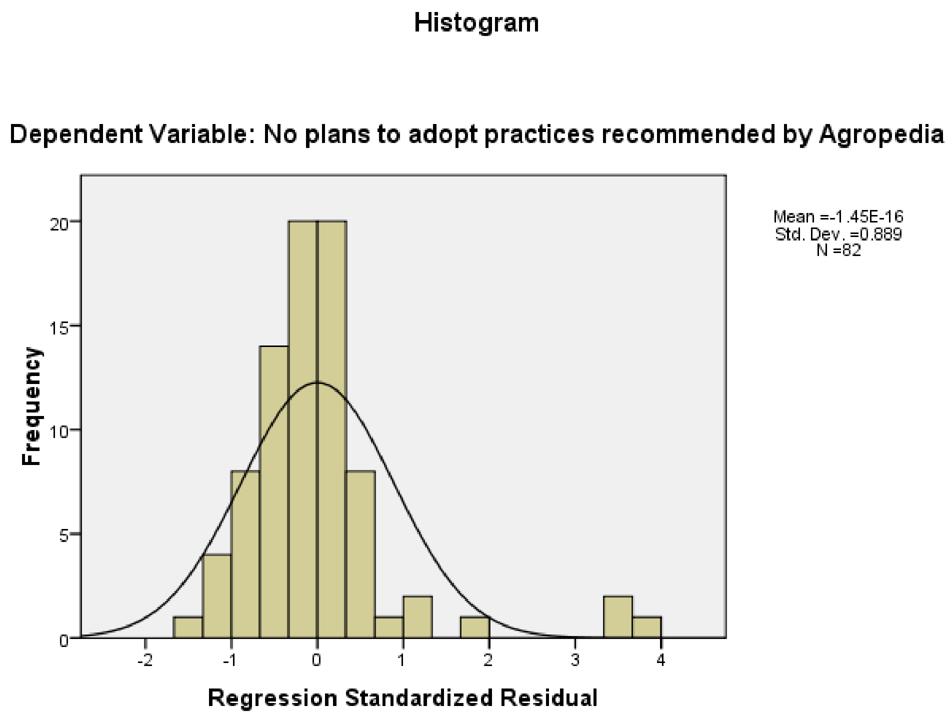

Histogram
Dependent Variable: Intend to practice the recommendations of aAQUA in future
Mean =-3.61E-16
Std. Dev. =0.889
N =82
Frequency
Regression Standardized Residual

Fig. 16 and 17


Histogram
Dependent Variable: No plans to adopt practices recommended by Agropedia
Mean =-1.45E-16
Std. Dev. =0.889
N =82
Frequency
Regression Standardized Residual

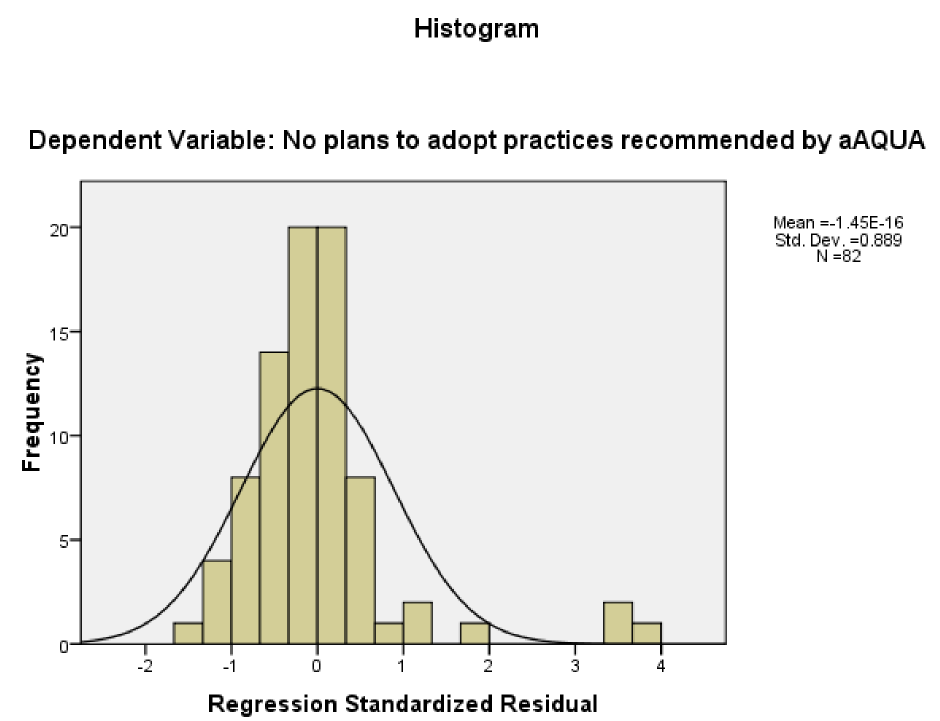

Histogram
Dependent Variable: No plans to adopt practices recommended by aAQUA
Mean =-1.45E-16
Std. Dev. =0.889
N =82
Frequency
Regression Standardized Residual

Fig. 18 and 19

Where

Y_1= overall knowledge gain

Y_2= Practicing prior to exposure of Agropedia

Y_3= Practicing prior to exposure of aAQUA

Y_4= Began practicing after exposure to Agropedia

Y_5= Began practicing after exposure to aAQUA

Y_6= Intend to practice the recommendations of Agropedia in future

Y_7= Intend to practice the recommendations of aAQUA in future

Y_8= No plans to adopt practices recommended by Agropedia

Y_9= No plans to adopt practices recommended by aAQUA

X_1= Age

X_2= Education

X_3= Occupation

X_4= Annual income

X_5= Caste

X_6= Gender

X_7= Marital status

X_8= Family type

X_9= Family size

X_{10}= Type of house

X_{11}= Communication media possession

X_{12}= Agricultural equipment possession

X_{13}= Farming experience

X_{14}= Land holding

X_{15}= Interpersonal sources of information

X_{16}= Social participation

X_{17}= Access to modern technology

R^2= Multiple correlation regression

SECTION - E

5.5. Opinion of other stakeholders

5.5.1 Opinion of other stakeholders about content relevance

Table 60: Distribution of stakeholders on the basis of content relevance of selected Agri-portals (N=40)

S.No.		Category	Agropedia	aAQUA
1		**Content relevance**		
	a)	Highly relevant	35 (87.50)	34 (85)
	b)	Somewhat relevant	5 (12.50)	6 (15)
	c)	Irrelevant	NIL	NIL
2		**Treatment of message**		
	a)	High technical words	13 (32.50)	1 (2.5)
	b)	Moderate technical words	22 (55)	21 (52.50)
	c)	Less technical words	5 (12.50)	18 (45.00)

3		**Adequacy of content**		
	a)	Adequate	17 (42.50)	23 (57.50)
	b)	Somewhat adequate	23 (57.50)	17 (42.50)
	c)	Inadequate	NIL	NIL
4		**Usefulness of content**		
	a)	Highly useful	19 (47.5)	10 (25.00)
	b)	Moderately useful	21 (52.50)	30 (75.00)
	c)	Not useful	NIL	NIL

Opinion of SAU scientists, KVK extension workers and portal managers of Agropedia and aAQUA (IIT, *Kanpur* and IIT, *Bombay*) was also taken on content relevance and design features. The responses are shown in Table 60. For Agropedia, majority (87.50 per cent) of the stakeholder reported its content as highly relevant followed by somewhat relevant (12.50 per cent). Majority (55.00 per cent) of the stakeholders reveled that moderate technical words were used in the content followed by highly technical words (32.50 per cent) and 12.50 per cent who reported that less technical words were used. Majority (57.50 per cent) of the stakeholders observed the content as somewhat adequate followed by as much as 42.50 per cent who reported it as highly relevant. Regarding the usefulness of content majority (52.50 per cent) reported the content as moderately useful for the farmers followed by 47.50 per cent reported as highly useful.

Opinion of stakeholders regarding content relevance of aAQUA is presented in Table 60. It is clear from the table that like Agropedia, majority of the stakeholders (85.00 per cent) said that the content is highly relevant followed by somewhat relevant (15.00 per cent). Moderate technical words were reported by over half (52.50 per cent) of the stakeholders followed by as much as 45.00 per cent as less technical words. Very few (2.50 per cent) stakeholders reported the aAQUA content as highly technical.

Regarding the adequacy of the content majority (57.50 per cent) of stakeholder reported the content as adequate followed by 42.50 per cent who reported it as somewhat relevant. So, in general the content of aAQUA is adequate enough for the farmers. Large majority (75.00 per cent) of stakeholders said that content was somewhat useful while 25.00 per cent considered it as highly relevant.

Thus, from the above description, it can be concluded that from the stakeholders' point of view content was relevant, useful, with more or less technical words and adequate enough to serve the farming community. The findings of the study are in line with the similar studies conducted by *Sasidhar* (2008).

5.5.2 Opinion of other stakeholders about design features

Table 61: Distribution of stakeholders based on design features of selected Agri-portals (N=40)

S.No.	Statements	Agropedia	
		Mean value	Rank
1	Home page is simple, well organized and attractive.	4.30	I
2	Readability of the text is appropriate.	4.17	II
3	Too many animations which distract the users.	4.15	III
4	Advertizing on home page is limited and non-obtrusive.	4.02	IV
5	The graphics are integrated with the information presented.	3.85	V
6	Video uploaded is appropriate to the textual information.	3.77	VI
7	All major parts of the Agri-portals are accessible from the home page.	3.75	VII
8	The information is not appropriately organized.	3.62	VIII
9	The webpage is heavily loaded with information.	3.55	IX
10	Synchronization is poor between the text uploaded and the visual icons.	3.52	X
11	The speed of uploading the graphics is poor.	3.25	XI
12	Use of too many colors made the Agri-portal very attractive.	2.85	XII

A perusal of Table 61 revealed that like farmers, stakeholders also opined that the home page of Agropedia was well organized, simple and attractive with the highest mean score of 4.30 followed by the readability of the text (mean score=4.17) and less animations which distract the users. They also reported that advertisements on home page were less and text was well supported by the graphics (mean score=4.02 and 3.85 respectively). Videos were appropriate and most of the major links can be accessed directly from the home page (mean score=3.77 and 3.75 respectively). Very few stakeholders supported the statement that information is not well organized (3.62), web page is heavily loaded (3.55), synchronization between text and visual is poor (3.52), speed of uploading the graphics was poor (3.25) and too many colors were used (2.85). Thus, from farmers as well as from stakeholders; somewhat common opinion came that Agropedia is fairly good for disseminating the latest agricultural information.

It is clear from Table 62 that with more or less difference in opinion aAQUA was also considered good by the stakeholders. It was reported that home page of aAQUA was good, with good readability, less advertisements and animations, and with better integration of text and graphics. Information was nicely organized and all links can be accessed from the home page, appropriate videos were used but comparatively more colors were used which may distract the user's attention.

Table 62: Distribution of stakeholders on the basis of design features of selected Agri-portals (N=40)

S.No.	Statements	aAQUA	
		Mean value	Rank
1	The home page is simple, well organized and attractive.	4.62	I
2	Readability of the text is appropriate.	4.30	II
3	Advertizing on home page is limited and non-obtrusive.	4.17	III
4	Too many animations which distract the users.	4.05	IV
5	The graphics are integrated with the information presented.	3.97	V
6	The information is not appropriately organized.	3.77	VI
7	All major parts of the Agri-portals are accessible from the home page.	3.77	VII
8	Video uploaded is appropriate to the textual information.	3.75	VII
9	The webpage is heavily loaded with information.	3.55	VIII
10	Synchronization is poor between the text uploaded and the visual icons.	3.42	IX
11	The speed of uploading the graphics is poor.	2.95	X
12	Use of too many colors made the Agri-portal very attractive.	2.60	XI

Table 63: Inputs used in implementation of selected Agri-portals

	Items	₹/Number
a.	**Financial resources spent****	
viii.	Fees paid to install offline boxes of Agri-portals	2,00,000
ix.	Money spent for conducting trainings	4,80,000
x.	Advertisements for popularization of Agri-portals	10,00,00
xi.	Stalls in farmers' fair	30,000
xii.	Books	3,00,000
	Total	11,10,000
	****Excluding time value of human resources**	

Table 64: Distribution of scientists on the basis of human resource involved

S. No.	Human resources involved	Particulars
v.	Number of agricultural scientists	
	d) Scientists from GBPUAT, Pantnagar Uttarakhand.	16
	e) Extension personnel from KVKs	
	1. KVK, *Kashipur*	6
	2. KVK, *Dhakrani*	6
	3. KVK, *Jeolikote*	6
	Total	**25**

vi.	Number of portal managers from Indian Institutes of Technology.	
	c) Portal managers from IIT, *Kanpur*	17
	d) Portal managers from IIT, *Bombay*	7
	Total	**24**
vii.	Number of registered participants in Agropedia:	**5376**
	Number of registered participants in aAQUA	

Table 63 and 64 revealed that total money spent on implementation and popularization of Agropedia and aAQUA in Uttarakhand state was ₹ 11, 10,000 (excluding the other expenses and time value of human resources). The total amount spent includes amount paid to installed offline boxes at selected KVKs, money spent for conducting trainings, stalls in farmers' fair and advertisements made to popularize the Agri-portals and lastly books purchased for concept maps and content development. Total human resources involved were 65 from Uttarakhand, IIT-*Kanpur* and IIT-*Bombay* which includes sixteen scientists from GBPUAT, *Pantnagar*; eighteen extension personnel from all the three *Krishi Vigyan Kendras*; seventeen portal managers from Indian Institute of Technology, *Kanpur* and seven portal managers from Indian Institute of Technology, *Bombay*. There were total 5728 registered users of Agropedia and 20,000 of aAQUA till November, 2011.

Activities and Output of the stakeholders

a. **Scientists:**

The activities allotted to and completed by the sixteen scientists were to make concept maps of five mandated crops includes Wheat, Rice, Sugarcane, Litchi and Vegetable pea. The concept maps were made using C-map tools software. After developing and uploading the concept maps the scientists have developed and uploaded the bilingual content of all the mandated crops onto Agropedia. So, in total 709 posts were added by the scientists on Agropedia.

Similarly for aAQUA they posted threads related to agriculture and animal husbandry and answered the queries posed by the farmers. Total 277 such threads were added to aAQUA.

Extension personnel of selected KVKs:

Baseline survey of the respective KVKs was completed by KVK, *Dhakrani* (Dehradun), KVK, *Kashipur* (Udham Singh Nagar) and KVK, *Jeolikote* (Nainital). Two offline boxes were installed at KVK, *Kashipur* and KVK, *Dhakrani* for offline Short Message delivery services.

Overall results showed that selected farmers exhibited a positive sign of accepting the information and communication tools for steady agricultural information. They used and shared the information from the selected Agri-portals with large number of farmers. They opined that development of Indian farmers is possible through such initiatives and they also want their children to make use of these techniques for better agricultural practices and yield. Moderately good relationship among the dependent and independent variables also supports the findings of the study. As a large majority of Indian farmers are illiterate thus, they cannot read the text, messages and in most of the cases their mobile did not support the script of the message. So, most of the farmers suggested that instead of text messages, voice messages should be sent to their mobiles for better understanding and utilization of the information.

Chapter 6 SUMMARY AND CONCLUSION

In agriculture and rural development, a variety of fairly large-scale and mature ICT-enabled projects demonstrate economic stability and provide social and economic value all along the agro-value chain by filling the information gap for small farmers. Such projects, directly linked to knowledge creation and income generating activities (for example better selling opportunities for agro-products and increasing yields through crop expert advice, potentially increasing farmers' income up to several times), have visible direct economic value for end-users, which may explain why people are ready to pay for them. The largest projects have impact on up to several million rural dwellers, while benefitting all actors of rural development.

The main challenge in this area is to create local information that reliably answers local needs – providing the right information at the right time in the right place and making it reliable and trustworthy for farmers to use it. Such a herculean task of creating crop, language and location specific agricultural content has been done by two premier Indian institutes: Indian Institute of Technology-Kanpur and Indian Institute of Technology-Bombay by launching Agropedia and aAQUA respectively. But, assessing the worth of such projects is also necessary for further improvement and there is very few impact studies have been conducted in this area. Keeping above facts in mind, the present investigation entitled **"Impact Assessment of ICT - enabled Knowledge sharing Agri-Portals in Uttarakhand"** is an attempt to assess the worth of the selected Agri-portals. The study was formulated with the following objectives:

1. To study the socio-economic and communication characteristics of farmers of Uttarakhand.

2. To study the impact of selected Agri-portals.

3. To find out the relationship between background variables and selected impact indicators.

4. To seek opinion of stakeholders on content relevance and design features of selected Agri-portals.

5. To study the constraints faced by users of selected Agri-portals.

The study has been carried out in the state of Uttarakhand. There are thirteen Agri-portals operating in India, of which two Agri-portals viz. Agropedia and aAQUA have been launched in the country. Since, these portals are in operation in Uttarakhand, Agropedia and aAQUA were purposively selected for the present investigation. Both Agri-portals have been initially launched in two representative districts of *Kumaon* and *Garhwal* i.e. in Dehradun and Udham Singh Nagar. District Nainital was adopted later by the Directorate of Extension Education, GBPUAT-Pantnagar (one of the consortium partner of the NAIP project entitled "redesigning the farmer-extension-agricultural research/education continuum in India with ICT-mediated knowledge management" under which the selected Agri-portals were launched as the additional one. Since, both these KVKs launched via the already existing KVK network so, respective KVKs viz. KVK-Dhakrani, Dehradun, KVK-Kashipur, Udham Singh Nagar and KVK-Jeolikote, Nainital were selected purposively.

Respondents were selected at two levels:

Level I

30 progressive farmers from each district were identified by the respective KVKs to attend the trainings on Agropedia and aAQUA. So, all the farmer trainees were selected through census method for the present study. Therefore, at the first level of sampling, around 90 farmers were selected. Out of these 90 farmers i. e. 30 from Dhakrani, 28 from Kashipur and 25 Farmers from Jeolikote were contacted for interviews.

Level II

At this level the portal managers of Agropedia, IIT, Kanpur (Seventeen) and aAQUA, IIT, Bombay (Seven), scientists from State Agricultural University, GBPUA&T, Pantnagar (Thirteen), and extension functionaries of respective KVKs {KVK *Dhakrani*, Dehradun; KVK *Kashipur*, and KVK, *Jeolikote* (6 from each)} were selected. In all 55 stakeholders were selected through census method. Opinion of these stakeholders was taken by sending the opinionnaire via electronic mail.

So, total 129 farmers and experts constituted the sample for the present study.

Depending upon the nature of study and to provide answers to selected research questions, analytical research design was used to assess the impact of selected Agri-portals. Since, Information and Communication Technology (ICT) for agricultural development have emerged recently, so any attempt to evaluate only the end results would be premature and it is too early to expect concrete and sound results from the ICT initiatives. Hence, for measuring the impact of selected Agri-portals, the evaluation was focused more on process impact rather than on end result impact. For measuring the impact of selected Agri-portals several evaluation and impact assessment models were critically examined and finally **Bennett Hierarchy Model of Planning and Evaluation (1976)** was found adapted for the present impact assessment study. The impact was assessed on seven levels: I - Input, II - Activities, III - output, IV - Reactions, V- Knowledge and Attitude change, VI - Practice change, and VII - Gratification of the services.

A judicial mix of quantitative as well as qualitative techniques was used for data collection. Collected data were tabulated and analyzed by using Statistical Package for Social Sciences (SPSS) like frequency, percentage, mean, standard deviation, coefficient of variance, multiple regression, ANOVA and test of significance.

Data collection was done with the help of interview schedule, impact assessment index and opinionnaire from May, 2011 to July, 2011. All the farmer respondents were personally interviewed by the researcher in the study area. Portal managers (IIT, Kanpur and IIT, Bombay), GBPUAT, scientists and the KVK functionaries were contacted through electronic mails.

6.1 Major findings

- Majority of the farmer respondents were from district Dehradun and Udham Singh Nagar (36.14 and 36.14 per cent respectively) followed by district *Nainital* (27.71 per cent).

- Majority of the farmer respondents (55.42 per cent) was found to be in the middle age category (20-48 years).

- Almost all farmer respondents in all three districts were literate. Majority of the farmers (49.39 per cent) were educated up to intermediate level.

- Majority (56.62 per cent) of the farmers' main occupation was agriculture.
- Nearly half (48.19 per cent) of the farmer respondents belonged to general caste followed by other backward caste (28.91 per cent) and SC/ST (22.89 per cent).
- Three fourth of farmers had 'medium' family income followed by nearly one fourth i.e. 22.98 per cent farmers with 'low' family income and only 13.25 per cent had 'high' family income.
- Majority (57.83 per cent) of the progressive farmers were married followed by (39.75 per cent) unmarried.
- Majority (87.95) of farmer respondents were males followed by farm women (12.04 per cent).
- Majority of the respondents (89.15 per cent) belonged to nuclear family followed by joint family (10.84 per cent).
- Vast majority (81.92 per cent) of farmers and farm women had medium size family followed by large family (12.04 per cent) and small size family (6.02 per cent).
- Majority (92.77 %) of farmers in all three districts had semi-pucca houses followed by farmers having pucca house (7.23 per cent).
- Most of the farming community (50.60 per cent) goes to *Krishi Vigyan Kendra* to access to the selected Agri-portals followed by 26.50 per cent farmers, accessed online information at their home and cyber café (19.27 per cent).

- Majority (68.67 per cent) of the farmers belonged to 'medium' level of communication media possession followed by high communication media (22.89 per cent) and low communication media possession group (8.43 per cent).

- Majority (53.01 per cent) of farmers possessed 'high' level of farm material followed by 36.14 per cent of those who had 'low' level of agricultural equipments.

- Maximum percentage (44.57 per cent) of farmers had medium household possession followed by those who had high (39.75%) and low (15.66 per cent) household material possession.

- Almost all (98.79 per cent) farmer respondents had metered electricity connection at their home.

- Maximum farmers (44.57 per cent) had a medium level of social participation followed by high (39.75 per cent) and (15.66 per cent) had a low social participation.

- All the (100 per cent) farmers contacted *Krishi Vigyan Kendra* (KVKs) for getting information about selected Agri-portals. Agriculture departments (67.46 per cent) and Animal husbandry departments (62.65 per cent) are among the next popular extension agencies contacted by them.

- Majority (96.38 per cent) of respondents contact fellow farmers to get agricultural information. This was followed by friends and about 90.36 per cent farmers contact them for information followed by family members or relatives (83.13 per cent), neighbors (68.67 per cent) and progressive farmers (59.03 per cent).

- Farmers mostly accessed television (95.18 per cent) followed by KVKs (93.97 per cent), farmer's fair (87.95 per cent) and trainings (78.31 per cent) were the next most popularly accessed media. Internet was used by almost half (49.39 per cent) of the farmers to get agricultural information followed by newspapers (42.16 per cent).
- Majority of farmers had low (63.85 per cent) farming experiences followed by medium (20.48 per cent) and high (15.66 per cent) farming experiences.
- Maximum (36.14 per cent) numbers of respondents were large farmers followed by medium (34.14 per cent) and small (28.91 per cent) farmers respectively.
- Majority (53.01 per cent) of the farmers had medium livestock possession followed by 36.14 per cent of those who had low and high livestock possession (9.00 per cent).
- Majority (50.60 per cent) of farmers grow 2-3 crops on yearly basis followed by 42.16 per cent farmers grow less than 2 crops and only 7.22 per cent farmers grow more than 3 crops in a season.
- All the farmers (100 per cent) were aware about the existence of selected Agri-portals viz. Agropedia and aAQUA.
- All the farmers (100 per cent) got aware about the existence of Agropedia and aAQUA two years back.
- Majority (97.59 per cent) of the respondents were aware of Agropedia through KVK scientists followed by scientists of Pantnagar University (46.98 per cent). 9.63 per cent farmers got aware through farmers'

fair followed by friends and relatives (4.81 per cent). Negligible number (1.20 per cent) was aware through neighbors.

- Majority (97.59 per cent) of the respondents was aware of Agropedia through KVK scientists followed by scientists of *Pantnagar* University (46.98 per cent), friends (9.63 per cent) and relatives (4.81 per cent).
- Majority of the farmers got aware about aAQUA through KVK scientists (95.18 per cent) followed by scientists from *Pantnagar* University (44.57 per cent), farmers' fair (9.63 per cent), friends and relatives (4.81 per cent) had been the other important sources of information.
- Half of the farmer respondents (50.60 per cent) visited Agropedia portal.
- Majority of the farmers (97.59 per cent) visited the aAQUA portal.
- Majority (96.38 per cent) of them visited Agropedia to get the agricultural information followed by getting latest market information (6.02 per cent).
- In case of aAQUA 86.74 per cent farmers visited for agricultural practices and rest 22.89 per cent were interested in getting updated market information.
- Majority (95.18 per cent) of farmers themselves registered onto Agropedia and aAQUA in a training program conducted at *Krishi Vigyan Kendra*.
- Majority (75.90 per cent) of farmers visited Agropedia and 78.31 per cent farmers to aAQUA according to their needs. 9.63 per cent

farmers visited both the Agri-portals monthly followed by weekly (4.81 per cent in both the cases) and a similar number of farmers (4.81 per cent for both the Agri-portals) daily.

- Majority (81.92 per cent) and (85.54) per cent of farmers had shared the information provided through Agropedia and aAQUA respectively.
- Maximum (43.37 per cent) number of farmers had shared the information about Agropedia and aAQUA to more than 10 persons. More than one third (25.30 per cent) of the farmers shared it with less than 5 persons.
- Majority (74.69 per cent for both) of the farmers shared the information of Agropedia and aAQUA with neighbor followed by relatives (66.26 per cent each). 60.24 per cent farmers shared the information with their family members followed by 57.83 per cent shared with friends and 32.31 per cent shared this information with the fellow farmers.
- Majority of the farmers i. e. 60.24 per cent and 77.10 per cent in case of Agropedia and aAQUA respectively were satisfied with the recommendations of selected Agri-portals.
- Majority of the respondents (74.69 per cent) were satisfied with overall services provided through Agropedia and in contrast only 4.81 per cent farmers were not satisfied.
- Majority (84.33 per cent) farmers were satisfied and only 2.46 per cent were not satisfied with the overall services of aAQUA.

- In response of the queries of registered farmers of Agropedia, most (26.50 per cent) of them got reply in more than one week followed by 13.25 per cent farmers who got the solution to their problem within a week. Very less (4.81 per cent) farmers reported to get the answers from portal experts within the same day.

- Maximum (43.37 per cent) number of farmers got the reply from aAQUA in more than one week followed by 30.12 per cent who got the answers within a week. Again very few (12.05 per cent) farmers got the solution to their problems within the same day.

- Maximum number (46.98 per cent) of farmers utilized the agricultural knowledge gained to a medium extent through the Agropedia followed by 36.14 per cent farmers have not utilized the knowledge gained and very few farmers (3.61 per cent) utilized it to the fullest extent.

- In case of aAQUA majority (68.62 per cent) of the farmers utilized the knowledge gained to the medium extent followed by 16.86 per cent farmers not utilized and 10.80 per cent, who utilized it to the fullest extent.

- Majority (68.67 per cent) of the farmers gained medium knowledge followed by 15.66 per cent high knowledge and 15.66 per cent low knowledge after exposure of the selected Agri-portals.

- Majority (66.26 per cent) of the farmers opined that the uploaded content of Agropedia was somewhat relevant followed by 22.89 per cent farmers reported that uploaded agricultural content was irrelevant.

- Moderately technical words were reported by 43.37 per cent farmers followed by high and less technical words reported by 36.14 per cent and 9.63 per cent farmers respectively. Majority (73.40 per cent) of the farmers reported adequacy of the uploaded agricultural content. Majority (79.51 per cent) of the farmers experienced that content on Agropedia was moderately useful followed by 10:84 per cent who said it is not useful.

- Over half (57.80 per cent) of the farmers reported that content provided through aAQUA was moderately relevant and rest of the farmers (37.30 per cent) found it highly relevant. Over half (54.21 per cent) of the farmers reported that the content provided by aAQUA was somewhat adequate followed by negligible number (1.20 per cent) of farmers who found it as inadequate. Nearly half (51.80 per cent) of the farmers found the aAQUA content as moderately useful followed by 43.37 per cent farmers reported as highly useful.

- Appropriateness of readability of text of Agropedia and aAQUA ranked as first (highest mean score=4.91 and 4.31 respectively).

- Most of the farmers believed that internet is the best means to learn new thing, thus they want their children to make full use of it for the betterment of farming community and they ranked it first with the highest mean score value of 2.97.

- Most of the farmers reported that they started following practices regarding land preparation (20.48 per cent), seeds/varieties (28.91 per cent), seed treatment (36.14 per cent), sowing methods (28.91 per cent), spacing (24.09 per cent), weeding (27.71 per cent), and plant protection (24.09 per cent) after being exposed to Agropedia.

- Farmers reported that they started following practices related to land preparation (21.68 per cent), seeds and varieties (28.91 per cent), seed treatment (36.14 per cent), sowing time (20.48 per cent), sowing methods (28.91 per cent), spacing and weeding (24.09 per cent and 27.71 per cent respectively) and plant protection (24.09 per cent) after exposure to aAQUA.

- Maximum (45.78 per cent) farmers reported somewhat positive changes followed by some changes in produce (44.58 per cent) due to adoption of the practices recommended by Agropedia. 75.90 per cent farmers reported no change in income level while 22.89 per cent reported that income status changes up to some extent. The large majority (85.54 per cent) farmers did not shift towards the diversified cropping pattern and still stuck to the traditional system of cultivation followed by 13.25 per cent farmers who changed to some extent and adopted the recommended diversified cropping system. 83.13 per cent farmers did not change the total number of crops grown in their fields every year followed by only few farmers (13.25 per cent) who changed to some extent while negligible (2.41 per cent) number of farmers changed up to a large extent. Majority (56.62 per cent) of farmers experienced no change in disease control followed by few farmers (32.53 per cent) who experienced some changes and relatively few farmers (7.23 per cent) experienced significant changes in disease control.

- Large majority (75.90 per cent) of farmers experienced that quality of produce improved due to the adoption of recommended practices from aAQUA followed by significant change in the quality of produce (3.61 per cent). The economic change due to adoption of practices recommendation shows that majority (51.81 per cent) of the farmers who experienced an increase in income level up to some extent followed by 42.17 per cent number of farmers reported no changes in income level followed by (6.02 per cent) farmers reported significant changes. Majority (62.65 per cent) of farmers reported no changes in number of crops grown every year followed by 24.09 per cent farmers reported somewhat increment and followed by 13.25 per cent farmers who reported significant changes in cropping pattern. Positive changes in crop diversification were reported by as many as 36.14 per cent farmers. 32.53 per cent farmers could control their crop disease up to a large extent.

- Less number of trainings on the use and application of selected Agri-portals were reported as the major constraints by the farmers (mean score=466).

- Education, communication media possession and agricultural equipment possession have positive and highly significant relationship with overall knowledge level and social participation, farming experience, land holding and access to modern technology are positively and significantly correlated with overall knowledge gain.

- Multiple correlation coefficient (R^2) is 0.799 which means all the independent variables are highly correlated with overall knowledge level.

- Positive and highly significant correlation was observed between dependent variable; practicing prior to exposure of Agropedia (Y_2) and agricultural equipment possession.

- Positive and significant relationship was observed between the dependent variable, caste and access to modern technology. The calculated value of multiple correlation coefficient (R^2) is 0.490 which indicates that all the independent variables are moderately correlated with practicing prior to exposure of Agropedia.

- Education, occupation and access to modern technology are positively and significantly correlated while marital status, agricultural equipment possession and family type are positively and highly significant (Fig. 19) with the dependent variable practicing prior to exposure of aAQUA (Y_3). The multiple correlation value (0.481) indicates a moderate association among all the variables.

- Annual income is positively and significantly correlated while marital status, family type, farming experience, and land holding are positively and significantly correlated (Fig. 20) with the dependent variable began practicing after exposure to Agropedia (Y_4).

- Family size, farming experience are positively and significantly but land holding is positively and highly significant with the dependent variable, began practicing after exposure to aAQUA (Y_5). Multiple correlation coefficient 0.345 and 0.369 display overall weak correlation (Fig. 21) among the independent and dependent variables.

- Positive and significant correlation was found among marital status, interpersonal sources of communication while positive and highly significant correlation was observed among education, family size, agricultural equipment possession, farming experience, and lands holding with intend to practice the recommendations of Agropedia in future (Y_6).

- Dependent variable, intend to practice the recommendations of aAQUA in future (Y_7) is positively and highly significant with annual income, caste and farming experience. Positive and significant correlation was found among education, marital status, land holding, agricultural equipment possession, and interpersonal sources of communication and dependent variable Y_7.The values of multiple correlation coefficient 0.367, 0.363 also verify the overall moderate association among these variables.

- Dependent variable, no plans to adopt the recommendations of Agropedia and aAQUA in future did not show any association with any of the independent variables.

- For Agropedia, majority (87.50 per cent) of the stakeholder reported its content as highly relevant followed by somewhat relevant (12.50 per cent). Majority (55.00 per cent) of the stakeholders revealed that moderate technical words were used in the content followed by highly technical words (32.50 per cent) and 12.50 per cent less technical words. Majority (57.50 per cent) of the stakeholders observed the content as somewhat adequate followed by highly relevant (42.50 per cent). Regarding the usefulness of content majority (52.50 per cent) reported it as moderately useful for the farmers followed by highly useful (47.50 per cent).

- Majority of the stakeholders (85.00 per cent) reported that the content is highly relevant followed by somewhat relevant (15.00 per cent). Moderate technical words were reported by over half (52.50 per cent) of the stakeholders followed by less technical words (45.00 per cent). Majority (57.50 per cent) of stakeholder reported the content as adequate followed by 42.50 per cent who reported it as somewhat relevant.

- Stakeholders also opined that the home page of Agropedia was well organized, simple and attractive with the highest mean score of 4.30 followed by the readability of the text (mean score=4. 17) and less animations which distract the users.

- Maximum number of stakeholders reported that home page of aAQUA was good, with good readability, less advertisements and animations, and with better integration of text and graphics. Information was nicely organized and all links can be accessed from the home page, appropriate videos were used but comparatively more colors were used which may distract the user's attention.

- Total money spent on implementation and popularization of Agropedia and aAQUA in Uttarakhand state was ₹ 11, 10,000 (excluding the other expanses and time value of human resources).

- Total human resources involved were 65 from Uttarakhand, IIT-Kanpur and IIT-Bombay.

- There were total 5376 registered users of Agropedia and 20,000 of aAQUA till November, 2011.

- The crop knowledge models of nine mandated crops and multilingual content of same crops were developed and digitized on Agropedia. So, in total 709 posts were added by the GBPUAT, Pantnagar scientists on Agropedia.

- Total 277 such threads were added to aAQUA.

6.2 Conclusion

Findings of the study revealed that majority of the farmers were middle aged, educated up to Intermediate, with main occupation as farming, general caste, medium family income, with majority of male, had nuclear family and medium family size, KVK as major point of access to internet and information, possess medium level of communication media, high level of agricultural equipment, medium household possession, medium level of social participation, and contact fellow farmers for most of the agricultural information. Television is the most popularly accessed media, majority had low farming experience, medium animal possession, grow 2-3 crops a year, all of them were aware of the Agri-portals' existence through KVK scientists, majority of them visited the selected Agri-portals for market information, majority visits the Agri-portals on monthly basis, shared the information provided through both the Agri-portals with neighbors, satisfied with Agri-portals' recommendations, got the answers of their queries posed to the Agri-portals, gained medium knowledge and utilized the gained knowledge to medium extent. Maximum number of farmers opined that uploaded content of Agropedia and aAQUA was somewhat and moderately relevant respectively, with high technical words, moderately useful content, with appropriate readability and believed that internet to be the best way to learn new things. Maximum farmers reported somewhat positive changes in income, quality of produce, crop diversification due to Agropedia and aAQUA. Less number of trainings was the most important constraint identified by the farmers. Education, communication media possession and agricultural equipment possession have positive and highly significant relationship with overall knowledge level. Dependent variable, intend to practice the recommendations of aAQUA in future is positively and highly significant with annual income, caste and farming experience.

Majority of the scientists and portal managers reported that content on both the Agri-portals were highly relevant, with well organized and attractive home page. Most of the farmer respondents reported that their mobile did not support the roman text of the messages being sent to them. However, they suggested sending the voice messages will be beneficial even for the small and marginal farmers who are largely illiterate and cannot access the Internet and read the text.

6.3 Implications

- ICT capacity needs to be strengthened in terms of availability and ease of access of ICT resources to every farmer as well as KVK scientists.

- The farmers are not fully informed about the existing services and various facilities of Agri-portals, creating awareness among farmers regarding the range of services provided may help the portal managers to increase its impact.

- Text messaging offers significant advantage over voice-based delivery in terms of convenience and content flexibility. Wherever literacy is a concern voice SMS can also be used.

- Information should be in the local language and easy to understand. Most of the farmers interviewed, were prepared to pay for information services as long as they felt that they would get the information they wanted in timely and reliable manner.

- Most preferred place to access the internet was KVK, so KVKs should be equipped with more number of computers with high bandwidth internet connections.

- Need assessment should be done before uploading the content onto Agri-portals or sending through the mobile telephony.
- Appropriate and timely training in the pedagogical use of ICT for better understanding should be organized.
- There is a need for an effective ICT policy, integrating ICT and efforts for the benefits of the farming community.

6.4 Suggested Area for Future Research

- An attempt can be made to study the impact of other such ICT initiatives in agriculture with expanded locale and more variables.
- Similar kind of study can also be conducted on small and marginal farmers regarding pattern of ICT utilization.
- Impact of information and communication technology on small and marginal farmers can be carried out using experimental and control group design, or pre-post test method.
- A study on needs of farmers in the field of information and communication technology can be undertaken.
- A comparative and qualitative study on ICT based agricultural projects can be conducted.

Adam, L. & Wood, F. (1999). An investigation of the impact of information and communication technologies in sub-Saharan Africa, *Journal of Information Science*, 25 (4), 307-318.

Aker, J. C. (2008). "Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger". University of California, Berkeley.

Aker, J. C. (2010). "Dial 'A' for Agriculuture: Using Information and Communication Technologies for Agricultural Extension in Developing Countries." Tuft University, Economics Department and Fletcher School, Medford MA02155.

Akinyokun, O. Charles; Angaye, O. Cleopas; and Ubaru, O. Moses (2010). "Factor Analysis of the Performance Indices of Information and Communications Technology Projects in the Public Sector of the Nigerian Economy". Journal of Technology Research.

Akpabio, I.A., Okon, D.P. and E.B. Inyang (2007) Constraints affecting ICT utilization by agricultural extension officers in the Niger Delta, Nigeria. *Journal of Agricultural Education & Extension* 13(4): 263-272.

Alvarez B. et al. (2008). "Participatory Impact Pathways Analysis: A practical method for project planning and evaluation". in: *ILAC Brief* No. 17. The ILAC Initiative, Bioversity.

Amariled, F; Paz, O. P; Russell, N and Johnson, N. (2006). "The Impact of Community Telecenter in Rural Columbia". Community Informatics, Vol. 2, No. 3

American Psychological Association (APA). 1966. Standards for educational and psychological tests and manuals. Washington, D.C. U.S.A.

Aneeja, G. and Shenoy, N.S. (2002). Information and communication technologies for agriculture. *Journal of Communication Studies*. 12 (2): 18-22.

Ansari, M.A and Yogeshwar, A. K (2009). "Empowering and Enabling Farmers: A Case Study of e-Chaupal in Uttarakhand". Abstract published in International Conference on Development Communication in the Era of Globalization; 9-11 July. School of Media Studies, Loyola College Chennai and Global Communication Research Association (GCRA). pp. 6-7

Ashraf, M.M., Hanisch, J. & Swatman, P. (2007). ICT intervention towards development in the third world countries: some perspectives of IS research, In *Proceedings of 9th International Conference on Computer and Information Technology (ICCIT)*, Bangladesh.

Austin E.J., Willock J., Deary I.J., Gibson G.J., Dent J.B., Edwards-Jones G., Morgan O., Grieve R., Sutherland A., (1998). Empirical models of farmer behaviour using psychological, social and economic variables. Part I: Linear Modelling. Agricultural Systems, 58, 2, 225 - 241

Australian Capital Territory Government. 2004. Learning technologies plan for ACT government schools and pre-schools 2004-2006.Transforming the way we teach and learn. Canberra: Australian Capital Territory Government. Retrieved 8th June, 2007 from http://activated.det.act.gov.au/admin/Itplan/pdf/LTPlan.pdf.

Avgerou, C. (1998). How can IT enable economic growth in developing countries? *Information Technology for Development*, 8 (1), pp 14-15.

Balaji, V; Meera, S. N and Dixit, Sreenath, (2007). "ICT enabled Knowledge Sharing in Support of Extension: Addressing the Agrarian Challenges of the Developing World Threatened by Climate Change, with a Case Study from India". SAT eJournal, eJournal.icrisat.org, December, 2007, 4(1).

Balit, S. (1998). "Listening to Farmers: Communication for Participation and Change in Latin America". Training for Agriculture and Rural Development (1997-98), FAO, Rome (Italy), pp 29-40

Barala, Purushotam and Kameswari, V.L.V (2006). "A Study of Rural Knowledge Centers in Nainital District of Uttaranchal". Unpublished M.Sc. Thesis, Department of Agricultural Communication, GBPUAT, Pantnagar.

Beardon, H. (2005). "ICT for Development: Empowerment of Exploitation?" Action Aid: UK.

Benigeri, M; and Pluye, P. (2003). "Shortcomings of Health Information on the Internet". Health Promotion International, 18 (4):381-386

Bennett, C. (1976). Up the hierarchy. *Journal of Extension* [On-line], 13(2). Available at:http://www.joe.org/joe/1975march/75-2-a1.pdf

Bennett, C., & Rockwell, K. (1995). *Targeting outcomes of programs (TOP): An integrated approach to planning and evaluation.* Unpublished manuscript. Lincoln, NE: University of Nebraska.

Bernard, M; Mills, P.M and Storrer, K (2001). "A Comparison of Popular Online Fonts: Which are Best and When?". Usability news. http://psychology.Wichita.edu/sur/usability news/3w/fontJR.htm

Bird, K. (2002). "Impact Assessment: An Overview". Retrieved from http://www.odi.org.uk/PPPG/Poverty_and_Inequality/publications/kb_impact_assessment.pdf.

Bisht, Kamini. (2008). "Assessing Information and Communication Technology Competence of Teachers of State Agricultural Technology". Unpublished PhD thesis, GBPUA&T, Pantnagar.

Bogue, D.J. 1969. Principles of Demography. John Willey and Sons Inc. New York.

Chatterjee, J and Prabhakar, T. V (2009). "On to Action – Building Digital Eco-system for Knowledge Diffusion in Rural India". http://www.cse.iitk.ac.in/users/tvp/papers/vof_pasadena.pdf (accessed on 5th July, 2009).

Chauhan *et al.* Cited in Jain, A. and Nagarwalla, D. J. (2007). "Why conserve forest? A basic baseline study to assess people's perceptions, attitude and practices for increasing people's involvement in conservation". Retrieved 7th September 2007 from http://www.atindia.org/

Chauhan, N. M. and Chauhan, N.B. (2006). Farmer's Opinion about use of Internet Technology in Agriculture at village level. Paper presented in National Seminar on Information & Communication Technology: Opportunities and Challenges for Revitalizing Extension System ,December 27-29, 2006 at NAU, Navsari, Gujarat, held by ISEE.

Chauhan, Nikulsinh M. (2010). Farmers' Perception about ICT Application: A Case study of Gujarat state. Indian Research Journal Extension Education, 10 (3), September, 2010. Accessed via http://seea.org.in/vol10-3-2010/5.pdf accessed on June, 3rd, 2010.

Chen, D.H. and Kee, H.L. 2005. A model on knowledge and endogenous growth World Bank policy. **cf :** OlaKulelhin, F.K. 2007. Information and communication technologies in teacher training and professional development in Nigeria. *Turkish Online Journal of Distance Education*. 8(1).

Conradie, P. & Jacobs, S. (2003). Bridging the digital divide, *Engineering Management*, 30-33.

DoA&C (2000). “Policy Framework for Agricultural Extension (draft)”. Extension division, Department of Agriculture and Co-operation, Ministry of Agriculture, Government of Indian, New Delhi.

Economist (2005). “Behind the Digital Divide: Development: Much is Made of the Digital Divide Between the Rich and Poor. What do people on the ground think about it?” The Economist, 3/12/2005, Vol. 374 Issue 8417, Special Section, pp 22-25

Eicher, C.K. (2002). “Mozambique: An Analysis of the Implementation of the Extension Master Plan”. Maize and Wheat Improvement Center (CIMMYT), Mexico D. F

FAO, (2000). “Impact Assessment of Agricultural Research: Context and State of the Art”. Workshop on Impact Assessment of Agricultural Research in Eastern and Central Africa (Uganda, November 1999).pp 46

Gandhi, Rikin; Veeraraghavan, Rajesh; Toyama, Kentaro and Ramprasad, Vanaja (2008). “Digital Green: Participatory Video for Agricultural Extension”. i4D Magazine, June, 2008 issue, www.i4donline.net

Gandhi, Rikin; Veeraraghavan, Rajesh; Toyama, Kentaro and Ramprasad, Vanaja (2008). “Digital Green: Participatory Video and Mediated Instruction for Agricultural Extension”. Information Technologies and International Development, 5(1), Spring 2009. Pp 1-

15. http://itidjournal.org/itid/article/view/327/150 (Accessed on 15th July, 2009)

Geethakutty, P.S (2008). "Evaluation of Women in Agriculture Program". Evaluation Capacity Building in Rural Resource Management: A Manual. Indian Agricultural Research Institute, New Delhi, Indian in collaboration with Michigan State University, East Lansing, USA. Pp. 140-158

Gelb, E., Offer, A., (2005). 'ICT Adoption in Agriculture: Perspectives of Technological Innovation'. *http://departments.agri.huji.ac.il/economics/gelb-main.html*

Gigler, B-S. (2004). Including the excluded - Can ICTs empower poor communities? In *Proceedings of 4th International Conference on the Capability Approach,* Italy, 5-7 September, 2004.

Gosling, L., & Edwards, M. (1995). "Toolkits: A Practical Guide To Assessment, Monitoring, Review And Evaluation*".* SCF Development Manual No. 5. London.

Goyal, A. (2010). "Information Direct Access to Farmers and Rural Market Efficiency in the Ethiopian Grain Market". Agricultural Economics, 25(2-3), pp 311-320

Gurumurthy, A. (2006). "Promoting Gender Equality? Some Development-Related Uses of ICTs by Women". Development in Practice, Vol. 16, No. 6, November 2006. Available online at http://www.siyanda.org/docs/gurumurthy.icts.pdf

Hailey, J. and James, R. (2003). "NGO Capacity Building: The Challenge of Impact Assessment." New Directions in Impact Assessment for Development Methods and Practice Conference.

Harris, R.W. (2005). "Explaining the success of rural Asian telecentres, *In Information systems in developing countries: theory and practice".* City University of Hong Kong Press, 83-100.

Heeks, R. (2002). "Information Systems and Developing Countries: Failure, Success, and Local Improvisations". *Information Society*, 18 (2), 101-112.

Heeks, R. (2005). Foundation of ICTs in Development: The information chain, *e Development Briefing*, 3(1), 1-2.

Heeks, R. and A. Molla. (2009). "Compendium on Impact Assessment of ICT-for-Development Projects", IDRC-CERD.

Higher Education Funding Council [HEFCE] (2004). "Conducting Impact Assessments for Equal Opportunities in Higher Education". 37. Available at http://www.hefce.ac.uk/Pubs/hefce/2004/04_37/

Hofstede, G. (2001). "Cultures and Organizations: Software of the Mind". Intercultural Cooperation and its importance for Survival, McGraw Hill, New York.

Horton, D., P. Ballantyne, W. Perterson, B. Uribe, D. Gapasin and K. Sheridan. (1993). *Monitoring and evaluating agricultural research: A sourcebook.* Wallingford: CABI and ISNAR.

IAEG (1999). "Methodological Review and Synthesis of Existing Ex Post Impact Assessments". Reports 1, 2 and 3. Prepared by L.J. Cooksy, Florida State University. IAEG Secretariat, Rome.

ICAR-FFTDDSA (2008). "ICAR Framework for Technology Development and Delivery System in Agriculture". www.icar.org.in/miscell/tdd_final.pdf (Accessed on 14th December, 2008).

IIM, Ahmedabad (2007) Impact Assessment Study of E-government Projects in India. Center for e-governance, Indian Institute of Management.

Imas, M; and Rist, R. (2009). "The Road to Results". (The World Bank, 2009). Accessible via http://www.worldbank.org/ieg/ie/, accessed 14 October 2009. pp 403

infoDev, (2008). "Framework for the Assessment of ICT pilot Projects: Beyond Monitoring and Evaluation of Applied Research". Information and Development Program. pp. 11

ITU (2010). "Measuring the Information Society 2010". International Telecommunication Union (ITU): Switzerland.

Jaggi, A. (2003). "Women Empowerment in Central Himalayan Region Using ICT as a Development Tool". Accessed via http://globalcn.tc.ca

Jain and Webster (2001). Cited in Jain, A. and Nagarwalla, D. J. "Why conserve forest? A baseline study to assess people's perceptions, attitude and practices for increasing peoples involvement in conservation". Retrieved 7th September 2007. Available at http://www.atindia.org/anmol%20jain.pdf

Jhunjunwala, A and Aiyer, A. (2007). "Case Study: Connecting Rural India with Broadband Wireless". Available at http://www.itu.int/ITU-D/studygroups/SGP2006-2010/events/CaseLibraryold/asiapacific/ITU%20India%20Case%20Study%2028%2006%2007.pdf.

Kandpal, S. K (1984). "Communication Gap and Constraints Analysis of Wheat Production Technology-A Study in Almora". Unpublished M.Sc thesis, G.B.P.U.A & T, Pantnagar.

Karthikeyan. C. (2008). "Formative Evaluation of Kisan Call Centers in Tamil Nadu". A Manual. Indian Agricultural Research Institute, New Delhi, Indian in collaboration with Michigan State University, East Lansing, USA. Pp. 87-106

Keniston, Kenneth (2002). "IT for the Common Man: Lessons from India". NIAS special publication, sp 7-02, Bangalore. National Institute of Advanced Studies, Indian Institute of Science.

Kerlinger, Fred. N. (2009). "Foundations of Behavioral Research". Second edition, Surjeet publications, New Delhi. pp. 28

Kirkpatrick, C; Bond, R; Curran, J; Francis, P; and Lee, N. (2001). "Integrated Impact Assessment for Sustainable Development: A Case Study Approach". World Development, Vol. 29, No. 6, pp 1011-1024

Kothari, C. R. (2007). "Research Methodology: Methods and Techniques". New Age International Publishers, New Delhi. pp 8

Krishna, S. and Madon, S. (Eds) (2003). Digital Challenge: Information Technology in the Development Context, ASHGATE, Aldershot.

Krishnareddy, P; and Ankaiah, R (2005). "A Framework of Information Technology-Based Agriculture Information Dissemination System to Improve Crop Productivity". Current Science, 88 (12).

Larose, R; Mastro, D and Eastin, M. S. (2001). "Understanding Internet Usage: A Social Cognitive Approach to Users and Gratifications". Social Science and Computer Review 19, 395-413.

Lazarus, W and Mora, F. (2000). "Online Content for Low-Income and Underserved Americans: A report by the children's partnership". Santa Monica. CA

Leewis, C. (2001). "Computers, Myths and Modeling: The Social Construction of Diversity, Knowledge, Information and Communication Technology in Dutch Agriculture and Extension". Washington, DC, 36.

Lukeeram, I; Bheenic, K. J and Travailleur, C. (2000). "Combining Audio Files and Graphics on the Web to Increase Accessibility to Agricultural Information for Non-English Speaking and the Illiterat Farmers in Mauritius: A Practical Example with PETIS". Accessed via http://www.uom.ac.mu/Faculty/FA/General/Information/FA/htm/

Maikhuri *et al.* (2001). Cited in Jain, A. and Nagarwalla, d. J. "Why conserve forest? A baseline study to assess people's perceptions, attitude and practices for increasing peoples involvement in conservation". Retrieved 7th September 2007. Available at http://www.atindia.org/anmol%20jain.pdf

Malik, N. and Bhardwaj, N. (2001). "Village Information Center: A Strategy for Using Information Technology for Rural Development". IASSI quarterly journal 19(3) pp 103-112

Maneja, S.L. 2002. Informatics communication technology in distance education in India. *Indian Journal of Open Learning*. 1: 269-277.

Marwick, A.D. (2001). "Knowledge Management Technology", IBM Systems Journal, Vol. 40(4), pp 814-830

Mathew, A. (2005). **"**Akshyaya: A Keraka State Initiative for Creating Powerful Social and Economic e-Network**".** Available online at http://www.akshaya.net/akshaya/project/

Mbarika, V.W.A., Okoli, C., Byrd, T.A. and Datta, P. (2005). "The neglected continent of IS research: A research agenda for sub-Saharan Africa". *Journal of the AIS* 6 (5) 130-170.

Meera, Shaik. N and Jhamtani, Anita (2004). "Critical Analysis of IT in Agricultural Develeopment: Impact and Implecations". Unpublished PhD Thesis, IARI, New Delhi.

Menou, M. (1998). "Does Information Make Any Difference?" British Library Research and Innovation Center Research Bulletin, Vol. 12, pp 10-12

Menou, M. (1998). "Does information make any difference?" British Library Research and Innovation Centre Research Bulletin, Vol. 12, Fall 1998, pp. 10-12.

Meso, P., Datta, P. & Mbarika, V. (2006). "Moderating information and communication technologies' influences on socioeconomic development with good governance: A study of the developing countries". *Journal of the American Society for Information Science & Technology*, 57 (2), 186-197.

Michailidis, A., Koutsouris, A. and K. Mattas (2010) Information and communication technologies as agricultural extension tools, *Journal of Agricultural Education & Extension* (forthcoming)

Mishra, P (2008). "Designing a Training Module for Extension Trainers: A study in Uttarakhand". Unpublished PhD Thesis, GBPUA&T, Pantnagar

Mittal, S; Gandhi, S; and Tripathi, G (2010). "Socio-Economic Impact of Mobile Phones on Indian Agriculture". ICRIER Working Paper No. 246. Available at http://www.mail-archive.com/cr-india@sarai.net/msg00744.html.

Mukhopadhyay, S.D and Ramudurai, D. (2001). "Farmers' Perception about the Credibility of Different Channels of Communication for Farming Information". Indian Research Journal of Extension Education, 1(1) pp11-22

Munyua, H. (2000). "Application of Information and Communication Technologies in Agricultural Sectors in Africa: A Gender Perspective in Gender and Information Revolution in Africa". Edited by Rthgeber, E and Adera, E. O. IDRC/ECA. Pp 85-123

Munyua, H. (2006). "Information and Communication Technologies for Rural Development and Food Security: Lessons from Field

Experiences in Developing Countries". ICT workshop Report, CAB International, Africa, Regional Center.

Murray, G and Costanzo, T. (1999). "Usability and the Web: An Overview". Information Technology Services, National Library of Canada. Retrieved March 4, 2010 from http://www.nlcbnc.ca/9/1/p1-260-e.html

NCVO (2003). "Measuring Impact: Case Studies of Impact Assessment in Small and Medium Sized Voluntary Organizations". Council for Voluntary Organizations, available at http://www.ncvo-vol.org.uk/asp/uploads/uploadedfiles/1/456/measuringimpactreport.pdf

Neilson J. (2001). "Did Poor Usability Kill e-Commerce?" Available at http://www.useit.com/alertbox/20010819.html accessed on January 27, 2010)

NPFF (2007). "National Policy for Farmers-2007". Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India, New Delhi.

NSAE (2009). "National Seminar on Agriculture Extension". 27-28th February, 2009, NAS Complex, PUSA, New Delhi. http://www.syngentafoundation.org/db/1/657.pdf (Accessed on 2nd May, 2009)

NSSO, (2005). "Access to Modern Technology for Farming, Situation Assessment Survey of Farmers". 59th Round Report No. 499, National Sample Survey Organization (NSSO), Ministry of Statistics and Program Implementation, Government of India, New Delhi.

Participatory Impact Pathways Analysis (2006). Retrieved on December, 5th, 2011 available at http://en.wikipedia.org/wiki/Participatory_Impact_Pathways_Analysis

Pathak, Chitra. (2003). Participatory message Development for Hill Women on Health and Nutririon; A study in Kumaon Division of Uttaranchal. Unpublished Ph.D thesis.G.B.P.U.A.& T, Pantnagar.

Paul, John; Robert, Katz; and Sean Gallagher (2004). "Lessons from the Field: An Overview of the Current Usage of Information and Communication Technologies for Development". Digital Dividend World Resource Institute. Pp 5-11. Accessed via http://www.digitaldividend.org/pdf/lessonspdf

PC, GOI (2007). "Recommendations of Working Group on Agricultural Extension for Formulation of Eleventh Five Year Plan (2007-12)". Planning Commission, Government of India, http://www.fao.org/docs/eims/upload//257364/Patil_presentation.pdf

Prabhakar, I. (2010). "Opinion and Preferences of Farmers Regarding Private Extension Services: A Study in Tarai Region of Uttarakhand". Unpublished M. Sc Thesis, GBPUA&T, Pantnagar.

Pradhan, K. and Liyanage, H. (2010). "South Asian Association for Regional Cooperation", In Akhtar, S and Arinto, P. (Eds.). Digital Review of Asia Pacific 2009-2010, Sage publications and IDRC: Canada. Available at http://www.idrc.ca/openbooks/456-7/

Prasad, K. (2008). "The Digital Divides: Implications of ICTs for Development in South Asia", Papers in International and Global Communications, No. 3 (2008), Center for International Communications Research, Institutes of Communication Studies, University of Leeds. Available at http://ics.leeds.ac.uk/papers/cicr/exhibits/56/LeedsCICRworkingpaper-Kiran.pdf

Radhakrishna, T. (2003). "Convincing People about e-Governance". Accessed on 19th June, 2003, via http://www.sify.com/home/interview

Rawat (2001). Cited in Jain, A. and Nagarwalla, D.J. Why conserve forest?. A base line study to assess people perceptions, attitude and practices for increasing people's involvement in conservation. Available at http://www.antindia.org/anmol%20jain.pdf

Richardson, D. (1997). "*The Internet and Rural and Agricultural Development: An Integrated Approach*". FAO, Rome.

Richardson, D; and Sirimanne, K (2001). *The Internet and rural development: recommendations for strategy and activity – final report.* Rome: Sustainable Development Department of the Food and Agriculture Organization of the United Nations. http://www.fao.org/sd-dimensions.

Rogers, P.J. (2005). 'Logic models' in Sandra Mathison (ed) Encyclopedia of Evaluation. Beverly Hills, CA: Sage Publications. p. 232

Roman, R. & Colle, R.D. (2003). Content creation for ICT development projects: Integrating normative approaches and community demand. *Information Technology for Development*, 10 (2), 85-94.

Rosenzweig, Clark. C., W., Long, D. & Olsen, S. (2009). "Double Bottom Line Project Report: Assessing Social Impact in Double Bottom Line Ventures". The Rockefeller Foundation, accessible via www.rockfound.org

Saade, George Raafat (2008). "Portal Impact Assessment: The NGO in Pakistan case". Proceedings of the Informing Science and IT, Education Conference (I^{n}SITE) 2008.

Sarvanan, R (2008). e-Arik. In **Bagga R. K and Piyush Gupta (Eds.).** "Transforming Government: e-Government Initiatives in India". The ICFAI University Press, Hyderabad.

Sarvanan, R (2010). "ICTs for Agricultural Extension: Global Experiments, Innovations and Experiences: India". New Age Publishing Agency, New Delhi, pp 129

Sasidhar, P.V.K (2008). "Evaluation of Backyard Poultry Farm School on All India Radio". Evaluation Capacity Building in Rural Resource Management: A Manual. Indian Agricultural Research Institute, New Delhi, Indian in collaboration with Michigan State University, East Lansing, USA. pp. 70-86

Sati and Sati (2000). Cited in Jain, A. and Nagarwalla, D. J. Why conserve forest? A baseline study to assess people‘s perceptions, attitude and practices for increasing peoples involvement in conservation. Retrieved 7th September 2007 from http://www.atindia.org/anmol%20jain.pdf

Selveraj, K (1985). "Communication Behavior of Farmers under T&V System in Andhra Pradesh". Indian Journal of Extension Education, vol. 17(34).

Semwal *et al.* (2001). Cited in Jain, A. and Nagarwalla, D. J. "Why conserve forest? A baseline study to assess people's perceptions, attitude and practices for increasing peoples involvement in conservation". Retrieved 7th September 2007. Available at http://www.atindia.org/anmol%20jain.pdf

Singh, B and Rathore, S. (2008). "The Scope of ICT in Rural Development". Indian Research Journal of Extension Education, Society of Extension Education; vol. 28(1)

Singh, Mohini; Alemayehu, Molla, Karanasios; and Sargent, Jason (2008). "Exploring the Impact of Government ICT Initiatives on the Livelihood of Australian Rural Communities". 21st Bled eConference, Overcoming Boundaries through Multi-Channel Interaction. June 15-18, 2008; Bled, Slovenia.

Singh, Neeraj (2008). "Evaluation of Frontline Demonstration (FLD) of Cowpea". A Manual. Indian Agricultural Research Institute, New Delhi, Indian in collaboration with Michigan State University, East Lansing, USA. Pp. 128-139

Singh, P. and Salooja, M. K (2004). "Using Information and Communication Technology in Agriculture Extension". Indian Journal of Open Learning, vol. 13(8) pp 181-187

Srivastava, A. K. (1990). "Communication Needs and Gratification of Nainital Farmers". Unpublished M. Sc thesis, G.B.P.U.A & T, Pantnagar.

Stufflebeam, Daniel L. (1987). "The CIPP Model for Program Evaluation". In G. F. Madus et al., (Eds.) Education Models: Viewpoints on Educational and Human Services Evaluation, Boston Kluwer: Nijhoff Publishing.

Sulaiman, R; Hall. Andy; Kalaivani. N. J; Dorai, Kumuda and Reddy, Vamsidhar (2011). "Necessary But Not Sufficient: Information and Communication Technology and its Role in Putting Research into Use". Discussion paper series 16, June, 2011

Swanson, A. (2000). "Technology in Education: Meeting the Future Challenges". 2nd International Crop Science Congress, Nov. 17-24, 1996, New Delhi, India. pp. 95

Swarup (1993). Cited in Jain, A. and Nagarwalla, D. J. "Why conserve forest? A baseline study to assess people's perceptions, attitude and practices for increasing peoples involvement in conservation". Retrieved 7th September 2007. Available at http://www.atindia.org/anmol%20jain.pdf

TARI (2009). Information note to the press (Press Release No. 56/2009). "Telecom Regulatory Authority of India (TARI)". Available at http://www.tari.gov.in (Accessed on 25th June, 2009).

Vaisla, K. S. and Bisht, M. K. (2010). "SWOT Analysis of e-Initiative in Uttarakhand". *International Journal of Computer Applications (0975 – 8887) Volume 12– No.5, December 2010*.

Valancy, F. (2005). "Social Impact Assessments: International Principles". Available at www.iaia.org/Members/Publications?Guidelines_Principles?SP2.pdf

Verma, D. (2008). "Impact of Mushroom Production Training on Below Poverty Line Beneficiaries of Udham Singh Nagar District**".** Unpublished M.Sc. thesis, G.B.P.U.A & T, Pantnagar.

Warren M.F., Soffe R.J., Stone M.A.H., (2000). Farmers, computers and the internet: a study of adoption in contrasting regions of England. Farm Management, 10, 11, 665 - 684

World Bank (2008) website on impact evaluation: http://www.worldbank.org/poverty/impact/

World Bank (2009). "Information and Communication for Development (IC4D) Extending Reach and Increasing Impact". World Bank: Washington, D. C. Available online at http://www.infodev.org/en/Article.384.html.

Annexure I

Interview Schedule

S.No. ....
Date................

Research Title: "Impact Assessment of ICT-enabled Knowledge Sharing Agri-portals in Uttarakhand".

Village:..

1. **Name :**
2. **Age (in years) :**
3. **Mobile/Phone no.:**
4. **Education** (modified scale of Mishra and Kaul (1999)

S. No.	Category	
1.	Illiterate	
2.	Primary level	
3.	Middle level	
4.	High school level	
5.	Intermediate	
6.	Graduate and above	

5. **Occupation:** Main.....................................

   Subsidiary...............................

6. **Annual Income:** ....

7. **Caste** :

   General ☐ OBC ☐ SC ☐ ST ☐

8. **Gender:** Male ☐ Female ☐

9. **Marital status:**

   Unmarried ☐ Married ☐ Any other (Specify) ☐

10. **Family Type:**

    Nuclear ☐ Joint ☐

11. **Family Size (in numbers)** : ....

12. **Indicate the type of house you have:**

Katcha ☐ Semi Pucca ☐ Pucca ☐

13. **Number of household assets:**

S. No.	Category	Y/N	Number
1.	Mobile phone		
2.	Radio		
3.	Landline		
4.	TV		
5.	Computer		
6.	Motor bike		
7.	Car/Jeep		
8.	Any other (specify)		

14. **Infrastructure Development Information**

S. No.	Infrastructure	Availability (Y/N)	Distance (Km.)
1.	Post-office		
2.	PCO		
3.	Health Care Center		
4.	Primary Agriculture Cooperative		
5.	Financial Institution/Banks		
6.	Cyber cafe		
7.	Krishi Vigyan Kendra		
8.	Any other (specify)		

B. Communication characteristics

15. Please indicate your interpersonal sources of information:

S. No.	Category	
1.	Friends	
2.	Family/Relatives	
3.	Neighbors	
4.	Fellow farmers	
5.	Progressive farmers	
6.	Any other (specify)	

***Multiple responses are allowed**

16. **Social interaction**

Have you ever been associated with the following organizations?

S. No.	Organization	Member	Office bearer	Extent of participation		
				Always	Sometimes	Never
1.	Panchayat					
2.	Panchayat samiti					
3.	Cooperative society					
4.	Farmers forum					
5.	Self-Help Groups					
6.	Youth club					
7.	Any other (specify)					

17. **Reach of Extension Agency**

S. No.	Extension Agency	Approximate no. of visits per month
1.	Agriculture department	
2.	Animal husbandry department	
3.	KVKs	
4.	Cooperatives	
5.	Any other (specify)	

18. **Access to modern technology**

S. No.	Sources	Whether accessed Y/N	If yes, frequency of contact	Type of information received (code)	Quality of information received Good-1, Fair-2, Poor-3	Whether received information was tried Y/N	Whether recommended practice has been adopted; Y/N	If N, in column 8, reasons for not adopting (code)	Suggestions for improvement in extension services (code)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	Participation in training programme								
2.	KVKs								
3.	Extension worker								
4.	TV								
5.	Radio								
6	Newspaper								
7.	Farmers Fair								
8.	Internet								
9.	ATIC								
10.	Information Kiosks								
11.	Input dealer								
12.	Progressive farmers								
13.	Private agencies								

CODE for item no. 19:
Column (4): frequency of contact: daily-1, weekly-2, monthly-3, seasonly-4, need based-5, casual contact-6
Column (5): type of information received: cultivation - Improved seed/variety (11); fertilizer application (12); plant protection (pesticide etc.) (13); farm machinery (14); harvesting/marketing (15); others (19)
Animal husbandry - breeding (21); feeding (22); health care (23); management (24); others (29)
Fishery - seed production (31); harvesting (32); management and marketing (33); others (39)
column (9): reasons for not adopting - lack of financial resources (1); non-availability of input and physical resources (2); lack of technical advice for follow up (3); difficulty in storage, processing and marketing of products (4); not useful (5); others (9)
Column (10): suggestions for improvement in extension services - improvement in quality and reliability of information (1); timeliness of information (2); increase in frequency of demonstration (3); improvement of quality of presentation (4); improvement of professional competence of information provider (5); others (9)

C. Farming characteristics

19. **Farming experience in years**:……………………………………

20. **Land assets**

A. Total area (ha):

a. Owned land
b. Area leased in
c. Area leased out

B. Crop wise cultivated area:

S.No.	Season	Area covered	Production/Acre
1.	**Kharif**		
2.	**Rabi**		
3.	**Zaid**		

21. **Utilities and non-land assets**

a. **Electricity connection at home:**
   a. Metered
   b. Non-metered
   c. None

b. **Average daily electricity supply (h/24h)**:……………………………………

c. **Total number of livestock animals**

a. Buffaloes
b. Cattle
c. Goats
d. Any other (specify)
e. Sheep
f. Pigs
g. Poultry

d. **Agricultural machines used**

S.No.	Agricultural Machines	Number	Leased/owned	Earnings (Rs)
1.	Tractor			
2.	Power tiller			
3.	Diesel/electric pump			
4.	Irrigation installation			
5.	Zero till ferti seed dril			
6.	Seeder			
7.	Sprayer			
8.	Combine harvester			
9.	Thresher			
10.	Bhusa reaper			
11.	Straw cutter			
12.	Fodder chopper			
13.	Any other			

22. **Human resource involved (secondary sources)**

a.	**Human resources involved**	
viii.	Number of agricultural scientists **f)** Scientists from Govind Ballabh Pant University of Agriculture and Technology, Uttarakhand. **g)** Scientists from University of Agricultural Science, Dharwad **h)** Scientists from ICRISAT, Hyderabaad	
ix.	Number of portal managers from Indian Institutes of Technology. **e)** Portal managers from Indian Institute of Technology, Kanpur **f)** Portal managers from Indian Institute of Technology, Bombay	
x.	Number of other technical personnel involved: **c)** Agropedia **d)** aAQUA	

xi.	Number of registered participants in Agropedia: **c)** Male **d)** Female Number of registered participants in aAQUA: **c)** Male **d)** Female	
Total		

23. **Inputs used for Agri-portals: (from item no. B to C, the data will be collected through secondary sources)**

a. Financial and human resources involved in the programme

	Items	Rs./Number
a.	**Financial resources spent****	
xiii.	Fee paid to install offline boxes of Agri-portals	
xiv.	Money spent for conducting trainings	
xv.	Honorarium for trainers	
xvi.	Advertisements for popularization of Agri-portals	
xvii.	Transport charges	
xviii.	Publications	
xix.	Stalls in farmers' fair	
Total		

****Excluding time value of human resources**

24. **Activities of key stakeholders of the Agri-portals and products developed:**

S. No.	Key stakeholder	Activities	Products developed
I.	SAU's scientists	a) .... b) .... c) .... d)	a) b) c) d)
II.	KVK functionaries	a) .... b) .... c) .... d)	a) b) c) d)
III.	Technical persons a) Portal managers (Agropedia) b) Portal managers (aAQUA) c) Other technical persons	a) .... b) .... c) .... d) .... a) .... b) .... c) .... d) .... a) .... b) .... c) .... d)	a) b) c) d) a) b) c) d) a) b) c) d)
IV.	Registered farmers	a)	a)

Annexure II

INTERVIEW SCHEDULE
ON
ASSESSING THE IMPACT OF SELECTED AGRI-PORTALS ON FARMERS

S.No. ....
Date...............

Research Title: "Impact Assessment of ICT-enabled Knowledge Sharing Agri-portals in Uttarakhand"

Below are the questions formulated to assess the impact of Agri-portals on farmers. The schedule is divided into two major halves: first part consists of general information about use of Agri-portals and constraints faced by them. The second part consists knowledge test, extent of adoption of the practices recommended by the selected Agri-portals, opinion of farmers and the economic changes between them as a result of use of Agri-portals.

A. General information

1. Do you know about Agropedia and aAQUA? If yes. Then what it is?

....
....

2. How do you come to know about selected Agri-portals? Please indicate by (√) mark.

S. No.	**Sources of awareness**	**Agropedia**	**aAQUA**
1.	Radio		
2.	Television		
3.	Newspaper		
4.	Agriculture Magazine		
5.	Krishi Vigyan Kendra		
6.	Farmers' fair		
7.	University scientists		

Note: Multiple responses are allowed

3. Have you ever visited aAQUA and Agropedia? Y/N

4. If Yes, then indicate the purpose of the visit by (√) mark:

S. No.	Purpose of visiting the selected Agri-portals	Agropedia	aAQUA
1.	It was clicked by chance		
2.	To convey about the new practices to others		
3.	To spend leisure time		
4.	For social networking		
5.	To know more about market prices		
6.	To know about agricultural practices.		

5. Are you a registered member of Agroedia and aAQUA? Y/N

6. If yes, then how do you get yourself registered?

- By sending a letter to the concerned portal manager
- Just clicking on sign up as a new user on the agropedia/aAQUA portal
- With the help of scientists of KVKs
- In a training on aAQUA and Agropedia by the portal managers and KVKs

7. Where do you often access these selected Agri-portals?

- Cyber café
- Krishi Vigyan Kendra
- At home
- Information kiosks
- Any other (please specify)

8. How often do you visit Agropedia and aAQUA?

S. No.	Frequency of visit	aAQUA	Agropedia
1.	Daily		
2.	Weekly		
3.	Fortnightly		
4.	Monthly		
5.	As per need		

9. Time of awareness of Agri-portals:

S. No.	Time of awareness	Agropedia	aAQUA
1.	Less than one year		
2.	One to two years		
3.	More than two years		

10. Information sharing behavior of the users of Agropedia/aAQUA

a. Please indicate by (√) mark whether you shared the practices recommended by the Agri-portals or not?

S. No.	Category	Agropedia	aAQUA
1.	Shared		
2.	Not shared		

b. With how many persons have you shared the information of Agri-portals? Please indicate by (√) mark:

S. No.	Number of persons shared	Agropedia	aAQUA
1.	Less than five		
2.	Six to ten		
3.	More than ten		

c. Please indicate by (√) mark the nature of persons shared about the Agri-portals

S. No.	Nature of persons	Agropedia	aAQUA
1.	Family members		
2.	Friends		
3.	Relatives		
4.	Fellow farmers		
5.	Neighbors		

11. Gratification of services of Agri-portals

Please indicate by (√) mark whether you are satisfied with the services of the selected Agri-portals or not?

S. No.	Category	Agropedia	aAQUA
A.	**Results of recommended practices**		
1.	Satisfied		
2.	Not satisfied		
B.	**Overall services**		
1.	Satisfied		
2.	Not satisfied		
C.	**Immediacy of feedback**		
1.	Within the same day		
2.	Within a week		
3.	More than a week		
D.	**Utilization of the knowledge gained**		
1.	Utilized to fullest extent		
2.	Utilized to medium extent		
3.	Not utilized		

12. Constraints faced by the users of Agropedia and aAQUA

Please, rate the constraints faced by you while using the Agri-portals on three point continuum (where 3= Always, 2= Sometime and 1= Never)

S. No.	Constraint	Always		Sometimes		Never	
		Agropedia	**aAQUA**	**Agropedia**	**aAQUA**	**Agropedia**	**aAQUA**
1.	Lack of accessibility						
2.	Erratic supply of electricity						
3.	Slow internet speed						
4.	Involves high technical skills						
5.	Less number of trainings on use and application of Agri-portals						
6.	Lack of follow-up trainings						
7.	Lack of experienced trainers						
8.	Content is not crop and language specific for Uttarakhand region						
9.	Involves too many steps to get information						
10.	Non-availability of computers						
11.	Computer illiteracy						
12.	Difficulty in following as per the portal's recommendations						
13.	Content is not updated						
14.	Lack of technical support of the extension personnel						
15.	Lack of efforts by the extension personnel to establish proper linkage between portal managers and farmers.						
16.	Delayed response to the queries of farmers						
17.	Recommendations are not ready to use						
18.	Any other (please specify)						

B. Measuring the Impact of selected Agri-portals

13. Knowledge level of farmers (Knowledge Test) :

Given below are the questions. Each question has one correct answer. Please give the correct answer by indicating (√) mark.

1) After opening of the home page, what is the first operation one has to do to access information on Agropedia?
    a. Simply click desired link
    b. Open chat box
    c. Register yourself
    d. Write message for information
2) In which link agricultural information is generally uploaded?
    a. Library
    b. Agrowiki
    c. Forum
    d. All of the above
3) On Agropedia, One may have the most authentic agricultural information from:
    a. Agrowiki
    b. Package of practices
    c. Library
    d. All of the above
4) Under the link "Agropedia images" one can search images of:
    a. Eminent personalities of agriculture
    b. Registered users of Agropedia
    c. Knowledge models
    d. Crop related images
5) Under the link "new in agropedia" what is new in it?
    a. New features of Agropedia
    b. New agricultural information
    c. Information about new user
    d. None of the above

6) Which crop knowledge models are uploaded onto Agropedia
   a. Rice
   b. Wheat
   c. Litchi
   d. Vegetable pea
   e. Sugarcane
   f. All of the above
7) If one has to ask a query on Agropedia, what link he/she has to click?
   a. Agroblog
   b. Forum (Q/A)
   c. Agrochat
   d. Package of practices
8) Generally, who can comment on Agropedia (on content/questions)?
   a. Only the portal managers
   b. All registered users
   c. Scientists
   d. Anyone
9) What does aAQUA stands for?
   a. All Questions Answered
   b. Almost All Questions Answered
   c. Both
   d. None of the above
10) aAQUA provides information on:
   a. Agricultural crops
   b. Animal husbandry
   c. Agriculture and allied fields
   d. All of the above
11) Other than recommendations and information, what is the unique feature of aAQUA?
   a. Related videos
   b. SMS alert on mobile
   c. Expert advice
   d. Market information

12) What is the last function to be performed to leave the Agri-portal:

a. Shut down the computer
b. Close the window
c. Sign out your account
d. None of the above

Given below are the questions related to knowledge regarding Agri-portals. Each question has two possible answers whether Yes or No. Please tick mark the right answer for each question.

13) One can see the latest uploads of agropedia on its home page itself. Y/N

14) Information onto agropedia and aAQUA are also available in *Kumaoni*/ *Garhwali* language. Y/N

15) On aAQUA, market information provided under the link "*Bhav poochhiye*". Y/N

16) "Crop doctor" is a feature of agropedia. Y/N

14. Please indicate by (√) mark the extent to which you have adopted the practices recommended by the Agri-portals:

S. No.	Practices recommended	Practicing prior to exposure of Agri-portals		Began practicing after exposure to Agri-portals		Intend to practice in the future		No plans to adopt	
		Agropedia	aAQUA	Agropedia	aAQUA	Agropedia	aAQUA	Agropedia	aAQUA
1.	Land preparation								
2.	Seeds/varieties								
3.	Seed treatment								
4.	Sowing time								
5.	Sowing methods								
6.	Spacing								
7.	Weeding								
8.	Plant protection a. Insects/pest b. Diseases c. Preventive measures								
9.	Critical stages of irrigation								
10.	Harvesting								
11.	Storage								
12.	Marketing								

15. Opinion of farmers about agropedia and aAQUA
Please indicated your opinion by (√) mark the chosen options on following headings:

a. Opinion about content relevance

S. No	Variable	Agropedia	aAQUA
1.	Content relevance	a) Highly relevant b) Somewhat relevant c) Irrelevant	a) Highly relevant b) Somewhat relevant c) Irrelevant
2.	Treatment of the message	a) Highly technical words b) Moderate technical words c) Less technical words	a) Highly technical words b) Moderate technical words c) Less technical words
3.	Adequacy of the content	a) Adequate b) Somewhat adequate c) Inadequate	a) Adequate b) Somewhat adequate c) Inadequate
4.	Usefulness of the content	a) Highly useful b) Moderately useful c) Not useful	a) Highly useful b) Moderately useful c) Not useful

b. Opinion on design features of Agropedia and aAQUA

Please indicate what you are feeling about these statements regarding design features of Agri-portals by indicating the degree of your agreement or disagreement as “Strongly Agree”, “Agree”, “Undecided”, “Disagree” and “Strongly Disagree”.

S. No.	Statements	Strongly agree		Agree		Undecided		Disagree		Strongly disagree	
		Agro-pedia	aAQUA	Agro-pedia	aAQUA	Agro-pedia	aAQUA	Agro-pedia	aAQUA	Agro-pedia	aAQUA
1.	Home page is simple, well organized and attractive.										
2.	The speed of uploading the graphics is poor.										
3.	The graphics are integrated with the information presented.										
4.	Too many animations which distract the users.										
5.	Synchronization is poor between the text uploaded and the visual icons.										
6.	Video uploaded is appropriate to the textual information.										
7.	Readability of the text is appropriate.										
8.	The information is not appropriately organized.										
9.	Use of too many colors made the Agri-portal very attractive.										
10.	Advertizing on home page is limited and non-obtrusive.										
11.	The webpage is heavily loaded with information.										
12.	All major parts of the Agri-portals are accessible from the home page.										

c. **Opinion of users about usability features of Agri-portals:**

Below is a list of statements about the extent to which you apply Agri-portals in farming. Please choose one description that best describes your situation on three point continuum (Agree=3, Partially agree=2, Disagree=1).

S.No.	**Statements**	**Agree**		**Partially agree**		**Disagree**	
		Agro-pedia	aAQUA	Agro-pedia	aAQUA	Agro-pedia	aAQUA
1.	It can be a very useful mean to the farmers during present time						
2.	It is a rich source to collect worldwide information on agriculture and allied fields						
3.	It is the fastest way to exchange agricultural information in shorter time						
4.	It is a costly affair for the farmers.						
5.	It is best mean to collect information on market prices of agricultural product						
6.	Using Agri-portal is nothing other than time pass activity						
7.	Information available on Agri-portal is easy to understand						
8.	Development of Indian farmers is possible through selected Agri-portal						
9.	I wish that my children should make positive use of Agri-portals for farming.						
10.	I wish that farmers should make use of Agri-portals.						

15. Please give your response on the extent of economic change among the users of Agropedia and aAQUA by indicating (√) mark on the following aspects.

S. No.	Change aspects	Agropedia	aAQUA
1.	**Increase in yield**	a. No change b. Up to some extent c. Up to large extent	a. No change b. Up to some extent c. Up to large extent
2.	**Change in quality of produce**	a. No change b. Some change c. Significant change	a. No change b. Some change c. Significant change
3.	**Income level**	a. No change b. Up to some extent c. Up to large extent	a. No change b. Some change c. Significant change
4.	**Number of crops grown on fields every year**	a. No change b. Up to some extent c. Up to large extent	a. No change b. Some change c. Significant change
5.	**Diversification of crops**	a. No change b. Shifted from traditional crops to cash crops c. Shifted from traditional varieties to hybrid varieties	a. No change b. Shifted from traditional crops to cash crops c. Shifted from traditional varieties to hybrid varieties
6.	**Disease control**	a. No change b. Up to some extent c. Up to large extent	a. No change b. Up to some extent c. Up to large extent

16. Additional information

a. In addition to Agropedia and aAQUA what ICT tools/services you are using for getting information about agriculture?

....
....

b. Please describe the factor (s) that would increase your use of Agri-portals in farming.

……………………………………………………………………………………………………
…………………………………………………………………………………………

c. **Please give further suggestions for the improvement of Agri-portals in Uttarakhand.**

……………………………………………………………………………………………………
……………………………………………………………………………………………

d. **Please use the space below for additional comments.**

……………………………………………………………………………………………………
……………………………………………………………………………………………

Annexure II

चयनित कृषि पोर्टलों का प्रभाव जानने के लिए साक्षात्कार अनुसूची

दिनांक ....

16ण सामान्य जानकारी

17ण क्या आप एग्रोपीडिया व ए–एक्वा के बारे में जानते हैं? यदि हाँ तो यह क्या है?

……………………………………………………………………………………………………

……………………………………………………………………………………………………..

18. आपको चयनित कृषि पोर्टलों के बारे में कैसे पता चला? (√) के चिह्न द्वारा इंगित करे।

क0 सं0	जानकारी के स्रोत	एग्रोपीडिया	ए–एक्वा
8.	समाचार पत्र		
9.	रेडियो		
10.	टेलीविजन		
11.	कृषि पत्रिका		
12.	कृषि विज्ञान केन्द्र के वैज्ञानिक		
13.	किसान मेला		
14.	पन्तनगर कृषि विश्वविद्यालय		

*नोटः एकाधिक प्रतिकियाओं की अनुमति है।

19. क्या आपने कभी एग्रोपीडिया व ए–एक्वा का दौरा किया है? हाँ/नहीं

20. यदि हाँ तो (√) के चिह्न द्वारा दौरे का उद्देश्य बताएं।

क0 सं0	चयनित कृषि पोर्टलों के दौरे का उद्देश्य	एग्रोपीडिया	ए–एक्वा
7.	कृषि पद्धतियों के बारे में पता करने के लिए		
8.	यह संयोग से क्लिक किया गया था		
9.	नये तरीकों के बारे में दूसरों को व्यक्त करने के लिए		
10.	खाली समय व्यतीत करने के लिए		
11.	सामाजिक नेटवर्किंग के लिए		
12.	बाजार कीमतों में अधिक जानकारी के लिए		

21. क्या आप एग्रोपीडिया व ए–एक्वा के पंजीकृत सदस्य हैं? हाँ/नहीं

22. यदि हाँ तो आपन स्वयं को किस प्रकार पंजीकृत किया?

- सम्बन्धित पोर्टल प्रबन्धक को एक पत्र भेजकर
- एग्रोपीडिया व ए–एक्वा पोर्टल पर नए उपयोगकर्ता के रूप में संकेत पर क्लिक कर के
- कृषि विज्ञान केन्द्र के वैज्ञानिक की सहायता से
- कृषि विज्ञान केन्द्र व पोर्टल प्रबन्धक द्वारा एक प्रशिक्षण में

23. आप एग्रोपीडिया व ए–एक्वा का दौरा कितनी बार करते हैं?

क0 सं0	दौरे की आवृत्ति	एग्रोपीडिया	ए–एक्वा
6.	प्रतिदिन		
7.	साप्ताहिक		
8.	पाक्षिक		
9.	प्रतिमाह		
10.	आवश्यकतानुसार		

24. कृषि पोर्टल के बारे मे जागरूकता का समय:

क0 सं0	जागरूकता का समय	एग्रोपीडिया	ए–एक्वा
4.	एक वर्ष से कम		
5.	एक से दो वर्ष		
6.	दो से अधिक वर्ष		

25. एग्रोपीडिया व ए–एक्वा के उपयोगकर्ता की जानकारी साझेदारी व्यवहार

- क्या आप चयनित कृषि पोर्टलों की जानकारी साझा करते है अथवा नही? (√) के चिह्न द्वारा इंगित करे।

क0 सं0	वर्ग	एग्रोपीडिया	ए–एक्वा
3.	साझा किया		
4.	साझा नहीं किया		

- आपने कितने लोगों के साथ चयनित कृषि पोर्टल की जानकारी साझा की? (√) के चिह्न द्वारा इंगित करे।

क0 सं0	साझा व्यक्तियों की संख्या	एग्रोपीडिया	ए–एक्वा
4.	पांच से कम		
5.	द्द से दस		
6.	दस से अधिक		

- चयनित कृषि पोर्टल के बारे में साझा व्यक्तियों की प्रकृति को (√) के चिह्न द्वारा इंगित करे।

क0 सं0	व्यक्तियों की प्रकृति	एग्रोपीडिया	ए–एक्वा
6.	परिवार के सदस्य		
7.	मित्र		
8.	रिश्तेदार		
9.	साथी किसान		
10.	पडोसी		

26. चयनित कृषि पोर्टलों की सेवाओं की संतुष्टि

- (√) के चिह्न द्वारा इंगित करें कि आप चयनित कृषि पोर्टलों की सेवाओं से संतुष्ट है अथवा नहीं?

क0 सं0	वर्ग	एग्रोपीडिया	ए–एक्वा
E. अनुशंसित तरीकों के परिणाम			
4.	संतुष्ट		
5.	असंतुष्ट		
F. समस्त सेवाएं			
3.	संतुष्ट		
4.	असंतुष्ट		
G. प्रतिकिया की शीघ्रता			
3.	एक ही दिन के भीतर		
4.	एक सप्ताह के भीतर		
6.	एक सप्ताह से अधिक		
H. प्राप्त ज्ञान का उपयोग			
4.	पूरी हद तक उपयोग किया		
5.	मध्यम हद तक उपयोग किया		
6.	उपयोग नहीं किया		

27. एग्रोपीडिया व ए–एक्वा के उपयोगकर्ताओं द्वारा बाधाओं का सामना
चयनित कृषि पोर्टलों का उपयोग करते समय सामने आई बाधाओं को निम्न तीन बिन्दु निरन्तरता पर (√) के चिह्न द्वारा इंगित करें।

क0 सं0	बाधाएं	सदैव		कभी– कभी		कभी नहीं	
		एग्रोपीडिया	ए–एक्वा	एग्रोपीडिया	ए–एक्वा	एग्रोपीडिया	ए–एक्वा
19.	पहुँच का अभाव						
20.	बिजली की अनियमित आपूर्ति						
21.	इंटरनेट की धीमी गति						
22.	उच्च तकनीकी कौशल						
23.	कृषि पोर्टल के उपयोग व आवेदन पर कम संख्या में प्रशिक्षण						
24.	अनुवर्ती प्रशिक्षणों का अभाव						
25.	अनुभवी प्रशिक्षणों की कमी						
26.	प्रस्तुत सामग्री उत्तराखंड के लिए फसल व भाषा विशिष्ट नहीं है						
27.	जानकारी प्राप्त करने के लिए अनेक चरणों से गुजरना पडता है						
28.	कंप्यूटर की अनुप्लब्धता						
29.	कंप्यूटर निरक्षरता						
30.	पोर्टल की अनुशंसा के अनुसरण में कठिनाई						
31.	सामग्री नवीनीकृत नहीं की जाती						
32.	प्रसार कर्मियों द्वारा तकनीकी सर्मथन का अभाव						
33.	पोर्टल प्रबन्धकों व किसानों के बीच संम्बन्ध स्थापित करने में प्रसार कर्मियों का अभाव						
34.	किसानों के प्रश्नों के प्रत्युत्तर की विलंबित प्रतिकिया						
35.	अनुशंसाएं तुरन्त उपयोग के लिए तैयार नहीं						
36.	कोई अन्य (कृपया बताएं)						

28. चयनित कृषि पोर्टलों के प्रभाव का मापन, किसानों के ज्ञान स्तर का परोक्षण :
नीचे दिये गये प्रश्नों में से प्रत्येक प्रश्न का एक सही उत्तर है सही उत्तर को (√) के चिह्न द्वारा इंगित करें।

17) एग्रोपीडिया के मुख्य पृष्ठ खोलने के बाद जानकारी एकत्र करने हेतु पहला ऑपरेशन क्या होता है?
- वांछित कडी को क्लिक करना
- चैट बॉक्स खोलना
- स्वयं को पंजीकृत करना
- जानकारी के लिए संदेश लिखना

18) आमतौर पर किस लिंक में कृषि सम्बन्धित जानकारी अपलोड की गई है?
- लाइब्रेरी
- एग्रोविकी
- फोरम
- उपरोक्त सभी

19द्ध एग्रोपीडिया पर कृषि सम्बन्धित सबसे प्रामाणिक जानकारी हासिल हो सकती है
- एग्रोविकी
- तरीकों के पैकेज
- लाइब्रेरी
- उपरोक्त सभी

20)एग्रोपीडिया इमेज लिंक के तहत किस प्रकार के चित्र खोज सकते हैं?
- कृषि की महान हस्तियों के
- एग्रोपीडिया के पंजीकृत उपयोगकर्ता
- ज्ञान मॉडल्स
- फसल सम्बन्धी चित्र

21)"न्यू इन एग्रोपीडिया" लिंक में क्या नया है?
- एग्रोपीडिया की नई सुविधाएं
- कृषि की नवीन जानकारी
- नए उपयोगकर्ता की जानकारी
- उपरोक्त कोई नहीं

22)एग्रोपीडिया में कौन–कौन से ज्ञान मॉडल्स अपलोड किए गये हैं?
- धान
- गेहूं
- लीची
- सब्जी मटर
- गन्ना
- उपरोक्त सभी

23)एग्रोपीडिया में प्रश्न पूछने के लिए कौन सा लिंक है?

- एग्रोब्लॉग
- फोरम
- एग्रोचैट
- तरीकों के पैकेज

24)आमतौर पर एग्रोपीडिया पर कौन (सामग्री/सवाल) कर सकता है?

- केवल पोर्टल प्रबन्धक
- सभी पंजीकृत उपयोगकता
- वैज्ञानिक
- कोई भी

25)ए–एक्वा का पूरा नाम बताऐ?

- ऑल क्वैश्चन्स आन्सर्ड
- ऑलमोस्ट ऑल क्वैश्चन्स आन्सर्ड
- उपरोक्त सभी
- उपरोक्त कोई नहीं

26) ए–एक्वा जानकारी देता है:

- कृषि फसलों पर
- पशुपालन पर
- कृषि व सम्बन्धित क्षेत्रों पर
- उपरोक्त सभी

27द्ध अनुशंसा व जानकारी के अलावा ए–एक्वा की अनूठी विशेषता क्या है?

- सम्बन्धित वीडियो
- मोबाइल पर संदेश
- विशेषज्ञ की सलाह
- बाजार की जानकारी

28) कृषि पोर्टल छोडने से पहले आखिरी कार्य क्या होता है ?:

- कंप्यूटर बन्द करना
- विन्डो बन्द करना
- अपने खाते को साइन आउट करना
- उपरोक्त कोई नहीं

नीचे दिये गये प्रश्न चयनित कृषि पोर्टलों से सम्बन्धित किसानों के ज्ञान स्तर को बताते हैं । प्रत्येक प्रश्न का एक सही उत्तर है**,** हाँ अथवा नहीं। सही उत्तर को (√) के चिह्न द्वारा इंगित करें।

29) एग्रोपीडिया के मुख्य पृष्ठ पर ही नवीनतम अपलोड देख सकते हैं। हाँ/नहीं

30) एग्रोपीडिया व ए–एक्वा पर जानकारी कुमाउनी व गढवाली में भी उपलब्ध है । हाँ/नहीं

31) ए–एक्वा पर बाजार की जानकारी ‘‘भाव पूछिए’’ लिंक में उपलब्ध है । हा/नहीं

32) ‘‘कॉप डॉक्टर’’ एग्रोपीडिया की विशेषता है । हाँ/नहीं

29. (√) के चिह्न द्वारा इंगित करें कि किस हद तक आपने चयनित कृषि पोर्टलो की अनुशंसाओं को अपनाया है।

क0 सं0	प्रथाओं की अनुशंसा	कृषि पोर्टल के दर्शन के पूर्व अभ्यस्त		कृषि पोर्टल के दर्शन के बाद अभ्यास प्रारम्भ		भविष्य में अभ्यास का इरादा		अपनाने की कोई योजना नहीं	
		एग्रोपीडिया	ए–एक्वा	एग्रोपीडिया	ए–एक्वा	एग्रोपीडिया	ए–एक्वा	एग्रोपीडिया	ए–एक्वा
13.	खेत की तैयारी								
14.	बीज/प्रजाती								
15.	बीज उपचार								
16.	बुवाई का समय								
17.	बुवाई के तरीके								
18.	अंतर								
19.	खरपतवार नियंत्रण								
20.	पादप संरक्षण a. कीट पतंगे b. रोग c. रोकथाम								
21.	सिंचाई की कान्तिक अवस्थाएं								
22.	कटाई								
23.	भण्डारण								
24.	विपणन								

30. एग्रोपीडिया व ए–एक्वा के बारे में किसानों की राय

(√) के चिह्न द्वारा एग्रोपीडिया व ए–एक्वा के बारे में निम्न बिन्दुओं पर अपनी राय व्यक्त करें

- सामग्री प्रासंगिकता के बारे में राय

क0 सं0	विषय	एग्रोपीडिया	ए–एक्वा
1.	सामग्री प्रासंगिकता	• अति प्रासंगिक • कुछ हद तक प्रासंगिक • अप्रासंगिक	• अति प्रासंगिक • कुछ हद तक प्रासंगिक • अप्रासंगिक
2.	संदेश का उपचार	• उच्च तकनीकी शब्द • मध्यम तकनीकी शब्द • कम तकनीकी शब्द	• उच्च तकनीकी शब्द • मध्यम तकनीकी शब्द • कम तकनीकी शब्द
3.	सामग्री की पर्याप्तता	• पर्याप्त • कुछ हद तक पर्याप्त • अपर्याप्त	• पर्याप्त • कुछ हद तक पर्याप्त • अपर्याप्त
4.	सामग्री की उपयोगिता	• अत्यधिक उपयोगी • कुछ हद तक उपयोगी • अनुपयोगी	• अत्यधिक उपयोगी • कुछ हद तक उपयोगी • अनुपयोगी

- एग्रोपीडिया व ए–एक्वा की डिजाइन सुविधाओं के बारे में राय

आप चयनित कृषि पोर्टलो की डिजाइन सुविधाओं के बारे मे क्या महसूस करते हैं । अपनी सहमती व असहमती को निम्न बिन्दुओं पर (√) के चिह्न द्वारा इंगित करें। (पूर्णतया सहमत, सहमत, निर्णय नहीं, असहमत व पूर्णतया असहमत)

क0 सं0	कथन	पूर्णतया सहमत		सहमत		निर्णय नहीं		असहमत		पूर्णतया असहमत	
		एग्रो - पीडिया	ए–एक्वा	एग्रो - पीडिया	ए–एक्वा	एग्रो - पीडिया	ए–एक्वा	एग्रो-पीडिया	ए–एक्वा	एग्रो - पीडिया	ए–एक्वा
1.	मुख्य पृष्ठ सरल, भली प्रकार संगठित व आकर्षक है										
2.	कृषि पोर्टल में ग्राफिक अपलोड एक कठिन काम है										
3.	ग्राफिक्स प्रस्तुत जानकारी के साथ एकीकृत करते है										
4.	अत्यधिक एनिमेशन उपयोगकर्ताओं का ध्यान भंग करते है										
5.	अपलोड किया गया पाठ व दृश्य चिन्ह के बीच तुल्यकालन ठीक नहीं है										
6.	अपलोड किये गये वीडियो प्रस्तुत जानकारी के लिये उपयुक्त है										
7.	पाठ की पठनीयता उपयुक्त है										
8.	जानकारी उचित प्रकार से संगठित नहीं है										
9.	बहुत से रंगों का प्रयोग कृषि पोर्टल को आकर्षित बनाता है										
10.	मुख्य पृष्ठ पर प्रचार सीमित व अबाधक है										
11.	वेबपेज अत्यधिक जानकारी से भरा हुआ है										
12.	कृषि पोर्टल के सभी प्रमुख भाग मुख्य पृष्ठ पर उपलब्ध है										

- उपयोगकताओं के कृषि पोर्टल के प्रयोज्य विशेषताओं के बारे में राय:

नीचे कृषि पोर्टल द्वारा दी गई जानकारियों को खेतों में प्रयोग करने संबन्धी वक्तव्यों की एक सूची है। निम्न बिन्दुओं पर (√) के चिह्न द्वारा आपकी स्थिति का चुनाव करे इंगित करें।

क0 सं0	कथन	सहमत		आंशिक रूप से सहमत		असहमत	
		एग्रो - पीडिया	ए—एक्वा	एग्रो - पीडिया	ए—एक्वा	एग्रो - पीडिया	ए—एक्वा
1.	यह वर्तमान समय में किसानों के लिए अत्यन्त उपयोगी साधन है।						
2.	यह कृषि सम्बन्धी क्षत्रों में विश्व स्तर की जानकारी एकत्र करने हेतु एक समृद्ध स्रोत है।						
3.	यह कम समय में तेजी से सूचना विनिमय का तरीका है।						
4.	यह तरीका किसानों के लिए महंगा है।						
5.	यह कृषि उत्पादों की बाजार कीमतों की जानकारी एकत्र करने का सबसे अच्द्दा तरीका है।						
6.	कृषि पोर्टल का उपयोग समय पास गतिविधि के अतिरिक्त कुद्द नहीं।						
7.	कृषि पोर्टल पर उपलब्ध जानकारी आसानी से समझी जा सकती है।						
8.	चयनित कृषि पोर्टलों के माध्यम से भारतीय किसानों का विकास संभव है।						
9.	मैं चाहता हूँ कि मेरे बच्चे खेती के लिए कृषि पोर्टलों का सकारात्मक उपयोग करें।						
10.	मेरी इच्द्दा है कि किसानों को कृषि पोर्टलों का उपयोग करना चाहिए ।						

15. एग्रोपीडिया व ए–एक्वा के उपयोगकर्ताओं में आए परिवर्तन को निम्नलिखित पहलुओं पर (√) के चिह्न द्वारा इंगित करें।

क0 सं0	परिर्वतन पहलू	एग्रोपीडिया	ए–एक्वा
1.	उपज में वृद्धि	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन
2.	उत्पादन की गुणवत्ता में परिर्वतन	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • महत्वपूर्ण परिर्वतन	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • महत्वपूर्ण परिर्वतन
3.	आय स्तर	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन
4.	खेतों में हर वर्ष फसलो की संख्या में वृद्धि	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन
5.	फसलों का विविधिकरण	• कोई परिर्वतन नही • परंपरागत फसलों से नकदी/सब्जी फसलों के लिए बदला गया • परंपरागत किस्मों से संकर किस्मों के लिए बदला गया	• कोई परिर्वतन नही • परंपरागत फसलों से नकदी/सब्जी फसलों के लिए बदला गया • परंपरागत किस्मों से संकर किस्मों के लिए बदला गया
6.	रोग नियंत्रण	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन	• कोई परिर्वतन नहीं • कुछ हद तक परिर्वतन • काफी हद तक परिर्वतन

16. अतिरिक्त जानकारी

- एग्रापीडिया व ए–एक्वा के अतिरिक्त कौन से आई0सी0टी0 उपकरण आप कृषि सेवाओं के लिए प्रयोग कर रहे है?

....
....
....

- खेती मे कृषि पोर्टलों के उपयोग के वृद्धि कारकों का उल्लेख करें।

....
....
....

- कृपया उत्तराखंड में कृषि पोर्टल के सुधार हेतु अपने सुझाव दीजिए ।

....
....
....

- अतिरिक्त टिप्पणी के लिए नीचे दिये गये स्थान का प्रयोग करें।

....
....
....

Department of Agricultural Communication, College of Agriculture,
G. B. Pant University of Agriculture and Technology, Pantnagar-263145
Distt. Udham Singh Nagar, Uttarakhand

Dr. Gyanendra Sharma
Professor

Dear Respondent,

One of my doctoral students, Ms. Kiran Yadav, ID. No. 29223 has taken up a research study entitled **"Impact Assessment of ICT-enabled Knowledge Sharing Agri-portals in Uttarakhand"**. She proposes to study the impact of selected Agri-portals i.e. Agropedia and aAQUA in Uttarakhand on the users i. e. farmers. In this opinion on different parameters will be taken from portal managers (Agropedia and aAQUA), scientists from GBPUAT, and extension functionaries from KVK, Kashipur, KVK, Dhakrani and KVK Jeolikote. Based on this it is proposed to develop a suitable strategy for effective functioning of the selected Agri-portals in Uttarakhand. The enclosed questionnaire comprises of certain questions on various parameters of Agri-portals. You are expected to give your opinion by filling the questionnaire.

I therefore, request you to kindly spare some of your valuable time to fill up the enclosed questionnaire. I would request you to cooperate in the successful and timely conduct of this research by sending your response at the earliest.

Looking forward for your co-operation.

Thanking you,

Yours sincerely

28.12.20

(Gyanendra Sharma)

Annexure-III
Opinionnaire for the stakeholders of Agropedia and aAQUA

S.No...

Date: June 11, 2011

Research Title: "Impact Assessment of ICT-enabled Knowledge Sharing Agri-portals in Uttarakhand"

Institute:..
....

Name of the respondent: ....

Age (in years): ....

Designation: ....

Given below are some statements regarding the opinion of Agropedia and aAQUA regarding: opinion about content relevance and design features of Agropedia and aAQUA. Please indicate your opinion by tick mark (√) in the appropriate category.

Opinion about aAQUA and Agropedia

1. **Opinion about content relevance**

   Please indicated your opinion by tick (√) mark your chosen options on following headings:

S. No	Variable	Agropedia	aAQUA
5.	**Content relevance**	d) Highly relevant ☐ e) Somewhat relevant ☐ f) Irrelevant ☐	d) Highly relevant ☐ e) Somewhat relevant ☐ f) Irrelevant ☐
6.	**Treatment of the message**	d) High technical words ☐ e) Moderate technical words ☐ f) Less technical words ☐	d) High technical words ☐ e) Moderate technical words ☐ f) Less technical words ☐
7.	**Adequacy of the content**	d) Adequate ☐ e) Somewhat adequate ☐ f) Inadequate ☐	d) Adequate ☐ e) Somewhat adequate ☐ f) Inadequate ☐
8.	**Usefulness of the content**	d) Highly useful ☐ e) Moderately useful ☐ f) Not useful ☐	d) Highly useful ☐ e) Moderately useful ☐ f) Not useful ☐

2. **Opinion about design features:**

Please indicate your opinion about these statements regarding design features of Agri-portals by indicating the degree of your agreement or disagreement as “Strongly Agree”, “Agree”, “Undecided”, “Disagree” and “Strongly Disagree”.

S. No.	Statements	Strongly agree		Agree		Undecided		Disagree		Strongly disagree	
		Agro-pedia	aAQUA	Agro-pedia	aAQUA	Agro-pedia	aAQUA	Agro-pedia	aAQUA	Agro-pedia	aAQUA
13.	Home page is simple, well organized and attractive.										
14.	The speed of uploading the graphics is poor.										
15.	Graphics are integrated with the information presented.										
16.	Too many animations which distract the users.										
17.	Synchronization is poor between the text uploaded and the visual icons.										
18.	Video uploaded is appropriate to the textual information.										
19.	Readability of the text is appropriate.										
20.	Information is not appropriately organized.										

21.	Use of too many colors made the Agri-portal attractive.										
22.	Advertizing on home page is limited and non-obtrusive.										
23.	The webpage is heavily loaded with information.										
24.	All major parts of the Agri-portals are accessible from the home page.										

3. Please suggest, how can these Agri-portals function more effectively in Uttarakhand?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

………………………………………………………………………………………

Thank you for your invaluable time in completing this survey.

VITA

Ms. Kiran Yadav, the authoress of this manuscript was born on 11th of June 1985 at Pantnagar in Uttarakhand (the then state of Uttar Pradesh). She completed High school from U.P. Board and Intermediate from Uttaranchal Board in the year 2000 and 2002 respectively. She graduated (B. Sc., Home Science) from G.B.P.U.A. & T, Pantnagar in the year 2006. Thereafter, she joined the Department of Agricultural Communication for her masters in Agricultural Extension and Communication in the same year. After completion of her Masters degree in 2008, she joined Ph.D program with major in Agricultural Extension and Communication in the same institute. She was the recipient of University Research Assistantship and Earn While You Learn Scholarship during her M.Sc and Ph.D degree programs. She has three international, one national research publications and five popular articles to her credit. She worked as an editorial trainee in three issues of Pantnagar News, a quarterly newsletter of Pantnagar University. She has given many straight talks and took interviews of scientists on agricultural issues; broadcast by All India Radio and done video recordings for Pantnagar Parikrama, a monthly Video Magazine of Pantnagar University. She has got the International fellowship for conducting her Ph.D research from International Crops Research Institutes for the Semi-Arid Tropics (ICRISAT), Patancheru, Hyderabad during April 2009 to June, 2010. She qualified ARS-NET and UGC-NET with JRF held during September, 2010 and December, 2010 in the subjects Adult & Continuing Education and Transfer of Technology respectively. The authoress was the recipient of 'INSPIRE' fellowship of Government of India during 2010-11 for Ph.D.

Address:

Kiran Yadav
D/o Sri Surya Deo Yadav
H.No. 1547/V, Ta colony, Pantnagar
District- Udham Singh Nagar, Uttarakhand
PIN- 263 145
E-mail- yadavkiran11@gmail.com

Abstract

Name: Kiran Yadav **Id. No.** 29223
Semester & Year of Admission: II Semester, 2008-09 **Minor**: Social Science
Major: Agricultural Extension and Communication **Department**: Agril. Comm.
Advisor: Dr. Gyanendra Sharma **Degree**: Doctor of Philosophy
Thesis title: "Impact Assessment of ICT Enabled Knowledge Sharing Agri-portals in Uttarakhand"

It has been argued that Information and Communication Technologies (ICT) can lead to development in developing countries. With this in mind, developing countries have been rushing to implement ambitious ICT projects in rural areas through the direct-indirect supervision of institutions such as, the World Bank, United Nations (UN) and other donor/local agencies. The main focus of the interventions has been the implementation of these ICT projects, rather than understanding their impacts at the recipient level. This lack of understanding has led to many failures of ICT projects reported in the literature. There is a need to understand impacts of ICT projects in their local context considering the participants' perspectives at the micro level.

The analytical research design was used to conduct the investigation. Two Agri portals viz. Agropedia and aAQUA were selected by census method. In an all 83 progressive farmers and 55 SAU and KVK scientists and portal managers from IIT, Kanpur and IIT, Bombay were selected as respondents. Interview Schedule, Impact assessment index and opinionnaire were developed to collect data from the farmers.

Findings of the study revealed that majority of farmers were middle aged, educated up to Intermediate, with main occupation as farming, general caste, medium family income, with majority of male, had nuclear family and medium family size, KVK as major point of access to internet and information, possess medium level of communication media, high level of agricultural equipment, medium household possession, medium level of social participation, and contact fellow farmers for agricultural information. Television is the most popularly accessed media, majority had low farming experience, medium animal possession, grow 2-3 crops a year, all of them were aware of the Agri-portals' existence through KVK scientists, majority of them visited the selected Agri-portals for market information on monthly basis, shared the information provided through both the Agri-portals with neighbors, satisfied with Agri-portals' recommendations, gained medium knowledge and utilized to medium extent. Maximum number of farmers opined that uploaded content of Agropedia somewhat and aAQUA content was moderately relevant, with high technical words, moderately useful content, with appropriate readability and had the opinion that internet is the best way to learn new things. Maximum farmers reported somewhat positive changes in income, quality of produce, crop diversification due to Agropedia and aAQUA. Less number of trainings was the most important constraint identified by the farmers. Education, communication media possession and agricultural equipment possession have positive and highly significant relationship with overall knowledge level. Dependent variable, intend to practice the recommendations of aAQUA in future is positively and highly significant with annual income, caste and farming experience.
Majority of the scientists and portal managers reported that content on both the Agri-portals were highly relevant, with well organized and attractive home page.

28.12.20

(Gyanendra Sharma)
Advisor

(Kiran Yadav)
Authoress

सारांश

नामः किरन यादव **परिचयांक संख्याः** 29223
सत्र एवं प्रवेश वर्षः द्वितीय, 2008–09 **उपाधीः** पी0एच0डी0
विभागः कृषि संचार विभाग **मेजरः** कृषि संचार एवं प्रसार
सलाहकारः डा0 ज्ञानेन्द्र शर्मा **माइनरः** सामाजिक विज्ञान
शोध का विषयः "उत्तराखण्ड में आई0सी0टी0 सक्षम ज्ञान वर्धक कृषि पोर्टलों का प्रभाव आंकलन"

यह तर्क संगत वक्तव्य है कि सूचना व संचार प्रौद्योगिकी (आई0सी0टी0) विकासशील देशों में विकास का नेतृत्व कर सकते हैं। इस विचार के साथ विकासशील देश ग्रामीण क्षेत्रों में उच्च संस्थानों जैसे विश्व बैंक, संयुक्त राष्ट्र व अन्य दाता/स्थानीय एजेंसियों के प्रत्यक्ष–अप्रत्यक्ष पर्यवेक्षण के माध्यम से कई महत्वाकांक्षी आई0सी0टी0 परियोजनाओं को लागू कर रहा है। इन आई0सी0टी0 परियोजनाओं का मुख्य ध्यान प्राप्तकर्ता के स्तर पर उनके प्रभावों को जानने के बजाय इनके कार्यान्वयन पर किया गया है। यह कमी आई0सी0टी0 परियोजनाओं की कई विफलताओं का कारण है। अतः इन आई0सी0टी0 परियोजनाओं के प्रभावों को सूक्ष्म स्तर पर स्थानीय संदर्भ में प्रतिभागियों के दृष्टिकोण से समझने की आवश्यकता है। प्रस्तुत जांच के संचालन हेतु विश्लेषणात्मक अनुसंधान डिजाइन का प्रयोग किया गया तथा दो कृषि पोर्टलों अर्थात् एग्रोपीडिया व ए–एक्वा का जनगणना विधि द्वारा चयन किया गया। इस प्रकार 83 प्रगतिशील किसान, 40 कृषि विश्वविद्यालय व कृषि विज्ञान केन्द्र के वैज्ञानिक तथा आई0 आई0टी0 कानपुर व आई0 आई0टी0 मुम्बई से पोर्टल प्रबन्धकों का उत्तरदाताओं के रूप में चयन किया गया। किसानों से सूचना एकत्र करने के लिए साक्षात्कार अनुसूची, प्रभाव आंकलन सूचकांक व अभिमत सूचकांक विकसित किए गए।

अध्ययन के निष्कर्ष में पाया गया कि प्रगतिशील किसानों में अधिकतर मध्यम आयु वर्ग, इण्टरमीडिएट स्तर तक साक्षर, मुख्य व्यवसाय के रूप में कृषि, सामान्य जाति, मध्यम आर्थिक स्तर, पुरूष प्रधान, एकाकी परिवार, मध्यम पारिवारिक आकार, सूचना व इण्टरनेट प्रयोग हेतु कृषि विज्ञान केन्द्र का प्रयोग, मध्यम स्तर के संचार माध्यमों, उच्च स्तर के कृषि उपकरणों व मध्यम स्तर के ही घरेलू उपकरणों के अधिकारी, मध्यम स्तर की सामाजिक भागीदारी तथा कृषि सम्बन्धित सूचनाओं के लिए साथी किसानों से सम्पर्क करते थे। टी0वी0 सबसे लोकप्रिय मीडिया था व अधिकतर किसान कम कृषि अनुभव वाले व 2–3 फसलें उगाते थे। सभी किसान चयनित कृषि पोर्टलों के अस्तित्व से कृषि विज्ञान केन्द्र के वैज्ञानिकों द्वारा परिचित हुए। अधिकतर किसान इन कृषि पोर्टलो का प्रयोग मासिक रूप से बाजार भाव जानने के लिए करते थे।किसानों ने कृषि पोर्टलों की सूचनाएं पडोसियों से साझा की तथा वे सभी इन सूचनााओं से संतुष्ट थे, उन्होने मध्यम स्तर का ज्ञानार्जन किया तथा मध्यम स्तर तक ही उसका उपयोग भी किया। अधिकतर किसानो के विचार से एग्रोपीडिया व ए–एक्वा पर अपलोड की गई सामग्री क्रमशः कुछ हद तक तथा मध्यम स्तर तक प्रासंगिक थी। उच्च तकनीकी शब्द तथा उपयुक्त पठनीयता भी दर्ज की गई। किसानो के विचार से इण्टरनेट नई चीजें सीखने का सबसे अच्छा तरीका है। अधिकतर किसानों ने आय, उत्पादन की गुणवत्ता तथा फसल विविधीकरण में कुछ सकारात्मक बदलाव महसूस किए। कम संख्या में प्रशिक्षण सबसे प्रमुख बाधा के रूप में सामने आयी। शिक्षा, संचार माध्यम व कृषि उपकरण, ज्ञान स्तर के साथ सकारात्मक रूप से काफी हद तक सम्बन्धित थे। ए–एक्वा की सूचनाओं को भविष्य में उपयोग करने सम्बन्धित निर्भर चर, वार्षिक आय, जाति व कृषि अनुभव के साथ सकारात्मक व महत्वपूर्ण रूप से सम्बन्धित थे। अधिकतर वैज्ञानिकों व पोर्टल प्रबन्धकों के अनुसार दोनों कृषि पोर्टलों पर अपलोड की गई सामग्री अत्यधिक प्रासंगिक तथा मुख्य पृष्ठ भली प्रकार व्यवस्थित तथा आकर्षक था।

(ज्ञानेन्द्र शर्मा) **(किरन यादव)**
सलाहकार **लेखिका**

Plate 17: KVK, Jeolikote (Nainital)

Plate 18: Interviewing KVK, functionary

Plate 19: KVK, Kashipur (U. S. Nagar)

Plate 20: KVK, Dhakrani (Dehradun)

Plate 21: Primary school at Dharmawala, Dehradun

Plate 22: Water source at Dharmawala, Dehradun

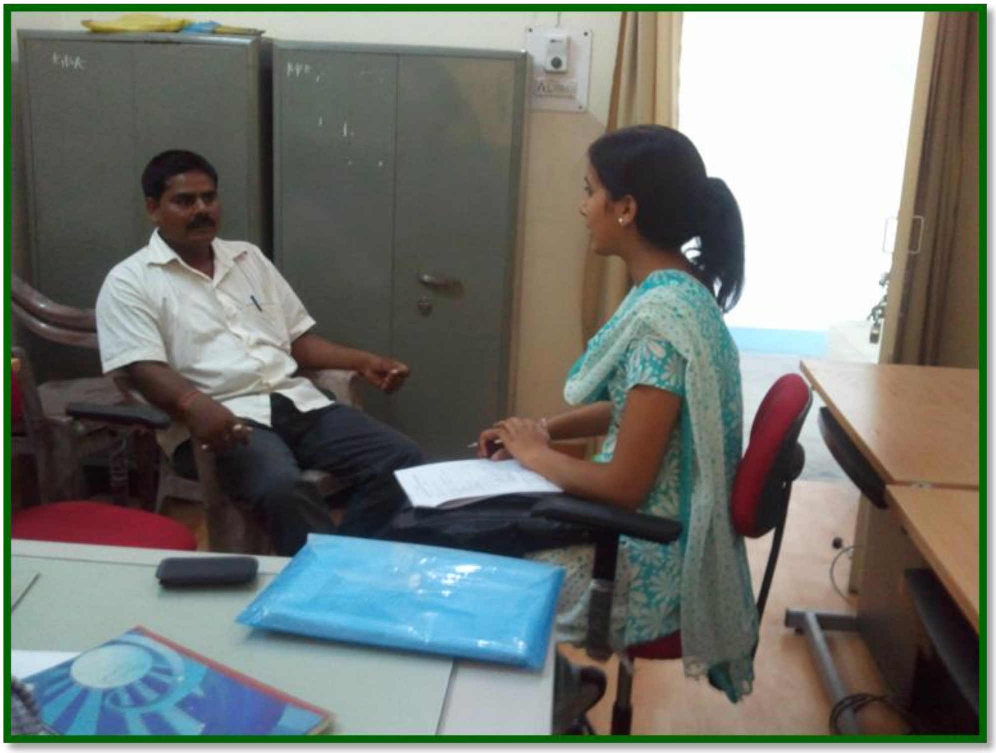


Plate 23&24: Researcher interviewing the farmers

Plate 25&26: Researcher interviewing the farmer and farm women

Plate 27&28: Researcher with farmer and farm women

Plate 29: Researcher with KVK scientist and farm women

Plate 30: Researcher with KVK scientist