USER-CENTERED DESIGN AND TESTING OF A BILINGUAL WEBSITE PROTOTYPE FOR THE DIRECTORATE OF EXTENSION, KERALA AGRICULTURAL UNIVERSITY

By

MRIDULA N

THESIS

Submitted in partial fulfilment of the requirement for the degree of

DOCTOR OF PHILOSOPHY IN AGRICULTURE

(Agricultural Extension)

Faculty of Agriculture

Kerala Agricultural University

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR-680656.

2014

DECLARATION

I hereby declare that the thesis entitled **"USER-CENTERED DESIGN AND TESTING OF A BILINGUAL WEBSITE PROTOTYPE FOR THE DIRECTORATE OF EXTENSION, KERALA AGRICULTURAL UNIVERSITY"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other university.

Vellanikkara, **MRIDULA N**

24 / 10 / 2014

CERTIFICATE

Certified that the thesis entitled "**USER-CENTERED DESIGN AND TESTING OF A BILINGUAL WEBSITE PROTOTYPE FOR THE DIRECTORATE OF EXTENSION, KERALA AGRICULTURAL UNIVERSITY"** is a record of research work done independently by Ms. Mridula N, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship or fellowship to her.

Vellanikkara
24 / 10 / 2014

Dr. P. Ahamed
Professor & Major Advisor,
Department of Agricultural Extension,
College of Horticulture.

CERTIFICATE

We, the undersigned members of the advisory committee of **Ms. Mridula N**, a candidate for the degree of Doctor of Philosophy in Agriculture, with major field in Agricultural Extension, agree that the thesis entitled "**USER-CENTERED DESIGN AND TESTING OF A BILINGUAL WEBSITE PROTOTYPE FOR THE DIRECTORATE OF EXTENSION, KERALA AGRICULTURAL UNIVERSITY"** may be submitted by Ms. Mridula N, in partial fulfilment of the requirement for the degree.

Approved by:

Major Advisor

Dr. P. Ahamed
Professor & Head,
Department of Agricultural Extension,
College of Horticulture,
Vellanikkara**.**

Advisory Committee Members

Dr. Jayasree Krishnankutty,
Associate Professor,
Department of Agricultural Extension,
College of Horticulture,
Vellanikkara.

Dr. A. Sakeer Husain,
Assistant professor (SS),
Centre for E-Learning,
College of Horticulture,
Vellanikkara.

Dr. S. Krishnan,
Associate Professor & Head,
Department of Agricultural Statistics
College of Horticulture
Vellanikkara

Dr. S. Helen
Associate Professor
Communication Centre
Directorate of Extension
Mannuthy,Thrissur

External Examiner:

Dr. C. Thamban, Principal Scientist, Central Plantation Crops Research Institute (CPCRI), Kasargode.

ACKNOWLEDGEMENTS

*I would like to gratefully and sincerely thank my much respected chairman, **Dr. P. Ahamed**, Professor and Head, Department of Agricultural Extension, COH, Vellanikkara, for his patience, understanding and kindness throughout my education and research at COH. His mentorship was paramount in providing me a well rounded experience as a human being. He encouraged me to not only grow as a researcher, but also as an instructor and an independent thinker. I am not sure many graduate students are given the opportunity to develop their own individuality and self-sufficiency by being allowed to work with such independence. For everything you've done for me, Dr. Ahamed, I thank you; without your meticulous guidance, this thesis would not have been possible. My special thanks for believing in me more than I do myself.*

*I am very much grateful to **Dr. S. Helen**, Associate Professor, Communication Centre, Directorate of Extension, Mannuthy, for her thoughtfulness, relentless support, friendship and encouragement. Always indebted to **Dr. A. Sakeer Husain**, Assistant professor (SS), Centre for E-Learning, for offering his expertise, assistance and moral support.*

*I sincerely record my thankfulness to **Dr. S. Bhaskaran**, Professor, Department of Agricultural Extension, COH, Vellanikkara, for his critical comments and deep scrutiny. Many thanks go to **Dr. Jayasree Krishnankutty**, Associate Professor, Department of Agricultural Extension, COH, Vellanikkara; **Dr. S. Krishnan**, Associate Professor and Head, Department of Agricultural Statistics, COH, Vellanikkara, and **Dr. Jiju P Alex**, Associate Professor, Department of Agricultural Extension, COH, Vellanikkara, for their inputs, valuable discussions, instantaneous corrections and suggestions provided.*

*I extend my gratitude to the Director of Extension, **Dr. P. V. Balachandran**, Associate Director of Extension, **Dr. Jose Mathew**, all the scientists and staff of*

Communication Centre, Agricultural Technology Information Centre, Central Training Institute, Krishi Vigyan Kendras, research stations and colleges under Kerala Agricultural University, all the other respondents, including extension officers from the State Department of Agriculture and farmers who have supported me and cooperated with this work.

I would like to thank ***Mr. Nithin*** *who has helped to develop the web prototype for DoE, KAU. All the help rendered by the students, project staff and non-teaching staff of Centre of e-Learning and Extension department will always be remembered.*

I would like to acknowledge the enormous help given to me by the other teaching and non teaching staff, students and the multitude of others from Kerala Agricultural University, that helped me, in one way or the other, to create this thesis.

Finally, and most importantly, I thank my family, where the most basic source of my life energy resides. I would like to thank my Appa and Amma for their limitless love and care, support, sacrifices and their faith in me, allowing me to be as ambitious as I wanted.

I bow before the Supreme Power and thankfully cherish and happily retain the divine energy flows from its loving embodiments, Shri Guru, LM, YG, PY and Sri M, that helped me to become the person I am today.

CONTENTS

List of tables

List of figures

List of plates

List of boxes

ABBREVIATIONS

DoE , KAU	Directorate of Extension, Kerala Agricultural University
UCD	User-Centered Design
INI	Information Need Index
DoA	Department of Agriculture
AO	Agricultural Officer
ICT	Information Communication Technology
ICAR	Indian Council of Agricultural Research
CTI	Central Training Institute
ATIC	Agricultural Technology Information Centre
KVK	Krishi Vigyan Kendra
RARS	Regional Agricultural Research Station
COA	College of Agriculture
COH	College of Horticulture
COF	College of Forestry
CCBM	College of Co-operation, Banking & Management
KCAET	Kelappaji College of Agricultural Engineering & Technology
PRS	Pepper Research Station, Panniyoor
ARS	Agricultural Research Station (Mannuthy & Anakkayam)
ARS	Agronomic Research Station, Chalakkudy
CRS	Cashew Research Station, Madakkathara
BRS	Banana Research Station, Kannara
PRS	Pineapple Research Station, Vellanikkara
AMPRS	Aromatic & Medicinal Plants Research Station
RRS	Rice Research Station
CRS	Cardamom Research Station, Pampadumpara
CRS	Coconut Research Station, Balaramapuram

INTRODUCTION

1. INTRODUCTION

In this 21st century, the world increasingly depends on information and communication technologies and the increased connectivity and productivity they enable. The Information Communication Technology (ICT) thus has become the nerve centre for the global economy. Information Communication Technology is an umbrella term, widely used to encompass all rapidly emerging, evolving and converging computer, software, networking, telecommunications, internet, programming, information systems and digital media technologies. New ICTs like internet can offer real opportunities to improve the quality of life by providing reliable and timely information to all (Ogbomo and Ogbomo, 2008). Improvements in information and communication technologies and people's abilities to productively use them are strategically important issues to individuals and organizations of all kinds and to local, state, national and global economies.

Information and communication being the keys for successful operation and management process of any development activity, the role of websites in extension for information dissemination and knowledge sharing is worth mentioning. In the context of agricultural development, ICTs play a promising role. Most of the developing countries have got fruitful results by using internet, mobile phones, radio and television for providing agricultural knowledge to the farmers (Chhachhar *et al.*, 2014). Realising this fact, the Union Budget 2014-15 of India has announced a new 24-hour television channel for farmers to provide real time information on various farming and agricultural issues.

A well-designed website is an internet identity and an essential part of the success and future of any organization. Those organizations that do not have a web presence are inadvertently making a statement about their inability to embrace technology and adapt to change in today's dynamic environment. Like any other organisation, research institutions like an Agricultural Universities can also present its professional and credible image to the users through a website. It will help to create a show case for its technologies and services, and will educate its users through the world wide exposure.

Kerala Agricultural University (KAU) is one of the prestigious institutions working in line with the mandates of the Indian Council of Agricultural Research (ICAR) in India. It is the principal instrumentality in providing human resources, skills and technology required for the

sustainable development of agriculture in the state of Kerala. The Directorate of Extension, KAU has been co-ordinating the extension activities of Kerala Agricultural University since its inception in 1971. It has been a long felt need of the Agricultural Extension System of Kerala State in general, and that of the four decades old Directorate of Extension, KAU in particular that an interactive website be launched as part of strengthening its extension activities. The working group on remandating extension approaches of KAU, in their report has raised this time and again (Alex, 2011). At present, the KAU has only one general website, www.kau.edu, which focuses mainly on the routine administrative matters and announcements, catering only to a narrow band of users. It does not have the required academic, research and extension contents. Koshy (2013) has suggested a study on web interface for the Directorate of Extension, Kerala Agricultural University.

The prime goal of the extension wing of the KAU is technology pooling, assessment, diffusion and handling the 'feed-forward and feedback' mechanisms. The lead functions of Directorate of Extension (DoE) include regular technology dissemination activities and field information services, on-farm technology assessment and refinement, human resource development in agriculture, analysis of technology potential for sustainable income and employment, constraint analysis (technological, economical and institutional) for promoting technology adoptions, formulating policy guidelines in streamlining extension strategies for the state, facilitating linkage between marketing, credit and post harvest operations and providing institutional innovations for distribution of quality planting materials/inputs to farmers.

Directorate of Extension, KAU, headed by the Director of Extension is governed by an Extension Advisory Council chaired by the Vice Chancellor and supported by Associate Directors of Extension (South, Central and North). The extension activities of the DoE are organised and conducted mainly through the Communication Centre, Central Training Institute (CTI), Agricultural Technology Information Centre (ATIC), KAU Press, Public Relations Office, seven Krishi Vigyan Kendras (KVKs), six Colleges, six Regional Agricultural Research Stations (RARS) and 26 Research Stations/Units. Even though, technology transfer is the mandate realized through Directorate of Extension, it is a fact that little about its services and activities are mentioned in the general website of KAU. Hence, that makes it an urgent need to develop a demand-driven website exclusively for DoE, KAU.

"Websites should look good from the inside and out"

~Paul Cookson.

To accomplish this, the philosophy of User-Centered Design (UCD) of a web site is necessary as it matches the priorities of its end-users. Such a website for DoE, KAU should be exhaustive, interactive, user–friendly, easily accessible and available in both English and the local language, Malayalam. The site should provide an online interaction and advisory platform for farmers, extensionists and scientists.

"The only way to find out if a great website really works is to *test* it" (Krug, 2005). Creating a working model of the website before developing the actual website would allow saving time and money by perfecting the features before major changes are difficult to implement. Thus, a website prototype is an early sample of website built to test a concept or process or to act as a thing to be replicated or learned from. It is with this grounding that the present study was taken up.

1 .1.OBJECTIVES OF THE STUDY

The study was done with the following objectives:-

1) To generate need based e-contents to develop the first level prototype of a bilingual website for the Directorate of Extension, Kerala Agricultural University.

2) Participatory assessment and refinement of the prototype before its final design by the host organization.

1. 2. SCOPE OF THE STUDY

A need based agricultural extension website will be more useful rather than developing a site with assumptions. The user-centered design and testing of the bilingual website prototype taken up by the present study will help to strengthen the cyber extension activities of Kerala Agricultural University. The web prototype developed as part of this study will give insights to the needs and preferences of the primary stakeholders: scientists, extensionists, and farmers, so that an efficient and effective website can be designed for the DoE, KAU. It is bilingual, available both in English as well as the local language - Malayalam. Such a website developed after prototyping will be a powerful and competent showcase to transfer new technologies, trends and information to the stakeholders in agriculture and rural development sector. The in-depth

analysis of the developed prototype will be of immense use to the professional designer to fine tune it. The methodology, the website assessment tools and protocol developed for the present study will be useful to future researchers in this area. The website, as a hub of the entire extension net work of the KAU, with additional web links, can function as a show window to expose, exhibit and explain the strategic research, extension and service agenda of the DoE. This will match the requirements of the farm sector and its clientele in today's extremely challenging farming environment in Kerala. Viewed from these perspectives, this study has immense relevance and promising dimensions.

1. 3. LIMITATIONS OF THE STUDY

The study was carried out as part of the doctoral degree programme, which imposed the constraints of time and resources for a more exhaustive analysis. Further, a dearth of content was faced for certain topics demanded by the respondents as the provision of those particular contents was very time consuming. The study being one that shows the way for other researches in this particular field, sparsity of literature was faced. Despite these facts, maximum effort and care were taken to make it as objective as possible.

1. 4. ORGANISATION OF THE THESIS

The study is presented under five sections. The first section is the introduction that features the need, scope, objectives and limitations of the study. A summary of the available and relevant literature is focussed in the second section. Locale of the study, selection of respondents, operationalisation and measurement of variables, data collection methods and statistical tools are explained in the third section, 'Materials and Methods'. Attention is drawn to the results of the study, along with substantiating discussion in the fourth section. The fifth section highlights the major findings and conclusions derived out of the study.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The review of literature gives a theoretical base for the study. The collected literature is presented under the following headings:

2. 1. Role of cyber extension / ICT in agriculture
2. 2. Concept and definition of technical terms used in the study
2. 3. Role of website and web portal in agriculture
2. 4. Information needs of the users
2. 5. Content organisation in websites
2. 6. Testing and assessment of websites/prototypes by the end-users
2. 7. Quality assessment of the websites
2. 8. Constraints in using websites

2.1. ROLE OF CYBER EXTENSION/ICT IN AGRICULTURE

Micro computer technologies have the potential to support all the major functions of agricultural extension, namely the technology generation, diffusion, adoption, and the efficient handling of descriptive, diagnostic, predictive and prescriptive type of information (Asher, 1995).

Application of ICT to agriculture and rural development is profoundly transforming extension services through innovative approaches based on interactive knowledge processes that involve researchers, extensionists and farmers (Gosh, 2001).

Web sites have become essential tools in the dissemination of content in digital format, especially in organisations where the generation, management and distribution of information and knowledge are among the major activities. This should also be true in agricultural research organisations where information and knowledge are the major by-products of agricultural research (Chisenga and Brakel, 2004).

Agricultural extension website is an access for researchers, extensionists and farmers to agricultural information resources, services, tools and facilities, and includes virtual conferencing, instant messaging system, virtual team workspace, discussion forums and document sharing (Chisenga and Brakel, 2005).

Throughout the developing world, ICTs are being integrated into classic rural advisory services, through radio, SMS, television, video, internet, libraries, the media, and mobile services. Advice and information provided via ICTs are becoming more varied, covering specific technologies and practices; climate change mitigation and adaptation; disaster management; early warning of drought, floods, and diseases; price information; political empowerment; natural resource management; production efficiency; and market access. It is not a one-way flow: ICTs open up new channels for farmers to document and share experiences with each other and with experts (Karanja, 2006).

Effective deployment of ICT can lead to increase in agricultural competitiveness through cuts in production and transaction costs, raising production efficiencies and farm incomes, conserving natural resources, and by providing more information, choice and value to stakeholders (Rao, 2007).

Cyber extension and computer-based information technology have significant role in helping the extensionists, farmers, and other stakeholders to make rational decisions and action programmes by providing information, knowledge and advice that are timely, reliable and consistent. Towards an agricultural knowledge revolution in Kerala, there is a need for harnessing the power, speed and accuracy of cyber extension for enhancing the State's agricultural competitiveness (Helen, 2008).

With wider access to and use of ICT, the potentials of opening up of communication as well as sharing information would be enhanced so as to assist farmers, researchers, extension workers and policy makers. It will also narrow the information gap that exists between the farmers and the researchers on the other hand because there will be a feedback (Ballantyne, 2009).

As pointed out by the study of Renwick (2010), ICT is a very useful tool crucial in processing and disseminating agricultural information to the farmers especially in rural areas; no matter they are literate or illiterate.

Part of the role of ICTs is to contribute to the many reforms that are urgently needed to empower and support small-scale farmers as developing countries seek to respond successfully to food security, market development, and climate change challenges (Christoplos, 2010).

Chisita (2010) explained how dissemination of agricultural information through ICTs is impacting on the agricultural production among small scale farmers in Zimbabwe. There is immense potential in harnessing ICTs for disseminating agricultural information thereby allowing small scale farmers to share knowledge and experience through utilizing social media, telecenters and other ICT driven communication devices. The use of ICTs will also help farmers to develop local content through engaging in virtual reality projects.

Low use of mass media adversely affected the adoption level of latest farm production technologies (Butt *et al*., 2011).

Alex (2011) highlighted the need for the development of cyber extension platforms, content development for cyber extension and maintaining an Extension Portal for Kerala Agricultural University.

2. 2. CONCEPTS AND DEFINITIONS OF THE TECHNICAL TERMS USED IN THE STUDY

Website

A website is a collection of related material that contains text, images, video, and audio and / or other media which can be as simple as a few static pages or as complex as several web applications running simultaneously, and everything in between. In other words, it is a connected group of pages on World Wide Web as a single entity, usually maintained by one person or organisation and devoted to a single topic or several closely related topics.

Web-site is the primary point of interface between the customer and any online business (Salum and Pather, 2007).

Website is a digital environment capable of delivering information and solutions and promoting interaction among people, places, and things to support the goals of the organization it is created for (Murtagh, 2013).

Web portal

The term portal comes from the Latin word 'porta' which means gate or gateway ; and many researchers agree it is a single, personalized interface where users can access information, resources and services in a secure, consistent and customizable manner (Bajec and Krisper, 2005).

A Web portal is also a type of website, but it differs in content and services from a typical website that provides only specialized information. A Web portal is a launch pad to a host of web based services such as email, shopping, gaming, news, weather and so on whereas a website is concerned with providing information about a company/organisation only. All websites are not portals.

Portals are a way of bringing together all the information that users need in a single place, accessible in a coherent way that provides for enhanced productivity (Franklin, 2004).

Uden and Salmenjoki (2007) defined portals as gateways to information and services on the Web, in both the public internet domain and corporate intranets.

Sulaiman *et al*. (2012) stated that in today's business arena, portals are very important in getting information and service delivery efficiency and effectiveness; it has the potential to develop the performance of an organization in terms of productivity and business process.

Koshy (2013) observed that a need-based, demand driven web portal for research management in KAU would act as a strong tool for efficient research management in the university.

User-Centered Design (UCD) of a website

User-centered design is a participatory design which is a set of theories for, and the practice of, using users' preferences to design products or systems (Bodker *et al*., 1988).

Carroll *et al*. (2000) presented an example of how *User-centered design* was applied in the design of a virtual school to support collaborative learning in middle-school and high-school physical science. Participatory design was employed in conceptualizing the project, foreseeing that the teachers' active participation must be continued even after the project ended to bring the

sustainable systemic change to public education that the project originally set forth as its main purpose. This project resulted in an enviable level of acceptance and use for the designed product.

Frick *et al.* (2005) added that UCD involves a rapid prototyping process with front and back ends to it. Although the focus was on Web design, the work demonstrates that rapid prototyping itself is needed for designing products that work well with intended users. Their inquiry based, iterative design process was developed after need assessment of the stakeholders, rapid prototyping on paper with usability testing, further rapid prototyping on computers with more usability evaluation, and creating and maintaining the product designed, as suggested by Reigeluth and Frick (1999).

A good example of participatory web design in which the stakeholders play major roles throughout the process was done by Reigeluth and Duffy (2007) in the Decatur Township school district. The participants include school teachers, administrators, students, their parents, and community members, as well as the design leaders. It helped them to achieve the goal of realization of their vision regarding what they want their school system to be.

User-Centered Design (UCD) of a web site is a philosophy and process wherein the deliverables of the host institution and the priorities of its end-users match. Such a design is a multi-stage process of need assessment, content generation and testing the validity by the users. Information and advisory text, visual design, organization and navigation should all work together to make it user-friendly. It tries to optimize the product around how users can, want, or need to use the site, rather than forcing the users to change their behaviour to accommodate the site (Brown and Adler, 2008).

User-centered design is an approach that places users at the centre of the design process, starting from the stages of planning and designing the system requirements to implementing and testing the product (Baek *et al.*, 2008).

Rubin *et al*. (2008) stated that in user-centered design (UCD), all "development proceeds with the user as the centre of focus." Early focus on users and tasks, empirical measurement and testing of product usage, and iterative design are the important principles of UCD.

User-centered design (UCD) is a method of designing products or services with the needs and capabilities of the user as the primary factor in most design decisions (Nielsen, 2012).

Web/site prototype

A prototype is a design tool used to help create a new product, much like a model. Prototyping is crucial to any product development as allows the developer to check for flaws and to make sure the product is easy to use. It also helps to make sure nothing is going to go wrong with the product.

A web prototype is a rudimentary working model of a website, usually built for demonstration purposes or as part of the development process. This is the basic version that is built, tested, and then reworked as necessary until an acceptable prototype is finally achieved from which the complete system can be developed (Rose, 2005).

A prototype model is built to test a concept or act as an early platform to validate that a design meets the target users' requirements. The prototype will typically include as many, if not all, priority aspects of the design including the hardware/software operation, mechanical and external interfaces. Of course, the goal of the prototype typically dictates which prototype implementation is used at what stage of the project's overall design cycle (Bailey, 2011).

A web prototype is developed based on the currently known requirements. By using this prototype, the client can get an "actual feel" of the system, since the interactions with prototype can enable the client to better understand the requirements of the desired system. Prototyping is an attractive idea for complicated and large systems for which there is no manual process or existing system to help determining the requirements. The prototypes are usually not complete systems and many of the details are not built in the prototype. The goal is to provide a system with overall functionality (Prasad, 2013).

2.3. ROLE OF WEBSITE AND WEB PORTAL IN AGRICULTURE

In an increasingly competitive web design environment, websites have to be to the utmost need and satisfaction of the clientele. Thus web designers have to choose those design elements that maximize the likelihood of user satisfaction, tempting users for frequent site visits (Zhang *et al*., 1999).

A member of Amalgamations Group, the TAPE, Chennai had launched an agricultural extension portal entitled farmindia.com for rendering information, advisory service, dissemination of production technologies, marketing of farm commodities, with provision for interaction, chatting and repository retrieval (Srinivasan *et al*., 2002).

An agricultural information portal is therefore a one-stop point of access for researchers to agricultural information resources, services, tools and facilities, and includes virtual conferencing, instant messaging systems, virtual team workspace, discussion forums, document sharing, and electronic white boarding (Chisenga and Brakel, 2005).

Frempong and Braimah (2006) found that 96 per cent of farmers believed that agricultural websites could provide access to information on farm production and marketing.

Websites with focused contents are known as portals. Agricultural portals offer users 'everything at once and at one place'. This means, most of their information needs would be met instantaneously. Users need not waste time seeking information at far off places (Silerova and Lang, 2006).

Besides the mandates and service agenda of the host organization, the information platforms and websites for farmers should contain general information , technology, post harvest handling, input price and availability, organic farming, management of pests and diseases, information on crop insurance , question answer services, marketing information and trade facilitation (Babu, 2006).

Myer (2007) discussed the importance of designing websites and highlighted the *modes operandi* to analyse the home page, navigation, site design, links, labels, search and search results, readability, performance and content.

Mekonnen *et al*. (2009) stated that having an agricultural portal with focused resources on Ethiopian agriculture creates efficiency and relevance for the envisaged audiences and contributes to the market oriented agricultural development strategy of the country.

The information and services should be temporally and spatially demand-driven, relevant and easily accessible to the stakeholders. Thus, the websites and portals of extension organizations have great demand in Kerala (Swafah, 2011).

By the implementation of sequence submission portal for the integration of genomic data pertaining to various agriculturally important species, it would provide higher level of data storage for faster access to the user. It would be made available on the public domain and facilitate information exchange through global exchange programmes, national, international consortiums for sharing resources with proper credit/ acknowledgement to the contributor for their findings. It would be feasible to extract meaningful biological information for enhancement of agricultural productivity through development and deployment of the parallel computing tools to enable faster access of the resources available on this portal (Lal *et al.,* 2013).

2.4. INFORMATION NEEDS OF THE USERS

According to Devadason and Lingman (1997), the understanding of information needs is essential as it helps in the planning, implementation, and operation of information system, and services in work settings.

Zhang (1998) stressed that a thorough understanding of user information needs are fundamental to the provision of successful information services.

Information need is defined as a state or process started when one perceives that there is a gap between the information and knowledge available to solve a problem and the actual solution of the problem. Information use depends on the appropriateness of such information in solving a certain problematic situation (Miranda and Tarapanoff, 2007).

Information competencies are defined as the capabilities developed to reach the solution of a problem by searching for new information or knowledge that could fill the perceived gap. Information competency can be identified on three dimensions: cognitive (knowledge); affective (attitude); and situational (abilities). They correspond to *knowing*, *know how*, and *know how to act* in work situations when one is dealing with information problems that need solving on a daily basis. According to Miranda and Tarapanoff (2007), information competency is a group of competencies put into action when one is working with information. It could be expressed by the

expertise forged when someone works with the information cycle and technologies and with different information contexts. This competency, put into operation in work situations, can be seen as one of the requirements for the necessary professional profile to work with information. It crosses different business processes (managerial and technical) and different parts of an organization or activity. It can be compared to basic competencies that are acquired in educational situations and formalized in cognitive and behaviour conquests. It is necessary to face problematic situations where information work has a primary role.

The main information needs of ICT using farmers as reported by Hassan (2008) were: market price of farm commodities, information on bio pesticides, bio fertilizers, organic farming and plant protection.

For successful use ICT by the farmers and rural communities, the first step is to empower farming communities to define their own needs (Ballantyne, 2009).

Koshy (2013) found that there was significant difference in the information needs of researchers and research administrators of KAU regarding the details of research results, technologies commercialised, recently developed technologies and success stories of technology utilisation.

2.5. CONTENT ORGANISATION IN WEBSITES

A survey conducted by Chisenga and Brakel (2004) revealed that international agricultural organisations are using their web sites to provide access to online databases, electronic publications, tools and software, discussion forums, information retrieval tools, data sets, online staff directories and links to various web resources.

Freeman and Yin (2005) opined that when browsing a large set of unstructured documents, it is advantageous if the documents have been organised and presented in a way that makes navigation efficient, understanding underlying concepts easy and locating related information quickly. They proposed a new method termed Treeview self-organising maps (Treeview SOMs) for clustering and organising text documents that clearly show underlying contents of the documents and help in browsing the document set more efficiently.

In the Indian scenario, there were researches on Indian users' expectations for the location of web objects on informational websites (Shaikh *et al*., 2006) and location of web objects and links in the websites of universities in Tamil Nadu (Kumar *et al*., 2010). The latter observed most of the web objects are common among the universities. Roth *et al.* (2010) indicated that the users generally agree upon the fixed locations for certain common web objects.

The content of any website is paramount to a site's success. High quality content will increase the site's likelihood of converting visitors. But beyond that, a site also needs to organize that content in a way that makes it accessible to visitors. Prioritizing the content figuring out what content is most important and how to arrange it will help in building a user friendly site (Chapman, 2010).

Raju and Harinarayana (2011) had analysed the location of web objects in library web sites.

Idler (2012) reminded us that content is the king. Content presentation by writing better web content, improving the readability on the site and increasing web credibility through content presentation are important in the development of a successful website.

Understanding that the location of web objects in the university websites is a key for the success of that website, a web analytic study was carried out by Suresh and Gopalakrishnan (2012) to determine the organization of content in the websites of Agricultural Universities in India. Their study identified 20 different web objects used in the Academic websites especially University websites, as listed in Box 1.

Koshy (2013) observed that researchers and research administrators of Kerala Agricultural University wanted information on organisational set-up, thrust area and PC group, contact information, capacity building, publishing of research works, research projects, research achievements and recognitions in the Directorate of Research web interface.

Box 1. Web objects used in the Academic websites (Suresh and Gopalakrishnan, 2012)

• About us / History	• Extension
• Academics	• Internal Search Engine
• Administration	• Library
• Admissions	• Links
• Back to Home	• Logo
• Careers	• Photo Gallery
• Contact Us	• Publications
• Copyright	• Research
• Current Events / News	• Site Map
• E-Mail	• Title

2.6. TESTING AND ASSESSMENT OF WEBSITES/PROTOTYPES BY THE END-USERS

End-user assessment of the e-commerce sites is necessary to predict user satisfaction and acceptance (Srivihok, 2000).

A strong view point emphasizing the importance of clients' preferences in website design and assessment by them was given by Salum and Pather (2006). They state that while the web-designers are developing web-sites with a service quality mindset, more can be done to take into account customer expectations.

Prototype testing involves users performing certain tasks with an early version of a product and observing them to see where they are encountering difficulties. The three levels of prototypes that can be used to get user feedback, even before you have a working system are; paper, low-fidelity, and high-fidelity.

- *Paper prototype* - use sketches of the user interface on paper.
- *Low-fidelity prototype* - A prototype quickly put together with tools such as Microsoft PowerPoint or Adobe Dreamweaver.

- *High-fidelity prototype* - An early version of the application which may be incomplete; for instance it may have some elements hard-coded which will be interactive in the future. They can be very helpful coming closer to a final design.

As part of testing the higher-fidelity prototypes test there can be a “naturalistic usability test" where the user is asked to determine their own tasks as they would normally do when using the system. While it is still helpful to have the user thinking aloud during a naturalistic usability test, it's important that they are not interrupted in their thought process (Crew, 2007).

Interacting with participants in a calm and neutral manner may well be the most difficult part of doing website usability testing. Dumas and Loring (2008) present the ten "golden rules” that maximize every session's value, offer targeted advice on how to maintain objectivity, discuss the ethical considerations that apply in all usability testing, demonstrate good and bad moderating techniques, explain how to reduce the stress that participants often feel and consider the special requirements of remote usability testing. These are all essential factors for an effective usability testing of a website by the end users.

According to Chapman (2011) usability and user experience testing was vital to creating a successful website.

Gube (2011) found that the most important and obvious thing to test for is whether users are able to accomplish their tasks and goals when they come to the website. It must be ensured that they are able to do so in the best and most efficient way possible.

User testing of the website shows focussing on key research questions and encouraging users to behave as naturally as possible can yield better results and this process is essential to increase the usability of any website (Rees, 2013).

2. 7. QUALITY ASSESSMENT OF THE WEBSITES

The six criteria used by the International Academy of Digital Arts and Sciences in webby awards in website assessment quality include (1) content, (2) structure and navigation, (3) visual design, (4) functionality, (5) interactivity, and (6) overall impression (Moustakis *et al.,* 2004).

Stefani and Xenos (2008) proposed model was based on Bayesian Networks and ISO 912 that provides a quality assessment process aiding developers to design and produce e-commerce systems of high quality.

Chiou *et al*. (2010) presented a web strategic framework for website evaluation. The framework was designed to be applied by a specific website in terms of its goals and objectives through a five-stage evaluation process. As such the framework was strategic oriented for specific website rather than an overall representative of general website evaluation.

Kate (2010) summoned up that a good website assessment involves technical assessment, user surveys and comparison data with similar sites. It looks at all the site design and content management platforms available. Along with assessing effectiveness, efficiency, easy access and interactivity there should be provision for e-branding and e-commerce. As social media is now mainstream marketing, as important as a website itself, integrating social media is a must. Taking the time to ask users about all these factors to the clients is a so valuable process.

Hasan and Abuelrub (2011) proposed a general criterion for evaluating the quality of any website regardless of the type of service that it offers. The dimensions of the criteria are content quality, design quality, organization quality, and user-friendly quality. These dimensions together with their comprehensive indicators and check list can be used by web designers and developers to create quality websites to improve the electronic service and then the image of any organization on the Internet.

A quality evaluation model to measure the quality of business-to-consumer electronic commerce systems was developed after weighting and adding the quality factors collected from the viewpoints of Saudi experts and end users. This can help developers design and produce e-commerce systems of high quality targeted at Saudi end users (Al-Safadi and Garcia, 2012).

The main aspects of usability in examining the websites by the users are: (i) effectiveness – the degree of correspondence between the website functionality and users needs, goals and search and navigation skills; (ii) efficiency - a quantification of the amount of useful activities through users' interactive browsing behaviour and (iii) user satisfaction – subjective, emotional and aesthetical user estimation about the interaction with the website (Stoimenova and Christozov, 2013).

A quality assessment on a website can be done both with user testing and through a questionnaire**.** The purpose of a quality assessment is to measure specific experience and content that is influential of a website and how well the user experiences and values these qualities. The assessment can contain questions about navigation, how relevant the content is, brand values, and comparisons with competitors (Fabbri, 2013).

2.8. CONSTRAINTS IN USING WEBSITES

Both the state and federal government should work towards the development of telecommunications infrastructure in all the rural areas (information centres). Griffith and Smith (1994) have reported from Nigeria that being equipped with up to date information and communication gadgets, such as computers with internet access, local area and wide area networks, radio and television sets, telephones and fax machines, multimedia projectors, video and audio recorders, will help the rural farmers to access agricultural information for optimal farm production overcoming the constraints.

The new ICTs were very limited in some areas by the lack of telecommunications infrastructure and reach only a small number of people in developing countries (Rudgard *et al*., 2011).

Illiteracy, non availability of electricity supply and inability of radio and television stations to broadcast agricultural information programmes in native dialect, lack of access roads for regular visits by extension officers, poor public relation of some extension staff, poor radio and television signals and lack of funds to purchase newsletters, leaflets on agricultural information were some of the constraints reported by farmers in Nigeria in accessing latest agricultural information through mass media and websites (Obidike, 2011).

The study results of Rahman (2011) showed that there were many constraints faced by the extensionists in the use of ICT including lack of personal computers, high cost of ICTs in general, lack of technical know-how, lack of good infrastructure, lack of internet centres of Ministry of Agriculture in the villages, and lack of internet cafes in the villages.

According to E-Agriculture and GenARDIS (2011) rural women in developing countries were among those who had the least access to ICTs, a result of the following constraints:

- Lack of financial resources to secure the use of ICTs.
- Higher levels of technological and language illiteracy among women and girls.
- Norms that discourage women and girls from using technology.
- Lack of control over and ownership of technology.

However, use of ICT facilities was constrained by the problem of maintenance, low level of production and rural poverty as found by Aphunu and Atoma (2011).

Mabe (2012) reported failure of service, poor basic infrastructure that encourages ICT, inability to maintain the ICT, high cost and non-availability of technical personnel as constraints in using websites.

The most common challenges to the adoption of ICT by farmers as reported by Musa and Githeko (2012) were low education levels, low income, cultural inertia, inadequate ICT skills among researchers and shortage of electricity. The paucity of relevant content in local languages was also cited as a hurdle to adoption and use of ICT.

Ogbonna and Agwu (2013) found that constraints in the use of ICTs by farmers included: high cost of ICT infrastructure; low income; frequent power failure; lack of necessary skills and poor ICT training.

Ineffective ICT policies of the government even when ICT tools are available lead to poor access and reception of information by the farmers (Sani *et al*., 2014).

MATERIALS
AND
METHODS

3. MATERIALS AND METHODS

This chapter deals with the description of the methods and procedures adopted in conducting the present research study, which is furnished under the following subheadings:

3.1. RESEARCH DESIGN

Kerlinger (1964) defined research design as the plan, structure and strategy to carry out the research. The present study is based on action research. Kurt Lewin, a social psychologist and educator who worked on action research throughout the 1940s in the United States, is credited with coining that term to describe work that did not separate the investigation from the action needed to solve the problem. Topics chosen for his study related directly to the context of the issue. His process was cyclical, involving a non-linear pattern of planning, acting, observing, and reflecting on the changes in the social situations. Lewin (1946) had argued that in order to understand and change certain practices, practitioners from real social world are to be included. This gave action research a method of acceptable enquiry.

Action research is focussed on immediate application giving emphasis to a problem in a local setting and the findings are evaluated in terms of local applicability, instead of universal validity (Best and Khan, 1986). It provides a set of decisions on how to systematically gather information towards practical objectives (Ramirez, 1986). Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction (Gilmore *et al.,* 1986).

Action research provides more opportunity to change the mode of operation to further improve the programme by overcoming the pitfalls, if any. The essentials of action research design follow a characteristic cycle whereby initially an exploratory stance is adopted, where an understanding of a problem is developed and plans are made for some form of interventionary strategy. Then the intervention is carried out (the "action" in Action Research) during which time, pertinent observations are collected in various forms. The new interventional strategies are carried out, and the cyclic process repeats, continuing until a sufficient understanding of (or implement able solution for) the problem is achieved. The protocol is iterative or cyclical in nature and is intended to foster deeper understanding of a given situation, starting with conceptualizing and particularizing the problem and moving through several interventions and evaluations.

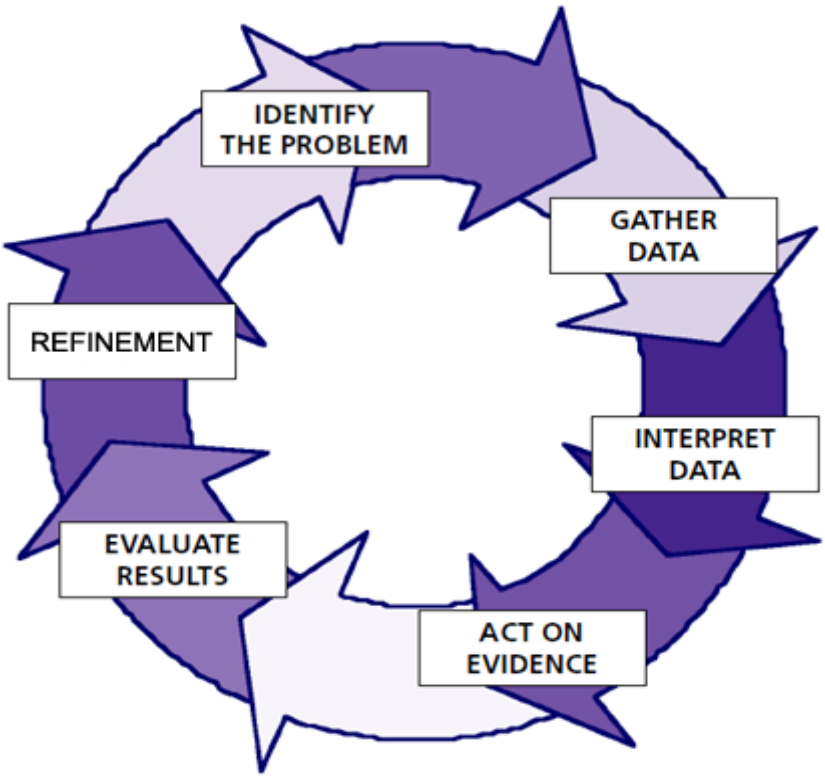


Fig. 1 Action research cycle

In the present study, the problem was identified from the absence of a proper extension website for KAU. The available website of KAU, at www. kau.edu does not provide much space for DoE and adequate and timely information on agricultural technologies and extension activities. This gap, together with the long felt need of Directorate of Extension to have an

interactive website, led to the present study on user-centered design and testing of the bilingual website prototype for DoE, KAU. The collection of data is an important step in deciding what actions are to be taken. To generate content for the website, the information needs of the users were collected through questionnaires, brainstorming sessions and focus group discussions. These data were analyzed and the Information Need Indices (INI) were found for all the items of the website. Interpretations based on the INI, suggestions from the users, and desktop analysis of various websites, led to the action of designing the first web prototype for DoE, KAU. In the second step, this prototype was evaluated by the end-users to further refine the same. Scores were given to web assessment traits. Based on the scores, suggestions and constraints reported by the users, the prototype was refined leading to the second web prototype for DoE, KAU. The second prototype thus developed would act as the foundation for the final website of Directorate of Extension, Kerala Agricultural University.

3. 2. LOCALE OF THE STUDY

Kerala state was the locale of the study. Kerala is the first e-literate state in India, as the result of implementation of Akshaya project, which was first started in the rural Malappuram district of the state in 2002, with the goal for one person in every family to be computer literate in that district. The IT policy of the Government, implemented through Information Kerala Mission, has laid emphasis on using ICT in all walks of life to improve living standards. FRIENDS (Fast Reliable Instant Efficient Network for disbursement of Services), SEVANA (Internet facility in rural libraries) and KISSAN Kerala (Karshaka Information Systems Services and Networking) are some successful initiatives within the state.

3.3. SELECTION OF RESPONDENTS

All the agricultural research stations of KAU and the Krishi Bhavans in Kerala are computerized and number of famers, researchers and extensionists in the state using ICT for getting agricultural information, advices and solutions for their field problems are increasing day by day. Hence three categories of respondents were selected for the study, viz; Scientists of Kerala Agricultural University (KAU), Extensionists of the Kerala State Department of Agriculture (DoA) and the Farmers of Kerala. The selection of respondents for the study is pictorially represented as shown in Figure 2 and 3.

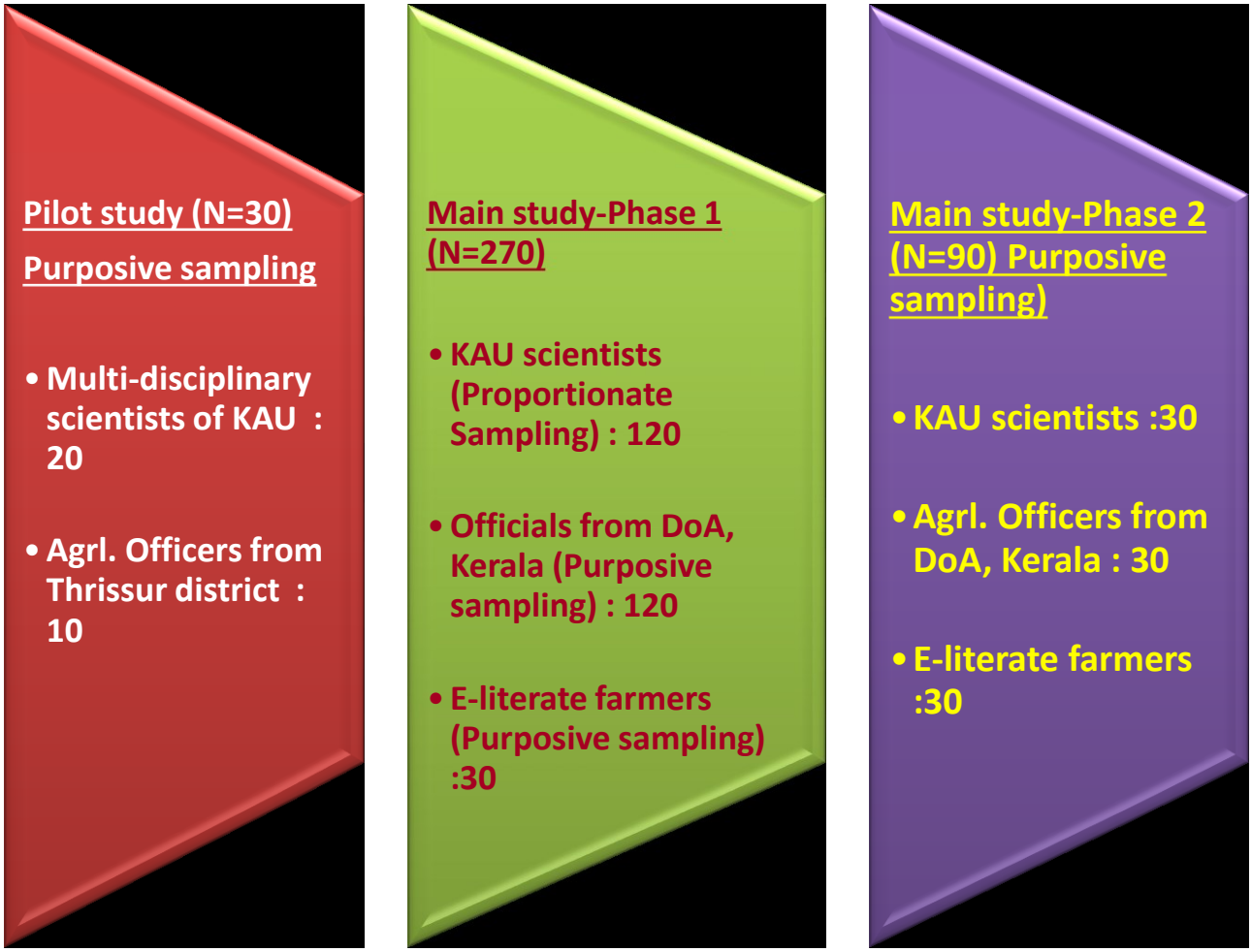


Fig 2. Pictorial representation of selection of respondents

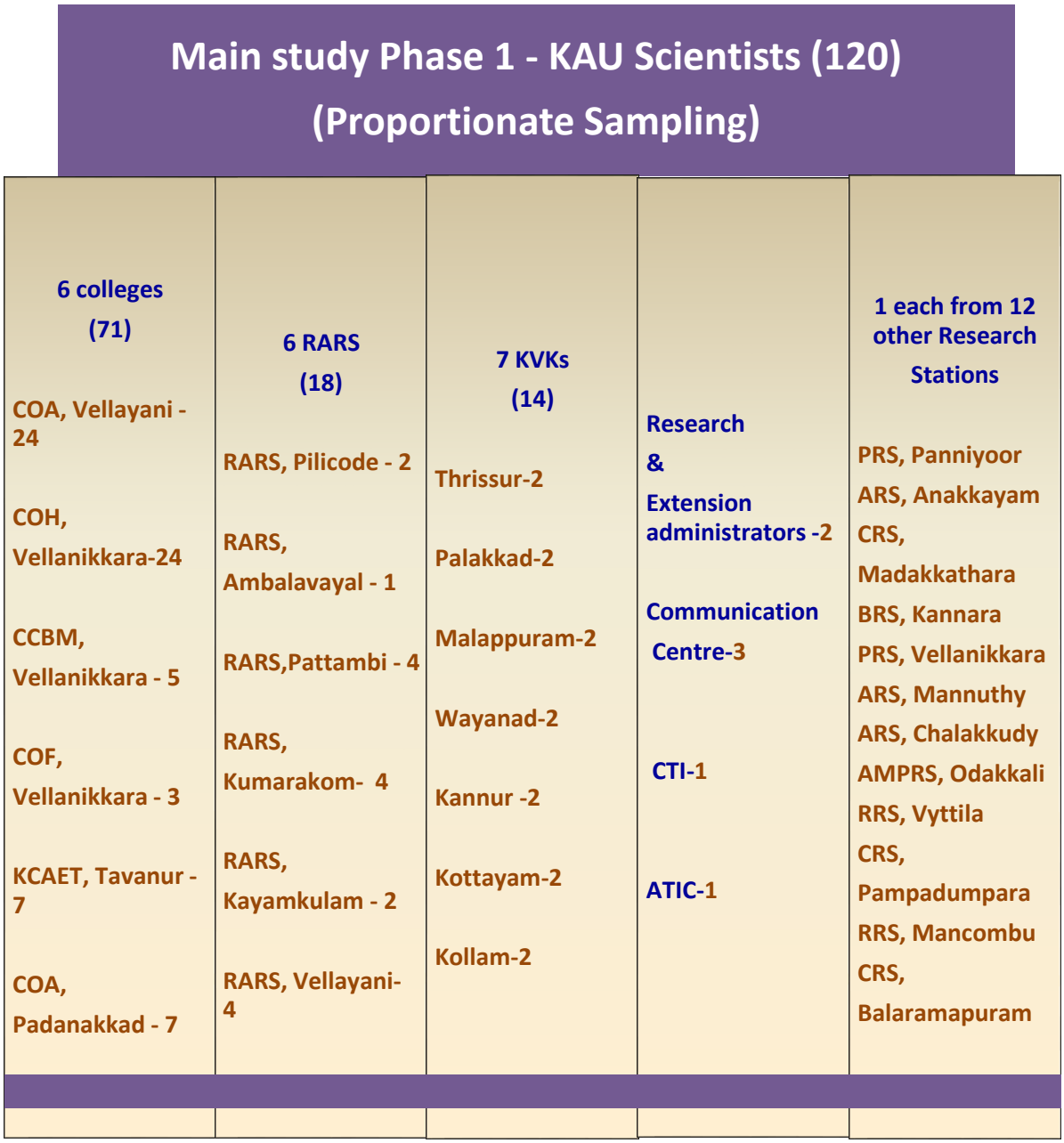


Fig 3. Pictorial representation of selection of officials from DoA, Kerala

3. 3. 1. Pilot study

For the pilot study, a group of 30 purposively drawn judges comprising 20 multidisciplinary scientists of Kerala Agricultural University (KAU) and 10 officers of the State Department of Agriculture were drawn specifically from Thrissur district of Kerala.

3. 3. 2. Main study-Phase 1

For the phase 1 of the main study, there were 270 respondents selected from the three categories – 120 KAU scientists, 120 officials from State Department of Agriculture and 30 farmers who were regular internet users. They were selected in order to identify their preferences for information needs and formats of presentation in the DoE website.

A sample of 120 scientists of KAU were drawn using proportionate sampling from the research and extension administrators, scientists from major disciplines of KAU belonging to the six colleges, the six Regional Agricultural Research Stations, all the other research stations under KAU, the seven Krishi Vigyan Kendras (KVK) of KAU, the Communication Centre, the Central Training Institute (CTI) and the Agricultural Technology Information Centre (ATIC).

A purposive sample of 120 officials was drawn from the state level and district level hierarchy of the Kerala State Department of Agriculture ranging from the Agricultural Officers (AOs) at the grassroots (Panchayath) level to Additional Directors at the apex level, as listed below :

State level Additional Directors : 3

State level Deputy Directors : 3

Officers of the Farm Information Bureau (FIB) : 2

District level Principal Agricultural Officers (PAOs) : 14

Deputy Directors of Agricultural Technology Management Agency (ATMA): 14

Assistant Directors of two agriculturally most predominant blocks of all the 14 districts of Kerala : 28

Two Agricultural Officers from each of the selected 28 Assistant Director of Agriculture (ADA) blocks : 56

A purposive sample of 30 farmers was drawn from Thrissur and Palakkad districts, who used internet/websites or visited Akshaya Kendras. Akshaya-e-Kendras are the most important strategic decision of Akshaya Project of Kerala, which are actually ICT access points that provide fast, reliable and transparent online services to the public. The farmer respondents were selected in consultation with Agricultural Officers and also from the FAQ repository of the agricultural portals viz; www.kissankerala.net, www. farmextensionmanager.com, www.celkau.in and www. theyoungfarmer.com.

3.3.3 Main study-Phase 2

For the phase two of the main study, purposive samples of 30 scientists of Kerala Agricultural University (KAU), 30 Officers of the State Department of Agriculture and 30 farmers, who were regular internet users, were selected. They were selected to assess the developed web prototype and to take part in the usability testing exercises.

3.4. OPERATIONALISATION AND MEASUREMENT OF VARIABLES

Based on the objectives, review of literature and discussions with experts, the following variables were selected for the study:

3.4.1. Observation for the main study-phase 1

a) Information needs of the stakeholders

The information need is a factual situation in which there exists an inseparable interconnection with information and need. It contributes to the achievement of a genuine purpose (Prasad, 2012).

Information need is defined as a state or process started when one perceives that there is a gap between the information and knowledge available to solve a problem and the actual solution of the problem (Miranda and Tarapanoff, 2007).

Information need is operationalised in the present study as the perceived information requirement of the stakeholders for the website of Directorate of Extension, Kerala Agricultural University. The information needs were identified by developing a domain under 15 captions as shown below.

1. About DoE, KAU
2. Schemes and Projects
3. Showcase of technologies
4. Locating your nearest KAU KVK
5. Crop Information
6. Agri Market Advisor
7. Weather
8. Promising agri-enterprises
9. Forthcoming events (in DoE/ KAU)
10. News and Information (in DoE/ KAU)

11. Publications (of KAU)
12. Media Gallery
13. Important links
14. Social media links
15. Contact Us

Under each caption, the information need items were categorised by collecting an exhaustive list from various sources like literature and by desktop analysis of websites of various organizations.

The respondents were asked to rate each item in a six point rating scale namely 'Highly Relevant', 'Relevant', 'Somewhat relevant', 'Less relevant', and 'Least Relevant' with a scoring of 5,4,3,2,1 respectively. Based on the scoring, Information Need Indices (INI) were calculated for each item by each of the three groups of respondents viz; scientists, extensionists and farmers.

$$\text{Information Need Index (INI)} = \frac{\text{Total obtained score}}{\text{Maximum possible score}} \times 100$$

The value of Information Need Index varied from a minimum of 20 to a maximum of 100. Those items with Information Need Index less than the mean value of 60 were avoided.

3. 4. 2. Observations for the main study-phase 2

Eight main attributes were identified to evaluate the web site prototype based on relevant literature search. Sub-items were identified under each category taking into consideration the results of the pilot study.

The respondents were asked to evaluate each trait of the website on a five point rating scale, ranging from five to one, indicating 'excellent' 'good', 'fair', 'poor' and 'very poor' respectively. Based on the scoring, mean score of each sub-item was calculated for the three groups of respondents viz; scientists, extensionists and farmers. Average of these mean scores of the sub-items by each group gave the score for the main observations which is the sub sample mean. The mean of these sub samples, that is the grand mean, was found for each of the eight

main observations. The attributes as well as their sub-items, with their operational meaning/definition are listed and explained hereunder:

(i) Contents and information management

Content is in essence, any type or 'unit' of digital information. It can be text, images, graphics, video, sound, documents, records etc., or in other words anything that is likely to be managed in an electronic format. Content management comprises the effective management of the content, by combining rules, process and/or workflows in such a way that its electronic storage is deemed to be managed rather than un-managed. Content and information management facilitate the creation, management and delivery of content. It was measured through attributes like relevance, coverage, accuracy, reliability, clarity and depth of contents.

Relevance means the practical applicability of the contents to the farming community.

Coverage specifies the adequacy of topics included in the website.

Accuracy answers whether the attributes of website are right or proven results or effects.

Reliability points to the credibility and dependability of the contents provided by the site.

Clarity is that attribute of a website, which conveys the intended meaning without any ambiguity.

Depth denotes the quantity of unique and relevant content of the website.

(ii) Website design and layout

Website design is the process of creating websites encompassing aspects of web page layout and graphic design. Web page layout is the arrangement and the composition of the content. Graphic design describes the visual appearance of a website involving contrast, colouring, fonts, imagery and general appeal of the website.

Organisation of the website indicates the professional tone in its design and layout.

Colour scheme indicates the colours used for the pages, fonts and background of the website.

Fonts show the type and size of fonts used in the website.

Adequacy of multimedia checks whether photos, images and videos are adequate in the website.

General appeal shows whether the website is pleasant and appealing to the users.

(iii) Linkage with relevant internet resources

Linkage facility of the website shows whether it links with other useful and relevant destinations in the web. It also checks whether these web links are ***adequate*** and whether they are ***functioning properly***.

(iv) Provisions for scaling up and updating

Provision for scaling up is the ability to enrich a website into a large web service improving the content or quality of the website and the possibilities of using it as training or online course platforms. Provision for updating tells whether the website is having the ability to add up-to-date and relevant information and whether it indicates how fresh the information on the site is.

(v) Information retrievability

It is defined as the ease with which a particular content or document is made accessible to the user by the website. This attribute tests the ***easiness and quickness*** of retrievability of any content.

(vi) Interactivity

Interactivity of a website indicates the degree to which it creates an interactive experience to the users making them actively engaged with the site beyond simply reading text and viewing images. This can check the performance of interactive facilities provided in the website.

(vii) User-friendliness

A user-friendly website effectively and efficiently satisfies a specified set of users by allowing them to achieve a specified set of tasks in a particular environment. A user-friendly website is a well organized site with acceptable format of content, quick loading, easy navigation and readability that are instinctive to the users.

Format of the content includes the lucidity and alignment of the content.

Speed is the quickness of loading of the web pages for receiving the information from the same.

Navigation checks whether the page to page, forward and backward movement and the like are easy in the website.

Readability denotes the easy comprehension of the content and ensures the balance between design, layout and content.

(viii) Perceived extent of use

Perceived extent of use reflects the perception of users about the possible scope of use of the website in terms of area, organizations, users and purpose. They were asked to tick the options given to them, if they thought those were correct.

3.5. HYPOTHESES SET FOR THE STUDY

Based on the objectives and review of literature, the following null hypotheses were set for the study.

1) There exists no significant difference in the information need indices among the three categories of respondents.

2) There exists no significant difference in the mean scores of the website assessment attributes by the three categories of respondents.

3.6. METHODOLOGY USED FOR THE STUDY

The methodology for user-centered design (UCD) of the bilingual web prototype for DoE, KAU was based on the guidelines for UCD project as per ISO 13407 (1999). The process consisted of four main steps.

1) Requirement specification of the web prototype
2) Requirement gathering for the web prototype
3) Design of the web prototype
4) Evaluation of the web prototype

3.6.1. Requirement specification of the web prototype

The web prototype was designed for the Directorate of Extension of Kerala Agricultural University. The prototype was visualised to serve as an effective model, based on which the final website for DoE could be launched. The purpose of the DoE website was to act as an efficient agricultural extension platform for the public, providing latest technologies, information and online consultancy services of KAU.

3.6.2. Requirement gathering for the web prototype

The most important requirement for an extension website is content. Content generation for the web prototype was based on the information needs of the respondents. Information need assessment for the user-centered design was conducted in two stages – pilot study and main study phase 1.

3.6.2.(i). Pilot study

A pilot study was conducted to identify the major prospective stakeholders of the intended website and to explore the main and sub contents of the website. It also identified the

sub-items of eight main assessment attributes of the prototype. A blend of questionnaires and brainstorming sessions were employed to get the feedback of the respondents, who included 20 multidisciplinary scientists of KAU and 10 officers of the State Department of Agriculture. Based on the responses, the information need assessment questionnaire was modified by adding relevant items keeping in view the objectives of the study. Utmost care was taken with regard to the wording and format to eliminate mistakes and ambiguity. The final, structured questionnaire thus developed was used for the phase 1 of the main study.

3.6.2.(ii). Main study-phase 1 (Information Need Assessment)

First phase of the main study was to identify the information needs of the stakeholders and to build the website based on these preferences. Structured questionnaires were mailed to elicit response from the 120 scientists of KAU and the 120 officers of the State Department of Agriculture. Focus group interviews were conducted to bring out responses from the 30 farmers, for which semi structured interview guides were used.

3.6.3. Design of the web prototype

A user-centered, bilingual (English and Malayalam), high fidelity website prototype, was developed after incorporating the suggestions of the 270 respondents. It was developed as a sub-domain and was temporarily hosted online, under the web address: http:// www.celkau.in/DE/.

3.6.4. Evaluation of the web prototype (Main study-phase 2)

Evaluation of the prototype included assessment of the prototype attributes and usability testing of the prototype.

3.6.4. (i) Assessment of the prototype attributes

The link of the hosted web prototype (http:// www.celkau.in/DE/) was mailed to the respondents, viz; 30 scientists of KAU, 30 Officers of the State Department of Agriculture and 30 farmers. Online testing saves cost and engages a geographically dispersed audience much more easily than hard copy. They were directed to familiarize with the website and were asked to give scores for the main and sub items of web assessment attributes identified after the literature review. Online questionnaires in Excel format were used for this purpose. Malayalam Excel questionnaires were provided to the farmers. The respondents were also requested to express their suggestions for further improvement of the prototype. The received suggestions were recorded. Rechecking was done whenever unclear responses were obtained.

3.6.4. (ii) Usability testing of the prototype

ISO 9241-11 (1998) defines usability as the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." Usability was also tested online by giving the same, specific task to all the respondents. The task was to fetch particular information from the developed DoE, KAU web prototype and to report it (See Appendix 3). All the respondents being e-literate, self-reported validation over email was used to determine the effectiveness of use, efficiency of use, and satisfaction of the user. The respondents were asked to report the correct answers for the task. Effectiveness of use was scrutinized by comparing the answers provided by the respondents with the correct answers. This helped to examine the number of respondents who have successfully and accurately completed the specific task assigned to them. Efficiency of use was measured by asking them to note down the time taken to successfully complete the task. Satisfaction was recorded by the user as the degree of comfort in using the website, as high level, medium level or low level (Joo *et al*., 2011). The constraints faced by them while taking the tests and using the prototype were recorded for further analysis of those problems.

3.6.5. Refinement of the web prototype

The results of the evaluation and the user feedback were incorporated into the design. The refined prototype was handed over to the host organisation along with the earmarked suggestions for the development of the final website by the DoE, KAU.

3.7 STATISTICAL TOOLS USED FOR THE STUDY

The following parametric and nonparametric statistical tools were used for the analysis of data:

3. 7. 1. Kendall's coefficient of concordance

Kendall's coefficient of concordance for ranks (W) is a nonparametric test that calculates agreements among raters as they rank a number of items according to particular characteristics. Kendall's coefficient of concordance was calculated to verify the agreement within the groups of 120 scientists, 120 extensionists and 30 farmers on the 15 main information needs. It was also used to find the agreement among the 90 respondents regarding the assessment attributes of the web prototype.

3.7. 2. Kruskal–Wallis one-way analysis of variance

The Kruskal-Wallis H test (sometimes also called the "one-way ANOVA on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. Using this test, we can decide whether the population distributions are identical *without* assuming them to follow the normal distribution.

Kruskal–Wallis one-way analysis of variance was used to find whether the scientists, extensionists and farmers differed significantly in their information needs regarding the 15 main contents of the website as well its sub-contents. It was also used to check if the respondents' mean scores varied significantly with respect to the features of web prototype assessment.

3. 7. 3. Paired t- test

The paired t test is a parametric test that provides a hypothesis test of the difference between population means for a pair of random samples whose differences are approximately normally distributed.

Paired t-test was done between 120 scientists and 120 extensionists to determine whether they differed from each other in a significant way regarding the information needs.

3. 7.4. Mean and grand mean

Mean is the average, obtained by dividing the sum of a collection of items by the number of items in the collection. Mean scores of 30 scientists, 30 extensionists and 30 farmers were calculated for comparative analysis of attributes of evaluation of the web interface. The grand mean is the mean of the means of several subsamples (Everitt, 2010). The mean score of the sub items under each main observation from each lot constituted the subsample mean. The mean of these subsample means is the grand mean. The eight main observations of prototype assessment were ranked according to this grand mean.

3. 7. 5. Percentage analysis

Percentage analysis consists of reducing a series of related amounts to a series of percentages of a given base. Percentage distribution of respondents who either needed specific information or who made a suggestion regarding the website prototype was worked out by dividing the frequency of an information need or suggestion with the total number of respondents

and multiplying the result by 100. It was also used for interpreting the prototype usability testing results.

3.8. Statistical package

Statistical package - SPSS Statistics 17.0 was used for the calculations.

RESULTS
AND
DISCUSSION

4. RESULTS AND DISCUSSION

The findings of the study are presented with appropriate discussions under the following headings**:**

4.1. Observations from pilot study
4.2. Observations from main study-phase1 (information need assessment)
4.3. Development of the web prototype
4. 4. Observations from main study-phase 2 (end user assessment of the prototype)
4. 5. Refinement of the web prototype.
4.6. Protocol for the development of a user-centered website.

4. 1. OBSERVATIONS FROM PILOT STUDY

4. 1. 1. Identification of major prospective stakeholders of the intended website

The pilot study identified the stakeholders of the website as well as the contents for the website. Agricultural scientists, agricultural extension officers and farmers were recognized as the major prospective stakeholders of the intended website. The other potential clients were identified as agripreneurs, researchers, school /college students, self-help groups, non-government organizations, banks, policy makers, other line departments, and private sector organizations.

4. 1. 2. Pilot exploration of the main and sub contents of the website

The pilot study came out with 15 main contents and their sub contents for the website. The main contents were : ‘About DoE’, ‘Schemes and Projects’, ‘Showcase of Technologies’, ‘Locating Your Nearest KAU KVK’, ‘Crop Information’, ‘Agri Market Informant’, ‘Weather’, ‘Promising Agri-Enterprises’, ‘Forthcoming Events’, ‘News & Information’, ‘Publications From KAU’, ‘Media Gallery’, ‘Important Links’, ‘Links To Social Network Media’ and ‘Contact Us’. (See Table1).

Table 1. Main contents of the website as explored by the pilot study

No:	Content	Respondents who found the item as 'essential' (n=30)	
		Number	Percentage
1.	About DoE	30	100
2.	Schemes and Projects	27	90
3.	Showcase of Technologies	30	100
4.	Locating Your Nearest KAU KVK	28	93.33
5.	Crop Information	30	100
6.	Agri Market Informant	30	100
7.	Weather	28	93.33
8.	Promising Agri-Enterprises	30	100
9.	Forthcoming Events	29	96.67
10.	News & Information	29	96.67
11.	Publications From KAU	30	100
12.	Media Gallery	28	93.33
13.	Important Links	27	90
14.	Links To Social Network Media	20	66.67
15.	Contact Us	30	100

The sub contents of the website under each main item as identified by the pilot study are given below (See Tables 2 to 12).

Table 2. Sub contents under About DoE, KAU

About DoE, KAU
History & Mandate
Vision & Mission
Services & Activities
Organizational setup
Staff profile
Constituent units of DoE, KAU

Achievements (of DoE)
Honours and awards (of DoE)
Success stories (of DoE)
Contingency planning & Planning for adverse situations

Table 3. Sub contents under Schemes & Projects

Schemes & Projects
Mission of Schemes &projects
Guidelines of funding agencies
Links to website of funding agencies

Table 4. Sub contents under Showcase of technologies

Showcase of technologies
Technologies developed (by KAU)
Technologies commercialized
Farmers' Innovations
Video clips of demonstration of technologies

Table 5. Sub contents under Crop Information

Crop Information
Crops (links to www.celkau.in)
Agri e-expert (links to www.celkau.in)
Availability & price of planting materials, bio control agents, organic manures,value added products from KAU

Table 6. Sub contents under Agri Market Informant

Agri Market Informant
Daily Market Price Information
Major markets in Kerala
Seasonal /farmer markets in Kerala
NGOs run markets in Kerala

Table 7. Sub contents under Promising agri-enterprises

Promising agri-enterprises
Mushroom cultivation
Honeybee rearing
Processing & Value addition of fruits & vegetables
Production of bio-fertilizers
Production of composts
Production of bio control agents
Plant propagation by tissue culture
Flower arrangement & dry flower products
Landscaping
Hi-tech/Precision farming
Plant propagation & Nursery management techniques
Medicinal plant cultivation

Table 8. Sub contents under Forthcoming events

Forthcoming events
Training programs *(in KAU)*
Technology week
Farmer scientist interactions
Exhibitions/Seminars/ symposia/workshop

Table 9. Sub contents under News & Information

News & Information
New releases
Ready for sale
Downloads
Letters and circulars
Geographical indications from Kerala (Agricultural and horticultural products)
Patents from Kerala Agricultural University

Table 10. Sub contents under Publications from KAU

Publications from KAU
List of publications
KAU Vision 2030
Publications in pipeline

Table 11. Sub contents under Important links

Important links
Public Agricultural Extension departments
Commodity Boards
Market Federations
ICAR Institutes

Table 12. Sub contents under Contact Us

Contact Us
Communication address
Feedback form
Discussion forum

4.2. OBSERVATIONS FROM MAIN STUDY-PHASE1

4. 2. 1. Information Need Assessment of the stakeholders

Information Need Indices (INI) of the respondents were calculated for the main contents as well as sub-contents of the proposed website. Tables 13 to 24 display these indices.

Table 13. INI of the stakeholders for the 15 main contents

No.	Contents	Information Need Indices		
		Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)
1.	About DoE, KAU	93.33	91.38	92.22
2.	Schemes & Projects	91.94	91.80	85.55
3.	Showcase of technologies	94.58	94.86	96.66
4.	Locating your nearest KAU KVK	92.91	91.25	90
5.	Crop Information	94.16	92.08	96.11
6.	Agri Market Informant	91.66	93.05	94.44
7.	Weather	91.25	88.47	92.77
8.	Promising agri-enterprises	94.02	86.11	94.44
9.	Forthcoming events	91.66	87.5	89.44
10.	News& Information	92.91	88.33	90
11.	Publications from KAU	93.33	90	90.55
12.	Media Gallery	93.88	90.55	92.22
13.	Important links	92.22	90.13	90.55
14.	Links to social network media	70.97	86.66	88.33
15.	Contact Us	97.36	95.97	98.33

Table 14. INI of the stakeholders for the sub contents of 'About DoE'

Contents	Information Need Indices		
	Scientists (n=120)	**Extensionists (n=120)**	**Farmers (n=30)**
About DoE, KAU			
History & Mandate	93.88	89.72	83.88
Vision & Mission	97.36	95.13	88.33
Services & Activities	98.47	91.52	92.22
Organizational setup	93.75	85.13	80
Staff profile	90	87.08	85.55
Constituent units of DoE, KAU	95.13	86.66	90.55
Achievements *(of DoE)*	92.22	84.44	91.11
Honours and awards *(of DoE)*	90.13	81.66	85.55
Success stories *(of DoE)*	90.83	89.02	88.88
Contingency planning & Planning for adverse situations	80.69	74.72	77.77

Table 15. INI of the stakeholders for the sub contents of 'Schemes & Projects'

Contents	Information Need Indices		
	Scientists (n=120)	**Extensionists (n=120)**	**Farmers (n=30)**
Schemes & Projects			
Mission of Schemes &projects	87.91	87.63	82.77
Guidelines of funding agencies	74.44	80.97	73.33
Links to website of funding agencies	72.5	81.11	68.88

Table 16. INI of the stakeholders for the sub contents of 'Showcase of technologies'

Contents	Information Need Indices		
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)
Showcase of technologies			
Technologies developed *(by KAU)*	98.33	94.72	93.88
Technologies commercialized	95.83	94.86	94.44
Farmers' Innovations	63.75	75.55556	91.11111
Video clips of demonstration of technologies	92.5	90.69444	92.22222

Table 17. INI of the stakeholders for the sub contents of 'Crop Information'

Contents	Information Need Indices		
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)
Crop Information			
Crops (links to www.celkau.in)	92.36	96.80	96.11
Agri e-expert (links to www.celkau.in)	92.77	93.19	90.55
Availability & Price of Planting materials, Bio control agents, Organic manures, Value added products	94.02	95	96.66

Table 18. INI of the stakeholders for the sub contents of 'Agri Market Informant'

Contents	Information Need Indices		
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)
Agri Market Informant			
Daily Market Price Information	90.97	94.86	94.44
Major markets in Kerala	85.97	84.86	90
Seasonal /farmer markets in Kerala	81.25	83.88	89.44
NGOs in Kerala doing agricultural marketing service	81.11	82.22	88.88

Table 19. INI of the stakeholders for the sub contents of 'Promising agri-enterprises'

Contents	Information Need Indices		
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)
Promising agri-enterprises			
Mushroom cultivation	87.63	86.66	88.33
Honeybee rearing	85.41	85.41	87.77
Processing & value addition of fruits& vegetables	86.80	85.27	87.77
Production of bio-fertilizers	82.5	81.66	86.11
Production of composts	85.13	87.08	91.11
Production of bio control agents	85.41	85.13	85.55
Plant propagation by tissue culture	84.16	84.58	90
Flower arrangement & dry flower products	84.58	81.66	78.88

Landscaping	84.72	81.25	79.44
Hi-tech/Precision farming	84.02	86.25	92.22
Plant propagation & Nursery management techniques	82.5	81.52	88.88

Table 20. INI of the stakeholders for the sub contents of 'Forthcoming events'

Contents	**Information Need Indices**		
	Scientists (n=120)	**Extensionists (n=120)**	**Farmers (n=30)**
Forthcoming events			
Training programs *(in KAU)*	87.77	87.63	90
Technology week	88.47	87.08	87.22
Farmer scientist interactions	88.61	88.19	86.11
Exhibitions/Seminars/ symposia/workshop	87.63	86.80	88.33

Table 21. INI of the stakeholders for the sub contents of 'News & Information'

Contents	**Information Need Indices**		
	Scientists (n=120)	**Extensionists (n=120)**	**Farmers (n=30)**
News & Information			
New releases	92.91	87.36	87.77
Ready for sale	93.05	89.30	90.55
Downloads	89.72	86.80	80.55
Letters and circulars	86.94	81.52	80.55

Geographical indications from Kerala (Agricultural and horticultural products)	87.91	81.66	82.77
Patents from Kerala Agricultural University	89.30	84.86	86.66

Table 22. INI of the stakeholders for the sub contents of 'Publications from KAU'

Contents	**Information Need Indices**		
	Scientists (n=120)	**Extensionists (n=120)**	**Farmers (n=30)**
Publications from KAU			
List of publications	90.41	82.36	90
KAU Vision 2030	86.52	81.52	78.88
Publications in pipeline	83.75	80.13	82.77

Table 23. INI of the stakeholders for the sub contents of 'Important links'

Contents	**Information Need Indices**		
	Scientists (n=120)	**Extensionists (n=120)**	**Farmers (n=30)**
Important links			
Public Agricultural Extension departments	82.36	86.80	87.77
Commodity Boards	81.11	83.88	82.77
Market Federations	82.22	82.22	81.11
ICAR Institutes	80	80.69	81.11

Table 24. INI of the stakeholders for the sub contents of 'Contact Us'

Contents	Information Need Indices		
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)
Contact Us			
Communication address	98.05	93.75	97.22
Feedback form	93.88	82.36	87.22
Discussion forum	84.30	82.77	80.55

The results of the analysis of the information needs are detailed hereunder:

4. 2. 1. Inter-rater agreement within scientists, extensionists and farmers in respect of the Information Need Indices (INI)

The results of Kendall's coefficient of concordance (W) test, (See Table 25), indicated that the inter-rater agreement within each group ranged from weak to moderate and was statistically significant at 0.01 level. Further, it is interesting to surmise that the 120 agricultural scientists were more united in their agreement regarding 'Links to social network media' (0.42) followed by 'Important links' (0.38) and 'Schemes and projects' (0.37). Majority of the scientists opined that links to social media is not an important content to be included in the DoE website. When social media is also acclaimed as an emerging agricultural extension tool internationally (Winstead, 2010), outlook of the scientists in this regard shows their insensitivity and unfamiliarity towards the developments of this field. The least agreement within the scientists were found for the information needs of 'Showcase of technologies'(0.27), 'Crop Information' (0.27) and 'Media Gallery' (0.27).

Among the 120 extensionists, the highest concordance was observed for the information needs of 'Schemes and projects' (0.50), 'Promising agri-enterprises' (0.43) and 'Links to social network media' (0.42). Monitoring schemes and projects as well as correspondence with the funding agencies are routine activities carried out by officials of the agricultural department. That might be the reason for their backing with respect to schemes and projects. They have encouraged adding the details related to agricultural enterprises and links to social media in the DoE website, which shows they are keeping abreast with the technological developments. Weak

concordance was found for the items like ‘Showcase of technologies’ (0.27), ‘Agri Market Informant’ (0.28) and ‘Contact Us’ (0.28).

However, in the case of 30 farmers, the agreement was highest for the information needs of ‘Agri Market Informant’ (0.62), ‘Media Gallery’ (0.55) and ‘About DoE, KAU’ (0.53). This supports the finding of Oyeyinka and Bello (2013) that market and price information are the most sought after information by the farmers around the entire world. They also wanted to include more audio-visuals related to agriculture in the website. Whereas, the least concordance was found in the information needs of ‘Schemes and projects’ (0.42), ‘Links to social network media’ (0.44), ‘Publications from KAU’ (0.44), ‘Locating your nearest KAU KVK’ (0.44) and ‘News and information’ (0.44). These contrasts in the interests of scientists, extension officers and farmers can be traced to the differences in their respective spheres of activity.

Table 25. Inter-rater agreement within groups of respondents

No.	Contents	Kendall's W values		
		Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)
1.	About DoE, KAU	0.28***	0.29***	0.53***
2.	Schemes & Projects	0.37***	0.50***	0.42***
3.	Showcase of technologies	0.27***	0.27***	0.51***
4.	Locating your nearest KAU KVK	0.30***	0.29***	0.44***
5.	Crop Information	0.27***	0.39***	0.49***
6.	Agri Market Informant	0.29***	0.28***	0.62***
7.	Weather	0.28***	0.40***	0.48***
8.	Promising agri-enterprises	0.28***	0.43***	0.50***
9.	Forthcoming events	0.29***	0.40***	0.51***
10.	News& Information	0.28***	0.39***	0.44***
11.	Publications from KAU	0.28***	0.39***	0.44***
12.	Media Gallery	0.27***	0.42***	0.55***
13.	Important links	0.38***	0.39***	0.52***
14.	Links to social network media	0.42***	0.42***	0.44***
15.	Contact Us	0.32***	0.28***	0.49***

*** Significant at 1% level

4.2.2. Differences in the information need indices among scientists, extensionists and farmers

The results of Kruskal-Wallis test show that the differences were significant at 0.05 level for ten items except in 'About DoE, KAU', 'Showcase of technologies', 'Locating your nearest KAU KVK', 'Agri Market Informant', and 'Contact Us'(See Table 26). All the respondents had agreed upon these five information items which are either directly beneficial for all users (like 'Showcase of technologies', 'Agri Market Informant' 'Locating your nearest KAU KVK',) or mandatory for any organisation's official website (like 'About DoE, KAU'and 'Contact Us'). Hence the null hypothesis, "there exists no significant difference in the information need indices among the three categories of respondents", is rejected and it is concluded that there is significant difference in the information needs among the three groups of respondents with respect to the 15 main items of DoE website.

Table 26. Differences in the INI among the respondents for the main information items

No.	Contents	Information Need Indices			
		Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)	H value
1.	About DoE, KAU	93.33	91.38	92.22	1.86
2.	Schemes & Projects	91.94	91.80	85.55	10.18**
3.	Showcase of technologies	94.58	94.86	96.66	0.42
4.	Locating your nearest KAU KVK	92.91	91.25	90	1.400
5.	Crop Information	94.16	92.08	96.11	6.26**
6.	Agri Market Informant	91.66	93.05	94.44	4.00
7.	Weather	91.25	88.47	92.77	11.68**
8.	Promising agri-enterprises	94.02	86.11	94.44	37.06**
9.	Forthcoming events	91.66	87.5	89.44	15.03**

10.	News& Information	92.91	88.33	90	17.82**
11.	Publications from KAU	93.33	90	90.55	10.18**
12.	Media Gallery	93.88	90.55	92.22	8.25**
13.	Important links	92.22	90.13	90.55	10.90**
14.	Links to social network media	70.97	86.66	88.33	28.37**
15.	Contact Us	97.36	95.97	98.33	4.44

** Significant at 5% level

Significant difference at 0.05 level was observed for INI of 'Schemes and Projects' (10.18), 'Crop Information' (6.26), 'Weather '(11.68), 'Promising agri-enterprises' (37.06), and 'Links to social network media' (28.37).

When all the scientists and extensionists wanted to see information on 'Schemes and Projects', farmers did not find it as important. It is well comprehensible that farmers are not interested in those schemes and projects which are neither initiated nor managed by them, whereas, the former groups are ought to deal with such programmes on a daily basis. Though the farmers welcome schemes and projects as beneficiaries, they are not much concerned about the rules, regulations and procedures governing the projects.

But it was found that the farmers needed more information than the scientists and extensionists on 'Crop Information', 'Weather', 'Promising agri-enterprises', 'Links to social network media' and 'Contact Us'. These are important information which has a direct bearing on farmers' day- to-day activities upon which all their important decisions are based upon, especially those regarding information on crops, weather and promising agricultural enterprises. Hence, they are more appropriate for the stakeholders like farmers than scientists or extension workers.

The highest INI for 'Links to social network media' and 'Contact Us' show that farmers consider it essential to contact each other as well as Kerala Agricultural University for sharing their information, clearing their doubts, getting remedies, advices or services. The encouraging

result of the social media influence on the farmers can be well interpreted from the fact that when only 73 per cent of the scientists preferred including social media links, all the farmers as well as the extensionists wanted that particular provision in the website. This is a proof for the ever growing, immense role of online social media in information dissemination in agriculture, which the farmers have identified and utilised than the other groups.

Significant variation at 0.05 level was noted in the INI among the three respondent groups on 'Forthcoming events' (15.03), 'News and information' (17.82), 'Publications from KAU' (10.18), 'Media Gallery' (8.25), and 'Important links' (10.90). It is interesting that all these are information directly pertaining to Kerala Agricultural University and all of the scientists have found them as relevant. On the other hand, extensionists recorded the least INI for all these five items. In general, extensionists show comparatively less interest in the information that is directly related to KAU. Farmers' INI fell between that of scientists' and extensionists' and they are in need of these information. It can be concluded that KAU being the main hub of knowledge as far as agriculture is concerned in the State of Kerala, the farmer population of the state is always eager to utilise the technology dissemination opportunities, and information facilities provided by Kerala Agricultural University in the form of trainings, workshops, seminars, technology weeks, farmer-scientists interactions, latest news, new releases, different publications and audio-visual media on agriculture and links to other important organisations.

4. 2. 3. Differences in the INI among the respondents for the sub-contents of main information items

Kruskal Wallis test was conducted to evaluate the differences in the information need indices among three groups of respondents (scientists, extensionists and farmers) on the sub contents of main information items. The results are presented in Tables 27 to 37.

Significant differences in the INI, at 0.05 level, were observed for the sub contents of 'About DoE, KAU', 'Showcase of technologies' , 'Agri Market Informant', 'Promising agri-enterprises', 'News and information', 'Publications from KAU', and 'Important links'.

Table 27. Differences in the INI for the sub-contents of 'About DoE, KAU'

Contents	Information Need Indices			
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)	H value
About DoE, KAU				
History & Mandate	93.88	89.72	83.88	23.27**
Vision & Mission	97.36	95.13	88.33	11.27**
Services & Activities	98.47	91.52	92.22	27.71**
Organizational setup	93.75	85.13	80	28.59**
Staff profile	90	87.08	85.55	14.80**
Constituent units of DoE, KAU	95.13	86.66	90.55	38.95**
Achievements *(of DoE)*	92.22	84.44	91.11	21.96**
Honours and awards *(of DoE)*	90.13	81.66	85.55	25.27**
Success stories *(of DoE)*	90.83	89.02	88.88	0.51
Contingency planning & Planning for adverse situations	80.69	74.72	77.77	10.12**

**Significant at 0.05 level

About DoE, KAU

"About Us" section is one of the most important elements on an organisation's website and also one that is the ubiquitous. The visitors in general pay much attention to it. It is the page where the world clicks to learn about any organisation , its goals, services offered, activities taken up, set up and successes which can contribute more respect and credibility to the organisation. It projects the professional image of the organization at a glance.

The information item 'About DoE, KAU' has the following sub contents.

- History and mandate

- Vision and mission
- Services and activities
- Organizational setup
- Staff profile
- Constituent units of DoE, KAU
- Achievements *(of DoE)*
- Honours and awards *(of DoE)*
- Success stories *(of DoE)*
- Contingency planning & Planning for adverse situations

Here, significant difference at 0.05 level was observed among the INI for all the above items except 'Success stories *(of DoE)'*. A clear understanding of what the organisation stands for, where it is going and what it hopes to achieve are best understood through the success stories of the organisation. Success stories of an agricultural university can prove to be a powerful tool for attracting all the stakeholders who can make the best out of the agricultural technologies and information provided by the university. That might be the reason why all the respondents recorded their need for 'Success stories' more or less similarly.

For all these sub items, INI of the scientists were the highest. This emphasises that loyal employees of any organisation try to highlight their organisation's services and other information useful for the public, than the other stakeholders.

Farmers showed the least INI for 'History and mandate', 'Vision and mission', 'Organizational setup', and 'Staff profile'. These information are not having much practical use in their day-to-day life, which might be the reason behind their lowest need index.

Extension officers' need indices were the lowest for 'Services and activities', 'Constituent units of DoE, KAU', 'Achievements *(of DoE)',* 'Honours and awards *(of DoE)', and* 'Contingency planning and planning for adverse situations'. Extension officers might not find this information as having novelty and applicability in their field of work. But as these are vital messages which are to be accentuated in the profile of any organisation, they found a place in this website too.

On the contrary, farmers showed a higher need index for 'Contingency planning & planning for adverse situations' (77.77) than extension officers (74.72). Farmers give due importance for the timely recommendations from organisations like KAU and State Agriculture department in the matters of disasters like pest and disease outbreaks, flood, torrential rains etc. in a comparable way. However, extension officers are more affiliated with the agricultural department's planning and programmes which they directly implement in farmers' fields. In case of emergencies, both KAU and Department of Agriculture work hand in hand to find solutions for the problems.

Showcase of technologies

Showcase of technologies features the different technologies developed, standardised and commercialised from KAU, along with farmers' innovations. It has the following sub-contents.

- Technologies developed *(by KAU)*
- Technologies commercialized
- Farmers' Innovations
- Video clips of demonstration of technologies

Table 28. Differences in the INI for the sub-contents of 'Showcase of technologies'

Contents	Information Need Indices			
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)	H value
Showcase of technologies				
Technologies developed *(by KAU)*	98.33	94.72	93.88	12.77**
Technologies commercialized	95.83	94.86	94.44	1.78
Farmers' Innovations	63.75	75.55556	91.11111	31.79**
Video clips of demonstration of technologies	92.5	90.69444	92.22222	2.95

**Significant at 0.05 level

Significant difference at 0.05 level was observed among the INI for 'Technologies developed *(by KAU)'* and 'Farmers' Innovations'. Information need indices for these two items throw light to the disparity in the respective respondents' interests. Scientists showed a high index of 98.33 for 'Technologies developed *(by KAU)',* whereas farmers showed the least index *(*93.88), and that of extensionists' was in between (94.72). Irrespective of the considerable technologies developed for the farming community, the comparatively low index of the farmers is a noteworthy observation. At this juncture, it would be ideal to verify whether KAU technologies are known to /adapted by the farmers. If not, the reasons for the same are to be examined. Farmers' index was the highest for 'Farmers' Innovations' (91.11) for which, as a paradox, the scientists showed an index as low as 63.75. This shows that when scientists encourage KAU technologies, they did not find farmers' innovations as an important content to be added in the DoE website. Of late, the global trend is that the useful and rational innovations are to be appreciated and accepted irrespective of the 'class of' innovators. Following that trend, the scientists should embrace a broader outlook regarding the farmers' innovations. Proper interventions and communication between scientists and farmers are needed to develop 'interactional expertise' in bringing together knowledge produced in farming and scientific contexts.

Agri Market Informant

'Agri Market Informant' informs about daily market prices at different markets, along with listing of major markets, farmer markets and NGO run markets in Kerala. The basic idea of adding this information in the DoE website is to harness the power of ICT to add value to the farm sector and empower the rural farmer by giving him access to vital information, which will enhance his livelihood and quality of life. It plays a pivotal role by providing timely information about the market conditions and realization of remunerative prices.

The sub-contents of 'Agri Market Informant' are as follows:

- Daily Market Price Information
- Major markets in Kerala
- Seasonal markets in Kerala
- NGOs in Kerala doing agricultural marketing service

Table 29. Differences in the INI for the sub-contents of 'Agri Market Informant'

Contents	Information Need Indices			
	Scientists (n=120)	Extensionists (n=120)	Farmers (n=30)	H value
Agri Market Informant				
Daily Market Price Information	90.97	94.86	94.44	17.71**
Major markets in Kerala	85.97	84.86	90	6.23**
Seasonal /farmer markets in Kerala	81.25	83.88	89.44	7.71**
NGOs in Kerala doing agricultural marketing service	81.11	82.22	88.88	8.62**

**Significant at 0.05 level

It may be noted that the information need indices showed significant difference for all the sub items at 0.05 level. It was observed that the indices of the farmers were the highest for all items. Scientists recorded the least indices for all except for 'Major markets in Kerala' for which extensionists showed the least index (84.86). This indicates that scientists and extensionists are not as keen as farmers to include market and market price details in the DoE website, but the farmers are remarkably concerned about it. This is because access to market information, its dissemination and sharing directly impact farmers than the former groups. In fact, it is crucial for better decision-making for the farmers.

Promising agri-enterprises

Agri-enterprises are avenues for self-employment as well as for generating employment opportunities for others. They are low cost, informal local business hubs for livelihood contributing to household income, and facilitating poverty alleviation of poor marginalized section of the society. The knowledge about these potential agri-enterprises will help the stakeholders to take up these opportunities. It might be with this hope that the respondents wanted to include this in the Directorate of Extension website.

The following sub-contents were included in the 'Promising agri-enterprises' which were inducted after the brain storming sessions of the pilot study.

- Mushroom cultivation
- Honeybee rearing
- Processing and value addition of fruits and vegetables
- Production of bio-fertilizers
- Production of composts
- Production of bio control agents
- Plant propagation by Tissue Culture
- Flower arrangement and dry flower products
- Landscaping
- Hi-tech/Precision farming
- Plant propagation and nursery management techniques
- Medicinal plant cultivation

Table 30. Differences in the INI for the sub-contents of 'Promising agri-enterprises'

Contents	Information Need Indices			
	Scientists (n=120)	Extensionists (n=120)	Farmers Index(n=30)	H value
Promising agri-enterprises				
Mushroom cultivation	87.63	86.66	88.33	0.91
Honeybee rearing	85.41	85.41	87.77	1.59
Processing & value addition of fruits& vegetables	86.80	85.27	87.77	1.28
Production of bio-fertilizers	82.5	81.66	86.11	3.60
Production of composts	85.13	87.08	91.11	7.32**
Production of bio control agents	85.41	85.13	85.55	0.03

Plant propagation by tissue culture	84.16	84.58	90	6.66**
Flower arrangement & dry flower products	84.58	81.66	78.88	14.55**
Landscaping	84.72	81.25	79.44	7.49**
Hi-tech/Precision farming	84.02	86.25	92.22	11.23**
Plant propagation & Nursery management techniques	82.5	81.52	88.88	10.21**

**Significant at 0.05 level

The need indices of 'Production of composts', 'Plant propagation by tissue culture', 'Flower arrangement & dry flower products', 'Landscaping', 'Hi-tech/Precision farming' and 'Plant propagation and nursery management techniques' among scientists, extension officers and farmers showed significant difference at 0.05 level.

Naturally farmers are highly interested in the information regarding agri-enterprises than the other two groups. They indicated highest need index for all the above sub contents except 'Flower arrangement and dry flower products' and 'Landscaping'.

Extension officers' indices were the highest for the enterprises like 'Production of Composts', 'Plant propagation by Tissue culture' and 'Hi-tech/Precision farming'. Trainings, demos and workshops are frequently conducted in these areas by KAU scientists. But extensionists, who know the pulse of farmers, favour their choices more.

Compost production, most commonly vermi compost or coir pith compost, is a profitable venture though organic farming is gaining momentum slowly in Kerala. Along with waste disposal from the farm, home, towns or villages, vegetable and animal refuses enrich the soil with more nutrients making it more healthy and suitable for production. Though commercial units need high capital, there are financial assistances to support the farmers and they soon become income generating avenues. Compost production can be successfully done even at household levels.

Tissue culture propagation or 'Micro propagation' is steadily gaining popularity as a good candidate among the biotechnology based enterprises as it multiplies plants in a relatively small space irrespective of the season of the year. Planting materials of horticultural crops like banana and several ornamental crops have year round demand and can be met economically if more farm women entered into micro propagation venture. For example, an exclusive all-woman organization in Thrissur district of Kerala, 'Nattika Vanitha Pushpa Krishi Samrakshana Samithi', is engaged in the production of orchids and other ornamental annuals through tissue culture.

Floriculture is an assuring commercial enterprise which is relatively new and is usually done at large scale level. Not many farmers have put their trust into the business area of flower arrangement and dry flower products, mainly owing to the high cost of fresh flowers, seasonality of certain dry flowers, little motivation and lack of knowledge. Large scale cut flowers and loose flowers growers usually have their wings or sister concerns solely for selling flower products. When it is comes to dry flowers, availability poses a problem, though demand is there throughout the year. But the enterprises in flower arrangement and dry flower products being upcoming, women can initiate them at small scale household level without huge investment. That is why the scientists and extensionists find it as a bright option. Here, for both items, scientists' indices were the highest. Extensionists' indices was lesser compared to the scientists'. It may be because extension officers are more aware of farmers' interests and preferences which are usually echoed in their activities. Similar is the case with landscaping which is usually carried out by professional groups. But adequate training in both these enterprises can motivate farmers, youngsters and women into flower products' business and, nursery owners into landscaping.

Hi-tech/Precision farming observes and responds to intra-field variations with the goal of optimizing returns on inputs while preserving resources. It requires less water, fertiliser, and is reported to give 75 per cent more yield than by the conventional farming, while the cost of production is saved by about 50 per cent. With these benefits farming goes hi-tech in Kerala and Department of Agriculture has started many projects to popularise precision farming techniques. There is no wonder that extension officers being from the line department, projected their interest in this enterprise in favour of the farmers of Kerala. Altogether it can be concluded that extension officers greatly favoured those enterprises which are trending, profitable and promising for the farming sector of the state.

Plant propagation is the process of multiplying plant species for production and maintenance of plant seedling which are used for commercial production. Nursery is a place where plants are grown, nurtured and sold out. Different plants are propagated by different methods. In general good quality & assured planting materials at reasonable price are not available. So persons having a skill of propagation of plants can go for this avenue as a successful agro-business.

In the case of 'Mushroom cultivation', 'Processing and value addition of fruits and vegetables', 'Production of bio-fertilizers', 'Production of bio control agents', 'Plant propagation & Nursery management techniques',and 'Medicinal plant cultivation', scientists registered the higher indices than extension officials. This is mainly because they have been working in these areas and giving training to stakeholders in different parts of the country. These are some common and successful training areas whose sessions are conducted very often in KAU, KVKs or research stations dealt by the concerned scientists. Many entrepreneurs have successfully undertaken processing of fruits and vegetables, and have raised mushroom, *Azolla* (bio-fertiliser), plant nurseries and medicinal plants.

Though production techniques of bio control agents involve highly sophisticated biotechnology, scientists believe that with proper training it can be a reassuring enterprise especially for self employment of the weaker sections. A woman self help group named Sabari, consisting of tribal women (youth) of Wayanad were given training by the scientists of Krishi Vigyan Kendra, Ambalavayal in the production of *Trichoderma* and *Pseudomonas.* Along with income generation that revolutionised their family income pattern, it also inculcated social awareness and confidence in them (Prabhu, 2012).

Honeybee rearing is an enterprise for which both scientists and extension officers recorded the same need index of 85.41. Various training sessions and classes have been conducted by KAU for honey bee growers and extensionists identify it as a promising one as more farmers are coming forward seeing others' successes and understanding its possibilities.

News and information

News and information gives an idea about the new releases *i.e.,* latest products released from KAU along with their prices, information on intellectual property rights in agriculture

products like that of geographical indications, patents, important letters and circulars, and materials for download. The sub-contents of this main item are given below.

- New releases
- Ready for sale
- Downloads
- Letters and circulars
- Geographical indications from Kerala (Agricultural and horticultural products)
- Patents from Kerala Agricultural University

Table 31. Differences in the INI for the sub-contents of 'News and information'

Contents	Scientists' Index(n=120)	Extensionists' Index(n=120)	Farmers' Index(n=30)	H value
News & Information				
New releases	92.91	87.36	87.77	22.989**
Ready for sale	93.05	89.30	90.55	21.856**
Downloads	89.72	86.80	80.55	11.876**
Letters and circulars	86.94	81.52	80.55	11.988**
Geographical indications from Kerala (Agricultural and horticultural products)	87.91	81.66	82.77	19.448**
Patents from Kerala Agricultural University	89.30	84.86	86.66	25.474**

**Significant at 0.05 level

Significant difference at 0.05 level was observed for all the items. The indices of scientists were the highest for all sub items which shows the eagerness and interest of the KAU scientists in disseminating the news and information related to KAU. The indices of extension officers were the least for 'New releases', 'Ready for sale', 'Geographical indications from Kerala (Agricultural and horticultural products)' and 'Patents from Kerala Agricultural

University'. The reason may be, the information on products from KAU are intended mainly for the farmers and those on intellectual property rights like geographical indications and patents do not have a direct use in any one's day-to-day life. On the other hand, farmers recorded the least index for 'Downloads' and 'Letters and circulars'. They might have found them as part of the administration which does not have a direct impact on their lives and farming.

Publications from KAU

Publications showcase all types of print and online publications from KAU. The sub-contents were,

- List of publications
- Publications in pipeline
- Document on KAU Vision 2030

Significant difference at 0.05 level was found for 'List of publications' and 'KAU Vision 2030'. The scientists' indices were the highest for both. A lot of publications are brought out by KAU as technical bulletins, books, booklets, leaflets, folders and the like which include information on agriculture and related technologies. The scientists wanted to include these in the DoE website for the benefit of the farming community. The extensionists' index was the least for 'List of publications' and that of farmers' were the least for 'KAU Vision 2030'.

Table 32. **Differences in the INI for the sub-contents of 'Publications from KAU'**

Contents	**Scientists' Index(n=120)**	**Extensionists' Index(n=120)**	**Farmers' Index(n=30)**	**H value**
Publications from KAU				
List of publications	90.41	82.36	90	30.333**
KAU Vision 2030	86.52	81.52	78.88	11.357**
Publications in pipeline	83.75	80.13	82.77	3.482

**Significant at 0.05 level

The extension officers were not as keen as the farmers about the KAU publications. Either they have not realised the importance of KAU publications or the details of these

publications were not available to them whenever it was required. Moreover, the State Department of Agriculture uses print publications for the wider dissemination of technologies or schemes and the extension officers mainly depend on the regular publications from the Farm Information Bureau (FIB), which are available on almost all agriculture related topics, for their extension activities. That may be the reason why they were less interested in KAU publications. But as the intended website was for DoE, KAU it is a necessity that the publications of KAU find a place in it. This information would help to create awareness about KAU publication among the different stakeholders. The low index of farmers for 'KAU Vision 2030' shows that majority of them are unaware of such a document. Such a publication does not have any direct influence on the farmers.

Important links

Important links include the relevant web links to be provided in the DoE website. The sub-contents were,

- Public Agricultural Extension departments
- Commodity Boards
- Market Federations
- ICAR Institutes

Table 33. Differences in the INI for the sub-contents of 'Important links'

Contents	Scientists' Index(n=120)	Extensionists' Index(n=120)	Farmers' Index(n=30)	H value
Important links				
Public Agricultural Extension departments	82.36	86.80	87.77	11.785**
Commodity Boards	81.11	83.88	82.77	4.561
Market Federations	82.22	82.22	81.11	0.240
ICAR Institutes	80	80.69	81.11	0.618

**Significant at 0.05 level

Significant difference (at 0.05 level) was found only for 'Public Agricultural Extension departments'. When the farmers gave highest index, scientists' index was the lowest. This shows that farmers find all the sources and information related to agriculture like animal husbandry, fisheries and forestry with the same importance, where as the agricultural scientists did not find them with that much relevance for including in the DoE website.

The analysis revealed that there were no significant differences in the need indices for the sub contents of 'Schemes and projects', 'Crop Information', 'Forthcoming events', and 'Contact Us'.

Table 34. Differences in the INI for the sub-contents of 'Schemes and projects', 'Crop Information', 'Forthcoming events', and 'Contact Us'.

Contents	Scientists' Index(n=120)	Extensionists' Index(n=120)	Farmers' Index(n=30)	H value
Schemes & Projects				
Mission of Schemes &projects	87.91	87.63	82.77	4.298
Guidelines of funding agencies	74.44	80.97	73.33	1.544
Links to website of funding agencies	72.5	81.11	68.88	1.930
Crop Information				
Crops (links to www.celkau.in)	92.36	96.80	96.11	5.587
Agri e-expert (links to www.celkau.in)	92.77	93.19	90.55	2.758
Availability & Price of Planting materials, Bio control agents, Organic manures,Value added products	94.02	95	96.66	1.104
Forthcoming events				
Training programs *(in KAU)*	87.77	87.63	90	1.561

Technology week	88.47	87.08	87.22	1.894
Farmer scientist interactions	88.61	88.19	86.11	1.491
Exhibitions/Seminars/ symposia/workshop	87.63	86.80	88.33	0.989
Contact Us				
Communication address	98.05	93.75	97.22	2.120
Feedback form	93.88	82.36	87.22	0.719
Discussion forum	84.30	82.77	80.55	0.381

To briefly explain, when 'schemes and projects' throw light on the various schemes, their mission and guidelines, 'Crop information' gives knowledge about different crop production techniques. While 'Forthcoming events' announces the important programmes scheduled in KAU including trainings, seminars and workshops, 'Contact Us' gives addresses of DoE, provision for feedback and discussion. The respondents' indices showed no much difference in their needs with regard to in these aspects.

4. 2. 4. Differences in the information need indices between 120 scientists and 120 extensionists

The 't' values obtained from the paired t-test indicated that the scientists and extensionists differed significantly in all the information items except two, viz; 'Schemes & Projects' and 'Showcase of technologies'(See Table 35). Extensionists and scientists are dealing with schemes and projects as part of the routine works in their area of activity. Both groups are working with agricultural technologies for the development of agricultural sector, when scientists develop them, extension officers disseminate them. These factors might have influenced them to feel that these two contents are quite important to be included in the DoE website.

Table 35. Differences in the INI between scientists and extensionists

No.	Contents	Scientists' Index(n=120)	Extensionists' Index(n=120)	t values
1.	About DoE, KAU	93.33	91.38	3.96**
2.	Schemes & Projects	91.94	91.80	0.42
3.	Showcase of technologies	94.58	94.86	1.42
4.	Locating your nearest KAU KVK	92.91	91.25	3.63**
5.	Crop Information	94.16	92.08	4.12**
6.	Agri Market Informant	91.66	93.05	3.28**
7.	Weather	91.25	88.47	7.00**
8.	Promising agri-enterprises	94.02	86.11	9.74**
9.	Forthcoming events	91.66	87.5	5.08**
10.	News& Information	92.91	88.33	5.81**
11.	Publications from KAU	93.33	90	4.76**
12.	Media Gallery	93.88	90.55	5.19**
13.	Important links	92.22	90.13	1.97**
14.	Links to social network media	70.97	86.66	9.77**
15.	Contact Us	97.36	95.97	3.28**

**Significant at 0.05 level

In general, it was found that scientists' information need indices were higher for all the information items where as extensionists recorded a comparatively less INI for those items. For example, when scientists wanted to see the following information more in the website like 'About DoE, KAU', 'Locating your nearest KAU KVK', 'Crop Information', 'Weather', 'Promising agri-enterprises', 'Forthcoming events', 'News & Information', 'Publications from KAU', 'Media Gallery', 'Important links', and 'Contact Us' , the extensionists wanted these

items more, that is, 'Agri Market Informant', and 'Links to social network media'. Here it is to be noted that most of the items preferred by the scientists were regarding Kerala Agricultural University (KAU) ('About DoE, KAU', 'Locating your nearest KAU KVK', 'Forthcoming events', 'News and information', 'Publications from KAU', 'Contact Us'). This might be because the scientists are working in KAU and they wanted to disseminate the useful information from the institution to the public. It is naturally expected that scientists will try to highlight their organisation's achievements and useful information. On the other hand, the extensionists were keener about information directly required by farmers like 'Agri Market Informant', which is crucial for them to make crucial economic decisions.

Another interesting point is that extensionists find 'Links to social network media' (86.67) as important, when scientists gave a very low INI for that as low 70.97. This indicates that extensionists have understood the prospects of using social media for information dissemination when the scientists think they are only for personal purposes. Many Krishi Bhavans are already active in social media like Facebook with regular updates. Lot of farmers are actively involved in social media and there is huge participation when it comes to farm-related matters. In this context, it is noteworthy to mention that Vattamkulam Krishi Bhavan(Agricultural Office), Malappuram district of Kerala which had started its Facebook page in 2013 attracted a lot of farmers, youngsters and entrepreneurs who became active in the page sharing and seeking information. Farmers take social media in a big way and they want to keep tabs on what they are doing (Raj, 2014). The role of many social media groups like 'Adukkalathottam', 'Agriculture'. 'Karshakan' and the like which promote home gardens by giving advice online as well as sending free seeds to the users are also important in this regard (Joshy, 2014). This suggests that scientists should start considering technology and information dissemination utilising the immense opportunity available through social media.

4.2.5. Suggestions on the contents to be included in the DoE website

The respondents were given the freedom to express their suggestions of various items or links to be included in the DoE website. They suggested the inclusion of the following contents in the DoE website (Table 36). The percentage of respondents who made a particular suggestion was found.

This table shows that the majority of the respondents wanted a website that provides up-to-date information. This implies that regular updating and enriching of the website is essential. All the information contents mentioned in the table were added to the prototype before the end-user assessment.

Table 36. Pooled suggestions for DoE website contents

No:	Content	No. & percentage of respondents who suggested (N=270)
1.	Regular updating of the website	256 (94.82%)
2.	Agricultural machineries	47 (17.41 %)
3.	List of restricted pesticides in Kerala	30 (11.11 %)
4.	Banana cultivation	27 (10.00 %)
5.	List of agencies providing agricultural inputs and equipments	15 (05.55 %)
6.	Price details of KAU publications	15 (05.55 %)
7.	Preparation of botanical pesticides	15 (05.55 %)
8.	Sericulture	13 (04.81 %)
9.	Link to organic Package of Practices	11 (04.07 %)
10.	Link to State Agricultural Management and Extension Training Institute (*SAMETI*)	06 (02.22 %)
11.	Link to Agricultural Technology Management Agency (*ATMA)*	06 (02.22 %)
12.	Link to Kerala Hi-tech Agriculture Portal	05 (01.85 %)
13.	Link to Kerala Soil Fertility Portal	05 (01.85 %)
14.	Link to Kerala Forest Department	04 (01.48 %)
15.	Link to National Seed Corporation	01 (00.37 %)
16.	The Kerala Conservation of Paddy Land and Wet Land Act, 2008	01 (00.37 %)

17.	Link to Food and Agricultural Organisation (FAO)	01 (00.37 %)
18.	Link to Consultative Group on International Agricultural Research*(*CGIAR)	01 (00.37 %)
19.	Link to International Food Policy Research Institute (*IFPRI*)	01 (00.37 %)
20.	Link to Journal of Tropical Agriculture	01 (00.37%)
21.	Dignitaries who visited KAU	01 (00.37%)
22.	Add Latest news to the home page	01 (00.37%)
23.	Add Announcements to the home page	01 (00.37%)

4. 3. DEVELOPMENT OF THE WEBSITE PROTOTYPE

A user-centered, bilingual (in English and Malayalam language), high fidelity website prototype was developed after incorporating the suggestions from the 270 respondents. A high-fidelity prototype is computer-based, and a true representation of the user interface which is more effective in collecting true human performance data. The web based programming languages, HTML (Hyper Text Mark-up Language) and CSS (Cascading Style Sheets) were used to develop the web interface. This prototype had 37 web pages.

The homepage of the prototype had a one-level navigation system without drop-down menus. It contained 23 navigation bars for the following sections: 'About DoE', 'Schemes & Projects', 'Showcase of technologies', 'Locating your nearest KAU KVK', 'Crop Information', 'Agri e-expert and agri online clinic', 'Agri Market Informant', 'Weather', 'Promising agri-enterprises', 'Forthcoming events', 'News & Information', 'Publications from KAU', 'Media Gallery', 'Important links', 'Links to social network media', 'Latest News', 'Announcements', 'RTI', 'Sitemap', 'Discussion forum', 'Last updated date' and 'Contact Us'. This supports the finding of Suresh and Gopalakrishnan (2012) that there is no much difference in the commonly found web objects in the agricultural university websites.

'About DoE' section gives a brief introduction about Directorate of Extension, Kerala Agricultural University, its vision, mission, mandate, services, activities and organisational set up. It also included DoE's staff profile, former Directors of Extension, constituent units of DoE, achievements and success stories, contingency planning etc. 'Schemes and projects' deals with

the goals of the completed and on-going schemes and projects where as ‘Publications’ lists the technical bulletins, books, booklets and leaflets from KAU, along with their price details. Description about ‘ATIC library’ and document on ‘KAU Vision 2030’ were added in this section.

‘Media gallery’ contains videos and photos of extension programmes of KAU as well as agriculture related technologies. ‘Latest news’, ’Forthcoming events’ and “Announcements’ in the homepage inform the audience of the news, upcoming events and other important notifications. ‘Agri Market Informant’ gives data on daily agri-market prices through VFPCK and Agmarknet links, enlists the major agricultural markets, farmers’ markets, seasonal markets as well as agricultural markets run by non-government organisations of the state. ‘Locating your nearest KAU KVK’ is a facility to take the user to their nearest KVKs of KAU on selecting their district.

‘Showcase of technologies’ demonstrates the different technologies developed, standardised and commercialised by KAU as well as those innovations advanced by the farmer scientists. ‘Crop information’ gives details on agricultural and agro-forestry crops. Agri e-experts links like ‘KAU Fertulator’, ‘KAU e-Crop Doctor’ and ‘Crop Health Diagnoser’ are provided under ‘Agri e-expert and online clinic’ which would help the farmers in assessing the health of the crops and to find out suitable remedial measures. When ‘Links to social network media’ indicates the social media presence of the organisation, ‘RTI’ provides address of the Public Information Officers (PIO) of KAU.

The link ‘Weather’ gives weather forecasts for the selected districts of the state along with providing weather details of the country and the world. ‘Promising agri-enterprises’ give a brief description on some successful agriculture related enterprises. ‘News and Information’ supply details of KAU products for sale, documents for download, and agriculture related geographical indications from Kerala and patent from KAU. ‘Important links’ guide the user to relevant and useful web links. ‘Discussion forum’ is provided to facilitate discussion among various users. ‘Sitemap’ lays out the web pages of the site for the user and ‘Contact Us’ provides the addresses of DoE, KAU for the users to contact through post, telephone, email or fax, along with a feedback form for the users, to report their observations and reactions about the website.

4. 4. END USER ASSESSMENT OF THE WEBSITE PROTOTYPE

The website prototype developed was temporarily hosted online as a sub-domain in the web address: http://www.celkau.in/DE/

End-user assessment of the web prototype by the respondents was conducted on-line after mailing the link of the hosted web prototype and excel questionnaire for scoring. The respondents allocated scores for each of the assessment attribute, supplied their suggestions for the final DoE website and outlined their constraints while taking the tests (task) given to them. The mean scores of the three groups of respondents were calculated, suggestions and constraints were carefully noted down for the refinement of the website prototype.

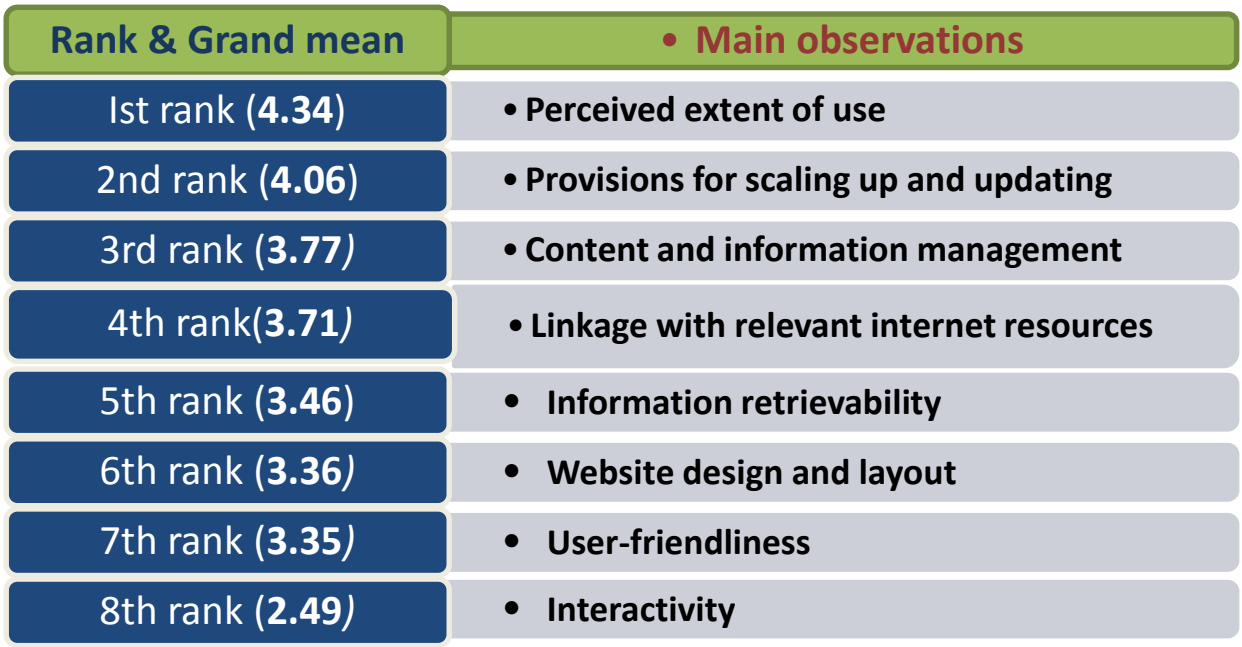
4.4.1. Assessment scores of the website attributes by the respondents

The assessment attributes of the web prototype were identified after extensive literature review. Eight main features identified for assessment are as follows: (i) Content and information management, Contents and information management, (ii) site design and layout, (iii) linkage with relevant internet resources, (iv) provisions for scaling up and updating, (v) information retrievability, (vi) interactivity, (vii) user-friendliness and (viii) perceived extent of use. The scores obtained for each assessment attribute of the prototype were analysed and the results are as follows.

4.4.1.1. Ranking of the main attributes based on the grand mean scores

The main observations for the website assessment were ranked based on the grand means obtained from the sub sample means. The results are displayed by the Figure 4.

Fig 4. Ranking of the main web attributes based on the grand mean scores



The figure 4 exhibits that 'Perceived extent of use' and 'Provisions for scaling up and updating' have got the highest grand mean score of 4.34 and 4.06 respectively. The respondents declared that the user-centered DoE website based on this prototype would have immense scope of use for all the people all over the globe for different purposes. They perceived that the website could also be used as an e-course platform with further enrichment of the site. The respondents found the provision for updating and informing the last updated date as a measure to increase the credibility of the information in the website. All of them noted poor working of the interactive facilities too. The other attributes were given fair scores indicating good performance of the prototype. User- friendliness was ranked seventh, but the fair grand mean score of 3.35 shows that the prototype was user-friendly. The lowest rank was recorded for 'Interactivity'. The presently unworkable interactive functions in the web prototype, might have contributed to the poor score of 2.49 to this trait. There is scope for improving the situation once the final website is prepared by the Directorate of Extension. Based on the grand mean scores, it can be concluded that the overall performance of the prototype can be rated as fair.

4.4.1.2. Assessment attributes of the website

Tables 18 to 25 display the means scores of each group of respondents for the various assessment traits of the web prototype. Mean scores from 1 to 5 indicate 'very poor', 'poor', 'fair', 'good' and 'excellent' respectively.

Kruskal Wallis test (H=0.698; p=0.705) showed that the difference among the mean scores of scientists, extension officers and farmers with respect to the assessment traits was not statistically significant. Hence the null hypothesis, "there exists no significant difference in the mean scores of the website assessment attributes by the respondents", is accepted. Further, the agreement among the respondents was calculated. The concordance strength was found to be very high; W=0.951. Comparing the p (0.000) with the significance level α = 0.05, it can be stated that the judges' assessments were statistically significant too. The statistically insignificant differences and the impressive agreement indicate that the prototype was judged in a comparable way by all the respondents.

1) ***Content and information management***

Observations under content and information management were given a mean score that indicated fair performance by all the respondents (See Table 37).

Table 37. Mean scores for 'Content and information management'

No:	Website assessment attributes	Mean scores		
		Scientists(n=30)	AOs (n=30)	Farmers (n=30)
(i)	**Content and information management**			
1	Relevance	3.80	3.88	3.75
2	Coverage	3.48	3.38	3.56
3	Accuracy	3.97	3.86	4.01
4	Reliability	3.88	3.78	3.99
5	Clarity	3.82	3.71	3.76
6	Depth of contents	3.82	3.52	3.92

High mean scores of farmers indicate that they were satisfied with accuracy (4.01), reliability (3.99), depth of contents (3.92) and coverage (3.56). Extension officers had a highest mean score for the relevance (3.88) and scientists' score was the highest for clarity (3.82). It is quite understandable that the farmers find the information from KAU as adequate, unique and

accurate. Extension officers found the prototype as having great practical and social applicability. The scientists have found that the website is making the users aware of the functions it can perform.

2) Website design and lay out

Features under web design and layout were awarded fair mean scores by the judges (See Table 38).

Farmers' mean scores were the highest for organisation (3.44), appeal (3.34) and colour scheme (3.25), for which the scientists' mean scores were the least. The scientists proposed a more professional organisation and colour scheme, thus suggested to improve the appeal.

Table 38. Mean scores for 'Website design and layout'

No:	Website assessment attributes	Mean scores		
		Scientists (n=30)	AOs (n=30)	Farmers (n=30)
(ii)	**Website design and layout**			
1	Organisation of the site	3.23	3.36	3.44
2	Colour scheme	3.09	3.13	3.25
3	Fonts	3.28	3.33	3.25
4	Adequacy of multimedia	3.86	3.63	3.72
5	General appeal	3.17	3.26	3.34

3) Linkage with relevant internet resources

When all the respondents judged the external links included as appropriate, the working of the links was rated with a low mean score by the scientists (2.95) thus warning a poor performance (See Table 39). Scientists reported that some of the external links were inaccessible. This might be mainly due to the experienced due to the maintenance works going on in those websites.

Table 39. Mean scores for 'Linkage with relevant internet resources'

No:	Website assessment attributes	Mean scores		
		Scientists (n=30)	AOs (n=30)	Farmers (n=30)
(iii)	**Linkage with relevant internet resources**			
1	Appropriateness of links	4.21	4.11	4.39
2	Working of links	2.95	3.15	3.43

4) Provisions for scaling up and updating

Farmers gave the highest mean score for provision of enrichment of the website in future, content and quality wise (3.99) so that they could interact with the scientists in a synchronous way (See Table 40).

Table 40. Mean scores for 'Provisions for scaling up and updating'

No:	Website assessment attributes	Mean scores		
		Scientists (n=30)	AOs (n=30)	Farmers (n=30)
D	**Provisions for scaling up and updating**			
1	Possibility for enrichment	3.91	3.83	3.99
2	Possibility as course platforms	4.23	4.01	4.18
3	Possibility to know the site freshness	4.10	4.20	4.12

Scientists' highest mean score showed that they believed in the possibility of using this website as a platform for online courses and trainings (4.23). All judged that the "last updated date" helps them to know the freshness of the site and is a necessary item to be checked before depending on the information available in the pages.

5) Information retrievability

Quick and easy retrieval of data was reported by the respondents (See Table 41). Highest mean score for easiness was reported by farmers (3.37) and for quickness, by scientists (3.84). The very purpose and advantage of a website is to retrieve information and data in the minimum time possible, with high level of easiness.

Table 41. Mean scores for 'Information retrievability'

No:	Website assessment attributes	Mean scores		
		Scientists (n=30)	AOs (n=30)	Farmers (n=30)
E	**Information retrievability**			
1	Easiness in retrieving data	3.28	3.13	3.37
2	Quickness in retrieving data	3.86	3.47	3.64

6) Interactivity

All respondents have given a low mean score declaring a poor performance of the interactive links of the prototype (See Table 42). The mean scores of scientists, extension officers and farmers were 2.31, 2.46 and 2.70 respectively. This was because the prototype was not a live, complete and fully functional webpage, but only an interactive experience for the participants in a secure testing environment, which was hosted as a sub-domain and lacked sufficient data base. So the items like 'search', 'discussion forum', and 'feedback form' were not working properly. These facilities could be made operative once the final website is launched as a complete domain with adequate database, by the host organization.

Table 42. Mean scores for 'Interactivity'

No:	Website assessment attributes	Mean scores		
		Scientists (n=30)	AOs (n=30)	Farmers (n=30)
F	**Interactivity**			
1	Working of interactive links	2.31	2.46	2.70

7) User-friendliness

The features under user-friendliness were given a fair mean score by all respondents (See Table 43). Scientists announced a highest mean score for the format (3.62), speed (3.29) and navigation (3.20), whereas agricultural officers' mean score was the highest for readability (3.59). This shows that scientists have found the content as lucid, quick to load and easy to navigate. Whereas, the agricultural officers evaluated that the content was easy to understand and there was balance between design and layout. Both these judgements are highly encouraging.

Table 43. Mean scores for 'User-friendliness'

No:	Website assessment attributes	Mean scores		
		Scientists (n=30)	AOs (n=30)	Farmers (n=30)
G	**User-friendliness**			
1	Format of the content	3.62	3.49	3.41
2	Speed	3.29	3.17	3.25
3	Navigation	3.20	3.08	3.12
4	Readability	3.45	3.59	3.48

8) Perceived extent of use

The high mean scores of all the respondents denoted that website would be an important agricultural knowledge source for all stakeholders and organisations, irrespective of their locations (See Table 44).

Table 44. Mean scores for 'Perceived extent of use'

No:	Website assessment attributes	Mean scores		
		Scientists (n=30)	AOs (n=30)	Farmers (n=30)
H	**Perceived extent of use**			
1	Based on area	4.05	4.25	4.18
2	Based on organisations	4.23	4.35	4.27
3	Based on stakeholders	4.37	4.20	4.52
4	Based on purpose	4.64	4.17	4.79

All the judges believed that the other prominent stakeholders could include school/college students, agripreneurs, researchers and policy makers and organisations like banks, self-help groups and educational institutions. They opined that the site would be beneficial in imparting knowledge, providing details on KAU technologies and products apart from providing agriculture market details and guidance in farming. This set of judgements by the end-users should be highly motivating for the DoE for venturing into frequent refinement, enrichment and updating of the contents.

4.4.2. Testing of the website prototype

Testing of the web prototype for usability helps in maximising the usability by discovering the problems, if any. All the respondents were given the same specific task to accomplish, through e-mail. The task was to fetch the information from the prototype after familiarising with the prototype and report the same (See appendix 3). Task success rates were registered through usability constructs like effectiveness of use, efficiency of use and satisfaction

of the users. All the respondents being e-literate, self-reported validation was used to determine the performance. Summary of the results are given in table 45.

Table 45. Prototype usability testing (Summary of the results)

No.		**No. & percentage of respondents who have successfully completed the task**		
		Scientists (n=30)	**Agricultural Officers (n=30)**	**Farmers (n=30)**
1	**Effectiveness of use**	25 (83.33%)	27 (90%)	28 (93.33%)
.		**Average time (in minutes) taken by the respondents who have successfully completed the task**		
2	**Efficiency of use**	12	11	4
3	**Satisfaction of the user**	**Level of satisfaction recorded by the respondents**		
	Low level	1(3.33%)	0	0
	Medium level	21 (70%)	18 (60%)	9 (30%)
	High level	8 (26.67%)	12 (40%)	21 (70%)

4.4.2.1. Effectiveness of use of the web prototype

Effectiveness of use was checked by enquiring to the respondents if they were able to successfully complete the specific task assigned to them. They were asked to report the correct answers for the task given along with the date of testing. Pictorial representation of the effectiveness of use of the prototype is shown in Figure 5.

When 93.33 per cent of farmers reported to have completed the task successfully and sent the answers accurately, only 83.33 per cent of the scientists were successful in that attempt. Whereas, 90 per cent of extension officers completed the task successfully. All the respondents being e-literate, paradoxically, the less number of scientists who have accomplished the task points to two possible reasons, either they did not show ample patience and interest to take the test and report the answers or they have failed in the attempt due to their unfamiliarity with the use of agricultural web sites, in spite of being internet users. Whereas the farmers who were regular internet users, have easily found the correct answers and reported them. This is an inspiring result pointing to the effectiveness of use of the prototype.

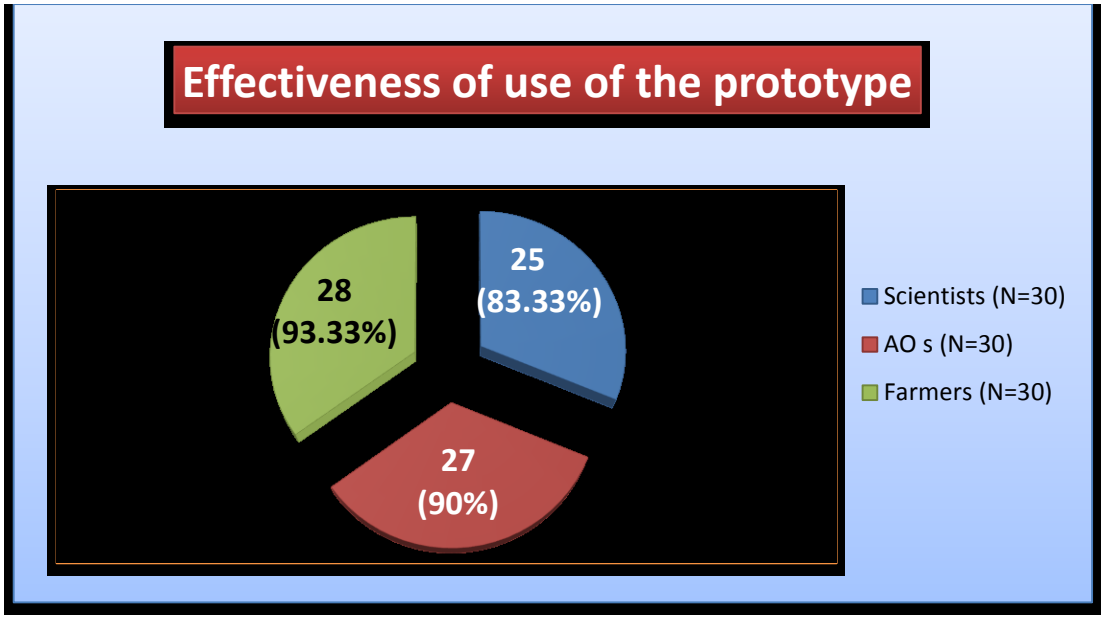


Fig 5. Effectiveness of use of the prototype

4.4.2.2. Efficiency of use of the web prototype

Efficiency of use was measured by asking the test participants to note down the average time taken to accurately complete the task. The result is pictorially shown in Figure 6.

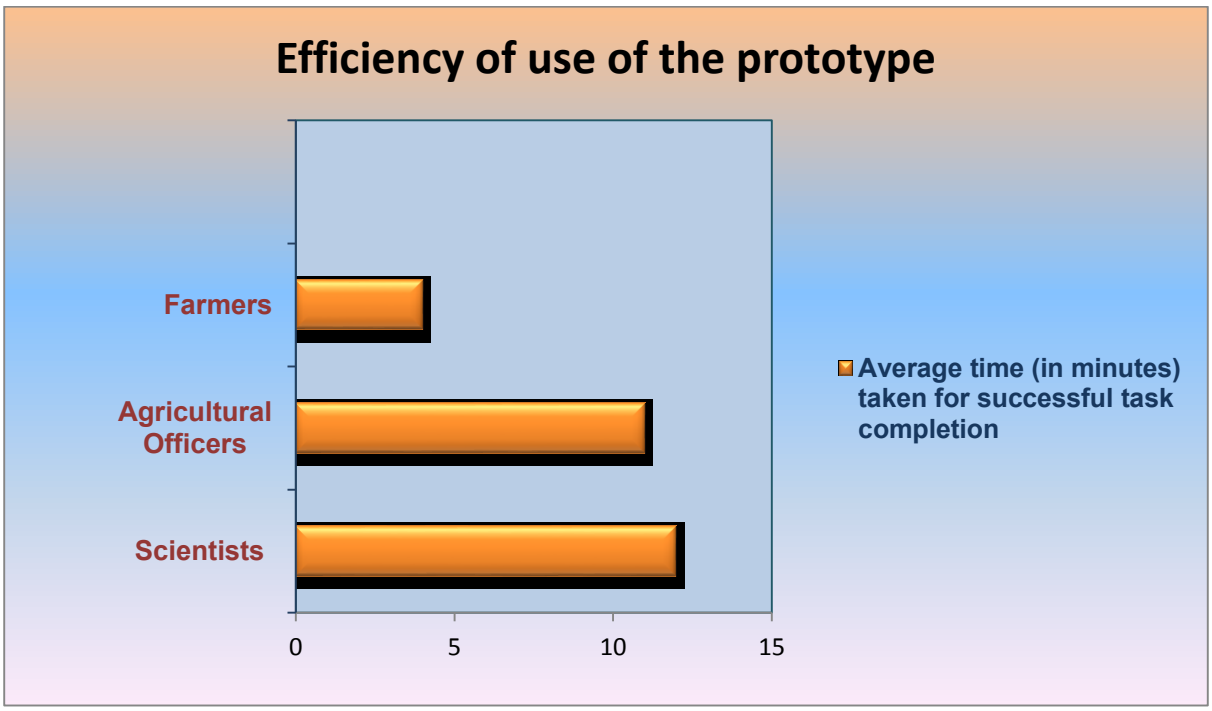


Fig 6. Efficiency of use of the prototype

When the average time taken by the farmers to complete the task was four minutes, the scientists and extensionists took thrice the time to complete the same task, taking 12 minutes and

11 minutes respectively. Here also there is a contradiction as one would expect the scientists and extensionists being computer savvy, to complete the task easily and well ahead of time when compared to the farmers. But the results of the test prove otherwise. The farmers selected were regular internet users, having active social media presence. Being more acquainted with websites they were quicker to discover the correct information compared to others. The farmers' inquisitiveness, keenness and high level of interest might also have contributed to this result. Irrespective of being e-literate, the other respondents, who don't use internet regularly like the farmers and who don't have an active social media presence, have taken longer time to find the correct answers for the task. The possible reason for this result could be the less accustomedness of the respondents with the use of agriculture related websites, compared to the farmers. This result suggests the necessity of training programs for the less or non-tech savvy extensionists and scientists to achieve the level of professionalism with regard to tech basics like e-mail, website and communications.

4.4.2.3. Satisfaction of the user

Satisfaction was recorded by the users as the degree of comfort as experienced by them in using the website, as high level, medium level or low level. All the respondents, irrespective of accomplishing the task have reported their satisfaction level regarding the prototype use. Figure 7 displays the results.

When 70 per cent of farmers recorded high level of satisfaction, the same per cent of scientists recorded medium level of satisfaction. Forty per cent of the extension officers were having high level of satisfaction and the rest showed medium satisfaction. Only 26.67 per cent of scientists were highly satisfied with the prototype. Low level of satisfaction (3.33 %) was reported by scientist respondents. Such a result has to be interpreted along with the results under the paragraph 4.4.2.1 and 4.4.2.2 (Effectiveness and efficiency of use of the web prototype). More farmers could complete the task successfully in lesser time and that explains their high level of satisfaction. In the mean while, only less number of scientists could achieve the task, but they have taken more time to finish the task. This might be the rationale behind the comparatively less satisfaction level of scientists. Anyhow, the agricultural officers' satisfaction level ranged between medium to high, irrespective of the longer time taken by them.

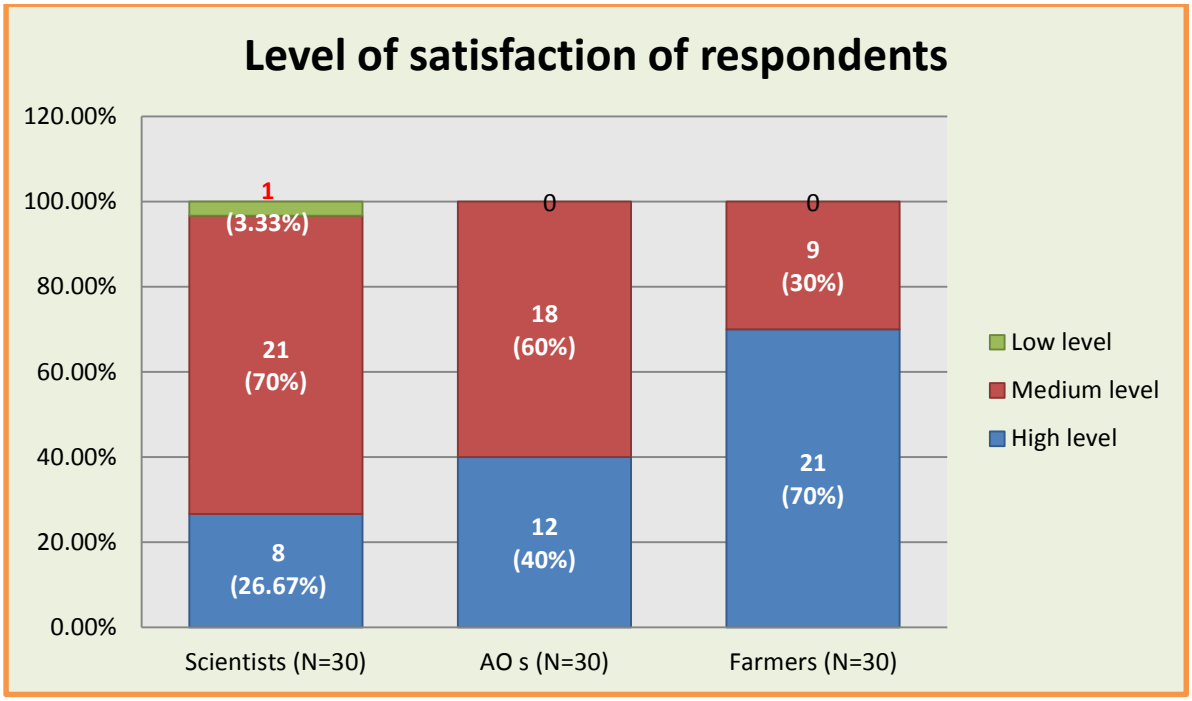


Fig 7. Satisfaction level of the respondents

Kerala Agricultural University and the State Department of Agriculture being decently computerised, the scientists and agricultural officers were assumed to be e-literate. The farmers selected for the study were regular internet users. The results of prototype testing reinforce the fact that the farmers were more successful in accomplishing the task assigned to them than the scientists. The farmers might have got an elated feeling for selecting them as respondents for a study related to KAU, an esteemed agricultural institution. The low acquaintance with internet and website usage and the less focussed interest in such assessment tests might be the reason for the less number of scientists and agricultural officers completing the task well. Also the scientists and extensionists took it longer to complete the task, and naturally their satisfaction level was less compared to the farmers. This supports the finding by Swafa (2011) that the number of agricultural officers having high level of familiarity with operating computer and accessing information from internet were very limited in Thrissur and Palakkad districts. Hence, the comparatively low task success rates of the scientists can be attributed to lack of familiarity in using websites.

4.4.3. Suggestions for the final DoE website

The respondents suggested the following modifications/additions to the final DoE website as seen in Table 46 through open-ended answers.

Table 46. Suggestions for the final DoE website

No:	Suggestions	No: & percentage of respondents who suggested
1	Include more content on precision/ hi-tech farming.	16 (17.78%)
2	Use colours suitable for a professional site.	09 (10%)
3	Too much content for the farmers.	07 (7.78%)
4	Photographs of pest and disease attack, nutrient deficiency, physiological disorders etc should be attached with each crop.	06 (6.67%)
5	Include content on farm tourism and zero budget farming.	01 (1.11%)
6	Provide facility for online meetings with scientists.	01 (1.11%)
7	Website should be specific as per the organisational set up of DoE.	01 (1.11%)
8	Include 'Analytical Services of KAU' and 'facility for feedback on impact of KAU technologies'	01 (1.11%)
9	Include information on NGOs / ICAR KVKs in Kerala (with their links)	01 (1.11%)
10	Include link to 'ECOSTATKERALA'	01 (1.11%)

1) Respondents, mainly Agricultural Officers and farmers, have demanded more content on precision/ hi-tech farming. This shows that farmers are highly motivated to follow this technique, which includes installation and maintenance of poly houses, green houses and rain shelters, and designing and setting up terrace gardens, all facilitating a massive production. The Kerala Government has accorded administrative sanction for a flagship project, named as the 'Model Hi-tech Green Village project' mooted by the State Department of Agriculture to establish poly houses and popularise precision farming techniques. Obviously, the Agricultural Officers, knowing this trend suggested including more details on this topic in the DoE website owing to its high demand.

2) The colour scheme used for the website especially in the Homepage was rated as improper by the scientists. They suggested changing the colour scheme to one that suits an official website. Colours being powerful tools for the visual appeal of a website and since they affect the users' feeling, perceptions, and interactions, the scientists rightly demanded the use of those colors that would make a user feel welcomed, comfortable, relaxed, and secure.
3) Agricultural Officers suggested that the content in the prototype was too wide and deep for the farmers. Logically the website of the Directorate of Extension of an agricultural university is not designed exclusively for the farmers, but the general population containing users from all levels of the society, from farmers to researchers. Hence the information can't be cut back.

4) Farmers and Agricultural Officers suggested adding photographs of pest and disease attack, nutrient deficiency, physiological disorders etc should be attached with each crop. They believed that this would help the farmers in easy identification of the disorder in the initial stages, enabling a better management of the problem.

5) Farm Tourism and zero budget farming are gaining popularity along with organic agriculture practices. Information on these topics was suggested to the DoE website. Farm Tourism is an integral part of eco-tourism, which keeps the agricultural interests of the farmers intact while providing them extra income through tourist visits to the farm. Kerala, being an agricultural predominant state, along with its scenic beauty it has tremendous potential for developing farm tourism in a big way without much additional investment. Zero budget farming is called so since all the required produces can be cultivated at the farm itself, with the least level of external inputs. It consists of mulching using agriculture waste generated from farm, mixed cropping with added importance on leguminous crops and also applying a set of preparations based on cowdung, and urine of traditional Indian cow.
6) Farmers proposed facility for on-line interactions with scientists in the DoE website through web conferencing, in the future. They believed this would help in more effective communication helping them to resolve the field problems. This facility can be thought of, as the popularity of the website catches up.
7) A recommendation insisted that "the website of DoE should be organised according to its constituent units as per its organisational set up". The prototype developed was seen as a general

extension website being a user-centered web prototype for DoE, instead of a specific website to DoE.

8) DoE can take up the addition of information on 'Analytical Services of KAU' and 'facility for feedback on impact of KAU technologies' in the final website.

9) The final website of DoE can have the information and links regarding NGOs / ICAR KVKs in Kerala and can include the link to 'ECOSTATKERALA'

10) As suggested, the details on Regional Agricultural Research Stations and other research stations were removed from the DoE web prototype.

4.4.4. Constraints reported during prototype testing process

The difficulties and constraints while trying out the prototype testing procedure were reported by the respondents through open-ended responses as seen in Table 47.

Table 47. Constraints reported during prototype testing process

No:	Constraints	No: & percentage of respondents who reported
1	Discussion forum, feedback form and search options are not working.	82 (91.11%)
2	Difficulty in downloading the Malayalam section	17 (18.89%)
3	Not mobile /smart phone friendly	11 (12.22%)
4	Dead links identified under important links section	06 (6.67%)
5	Some external links take too long to open	05 (5.56%)
6	Some documents take too long to download	02 (2.22%)
7	Difficulty in locating the position of contents	01 (1.11%)

The above seven constraints are interpreted and discussed hereunder:

4.4.4.1. A web prototype, being an incomplete working model, without sufficient data base, interactive facilities would not be functional in it. Hence the users found the options like discussion forum, feedback form and search as non-functional.

4.4.4.2. Respondents found difficulty in downloading Malayalam section. This section has used pdf files for the time being. Difficulty in downloading could be attributed to the poor internet connection.

4.4.4.3. The respondents who used mobiles and smart phone reported difficulty in accessing the web prototype. The prototype was mainly designed for desktop resolutions. Hence it may not function properly in all types of mobile phones / smart phones, especially in the low-end models. At the same time, some of the users reported it was working well in their mobile phones.

4.4.4.4 A few organisations' links were under construction at the time of this prototype testing. So the respondents judged those links as dead as they were unable to access them. They were rectified later and all links were found to be dynamic.

4.4.4.5. The respondents commented that some external links took longer to load. This might either be due to slow internet speed or due to the page type of the external website.

4.4.4.6. Certain documents were accused of taking much time to load. This also might be attributed to the users' poor internet connection.

4.4.4.7. One user reported difficulty in locating the contents. The user also evaluated that the labelling of the navigation bars was of little help to find the required contents easily. In addition, the user suggested changing the position of 'About DoE' from the bottom of the page to the top. In this context it is worthy to mention the finding of Suresh and Gopalakrishnan (2012) that there is significant difference in the *location* of the web objects commonly found in the agricultural university websites.

4. 5. REFINEMENT OF THE WEBSITE PROTOTYPE

The web prototype refinement was done incorporating all the possible suggestions and solving the constraints (See Tables 48 and 49). The rest of the suggestions were submitted to the DoE for inclusion in the final website. The refined prototype-prototype 2- had 57 links in the Homepage and a total of 104 web pages.

Table 48. Actions taken on the suggestions of the respondents

No:	Suggestions	Modifications done/ submitted to DoE
.	Include more content on precision/ hi-tech farming.	Submitted to DoE for inclusion in the final website.
.	Use colours suitable for a professional site.	Colour schemes of the design of web pages, background, and fonts, were changed to those befitting an official website.
.	Too much content for the farmers.	Contents are not reduced as the website is for the general public, ranging from farmers to academicians.
.	Photographs of pest and disease attack, nutrient deficiency, physiological disorders etc should be attached with each crop.	Submitted to DoE for inclusion in the final website.
.	Include content on farm tourism and zero budget farming.	Submitted to DoE for inclusion in the final website.
.	Provide facility for online meetings with scientists.	Submitted to DoE for inclusion in the final website while scaling up.
.	Website should be specific as per the organisational set up of DoE.	The prototype being a user-centered extension platform, design of the website was done giving primary importance to the information requirements of the users.

Table 49. Solutions for the reported constraints

No:	Constraints	Solutions made /proposed
1.	Discussion forum, feedback form and search options are not working.	These would be functional only in the final website, since a prototype does not support these interactive functions due to lack of sufficient database.
2.	Difficulty in downloading the Malayalam section	Use of better working internet connection. Familiarisation in downloading the Malayalam fonts is required.
3.	Not mobile /smart phone friendly	Prototype was designed for desk top

		resolutions, which may not be supported by all mobile phones, especially the low-end models.
4.	Dead links identified under important links section	All the links were found working properly.
5.	Some external links take too long to open	Use high speed internet connection.
6.	Some documents take too long to download	Use high speed internet connection.
7.	Difficulty in locating the position of contents	Navigation bars of the initial prototype were relabelled and the content locations were rearranged facilitating the easy access of information by the users.

Plate 1. Homepage of the user-centered web prototype 1 of DoE, KAU

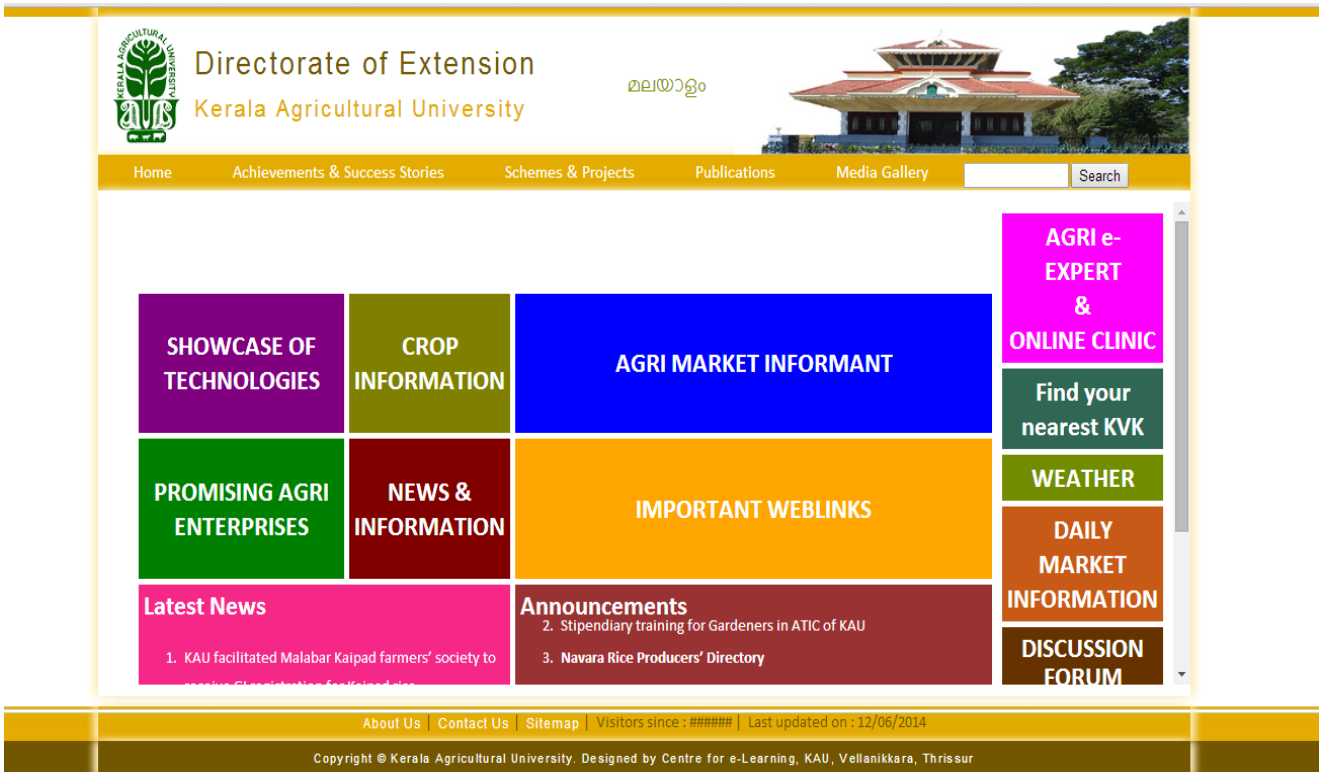
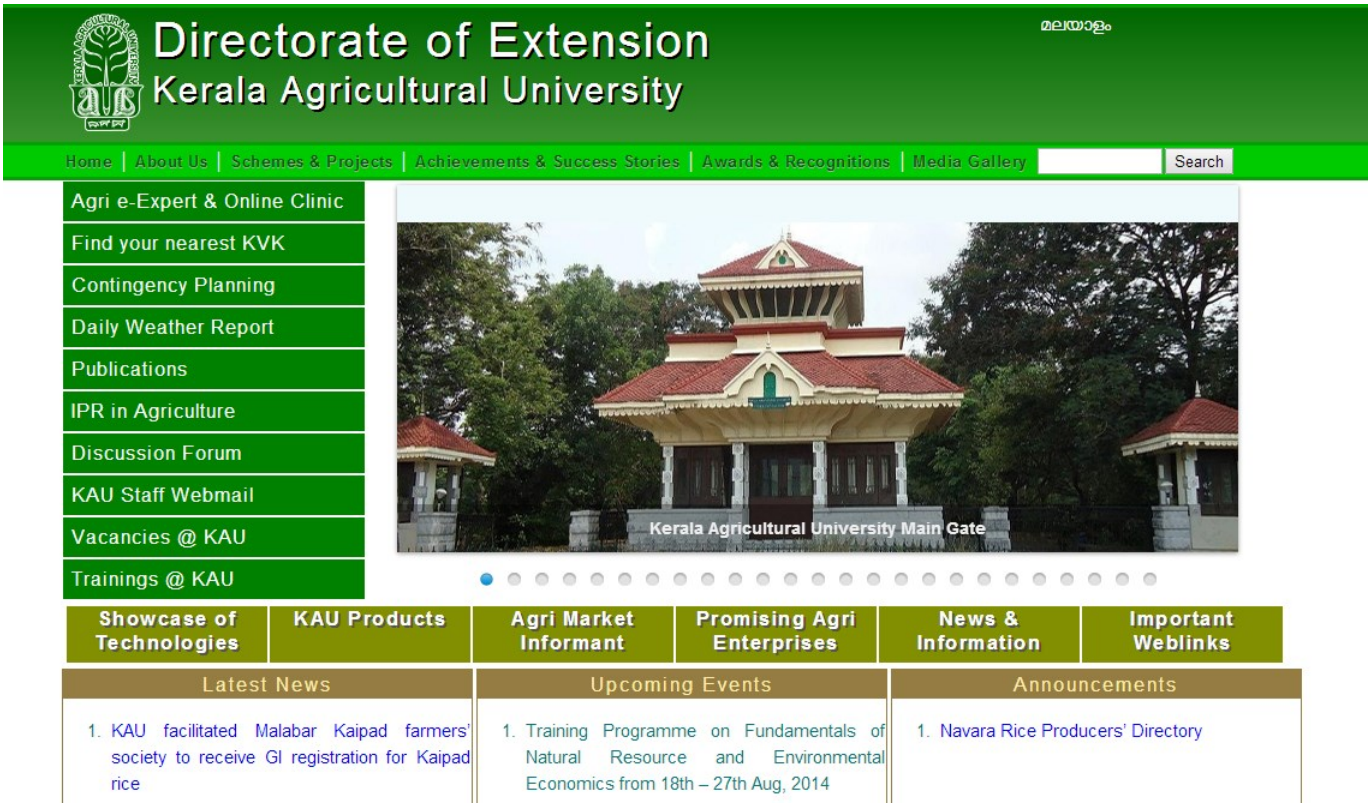


Plate 2. Homepage of the user-centered web prototype 2 of DoE, KAU



4.6. SUGGESTED MODEL PROTOCOL FOR THE DEVELOPMENT OF A USER-CENTERED WEBSITE.

The present study, besides delivering a website prototype to the DoE, KAU, has contributed an easy to follow sequential steps and procedures (protocol) which the future researchers in the same line can follow. Based on the present work, the following protocol is put forth for the development of a user-centered website.

Fig 8. Protocol for the development of a user-centered website.

SUMMARY
AND
CONCLUSIONS

5. SUMMARY AND CONCLUSIONS

With the advent of internet as an unrivalled gateway to a vast wealth of knowledge and information, the World Wide Web has got deeply ingrained in our culture and everyday lives. Millions of people from all walks of life are connected every day and its uses are virtually unlimited.

The web presence offers a professional and credible image for any organisation. Kerala Agricultural University (KAU) being one of the prestigious institutions under Indian Council of Agricultural Research (ICAR) had a long felt need that Directorate of Extension (DoE), KAU launched a need-based website as a part of strengthening its extension activities. The present KAU website, www.kau.edu, contains more of academic matters and does not cater to the information needs of all the stakeholders.

It was with this background that the present study on user-centered, bilingual, website prototype for DoE, KAU was undertaken, with the following objectives:

1) To generate need based e-contents to develop the first level prototype of a bilingual website for the Directorate of Extension, Kerala Agricultural University.

2) Participatory assessment and refinement of the prototype before its final design by the host organization.

A web prototype is a rudimentary working model of a website that allows the developer to check for flaws and to make sure that the website will be easy to use. Prototyping helps to save the time, cost and effort for correction and refinement in the later stages of website development process.

The location of the present study was the state of Kerala, it being the first e-literate state in India. The respondents included scientists of Kerala Agricultural University (KAU), extensionists of the Kerala State Department of Agriculture and the farmers of Kerala. A pilot study, done among 20 multidisciplinary scientists of Kerala Agricultural University (KAU) and 10 officers of the State Department of Agriculture were drawn specifically from Thrissur district of Kerala, identified the major prospective stakeholders of the intended website and explored the main and sub contents of the website. The first phase of the main study, with 120 scientists of KAU**,** 120 officers of the State Department of Agriculture and 30 farmers from Thrissur and

Palakkad districts as the respondents, identified their information needs and provided suggested further contents. The web prototype thus built in English and Malayalam, based on the preferences of the stakeholders was temporarily hosted online. The second phase of main study assessed this prototype, by examining the mean scores of 30 scientists of KAU, 30 Officers of the State Department of Agriculture and 30 farmers regarding the contents and formats of presentation, information management and other important attributes of the web site. The link was mailed to them along with the excel questionnaire. Their suggestions were recorded for the development of the final DoE website. Testing of the usability of web prototype was done by giving testing exercise (task). Self reported validation was used for task success rates in terms of effectiveness of use, efficiency of use and satisfaction of the user. The solutions for the constraints listed by the users were found. The refinement of the website prototype was done based on the feedback obtained from the respondents. The refined prototype together with the suggestions was handed over to the Directorate of Extension, KAU for final website development and launching.

Salient findings of the study are as follows:

5.1. The pilot study identified agricultural scientists, agricultural extension officers and farmers as the major prospective stakeholders of the intended website. The other potential clients were identified as agripreneurs, researchers, school /college students, self-help groups, non-government organizations, banks, policy makers, other line departments, and private sector organizations.

5.2. The pilot study explored the following 15 main contents and their sub contents for the website. The main contents were 'About DoE', 'Schemes & Projects', 'Showcase of Technologies', 'Locating Your Nearest KAU KVK', 'Crop Information', 'Agri Market Informant', 'Weather', 'Promising Agri-Enterprises', 'Forthcoming Events', 'News& Information', 'Publications From KAU', 'Media Gallery', 'Important Links', 'Links To Social Network Media' and 'Contact Us'.

.**5.3**. The sub contents under each main item were as follows.

(a)'About DoE' included details on 'History and Mandate', 'Vision And Mission', 'Services and Activities,' 'Organisational set up', 'Staff profile', 'Constituent units of DoE, KAU', 'Honours and Awards', 'Achievements', and 'Success Stories'. Contents like 'Planning for Contingency /

adverse Situations' and 'RTI officer / Public Information Officer' were additionally suggested.

(b) 'Schemes and projects' had the 'Mission of each scheme and project', 'Guidelines of funding agencies' and 'Links to website of the funding agencies'.

(c) 'Showcase of technologies' documented 'Technologies developed *(by KAU)',* 'Technologies commercialized', 'Farmers' innovations', 'Video clips of demonstration of technologies'.

(d) 'Crop Information' included 'Crops' which led to Centre of e-learning link describing crop production details, 'Agri e-expert links' that led to crop health guides like KAU fertulator, crop health diagnoser, and information on 'Availability and rate of planting materials, bio control agents, hybrid seeds, organic manures, and value added products' from KAU.

(e) 'Agri Market Informant' had 'Daily agri-market price information', 'Major markets', 'Seasonal markets in Kerala'. 'Farmers markets' and 'NGO run markets' of Kerala were suggested by the respondents.

(f) 'Promising agri-enterprises' included information on 'Mushroom Cultivation', 'Honeybee Rearing', 'Processing & Value Addition Of Fruits& Vegetables', 'Production Of Bio-Fertilizers', 'Production Of Composts', 'Plant Propagation By Tissue culture', 'Flower Arrangement & Dry Flower Products', 'Hi-Tech/Precision Farming', 'Plant Propagation & Nursery Management Techniques' and 'Medicinal Plant Cultivation'. 'Production of Bio Control Agents' and 'Landscaping' were suggested by the respondents.

(g) Respondents proposed to include details on 'Training Programs', 'Technology Week', 'Farmer-Scientist Interactions', 'Exhibitions, Seminars, Symposia, Workshop' under 'Forthcoming Events'.

(h) 'News and Information' had sub-contents like 'Ready for Sale', 'Downloads', 'Letters and Circulars', and 'Agriculture Related Geographical Indications From Kerala'. Respondents recommended 'Patents from KAU' as needed information.

(i) 'Publications' included 'List of Publications' and 'KAU Vision 2030'. Further 'Publications in pipeline' was suggested.

(j) 'Important links' comprised links to 'Public Agricultural Extension Departments', 'Commodity Boards', 'Market Federations' and 'ICAR Institutes'.

(k) 'Contact Us' had 'Communication Address', 'Feedback Form', and 'Discussion Forum'.

5.4. Statistically significant, weak to moderate inter-rater agreement was found within 120 scientists, 120 extensionists and 30 farmers on the 15 main information needs.

5.5. The 120 research scientists were united in their agreement regarding 'Links to social network media' followed by 'Important links' and 'Schemes & Projects' .

5.6. Among the 120 extensionists, the highest concordance was observed for the information needs indices of 'Schemes & Projects', 'Promising agri-enterprises' and 'Links to social network media'.

5.7. In the case of 30 farmers, the agreement was highest for the information needs indices of 'Agri Market Informant', 'Media Gallery' and 'About DoE, KAU'.

5.8. The least agreement within the scientists was found for the information needs of 'Showcase of technologies', 'Crop Information' and 'Media Gallery'. For the extensionists, they were 'Showcase of technologies', 'Agri Market Informant 'and 'Contact Us'. In contrast, for the farmers least concordance was found in the information needs of 'Publications from KAU', 'Links to social network media', 'Schemes & Projects', 'Locating your nearest KAU KVK' and 'News and Information'.

5.9. Out of the 15 main information needs significant differences were found for 'Schemes and Projects', 'Crop Information', 'Weather', 'Promising agri-enterprises', 'Links to social network media', 'Forthcoming events', 'News & Information', 'Publications from KAU', 'Media Gallery' and 'Important links'.

5.10. When all scientists and extensionists wanted to see information on 'Schemes and Projects', farmers didn't find it as important.

5.11. Farmers' INI were highest for 'Crop Information', 'Weather', 'Promising agri-enterprises', 'Links to social network media' and 'Contact Us'.

5.12. When only 73 per cent of the scientists preferred including social media links, 100 per cent farmers as well as extensionists wanted that provision in the website.

5.13. Scientists showed the highest INI among three groups for 'Forthcoming events', 'News & Information', 'Publications from KAU', 'Media Gallery', and 'Important links'.

5.14. Extensionists showed the least INI for 'About DoE, KAU' 'Crop Information', 'Weather', 'Promising agri-enterprises', 'Forthcoming events', 'News& Information', 'Publications from KAU', 'Media Gallery', 'Important links' and Contact Us.

5.15. Significant differences in the INI, at 0.05 level, were found for the sub contents of 'About DoE, KAU', 'Showcase of technologies' , 'Agri Market Informant ','Promising agri-enterprises', 'News& Information', 'Publications from KAU', and 'Important links'.

5.16. Scientists' INI were the highest for all the sub-contents of 'About DoE, KAU'. Farmers showed the comparatively least INI for 'History & Mandate', 'Vision & Mission', 'Organizational setup', and 'Staff profile'. Extension officers need indices were the lowest for 'Services & Activities', 'Constituent units of DoE, KAU', 'Achievements *(of DoE)',* 'Honours and awards *(of DoE)', and* 'Contingency planning & Planning for adverse situations'.

5.17. Scientists showed highest INI for 'Technologies developed *(by KAU)'* and farmers' were the highest for 'Farmers' innovations'.

5.18. The indices of the farmers were the highest for all items in Agri Market Informant, whereas scientists recorded the least INI for most sub-items regarding agricultural markets and prices.

5.19. Farmers' indices were the highest for all agri-enterprises except 'Flower arrangement & dry flower products' and 'Landscaping', for which the scientists registered the high indices.

5.20. Scientists showed high need indices than extension officers in the case of enterprises like'Mushroom cultivation', 'Processing & Value addition of fruits& vegetables', 'Production of bio-fertilizers', 'Production of bio control agents', 'Plant propagation & Nursery management techniques', and 'Medicinal plant cultivation'.

5.21. Extension officers' indices were the higher than the scientists' for the enterprises of 'Production of Composts', 'Plant propagation by Tissue Culture' and 'Hi-tech/Precision farming'.

5.22. The indices of scientists were the highest for all sub items of news and information, where

as that of the extensionists' were the least for 'New releases', 'Ready for sale', 'Geographical indications from Kerala (Agricultural and horticultural products)' and 'Patents from Kerala Agricultural University'. Farmers indicated least indices for 'Downloads' and 'Letters and circulars'.

5.23. Scientists' index was the highest for 'List of publications' and 'KAU Vision 2030' whereas the extensionists showed the least index for the former and farmers showed the least index for the latter.

5.24. The farmers gave highest index for links to the 'Public Agricultural Extension departments' and the scientists' index was the lowest for the same.

5.25. There were no significant differences in the need indices of the sub contents of 'Schemes & Projects', 'Crop Information', 'Forthcoming events', and 'Contact Us'.

5.26. Significant differences in the information needs were found between 120 scientists and 120 extensionists except in all the main contents except 'Schemes & Projects' and 'Showcase of technologies'. The scientists' information need indices were higher for all the 15 main information items where as the extensionists recorded a comparatively less INI for those items.

5.27. The respondents suggested the following contents for the DoE website.

1) Regular updating of the website
2) Agricultural machineries
3) List of restricted pesticides in Kerala
4) Banana cultivation
5) List of agencies providing agricultural inputs and equipments
6) Price details of KAU publications
7) Preparation of botanical pesticides
8) Sericulture
9) Link to organic Package of Practices
10) Link to State Agricultural Management and Extension Training Institute (SAMETI)
11) Link to Agricultural Technology Management Agency (ATMA)
12) Link to Kerala Hi-tech Agriculture Portal

13) Link to Kerala Soil Fertility Portal
14) Link to Kerala Forest Department
15) Link to National Seed Corporation
16) The Kerala Conservation of Paddy Land and Wet Land Act, 2008
17) Link to Food and Agricultural Organisation (FAO)
18) Link to Consultative Group on International Agricultural Research(CGIAR)
19) Link to International Food Policy Research Institute (IFPRI)
20) Link to Journal of Tropical Agriculture
21) Dignitaries who visited KAU
22) Add Latest news to the home page
23) Add Announcements to the home page

5.28. The main observations for the website assessment were ranked based on the grand means obtained from the sub sample means. 'Perceived extent of use' and 'Provisions for scaling up and updating' have got the highest grand mean score. The other attributes were given fair scores. The lowest rank was recorded for 'Interactivity'.

5.29. The differences among the mean scores of scientists, extension officers and farmers with respect to the assessment traits were not statistically significant. Excellent concordance was noted among the respondents.

5.30. Under 'content and information management', farmers' scores were the highest for accuracy, reliability, depth of contents and coverage. Extension officers had a highest mean score for the relevance and scientists' score was the highest for clarity.

5.31. Farmers' mean scores were the highest for organisation, appeal and colour scheme for which the scientists' mean scores were the least.

5.32. When all the respondents judged the external links included as appropriate, the working of the links was rated with a low mean score by the scientists.

5.33. Farmers gave the highest mean score for provision of enrichment of the website in future, content and quality wise. Scientists' highest mean score showed that they believed in the possibility of using this website as a platform for online courses and trainings.

5.34. Highest mean score for easiness was reported by farmers and for quickness, by scientists.

5.35. The mean scores of scientists, extension officers and farmers for interactivity were showing a poor performance.

5.36. Scientists announced a highest mean score for the format, speed and navigation, whereas agricultural officers' mean score was the highest for readability.

5.37. The high mean scores of all the respondents for 'perceived extent of use' denoted that website would be an important agricultural knowledge source for all stakeholders and organisations, irrespective of their locations.

5.38. Testing of the web prototype was done online by giving specific task to the respondents and self reported validation was used to assess task success rates. The task success rates were determined by effectiveness of use, efficiency of use and satisfaction of the users.

5.39. Effectiveness of use was checked by enquiring the respondents if they were able to successfully complete the specific task assigned to them. When it was 93.33 per cent for the farmers, it was 90 per cent and 83.33 per cent for the extensionists and the scientists respectively.

5.40. Efficiency of use was measured by asking them to note down the average time taken to accurately complete the task. It was 12 minutes, 11 minutes and 4 minutes for the scientists, extensionists and farmers respectively.

5.41. Satisfaction was recorded by the user as the degree of comfort in using the website, as high level, medium level or low level. When 70 per cent of farmers recorded high level of satisfaction, the same per cent of scientists recorded medium level of satisfaction. Thirty per cent of farmers showed medium level satisfaction. Sixty per cent of the extension officers were having medium satisfaction and the rest showed high satisfaction. Only 26.67 per cent of scientists were highly satisfied with the prototype, 3.33 per cent indicated a low level of satisfaction.

5.42. Suggestions provided by respondents for the refinement of the final DoE site:

1. Include more content on precision/ hi-tech farming.

2. Organise contents and use colours suitable for a professional site.

3. Too much content for the farmers.

4. Photographs of pest/disease attack, nutrient deficiency, physiological disorders etc should be attached with each crop.

5. Include content on farm tourism and zero budget farming.

6. Provide facility for online meetings with scientists.

7. Website should be specific as per the organisational set up of DoE.

5.43. Constraints reported by the respondents:

1. Discussion forum, feedback form and search options are not working.
2. Difficulty in downloading the Malayalam section
3. Not mobile /smart phone friendly
4. Dead links identified under important links section
5. Some external links take too long to open
6. Some documents take too long to download
7. Difficulty in locating the position of contents

Conclusion

In today's time of internet popularity and globalization, a website is a dynamic tool for any institution. Directorate of Extension, KAU can use it as an extension tool for easy information dissemination as well as to inform about the products and services it can offer. The present general website of KAU caters to the needs of only a narrow band of users, due to its administrative nature. A user-centered, bilingual website would be a well advised solution to this problem. Directorate of Extension, KAU can successfully use an interactive website as a prominent information dispersal tool in the coming days. Once the final DoE website is linked with the popular agri-tech portals, it can become a strong website both for technology dissemination and administration. The user centered web prototype developed for DoE, KAU, in English and Malayalam as part of this study, was based on the information needs of KAU scientists, extension officers from State Department of Agriculture and farmers. The end-users welcomed such a gesture of KAU with great enthusiasm. They recognised the developed user-centered, bilingual DoE web prototype as an informative, user-friendly and indispensable communication tool of KAU. They were highly assured of the usefulness of such a website and were highly confident about its content and information management, design and layout, linkage provided and information retrievability. The area that needed modification was the interactivity

of the prototype. The users identified the possibilities of scaling up the website in the future enriching the content and quality enabling its use as a platform for online courses and training. The users were eager about the early completion of the final DoE website that would be fully functional, so that it would be an effective information tool for all the stakeholders. The present prototype after refinement, along with the suggestions and further information needs, were handed over to the DoE, KAU. Directorate of Extension, KAU may take up the challenge of developing the final DoE website based on the present prototype as early as possible taking up value addition and updating.

Suggestions for future work and research

1. The DoE, KAU may develop the final website with further refinement and enrichment of the present prototype.
2. Regular updating, refinement, enrichment and upgrading of the website can be periodically.
3. The Malayalam version can be suitably modified by the DoE, based on their future needs.
4. Inclusion of web conferencing facilities can be thought of while scaling up the DoE website.
5. End user evaluation of the final version of the website can be taken up.
6. Frequent user-based assessment and refinement of the website can be done.

Modifications done in the web prototype 2 based on the suggestions of Ph.D. defense seminar committee

Provisions for the information as given below have been made in the website prototype 2 as part of the modifications / recommendations given by the PhD defense seminar evaluation committee.

1) Provision for adding details of the major industries connected with agriculture and crops.
2) Provision for supplying the details on varieties / planting materials, quantity available in the season, season of availability, price, facility for advance booking etc.
3) Provision for adding details of the scientific staff, with their mobile number, email address and area of specification.
4) Provision for adding links to the Krishi Bhavans and Agricultural departments with their contact details.
5) Provision for adding details of scientists who are ready for online discussion with the users.
6) It was asked whether free access to all the area in the website was necessary or any registration was needed. Being a web prototype with no confidential data, users were given free access to all the available information present in it.
7) Removed the Public Relation Officers' details to the organizational setup and RTI details were given separately.
8) Provision for linkage with promising farmers in different districts.
9) Provision for adding authors' names along with the publications' list.
10) Provision for including details of pesticides and their market availability.
11) Provisions for including photos in the agri-enterprises like mushroom cultivation, sericulture etc.

REFERENCES

REFERENCES

Alex, J. P. 2011. *Re-mandating the DoE*. Report of the Committee on re-mandating the DoE and establishing the Centre for Studies on Technology Society Interface and Policy in Agriculture (C-STIP). Directorate of Extension, Kerala Agricultural University, Thrissur, 13p.

Al-Safadi, L. A. and Garcia, R. A. 2012. ISO9126 Based Quality Model for Evaluating B2C e-Commerce Applications – A Saudi Market Perspective. *International Journal of Computer and Information Technology*. 3(2):8-15.

Aphunu, A. and Atoma, C. N. 2011. Extent of Use of ICTs by Fish Farmers in Isoko Agricultural Zone of Delta State, Nigeria. Journal *of Agricultural Extension* .15(1):10-21.

Asher, R. 1995. Networked communications in extensions. In: Bridge, P., Jeffries, P., Morse, D.R., and Scott, P.R.(eds.) *Information Technology, Plant Pathology and Biodiversity*. CAB International, London, pp. 407-417.

Babu, A. 2006. A comparative analysis of readiness and perception of information communication technology (ICT) beneficiaries in Kerala. M.Sc (Ag) Thesis, University of Agricultural Sciences, Bangalore, 212p.

.Baek, E., Cagiltay, K., Boling, E., and Frick, T. 2008. User-Centered Design and Development. In: Spector, J. M., Merrill, M.D., Merriënboer, J. V., and Driscoll, M. P.(eds.) *Handbook of Research on Educational Communications and Technology*(3rd Edition). Lawrence Erlbaum Associates, New York, pp 659-670.

Bailey, B. 2011. *Prototypes: What is a prototype?* [On-line]. Available: http://www.eetimes.com/author.asp?section_id=36&doc_id=1285614. [10-07-2014].

Bajec, M. and Krisper, M.. 2005. A methodology and tool support for managing business rules in organizations. *Information Systems.* 30(6): 423-443.

Ballantyne, P. 2009. Accessing, sharing and communicating agricultural information for development: an emerging trends and issues. Information Development, 25(4): 260-271.

Best, W. J. and Khan, V. J. 1986. *Research in education*. Prentice Hall of India, New Delhi. 112p.

Bodker, S., Ehn, P., Knudsen, J. L., Kyng, M., and Madsen, K.H. 1988. Computer support for cooperative design. In: *Proceedings of CSCW 88: Second Conference on Computer-Supported Cooperative Work,* 26–28, September 1988, Portland, pp-377-394.

Brown, J. S., and Adler, R. P. 2008. *Minds on fire: Open education, the long tail, and learning 2.0. EDUCAUSE Rev.* 43(1):16–32.

Butt, B., Shortridge, A., and Winklerprins, A. 2011. Pastoral herd management, drought coping strategies, and cattle mobility in Southern Kenya. *Ann. Assoc. Am. Geogr.* 99(2): 309-334.

Carroll, J. M., Chin, G., Rosson, M. B., and Neale, D. C. 2000. The development of cooperation: five years of participatory designing the virtual school. In: *Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods and Techniques*, June 25–28, London, pp. 239–251.

Chapman, C. 2011. *Comprehensive Review Of Usability And User Experience Testing Tools.* [On-line]. Available: http://www.smashingmagazine.com/2011/10/20/comprehensive-review-usability-user-experience-testing-tools/ [10-07-2014].

Chapman, C.2010. Content Organization: Deciding What Matters Most. [On-line]. Available: http://www.webdesignerdepot.com/2010/07/content-organization-deciding-what-matters-most/ [10-07-2014].

Chhachhar, A. R., Qureshi, B., Khushk, G.M., and Ahmed, S. 2014. Impact of Information and Communication Technologies in Agriculture Development. *J. Basic. Appl. Sci. Res*. 4(1)281-288.

Chiou, W.C., Lin, C.C., and Perng, C. 2010. A strategic framework for website evaluation based on a review of the literature from 1995–2006. *Information & Management.* 47 : (5–6), 282-290.

Chisenga, J. and Brakel, P.A. 2004. Content on Agricultural Research Organisation Web Sites: A Study of International Trends. *Libri.* 54:123–135.

Chisenga, J. and Brakel, P. A. 2005. Guidelines for developing agricultural information portals in the Southern African Development Community Region (SADC). *South African Journal of Information Management*. (7(1):1-19.

Christoplos, I. 2010. *Mobilizing the Potential of Rural and Agricultural Extension* [on-line]. Food and Agriculture Organization (FAO), Rome. Available: http://www.fao.org/docrep/012/i1444e/i1444e00.htm [10-07-2014].

Chisita, C.T. 2010. An investigation into the use of ICT in the provision of agricultural information to small scale farmers in Harare. In: Proceedings of *World library and information congress*: *76th IFLA general conference and assembly* [on-line].10-15 August 2010, Gothenburg, Sweden. Available: http://conference.ifla.org/past-wlic/2010/85-chisita-en.pdf [10-07-2014].

Crew, I. 2007.*User-centered design for IT services: The usability toolbox, part 2*. [On-line]. Available: https://inews.berkeley.edu/articles/Fall2007/999.html [10-07-2014].

Devadason, F. J., and Lingman, P. P. 1997. A methodology for the identification of information needs of users. *IFLA Journal. 23* (1); 41-51.

Dumas, J. and Loring, B.A. 2008. *Moderating Usability Tests: Principles and Practices for Interacting (Interactive Technologies)*. Morgan Kaufmann Publishers, Massachusetts. 208 p.

E-Agriculture and GenARDIS (Gender, Agriculture and Rural Development in the Information Society). 2011. *Gender, Information and Communication Technologies (ICTs) and Rural Livelihoods.* Policy Brief and Summary of the E-Consultation, 5-16th July 2010. [On-line]. Available: http://www.fao.org/docrep/017/ap856e/ap856e.pdf [10-07-2014].

Everitt, B. S. 2010. *Cambridge Dictionary of Statistics* (4th ed.), Cambridge University Press, Cambridge, UK. 478p.

Fabbri, M. 2013. *Quality assessment: Measuring specific experiences of a website.[On-line]*. Available: http://malinfabbri.com/2013/03/26/quality-assessment-measuring-specific-experiences-of-a-website/ [10-07-2014].

Franklin, T. 2004. *Portals in Higher Education: concepts & models*. The Observatory on Borderless Higher Education Report. Tom Franklin Consulting Ltd, London, 26p.

Freeman, R. T. and Yin, H. 2005. Tree view self-organisation of web content. *Neurocomputing*, 63:415–446.

Frempong, G., and Braimah, I. 2006. Assessing universal access to ICT in Ghana. In: Marshall, S., Taylor, W., and Yu, X. (eds.), Encyclopedia of Developing Regional Communities with Information and Communication Technology. Idea Group Reference, UK, pp. 28-34.

Frick, T., Su, B., and An, Y. J. 2005. Building a large, successful website efficiently through inquiry-based design and content management tools. *TechTrends*. 49(4):20–31.

Gilmore, T., Krantz, J., and Ramirez, R. 1986. Action Based Modes of Inquiry and the Host-Researcher Relationship. *Consultation.* 5 (3):160-176.

Gosh, S. 2001. ICT in Rural development, *Kurushethra* 52:27.

Griffith, J.B., and Smith, M.S. 1994. Information policy: The InformationSuperhighway and the National Information Infrastructure (NII). *Journal of Academic Librarianship*. 20 (2) : 93-95.

Gube, J. 2011. *22 Essential Tools for Testing Your Website's Usability*. [On-line]. Available: http://mashable.com/2011/09/30/website-usability-tools/ [10-07-2014].

Hasan, L. and Abuelrub, E. 2011 .Assessing the quality of web sites. *Applied Computing and Informatics* 9(1):11-29.

Hassan, S.N. 2008. Effective agricultural information delivery System - an action research among farmers. Ph.D. thesis, College of Agriculture, Kerala Agricultural University, Vellayani, 118p.

Helen, S. 2008. Agricultural expert system: A participatory assessment. Ph.D. thesis, College of Horticulture, Kerala Agricultural University, Vellanikkara, 158p.

Idler, S. 2012. Top 9 Guidelines For A Better Content Organization. [On-line]. Available: http://blog.usabilla.com/the-ultimate-guide-to-content-organization-in-web-design/ [10-07-2014].

ISO 9241-11. 1998. *Ergonomic requirements for office work with visual display terminals (VDT)s - Part 11 Guidance on usability*. International Organization for tandardization, Geneve.

ISO 13407. 1999. *Human-Centred Design Processes for Interactive Systems.* International Organization for Standardization, Geneve.

Joo, S., Lin, S. and Lu, K.2011. A Usability Evaluation Model for Academic Library Websites:Efficiency, Effectiveness and Learnability . *Journal of Library and Information Studies*. 9(2) :11-26.

Joshy, P.M. 2014. Navamadhyama mathrukayumaayi itha oru Krishi Bhavan. *Kerala Karshakan.* May 2014, pp.64-66.

Karanja, G. 2006. "African Tertiary Institutions Connectivity Survey (ATICS) 2006 Report. [On-line]. International Development Research Centre, Ottawa. Available: http://ahero.uwc.ac.za/index.php?module=cshe&action=viewtitle&id=cshe_172 [30-07-2014].

Kate, H. W. 2010. *Ten website assessment criteria.* [On-line]. Available: http://keykate.wordpress.com/2010/06/14/ten-website-assessment-criteria/ [10-07-2014].

Kerlinger, F. N. 1964. Research design, meaning, purpose and principles. *Foundations of behavioural research*. (11th Indian reprint) 2009. Surjeet Publications, New Delhi. 300p.

Koshy, S. M. 2013. Development and validation of web interface for research management in Kerala Agricultural University. M.Sc. (Ag) thesis, College of Horticulture, Kerala Agricultural University, Thrissur, 107p.

Krug, S. 2005. *Don't Make Me Think: A Common Sense Approach to Web Usability* (2nd ed). New Riders Publishing, California, 216 p.

Kumar, N. A.M., Babu, B.R., Gopalakrishnan, S. and Rao, P.N.2010. Location of web objects and links in the web sites of universities in Tamil Nadu: A study. SRELS Journal of Information Management. 47(3):325-338.

Lal, S.B., Pandey, P.K., Rai, P. K. Rai, A., Sharma, A., and Chaturvedi, K.K. 2013. Design and development of portal for biological database in agriculture. Bioinformation. 9(11): 588–598.

Lewin, K. 1946. Action research and minority problems. *J. of Social Issues* 2:34-46.

Mabe L. K. 2012. Constraints related to use of Information Communication Technologies tools among extension officers in the North- West Province, South Africa. *Life Science Journal* 9(3):1616-1619.

Mekonnen, F., Sehai, E., Tegegne, A. and Tsegaye, D. 2009. A web portal on Ethiopian agriculture: IPMS experience. In: *Proceedings of 19th Annual Conference of the Ethiopian Society of Animal Production.* 15-17 December, 2011, Addis Ababa, Ethiopia, pp 13.

Miranda, S. V. and Tarapanoff, K. M. A. 2007. Information needs and information competencies: A case study of the off-site supervision of financial institutions in Brazil. *Information Research. 13*(2). Paper 344. Available: http://informationr.net/ir/13-2/paper344.html [10-07-2014].

Moustakis, V.S., Litos, C., Dalivigas, A., and Tsironis, L. 2004. Website quality assessment criteria. In: *Proceedings of the Ninth International Conference on Information Quality (ICIQ-04).* [On-line]. Available: http://mitiq.mit.edu/ICIQ/Documents/IQ%20Conference%202004/Papers/WebsiteQualityAssessmentCriteria.pdf [10-07-2014].

Murtagh, R. .2013. Million Dollar Websites : Build a Better Website Using Best Practices of the Web Elite in E-Business, Design, SEO, Usability, Social, Mobile and Conversion(1st ed.), Earl Press, United States, 300p.

Musa, N. and Githeko, J. 2012. The Adoption and Use of ICT by Small Scale Farmers in Gezira State, Sudan. In: *Proceedings of Third IAALD Africa chapter conference on E-agriculture for improved livelihoods and food security in Africa*. 21-23 May 2012 Johannesburg, South Africa.12p.

Myer, T. 2007. How to conduct a Web site competitive analysis [online]. Available: http://www.ibm.com/developerworks/webservices/library/us-analysis.html [5 Sept. 2011].

Nielsen**, J.** 2012. *Usability 101: Introduction to Usability* [On-line]. Available: http://www.nngroup.com/articles/usability-101-introduction-to-usability/ [10-07-2014].

Obidike, N. A. 2011. Rural Farmers' Problems Accessing Agricultural Information: A Case Study of Nsukka Local Government Area of Enugu State, Nigeria. *Library Philosophy & Practice Case study* [On-line]. Available: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1734&context=libphilprac [10-07-2014].

Ogbomo, M. O. and Ogbomo, E. F. 2008. Importance of Information and Communication Technologies (ICTs) in Making a Healthy Information Society: A Case Study of Ethiope East Local Government Area of Delta State, Nigeria. *Library Philosophy and Practice* [on-line] Paper 219. Available: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1220&context=libphilprac [10-07-2014].

Ogbonna, O. I. and Agwu, A.E. 2013. Availability, level of use, importance and constraints to utilization of information communication technologies by farmers in Enugu state, Nigeria. *Direct Research Journal of Agriculture and Food Science* 1 (4):44-48.

Oyeyinka, R. A. and Bello, R. O. 2013. Farmers Use of ICTs for Marketing Information Outlets in Oyo State, Nigeria . *Journal of Agricultural Science*. 5(11):150-158.

Prabhu, M. J. 2012. Mass production of bio-control agent empowers tribal women .*The Hindu [On-line]*. 7 Nov 2012. Available: http://www.thehindu.com/sci-tech/agriculture/mass-production-of-biocontrol-agent-empowers-tribal-women/article4074467.ece [10-07-2014].

Prasad, H. N. 2012. *Information need and users*. (2nd ed.) B.R. Publishing corporation, Delhi, 225p.

Prasad, S. 2013. Prototying Model [On-line]. Available : http://studentsrokz.blogspot.in/2013_02_01_archive.html [10-07-2014].

Rahman, A. A. M. 2011. Use of Information and Communication Technologies (ICTS) by Agricultural Extensionists in the Gezira State, Sudan. In: *Proceedings of African Forum for Agricultural Advisory Services Symposium* 2011. 12th – 14th April 2011, Accra, Ghana.19p.

Raj, R. 2014. A good harvest with FB support. *Deccan Chronicle.*8 May 2014.p13.

Raju, V. N. and Harinarayana, N.S. 2011. Identifying the location of web objects: a study of library web sites. In: *Proceedings of 8th International CALIBER - 2011*, 02-04 March 2011, Goa University, Goa, pp 28-39.

Ramirez, M. M. 1986. Participatory action research as a communication process. *Media Asia.* 13: 184-194.

Rao, N. H. 2007. A framework for implementing information and communication technologies in agricultural development in India. *Technological Forecasting & Social Change* .74: 491 – 518.

Rees, D.2013. *Improving Your Website Usability Tests*. [On-line]. Available: http://www.smashingmagazine.com/2013/01/08/improving-your-website-susability-tests-2/ [10-07-2014].

Reigeluth, C. M. and Duffy, F. M. 2007. Trends and issues in P-12 educational change. In: Reiser, R. A. and Dempsey, J. V. (eds.). *Trends and Issues in Instructional Design and Technology*, (2nd ed.). Prentice Hall, New Jersey, pp. 209–220.

Reigeluth, C. M. and Frick, T. 1999. Formative research: a methodology for creating and improving design theories. In: Reigeluth, C. (ed.) *Instructional-Design Theories and Models*. Vol. II, Lawrence Erlbaum Associates, New Jersey, pp. 633–652.

Renwick, S. 2010. Current trends in agricultural information services for farmers in Trinidad and Tobago Caribbean. In : *Proceedings of the 76th IFLA General conference and assembly*, 10-15 August 2010,Gothenburg, Swede, pp 1-12.

Rose, M. 2005. *Prototype.* [On-line]. Available: http://searchmanufacturingerp.techtarget.com/definition/prototype [10-07-2014].

Roth, S. P., Schmutz, P., Pauwels, S. L., Bargas-Avila, J. A.and Opwis, K. 2010. Mental models for web objects: where do users expect to find the most frequent objects in online shops, news portals, and company web pages? *Interacting with Computers*. 22:.140-152.

Rubin, J.,Chisnell, D., and Spool, J. 2008. *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests* (2nd ed). *John Wiley & Sons, Inc,USA, 384p.*

Rudgard S., Ballantyne, P Castello, R. D., Edge, P. , Hani, M. , Maru, A., Morras, E., Nichterlein, K., Porcari, E., And Treinen, S. 2011. *ICTs as enablers of agricultural innovation systems.* In: *ICT in agriculture Connecting small holders to knowledge network and institutions.* World Bank Report No. 64605, World Bank, Washington DC, pp. 113-14.

Salum, A and Pather, S. 2006. Harmonising website design and service quality criteria. In: *Proceedings of the 8th Annual Conference on World Wide Web Applications.* 6-8 September 2006, Bloemfontein, South Africa.18p.

Salum, A. and Pather, S.2007. Harmonising website design and service quality criteria. In: Brakel, P.A. (ed). *Proceedings of the 8th annual conferenceon World Wide Web applications*. 6-8 September, 2006, Bloemfontein , South Africa.18p.

Sani, L., Boadi, B.Y., Oladokun, O., and Kalusopa, T. 2014. The Generation and Dissemination of Agricultural Information to Farmers in Nigeria: A Review. *Journal of Agriculture and Veterinary Science* 7(2):102-111.

Shaikh, D. A., Chaparro, B S., and Joshi, A. 2006. Indian users' expectations for the location of web objects on informational websites. In: *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* October 2006, 50(17): 1922-1926.

Silerova, E. and Lang, K. 2006. Information systems - tool for changing our future. *Zemedelska Ekonomika*. (Czech). 52(10): 447-450.

Srinivasan, K. , Singh, S.K. , and Ravi Natarajan. 2002. Enhancing input use efficiency for plant protection - the IT way. In: Sreedharan, K. , Vinod kumar, P. K., Jayarama, and Chulaki, B. M. (eds.), *Proceedings of the fifteenth Plantation Crops Symposium*, Mysore, India, pp. 481-486.

Srivihok, A. 2000. *An Assessment Tool for Electronic Commerce: End User Evaluation of Web Commerce Sites.* Technical Report, Faculty of Science, Kasetsart University, Bangkok, Thailand, 6p.

Stefani A. and Xenos M. 2008. E-Commerce System Quality Assessment using a Model based on ISO 9126 and Belief Networks. *Software Quality Journal,* 16 (1): 107-129.

Stoimenova, S.T. and Christozov, D.2013. Informing via Websites: Comparative Assessment of University Websites. *Issues in Informing Science and Information Technology* 10: 525-537.

Sulaiman, F., Zailani, S., Ramayah, T. 2012. Intranet Portal Utilization: Monitoring Tool for Productivity - Quality and Acceptance Point of View. *Procedia - Social and Behavioural Sciences.* 65:381 – 386.

Suresh, K. and Gopalakrishnan, S., 2012.Content Organization in Websites of Agricultural Universities in India: A Web Analytic Study. *Library Philosophy and Practice* [On-line]. Available: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2017&context=libphilprac/ [10-07-2014].

Swafah, C. 2011. Decision support system on nutrient recommendations for rice - an end user assessment. M.Sc. (Ag) thesis, College of Horticulture, Kerala Agricultural University, Thrissur, 87p.

Uden, L, & Salmenjoki, K. 2007. Evolution of portals. In: Tatnall, A. (ed.), *Encyclopedia of Portal Technologies and Applications*. IGI Publishing, Hershey, USA, 1223p.

Winstead, A.T. 2010. Precision Agriculture Education: Using Social Media. In: *10th International Conference on Precision Agriculture*. 18-21 July, 2010, Denver, Colorado. Alabama Co-operative Extension System,16p.

Zhang, P., Von Dran, G., and Small, R.V; 1999. Websites that satisfy users: A theoretical framework for Web user interface design and evaluation [abstract].In: *Abstracts,* 32nd Annual Hawaii International Conference on System Sciences (HICSS-32); 5-8 January, 1999, Hawaii. IEEE Computer Society, Maui, Hawaii, pp.2016.

Zhang, W. 1998. Analyzing faculty and staff's information needs and use of electronic technologies: A liberal arts college's experience. *Journal of Education Media and Library Sciences. 35*(3): 218-241.

APPENDICES

Appendix -1

KERALA AGRICULTURAL UNIVERSITY
Department of Agricultural Extension
College of Horticulture Vellanikkara, Thrissur

Dr. P. Ahamed
Professor (Agril. Extension)

Dear Sir/Madam, Date: 21/3/2013

Warm Greetings!

This is a request from me as the Chairman of the Doctoral student Miss. Mridula, N (2010-21-106) who has taken up the research programme entitled **"User-centered design and testing of a bilingual website prototype for the Directorate of Extension, Kerala Agricultural University"**, for her Ph.D. work. The website prototype she is going to design and develop in English and Malayalam, after refinement, can straight away be used by the Directorate of Extension, KAU. It is a long cherished need that the DoE, KAU come up with a comprehensive website, as a portal comprising both administrative and technical contents. Considering the practical utility and urgency of the work, I request you to kindly bestow your sincere participation as judges and advisors.

Please go through the Questionnaire attached and give your valuable suggestions. Please send it back in the self-addressed stamped envelope in my address.

Kindly bear with my encroaching into your busy schedule and time. Thank you for your support and attention to this matter.

Expecting your participation and support.

With best regards,

Yours sincerely,

P. Ahamed,
Chairman

KERALA AGRICULTURAL UNIVERSITY
Department of Agricultural Extension,
College of Horticulture Vellanikkara, Thrissur

User-centered design and testing of a bilingual website prototype for the

Directorate of Extension, Kerala Agricultural University

Questionnaire (Main study)
(For Academic purpose only)

Name of the Ph.D Scholar**: Mridula, N. (**mridulanarayanan@gmail.com 9495053161)
Major Advisor **: Dr. Ahamed, P**. (ahamedpkau@gmail.com 9496169140)

Kindly note:This is a need-oriented study demanded by the Directorate of Extension, KAU.

The research programme is intended for : 1) Developing a need based, first level prototype of a bilingual website for the Directorate of Extension, Kerala Agricultural University 2) Participatory assessment and refinement of the prototype before its final design by the host organization.
Therefore, in addition to giving responses to the questions below, please give your suggestions in each area.

I. In order to develop a website for Directorate of Extension (DoE), desktop analysis of websites of various organizations was done and some links (navigation bars) were identified and modified in such a way that it suits to the prospective Home page of DoE of KAU. The suggestions that came up from the pilot study are also included in this questionnaire. Please rate the necessity of the following links in the prospective Homepage and inner pages of the web site of Directorate of Extension (DoE), KAU. Please put a tick mark (✓) in the appropriate column.

Highly Relevant –HR; Relevant -R; Somewhat relevant - SR;
Less relevant- LR ; Least Relevant-LeR

Sl.No.	**Proposed link**	Put tick (✓) mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1.	About DoE, KAU					
2.	Schemes & Projects					
3.	Showcase of technologies					
4.	Locating your nearest KAU KVK					
5.	Crop Information					
6.	Agri Market Informant					
7.	Weather					
8.	Promising agri-enterprises					
9.	Forthcoming events *(in DoE/ KAU)*					
10.	News& Information *(in DoE/ KAU)*					

11.	Publications from KAU					
12.	Media Gallery					
13.	Important links					
14.	Links to social network media (*Facebook, Twitter, You Tube etc.)*					
15.	Contact Us					

(ii)If you have any other suggestions, please mention here:

II. The information that has to be included under each Navigation bar of the Home page (mentioned in the previous page of this questionnaire) of Directorate of Extension is also to be identified. Please put tick mark against the items to be included, in the following 5 point scale.

1.(a) Mention the contents to be included under '**About DoE'**. Please put a tick mark (✓) in the appropriate column.

About DoE						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	History & Mandate					
2	Vision & Mission					
3	Services & Activities					
4	Organizational setup					
5	Staff profile					
6	Constituent units of DoE, KAU *(Links to)*					
7	Achievements *(of DoE)*					
8	Honors and awards *(of DoE)*					
9	Success stories *(collected by DoE)*					
10	Contingency planning & Planning for adverse situations (drought, pest attack)					

(b)If you have any more detailed suggestions, please mention here:

2. (a) Mention the contents to be included under '**Schemes & Projects'**. Please put tick mark against the items to be included, in the following 5 point scale.

Schemes & Projects *(done by DoE)*						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Mission of scheme /project					
2	Guidelines of funding agencies					
3	Links to website of funding agencies					

(b)If you have any more detailed suggestions, please mention here:

3.(a) Mention the contents to be included under '**Showcase of technologies'**. Please put tick mark against the items to be included, in the following 5 point scale.

Showcase of technologies						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Technologies developed *(by KAU)*					
2	Technologies commercialized					
3	Farmers' Innovations					
4	video clips of demonstration of technologies					

(b)If you have more detailed suggestions, please mention here:

4. (a) Mention the contents to be included under **'Crop Information'**. Please put tick mark against the items to be included, in the following 5 point scale.

Crop Information						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Crops (links to www.celkau.in) (The recent Agri-tech portal launched by KAU through the Center for E-Learning)					
2	Agri e-expert (links to www.celkau.in)					
	• KAU Fertulator • E-crop Doctor • Crop Health Diagnosis					
3	Availability & Rate of :-					
	- Planting materials - Bio control agents - Hybrid Seeds - Organic manures - Value added products					

(b) If you have any suggestions, please mention here:

5. (a) Mention the contents to be included under '**Agri Market Informant'**. Please put tick mark against the items to be included, in the following 5 point scale.

Agri Market Informant						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Daily Market Price Information					
2	Major markets in Kerala					
3	Seasonal markets / Farmer markets in Kerala					
4	NGOs run agricultural markets in Kerala					

(b) If you have any suggestions, please mention here:

6. (a) Mention the contents to be included under '**Publications'**. Please put tick mark against the items to be included, in the following 5 point scale.

Publications						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	List of Publications					
2	KAU Vision 2030					
3	Publications in pipeline					

(b)If you have any suggestions, please mention here:

7. (a) Mention the contents to be included under '**Important Links'**. Please put tick mark against the items to be included, in the following 5 point scale.

Important links						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Public Agrl.Extension departments					
2	Commodity Boards					
3	Market Federations					
4	ICAR Institutes					

(b)If you have any suggestions, please mention here:

8. (a) Mention the contents to be included under '**Promising agri-enterprises'**. Please put tick mark against the items to be included, in the following 5 point scale.

Promising agri-enterprises						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Mushroom cultivation					
2	Honeybee rearing					
3	Processing & Value addition of fruits& vegetables					
4	Production of bio-fertilizers					
5	Production of Composts					
6	Production of bio control agents					
7	Plant propagation by Tissue Culture					
8	Flower arrangement & dry flower products					
9	Landscaping					
10	Hi-tech / Precision farming					
11	Plant propagation & Nursery management techniques					
12	Medicinal plant cultivation					

(b)If you have any suggestions, please mention here:

9.(a) Mention the contents to be included under 'Forthcoming events'. Please put tick mark against the items to be included, in the following 5 point scale.

Forthcoming events						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Training programs *(in KAU)*					
2	Technology week					
3	Farmer scientist interactions					
4	Exhibitions/Seminars/ symposia/workshop					

(b)If you have any suggestions, please mention here:

11. (a) Mention the contents to be included under '**News & Information'**. Please put tick mark against the items to be included, in the following 5 point scale.

News & Information						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	New releases					
2	Ready for sale					
3	Downloads					
4	Letters and circulars					
5	Geographical indications from Kerala (Agricultural and horticultural products)					
6	Patents from Kerala Agricultural University					

(b)If you have any suggestions, please mention here:

12. (a) Mention the contents to be included under '**Contact Us**'. Please put tick mark against the items to be included, in the following 5 point scale.

Contact Us						
Sl.No.	**Contents Proposed**	Put tick **(✓)** mark in the appropriate column				
		HR	**R**	**SR**	**LR**	**LeR**
1	Communication address					
2	Feedback form					
3	Discussion forum					

(b)If you have more detailed suggestions, please mention here:

Your Name:
Address:

e-mail ID :
Mob. Phone:

Thank you

….P. Ahamed

Appendix -2

END - USER WEBSITE ASSESSMENT QUESTIONNAIRE

1. Content and information management	
(Select your score: Very poor: 1 / Poor: 2 / Fair: 3 / Good: 4 / Excellent: 5)	
1.**1. Relevance (Score should be based on the questions given)**	Score=
a. Is the content relevant to the user?	
b. Is it timely?	
1.**2. Coverage (Score should be based on the questions given)**	Score=
a. Does the website cover all the important details needed by the users?	
b. Does it provide additional/related information?	
c. Is there any overlapping of information in the site?	
1.**3. Accuracy (Score should be based on the questions given)**	Score=
a. Is the information provided precise?	
b. Is the text devoid of errors?	
1.**4. Reliability (Score should be based on the questions given)**	Score=
a. Are the information in the site reliable?	
b. Does it show the information source?	
1.**5. Clarity (Score should be based on the questions given)**	Score=
a. Are the contents understandable without any confusion?	
b. Is it simple?	
c. Is the narration lucid?	

	Score=
1.6. Depth of contents (Score should be based on the questions given)	
a. Does the contents are adequate to cater the needs of the users?	
b. Is there any unrelated/unwanted content?	

2. Website design and layout	
(Select your score: Very poor: 1 / Poor: 2 / Fair: 3 / Good: 4 / Excellent: 5) **Score should be based on the questions** given.	
2.1. Organisation of the site	Score=
a. Is there a positive professional tone avoiding all bias?	
b.Is the site systematically organised with readable chunks?	
2.2. Color scheme	Score=
a.Is the color consistent from page to page?	
b. Is the contrast between text and its background color soothing to the eye?	
c. Are the font colors appropriate?	
2.3. Fonts	Score=
a. Are the fonts easy to read?	
b. Are the font sizes proper?	
c . Are the font types suitable?	
d. Is the font size appropriate?	
2.4. Adequacy of multimedia	Score=
a. Adequacy of photographs used	
b. Adequacy of videos used	
2.5.General appeal of the site	Score=
Is it pleasant and attractive?	

3. Linkage with relevant Internet resources

(Select your score: Very poor: 1 / Poor: 2 / Fair: 3 / Good: 4 / Excellent: 5)

Scores should be based on the questions given.

3.1. Appropriateness of links	Score=
a. Is the website linked to useful and informative resources?	
3.2. Working of the links	Score=
a. Are there any dead or broken links?	

4. Provisions for scaling up and updating (Scaling up=possibility for time-to-time or future enrichment of website content, quality etc.)

4.1. *Scaling up* (Select your score: Least possible: 1 / Less possible: 2 / somewhat possible: 3 / Possible: 4 / Most possible: 5) Score should be based on the questions given.

4.1.Possibility for enrichment	Score=
a. Can the website add more content in future?	
b. Can the website add more pictures, videos, multimedia etc.?	
4.2. Possibility as course platforms	Score=
a. Will it be possible to use the site as an online-training platform?	
b.Will it be possible to use the site as a platform for running online courses?	

4. 2.*Updating* (Select your score: Very poor: 1/ Poor: 2 / Fair: 3 / Good: 4 / Excellent: 5) Score should be based on the questions given.

4.3. Possibility to know the site freshness	Score=
a. **Does the 'last updated date' on each page make the website dependable?**	

5. Information Retrievability

(Select your score: Very poor: 1 / Poor: 2 / Fair: 3 / Good: 4 / Excellent: 5)

Score should be based on the questions given.

1. Easiness (Is it easy to access the content available in this website?) Score=

2.Quickness (Are you able to receive the required content quickly from the website?) Score=

6. Interactivity (Is this website interactive?) Score=

(Select your score: Very poor: 1 / Poor: 2 / Fair: 3 / Good: 4 / Excellent: 5)

Kindly select a suitable score after overall consideration of the following links.

1. Nearest KVK of KAU in the district

2. Form for feedback provided in the site

3. Discussion forum in the site

4.Links to interactive interfaces like CEL, VFPCK, and Agmarknet

7. *User-friendliness*

(Select your score: Very poor: 1 / Poor: 2 / Fair: 3 / Good: 4 / Excellent: 5)

Score should be based on the questions given in brackets.

7.1. Format of the content Score=

a. Layout of the contents (Is it appealing / pleasing to you as a user?)

b. Alignment of the content (Is it proper?)

7. 2. Speed Score=

a. Quick loading (Are the pages loading quickly?)

b. Time saving (Does using the website for calculations save users' time?)

7. 3. Navigation Score=

a. Quickness (Is it quick to navigate page to page forward and backward?)

b. Easy identification of clickable items (Are they distinctly spelt out?)

c. Site map (Does it show how pages are associated with each other?)

7. 4. Readability Score=

a. Ease of Comprehension (Is the content easy to understand?)

b. Legibility (Is it easy to read the website?)

c. Language (Is it matching to the user, avoiding jargons?)

d.Website quality (Is there a balance among the quality of design, layout, content, appearance etc.?)

8. Perceived extent of use

(Select your score: Least applicable: 1 / Less applicable: 2 / Somewhat applicable: 3 / Applicable: 4 / Most applicable: 5)

8. 1. Based on area of users (Tick the applicable options) Score=

a) The site can be used by users within Kerala.

b) The site can be used by users within India.

c) The site can be used by users from abroad.

8. 2. Based on Organizations(Tick the applicable options) Score=

a) The site can be used by line departments.

b) The site can be used by SHGs/NGOs

c) The site can be used by banks.

d) The site can be used by educational institutions.

e) The site can be used by private sector organizations.

8.3. Based on Stakeholders(Tick the applicable options) Score=

a) The site is useful to agripreneurs.

b) **The site is useful to researchers.**

c) **The site is useful to** school/college students.

d) **The site is useful to policy makers.**

8.4. Based in this website's purpose(Tick the applicable options) Score=

a) **The website can be used to gain knowledge.**

b) **The website can be used for guidance in farming.**

c) **The website can be used to be informed of the latest KAU technologies.**

d) **The website can be used to know more about KAU's extension activities.**

e) **The website can be used to know input availability.**

f) **The website can be used to know market details.**

Your suggestions for improvement of this website, if any:-

Name:

Address & Designation :

Thank you.

Appendix -3

Task for Usability Testing of DoE web prototype

Dear Sir/Madam,

- *Please go through the website prototype (www.celkau.in/DE/), before taking these exercises.*
- *The answers to all these 3 questions are available in the website prototype. (www.celkau.in/DE/)*
- *Record the answers and time taken by you to find the correct answer.*
- *Also record the date on which you are taking these tests.*

1. Find out the **latest** market price of these items VFPCK link and **enter the answers.**

   (a) GREEN AMARANTHUS-
   (b) BANANA NENDRAN-
   (c) CUCUMBER-
   (d) COWPEA -

2. (a.) Find the weather forecast for **Malappuram** for the next 5 days and the farming operations to be done for crops, using KAU Agromet Advisory services link.
   (Enter the answer here)

(b.) Find today's weather using Hourly world weather observations and **enter the answers**.

Australia-

Ludhiana -

Thrissur-

3. Find using KAU products' list

   a. Price of KAU **brinjal variety Haritha-**
   b. Price of **Pseudomonas** from KAU-

c. Price of **PGPR mix** from KAU-
d. Find the agriculture related **GI products** from Kerala-

Report

- **Time taken to find answers for the above three questions (in minutes)**

- **Enter your satisfaction level (Low/Medium /High)**

Please mention the constraints you have faced while taking the tests and using this website.

USER-CENTERED DESIGN AND TESTING OF A BILINGUAL WEBSITE PROTOTYPE FOR THE DIRECTORATE OF EXTENSION, KERALA AGRICULTURAL UNIVERSITY

By

MRIDULA N

ABSTRACT OF THESIS

Submitted in partial fulfilment of the requirement for the degree of

DOCTOR OF PHILOSOPHY IN AGRICULTURE

(Agricultural Extension)

Faculty of Agriculture

Kerala Agricultural University

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR-680656.

2014

ABSTRACT

In today's digital era websites offer a professional and credible image for any organization. Kerala Agricultural University (KAU) had a long felt need that the Directorate of Extension (DoE), KAU launched a need-based website as a part of strengthening its extension activities. The working group on remandating extension approaches of KAU had recommended it. The present KAU website, www.kau.edu, does not cater to the information needs of all the stakeholders. The present study was undertaken with the objectives of generating need based e-contents to develop the first level prototype of a bilingual (English and Malayalam) website for DoE, KAU and participatory assessment and refinement of the same before its final design by the host organization.

Too often, websites are designed with a focus on the technological capabilities of hardware or software tools that this approach omits the most important part of the process – the end user. User-Centered Design (UCD) of a website is the process of designing it, from the perspective of how it will be understood and used by a human user. User-centered design (UCD) places users at the centre of the design process, starting from the stages of planning and designing the system requirements to implementation and testing of the product. A web prototype is a rudimentary working model of a website that allows to check for flaws and to make sure that the website will be easy to use. The methodology followed in this study for the web prototype design was based on the ISO 13407 guidelines for a UCD project following the steps of requirement specification, requirement gathering, design and evaluation.

The pilot study identified agricultural scientists, agricultural extension officers and farmers as the major prospective stakeholders of the intended website along with the other potential clients like agripreneurs, researchers, school / college students, self-help groups, non-governmental organizations, banks, policy makers, other line departments, and private sector organizations. It also explored 15 main contents *viz;* 'About DoE', 'Schemes & Projects', 'Showcase of Technologies', 'Locating Your Nearest KAU KVK', 'Crop Information', 'Agri Market Informant', 'Weather', 'Promising Agri-Enterprises', 'Forthcoming Events', 'News & Information', 'Publications from KAU', 'Media Gallery', 'Important Links', 'Links To Social Network Media' and 'Contact Us' as well as their sub contents.

The first phase of the main study assessed the information needs of the respondents regarding the main contents as well as their sub-contents. Out of the 15 main information needs,

need indices significantly varied for 'Schemes and Projects', 'Crop Information', 'Weather 'Promising agri-enterprises', 'Links to social network media', 'Forthcoming events', 'News & Information', 'Publications from KAU', 'Media Gallery' and 'Important links'. Need indices for the sub contents of 'About DoE, KAU', 'Showcase of technologies', 'Agri Market Informant', 'Promising agri-enterprises', 'News& Information', 'Publications from KAU'and 'Important links' also varied significantly. The respondents also suggested inclusion of 23 items in the website, as contents and links.

The respondents welcomed the web prototype with great enthusiasm. In the online end-user assessment, the web prototype was evaluated with respect to eight main attributes- content and information management, site design and layout, linkage with relevant internet, provisions for scaling up and updating, information retrievability, interactivity, user-friendliness and perceived extent of use. 'Perceived extent of use' and 'Provisions for scaling up and updating' got the highest grand mean scores. The scores of the other features showed a fair performance, but 'Interactivity' warned of poor performance. The respondents' suggestions were noted for the refinement of the website.

Usability is one of the essential features of a website, and is a measure of the interactive user experience. A user-friendly interface design is easy-to-learn, supports users' tasks and goals efficiently and effectively, and is satisfying and engaging to use. An interface's level of usability can be measured by inviting intended users of the system to participate in a usability testing session. Testing of the web prototype was done online by giving specific exercise (task) to the respondents and self reported validation was used to assess the task performance. The task success rates were measured by attributes *viz;* 'effectiveness of use', 'efficiency of use' and 'satisfaction of the users'. Constraints reported by the users were recorded.

The present work has also rendered a methodical guidance to future researchers in the form of a protocol for developing a user-centered website. The prototype was refined incorporating all possible suggestions and solving the constraints. The user centered web prototype developed for DoE, KAU, can act as an efficient base for the final DoE website, which could be a prominent information dispersal tool in the coming days. The Directorate of Extension, KAU may take up further refinement, frequent updating and upgrading of the prototype to make it a fully functional website.

***