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**STRATEGIES FOR CAPACITY BUILDING OF EXTENSION
PERSONNEL FOR USING INFORMATION AND
COMMUNICATION TECHNOLOGIES**

By

CHITHRA GANGADHARAN

(2013-11-157)

THESIS

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requirement for the degree of*



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DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR - 680656

KERALA, INDIA

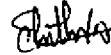
2015

DECLARATION

I hereby declare that this thesis entitled “**Strategies for capacity building of extension personnel for using Information and Communication Technologies**” is a bonafide record of research done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, fellowship or other similar title, of any other University or Society.

Vellanikkara

20.08.2015




CHITHRA GANGADHARAN

(2013-11-157)

CERTIFICATE

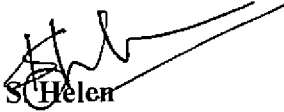
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Vellanikkara
20.08.2015

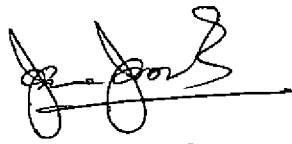

Dr. S. Helen
(Chairperson, Advisory Committee)
Associate Professor
Communication Centre
Mannuthy

CERTIFICATE


We, the undersigned members of the advisory committee of Chithra Gangadharan., a candidate for the degree of **Master of Science in Agriculture** with major in extension, agree that the thesis entitled “**Strategies for capacity building of extension personnel for using Information and Communication Technologies**” may be submitted by Chithra Gangadharan, in partial fulfillment of the requirement for the degree.




Dr. S. Helen
Associate Professor
Communication Centre
Mannuthy



Dr. Jose Joseph
Professor & Head
Dept. of Agricultural Extension
College of Horticulture
Vellanikkara



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



Dr. A. Sakeer Husain
Assistant Professor (SS)
Centre for E-Learning
Vellanikkara



EXTERNAL EXAMINER

Dr. C. Ramachandran

Principal Sree

SEETTI, CMAKI, Kochi .

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Chithra Gangadharan

Introduction

I. INTRODUCTION

Information and Communication Technologies (ICTs) generally refer to an expanding assembly of technologies that are used to handle information and aid communication. These include media for collection, storage, processing, transmission and presentation of information in any format (i.e., voice, data, text and image), comprising of computers, the Internet, CD-ROMs, email, telephone, print media, radio, television, digital cameras etc. The advent of personal computers, Internet and mobile telephone during the last two decades has provided a much wider choice in collection, storage, processing, transmission and presentation of information in multiple formats to meet diverse requirements and skills of people. ICTs are believed to bring about social and economic development by creating an enabling environment. Almost every single activity in the modern world is becoming more dependent on the application of ICTs. The benefits of ICTs reach even those who do not themselves have first-hand access to them. ICT in agriculture is an emerging field that involves application of innovative ways to use Information and Communication Technologies (ICTs) in the rural domain. The advancements in ICTs can be utilized for providing accurate, timely and relevant information and services to farmers, there by facilitating an environment for more remunerative agriculture.

The importance of ICTs in development process was long recognized and access to ICTs was even made one of the targets of the Millennium Development Goal No. 8 (MDG 8), which emphasizes the benefits of new technologies, especially ICTs in the Fight against poverty. “With 10 per cent increase in high-speed internet connections, economic growth increases by 1.3 per cent”, observed the recent World Bank report on Information and Communication for Development (World Bank, 2009). The same report also observed “connectivity – whether the Internet or mobile phones is increasingly bringing market information, financial services and health

services to remote areas, and is helping to change people's lives in unprecedented ways”.

The challenge for the Indian government and policy makers is to regain the dynamism in agricultural sector as was evident in the 1970s during the era of green revolution. A major dilemma in the present situation of rising food prices and an ever growing population is to strike a balance between policies for food security and policies to improve income levels of farmers. With agriculture being constrained by the availability of land, improving productivity remains a crucial factor for the future of India's food security. The development of markets improves input-output market interface and this is important for productivity growth. In agriculture, education and access to knowledge creates conditions that enable farmers to acquire and use information for decision making regarding allocative and technical matters effectively.

Realizing the untapped potential of ICTs, government of India, has launched 'Digital India' programme in 2015, aimed at creating digitally empowered society and knowledge economy. A major intervention of ICTs in agriculture sector is also expected in near future. For that our extension personnel should be equipped to utilize the benefits of ICTs in transfer of technology.

Agricultural extension systems in most developing countries are under-funded and have had mixed effects. Much of the extension information has been found to be out of date, irrelevant and not applicable to small farmers' needs, leaving such farmers with very little information or resources to improve their productivity. Agricultural extension has to escape from the narrow mindset of transferring technology packages to transferring knowledge or information packages. If this can be achieved, with the help of Information and Communication Technology, extension will become more diversified, more knowledge-intensive, and more demand driven, and thus more effective in meeting farmers' information needs. (Meera *et al.* 2004).

Broad basing agricultural extension activities, developing farming system research and extension having location-specific modules of research and extension, promoting market extension, sustainable agricultural development, participatory research etc. are some of the numerous areas where ICT can play an important role.

Agricultural extension officers are the direct link bridging the communication gap between the agricultural researchers and the farmers. In order to perform this role effectively and efficiently, agricultural extension personnel must have steady access to upto date agricultural information. This brings to fore the need for a comprehensive and well articulated agricultural extension programme which ensures adequate and timely delivery of services to farmers, if meaningful growth is to be achieved in the agricultural sector.

The common problems in adoption of ICTs generally are lack of awareness, non availability of relevant and localized contents in their own language, accessibility of ICT tools, non- willingness for adoption of new technologies, remote areas, fast changes. Extension personnel must be equipped in using the latest ICTs to tap the full potential of ICTs in agricultural sector. Thus, there is a need to know the accessibility and utilization of ICT tools and training needs of extension personnel for onward transfer of technologies. Moreover, till now, there are no systematic studies reported on the use of ICT tools by the extension personnel for transfer technology. Hence the findings of the proposed research study will be of immense utility to the extension personnel, researchers, administrators and policy makers to formulate and execute suitable strategies for enhancing the use of ICT tools among extension personnel for effective transfer of technologies in the agricultural sector.

1.1 Objectives of the study

This study aims to address four key specific objectives regarding the utilization of ICT tools by agricultural extension workers:

1. To analyze the utilization pattern of Information and Communication Technologies (ICTs) among the agricultural extension personnel of Kerala.
2. To assess the training needs of agricultural extension personnel in using ICT tools.
3. To identify the constraints faced by the extension personnel in using ICTs.
4. To work out strategies for capacity building of agricultural extension personnel in using ICTs for agricultural development in Kerala.

1.2 Scope of the study

Most of the studies on ICTs have significantly addressed the scope and understanding of the sector in terms of contribution towards extension activities. Despite the huge potential of harnessing ICT for agricultural development, only a few isolated projects have been initiated in India and in other parts of the world. Interestingly, many of these projects were initiated by NGOs, private organizations, cooperative bodies and governmental organizations rather than by government-established agricultural departments. This shows the apathy of agricultural development departments towards incorporating ICT in their day-to-day activities. To formulate a strategy for overall agricultural development, the utilization pattern and the constraints faced by the extension personnel in using ICT tools need to be studied and the experience gained must be documented in order to draw lessons for the future. On the other hand, the need to market agricultural produce at competitive prices will also change the farmers' attitude towards usage of ICTs. ICT will thus help to sustain Indian agriculture.

It is necessary to develop ICT based agricultural services along with a communication backbone such as a fiber optic network in rural areas. Though the use of Information and Communication Technology in agriculture is in a nascent phase in India, ICT has immense potential to standardize and regulate agricultural processes and address the needs of farmers. It will therefore definitely serve as an important tool for agricultural development in the near future.

As part of the 'Digital India' initiative of the government of India, agricultural sector will also be digitalized. Extension personnel are the important category of change agents who are supposed to become part and parcel of digitalization of the State Department of Agriculture. Therefore the analysis of the existing situation among extension personnel using ICTs such as utilization pattern, training needs, constraints in using ICTs and formulation of strategies for the capacity building of extension personnel in using ICTs will be useful in equipping the extension personnel to meet the challenges of introducing latest technologies in ICTs in the State Department of Agriculture.

1.3 Limitations of the study

The study was conducted as a part the research work done during master's degree programme. The study was conducted in 5 agro climatic zones of Kerala. From each of the agro climatic zones, one district was selected for the data collection. The study had the inherent limitations of resources such as time, finance and researchers' experience. As such the student researcher confined the coverage of the study to a feasible level in terms of sample size, location etc. Regardless of the limitations, efforts were made to conduct the study in an objective and systematic manner as possible. The present study targeted a comparatively small scale sample. Still an attempt has been made to come out with tangible and comprehensive suggestions.

1.4 Presentation of the thesis

The thesis is presented in six chapters. The first chapter is an introductory section, highlighting the objectives, scope, importance and limitations of the study. The second chapter provides the review of literature in line with the objectives of the study. The third chapter is the methodology that was followed in carrying out the research. The fourth chapter deals with the results and discussion of the study. The fifth chapter includes summary, implications and suggestions for future study. References, appendix and abstract are furnished at the end.

Review of Literature

II. REVIEW OF LITERATURE

A literature review is a body of text that aims to review the critical points of current knowledge and or methodological approaches on a particular topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work. A well-structured literature review is characterized by a logical flow of ideas; current and relevant references with consistent, appropriate referencing style; proper use of terminology and an unbiased and comprehensive view of the previous research on the topic. Hence, earnest efforts were made to review the related literature, which was found to be meaningful and having direct and indirect bearing on this study and furnished under the following headings:

- 2.1. Profile characteristics of extension personnel using ICT tools
- 2.2. Availability and accessibility of ICT tools among extension personnel
- 2.3. Utilization pattern of ICT tools among extension personnel
- 2.4. Training needs of extension personnel
- 2.5. Constraints in using ICT tools by extension personnel

2.1. Profile characteristics of extension personnel using ICT tools

2.1.1. Age

Adesope *et al.* (2007) in their study on the effect on the personal characteristics of extension managers and supervisors on information technology needs reported that majority of the respondents were between 40 and 45 years old, with mean age of 42.4 years.

Bahgat and Antar (2007) in their study on evaluation of extension personnel in their levels of knowledge, use and the degree of importance of information communication technology revealed that 55 per cent of the respondents belonged to 50 years old or more.

Agwu *et al.* (2008) reported that 42.5 per cent of the extension workers were within the age range of 30-39 years, while 32.5 per cent were 40- 49 years. Only 20 per cent of the extension workers were 30 years, while 5 per cent of them were 50 – 59 years.

Nagalakshmi (2008) in her study on integrating ICT with multiple functions for agricultural development concluded that majority of the extension personnel (52.94%) were under old age category, 24.47 per cent of extension personnel were under young category.

Salau and Saingbe (2008) in their study on access and utilization of Information and Communication Technologies (ICTs) among agricultural researchers and extension workers found that the mean age for the researchers and extension workers were 44.83 and 41.06 years respectively.

Ahmadpour *et al.* (2010) in their study on factors affecting the development of electronic learning in agricultural extension network and found that the average age of extension agents were 39.66 years.

Al-Shayaa *et al.* (2011) identified that half of the agricultural workers (50%) were in the age of thirties. This indicated that half of the workers were young and capable of using the computers.

Omotesho *et al.* (2012) revealed that about 70 per cent of the agricultural extension officers were below the mean age of 42.5 years for extension agents and 43 for Subject Matter Specialists respectively. Still being relatively young, it could be expected that they should be able to adapt to new innovation in agricultural development brought about by ICT.

Sankri (2012) stated that majority of the respondents(48.34%) were in the middle age group, followed by 46.67 per cent in old age group and only 5 per cent in young age group.

Ravikishore (2014) conducted a study on innovations in e-agricultural extension technology(e-AET):diffusion and adoption of agri-expert systems among extension professionals in Kerala and reported that majority of the extension personnel belonged to middle age category (82.5%).10 per cent belonged to old age category and only 7.5 per cent was found to be under the young age category.

Yakubu *et al.* (2014) found that 49.8 per cent of the respondents were within the ages of 41-50 years and only 16.3 per cent were within 21-30 years. The mean age of the respondents was 40.6 years. This indicated that most of the extension agents were in their middle age and were therefore matured enough to take decision on the use of ICTs.

Raksha and Meera (2015) reported that slightly more than half (51.67%) of the extension personnel were young followed by middle (28.33%) and old age (20.00%).

2.1.2 Gender

Gregg and Irani (2004) found that 57.86 per cent of the respondents were female and 42.14 per cent males, close to that of the general population of FLCES county extension agents.

Agwu *et al.* (2008) reported that 70 per cent of the extension workers were males while 30 per cent were females.

Salau and Saingbe (2008) in their study on access and utilization of Information and Communication Technologies (ICTs) among agricultural researchers

and extension workers reported that majority of the respondents (86.66%) for researchers and (66.66%) for extension workers were males.

Mabe and Oladele (2012) observed that majority of the extension officers were male (76%) with the mean age of 44.6 years.

Raksha and Meera (2015) found that majority (36.37%) of the respondents were old age followed by middle (33.33%) and young (30.00%).

2.1.3 Educational status

Agwu *et al.* (2008) revealed that 35 per cent of the extension workers had Higher National Diploma (HND) certificates while 32.5 per cent had BSc. Also, 22.5 per cent had MSc degrees while the remaining 10 per cent had Ordinary National Diploma (OND).

Salau and Saingbe (2008) stated that majority (51.11%) of the extension workers had National Diploma as their highest qualifications.

Isiaka *et al.* (2009) reported that all the extension workers had one form of academic degree or the other. Majority of them (72.7%) had first degree (Bachelor of Science or Higher National Diploma in agriculture) as their minimum level of education. About 15.2 and 1.5 per cent of them had Master's and Doctoral degrees respectively.

Meera *et al.* (2010) opined that 63 per cent of the respondents had the Master's Degree in agriculture as their educational qualifications.

Yakubu *et al.* (2013) revealed that 35.8 per cent of the extension agents had Higher National Diploma (HND), 33% had Ordinary National Diploma (OND), 27.2% had Secondary School Certificate and 3.6% had a Bachelor Degree (B. Sc or B. A) as their highest educational level.

Tanko *et al.* (2013) identified that all of the respondents were literate with educational qualifications ranging from secondary school leaving certificate to Ph.D.

Ravikishore (2014) found that half of the sampled respondents were holding masters degree whereas remaining half of the sampled respondents were graduate and doctoral degree holders with 24 per cent and 26 per cent respectively.

Raksha and Meera (2015) conducted a study on Determinants of ICTs in Agricultural Extension System and concluded that in case of educational status of the respondents, majority of them were post-graduates (60.56%) followed by doctorates (21.11%) and graduates (18.33%).

2.1.4 Experience

Adesope *et al.* (2007) reported that majority of the respondents had working experience ranging from 5 to 15 years with a mean working experience of 15.52 years.

Helen (2008) reported that less than half the percentage of extension personnel (40.56%) had experience upto 10 years, 40 per cent of the extension personnel possessed the experience from 11-20 years and only 14.44 per cent of the extension personnel gained above 21 years of experience.

Salau and Saingbe (2008) showed that most (71.11%) of the extension workers had put in over 20 years in service. This means that the extension workers had longer working experience.

Isiaka *et al.* (2009) reported that all the extension workers surveyed in the study area had spent between 5 and 20 years on the job. Majority of them, 56.1 per cent, had spent between 11 and 15 years on the job.

Kumaran *et al.* (2011) stated that about 40 per cent of the respondents had more than 10 years and 20 years of experience, respectively in the fisheries departmental activities.

Swafah (2011) reported that majority of the respondents experience was between 11-20 years. Less than 50 per cent of the respondents had an experience below 10 years.

Omotesho *et al.* (2012) reported that the mean years of work experience given as 12.3 years for extension agents and 15 years for Subject Matter Specialists could be expected to have a positive effect on the extension officers' disposition to ICTs.

Yakubu *et al.* (2013) concluded that majority (52.9%) of the extension agents had a working experience of 15-20 years. It indicated that most of the extension agents were over 15 years in the service.

Samansiri and Wanigasundera (2014) revealed that the majority (65.3%) had achieved more than 20 years of work experience while 31.7 per cent have achieved 10 to 20 years of work experience and the balance 3 per cent had gained only less than 10 years of work experience.

Raksha and Meera (2015) conducted a study on e-Readiness in Agricultural Extension System and concluded that with slightly higher than half of the respondents (51.56%) belonged to less years of service followed by high (25.00%) and middle (23.33%).

2.1.5 Trainings received on ICTs

Lakshminarayan (1992) in his study on extension teaching methods used by Agricultural Assistants found that 80.00 per cent of the Agricultural Assistants undergone refresher training and 20.00 per cent of them did not undergo any refresher training.

Rao (2000) in his study on the communication techniques used by the agricultural assistants of Dharwad district opined that all the agricultural assistants received training in communication techniques during their fortnightly meeting along with subject matter areas. In addition to this 38.33 per cent of agricultural assistants had received special training in Rural Development Training Centre (RDTC).

Frempong *et al.* (2006) in their research study in Ghana on challenges of infusing information and communication technologies in extension for agricultural and rural development revealed that 23.7 per cent respondents had attended professional courses on ICTs, while 29.2 per cent of the respondents had received ICT trainings on their own at business centres such as community learning centres.

Adesope *et al.* (2007) revealed that 68.9 per cent and 70.4 per cent of researchers and extensionists respectively had been exposed to ICTs between 2 and 5 years with the mean years of exposure of 4.5 years.

Helen (2008) reported that more than half of the extension personnel (56.6%) had undergone low level of trainings related to ICTs and one-third of them (33.33%) received medium level of trainings.

Swafah (2011) found that majority of the respondents from Palakkad district had undergone medium level of training on computer and more than half of the respondents (65%) from Thrissur district had undergone medium level of training on computer applications.

Ravikishore (2014) reported that 80 per cent of the extension personnel had undergone 1.-3 days training programme with a very few per cent having undergone training for more than 3 days.

Samansiri and Wanigasundera (2014) revealed that 4.3 per cent of the respondents had undergone more than 7 days in-service training, 13.9 per cent for 5 - 7 days, 14.8 per cent for 2 - 4 days and 44.3per cent for 1 day in-service training on the use of ICT and related subjects. However, there were 22.6 per cent respondents who had never undergone any kind of in-service training on ICT use in their career. Majority (65.2%) of the participants had attended the training programs only once.

2.1.6 Mass media utilization

Pillegowda *et al.* (1997) reported that most important mass media used by agricultural extension personnel in communicating farm information to the farmers were package of practice booklets followed by agricultural magazines and wall news papers.

Meera *et al.* (2004) conducted a study entitled “Information and communication technology in agricultural development: a comparative analysis of three projects from India”, found that nearly 50 per cent had high exposure to the mass media, and about 38 per cent under medium exposure, leaving only 12 per cent in the low exposure category.

Abubakar (2009) indicated that majority (85%) of the respondents received agricultural information from radio and television and 8.75 per cent of the respondents received agricultural information from extension bulletins, while 6.25% of the respondents got agricultural information from posters.

Dhaka and Chayal (2010) conducted study on farmers' experience with ICTs on transfer of technology in changing agri-rural environment and concluded that 44 per cent had high exposure to the mass media followed by 30.67 per cent and 25.33 per cent had medium and low exposure to the mass media respectively.

Manty (2011) observed that 40 per cent of University of Agricultural Sciences Dharward (UASD) extension personnel had medium level of mass media utilization followed by low (32.5%) and high (27.5%) respectively. Further, in case of Karnataka State Department of Agriculture (KSDA) extension personnel 42.50 per cent had low level of mass media participation followed by medium (35%) and high (22.5%) respectively.

2.1.7 Innovation proneness

Senthilkumar (2000) found that majority (67.74%) of the extension professionals were having medium level of innovativeness followed by high level (31.66%) of innovativeness and only 5 per cent having low level of innovativeness.

Babu (2006) reported that majority of the Akshaya beneficiaries belonged to medium category (52.5%) of innovation proneness followed by low (30%) and high group (17.5%). With respect to KISSAN Kerala most of the respondents were observed in medium group (62.5%), then high group(35%)of innovation proneness . Similar trend was true with farmers wherein majority of them found in medium group (50%) followed by low (25%) and high group (25%) of innovation proneness.

Murali and Venkataramaiah (2008) in their research study on Relationship between profile characteristics of students with their exposure to agricultural websites concluded that higher the innovativeness, the higher would be the exposure to agricultural websites.

Sarala (2008) reported that agricultural officers who were innovative constituted 80 per cent followed by less innovative (12.63%) and highly innovative (7.37%).

Manty (2011) revealed that 50 per cent of UASD extension personnel was under high innovative proneness category followed by medium (30%) and low (20%) respectively. Whereas, 45 per cent of KSDA extension personnel were under low innovative proneness category followed by high (30%) and medium (20%) respectively.

Ravikishore (2014) identified that 44 per cent of the extension professional were under high innovation proneness followed by medium (37%) and low (19%) respectively.

2.1.8 Attitude towards ICTs

Meera *et al.* (2004) conducted comparative analysis of three projects from India and identified that out of the three projects, the staff of iKisan were most favorably disposed to ICT extension (70%). Only 26.6 per cent of the personnel in the Warana project were favorable and in Gyandoot it was 33 per cent.

Chetsmon (2005) reported that extension agents' attitude towards the use of POSOP expert system and its determinants, their belief with regard to using POSOP expert system, and their evaluation of expected outcomes from using POSOP expert system, were all positive or favorable, with means of 3.63, 3.40 and 3.65 respectively.

Sarala (2008) found that majority of the agricultural officers had favorable attitude towards computer mediated communication followed by unfavorable group (14.74%).

Chou and Shie (2011) in their study on the digital divide in Taiwanese unemployed adult population observed that the unemployed adult novices

characterized by male gender, young group, high education, or low learning performance were found to be more positive attitude toward computer use. The young adult subjects and high-education subjects perceived higher level of attitudes towards computers. Whereas the low-education subjects had the lowest level of all of the classified groups.

Ajayi *et al.* (2013) identified that the statement “knowledge of ICT use had a great significance in agricultural development” ranked highest with mean score of 4.47. This was followed by the statement “it’s a waste of time bringing ICT into agriculture” with a mean score of 4.39. However, the statement “infrastructural facilities to support ICT use are not available” ranked lowest with a mean score of 2.60.

Hashemi *et al.* (2013) assessed the extent of respondents’ agreement with 23 items measuring extension workers’ attitudes toward using ICT in extension. Based on a Likert type scale, their responses showed both positive and negative views about the impacts of ICTs in extension services. The grand mean of 4.31 (SD = 0.70) regarding “ICTs as a useful tool for extension” and the total mean of 86.17 (SD=7.17) computed by the 23 items revealed that the extension workers tended to have positive attitudes towards using ICTs.

Ibezim and Osondu (2014) found that the extension personnel in Imo State had favorable and clear perception of the relevance of ICTs in extension service delivery. This was evident from their positive responses in support of those perception statements which highlighted the positive effects of ICTs on extension service delivery. Such statements include those which indicated that ICTs: increase networking of all researchers and access to information (mean score = 4.75); facilitate linkages between information sources and extension (4.72); promote global cross fertilization of ideas (4.45); ICTs can lead to increased contacts between extension

and the clientele (4.48); incorporate feed forward mechanism into research extension (3.74); make extension cost-effective (3.28) and increase the pace of rural development (4.31).

Samansiri and Wanigasundera (2014) revealed that most respondents had perceived that all ICTs used in the study were useful for getting required information. However, except the Internet, e-mail and VCD/DVD/ IMM-CD and other ICTs were found to be easy to use.

Kabir and Roy (2015) showed that the possible attitude score of the respondents towards ICTs could range from 8-24, 8 indicating highly unfavorable attitude and 24 indicating highly favorable attitude. The computed attitude scores of the respondents ranged from 13- 22 where, mean being 18.11 with a standard deviation of 1.98. Data indicated that almost all the respondents (93.8%) had highly favorable attitude towards ICTs while 6.3 per cent had moderately favorable attitude and there was no respondent had slightly favorable attitude towards ICTs.

2.1.9 Infrastructure and other resource facilities

Meti (1992) in his study on perception of organizational climate and job satisfaction of Agricultural Assistants in NAEP, found that majority (67%) of the Agricultural Assistants were under somewhat satisfactory category, followed by a more or less equal distribution of respondents coming under satisfactory (18%) and not satisfactory (15%) categories.

Sontakki (1995) in his study on organizational climate perception of taluk level fisheries extension personnel found that majority of the respondents belonged to moderate satisfaction of availability of facilities at their work.

Nagananda (2005) in his study on organizational climate perception of ADA and Agricultural officers of Karnataka State Department of Agriculture found that

comparatively more number of Assistant Directors of Agriculture (68.3%) were noticed in moderate perception of facilities and resources at their work as compared to Agriculture Officers (30.0%).

Manty (2011) reported that 47.50 per cent of UASD extension personnel belonged to high infrastructure and other resource facilities category followed by low (35%) and medium (17.5%) respectively. Whereas, 57.50 per cent of KSDA extension personnel belonged to low infrastructure and other resource facilities category followed by high (27.5%) and medium (15%) respectively.

Yekinni and Akinbile (2014) revealed that the level of ICT use was significantly ($t=2.043$; $p=0.041$) influenced by the availability of ICT facilities. This implied that availability of ICT facilities to the practitioners increased probability of its use by them. It also showed a significant ($t=2.625$; $p=0.009$) relationship between level of use and official access to ICTs; implying that more official access to ICTs increased the probability of using the facilities by the practitioners.

2.2.1 Accessibility to ICT tools by the extension personnel

Salau and Saingbe (2008) observed that all (100%) extension workers had access to only radio, television and video films. Very few (49%) had access to computers among the extension workers.

Ann (2013) showed that the extension agents had operational literacy on utilization of ICT facilities at varying levels. Majority of the extension agents could operate radio, phones, cassette recorder/ player and television at excellent and very good levels, respectively. Few could operate most of the modern/cotemporary ICTs such as internet connected computer, printers/ libraries, projector and GIS.

Yakubu *et al.* (2013) reported that the entire extension agents (100%) had access to radio while 99.1 per cent had access to television, 98.2 per cent to telephone, 94.6 per cent to video, and 93.7 per cent to camera. Others were 88.7 per cent to DVD, 85.5 per cent to computer, 78.7 per cent to printer and 68.8 per cent to satellite. Low access was noted for web publishing (3.6%), fax (7.7%), scanner (28.1%) and search engines (29.4%). Others were the Web (37.6%), CD-ROM (41.2%) and E-mail (46.2%). About 52 (74.29%) had radio recorders, 74.29% had cameras, while 60.00 per cent had video recorders. Results also indicated that available telecommunication facilities included telephone (85.71%), computer (85.71%) and e-mail services (27.14%). It was also indicated that (85.71%) of the respondents had newspaper within reach while about (82.86%) had access to newspapers and (71.43%) used newspaper. Respondents also used research bulletins at the lowest, constituting about 1.43 per cent of sample respondents.

Samansiri and Wanigasundera (2014) conducted a study entitled Use of Information and Communication Technology (ICT) by extension officers of the tea small holdings development authority of Sri Lanka and revealed that the availability of mobile phone among the respondents was 100% while the access to fixed phones was 95.0%. Only 5.0% of respondents had the access to facsimiles. Having Internet connectivity was reported by 36.6%, but 38.6% used e-mail. Two respondents said that they got the email documents through the email accounts of their subordinates. Out of the computer-based ICT, 47.5% reported that they had access to VCD/DVD/IMM-CD.

Yekinni and Akinbile (2014) reported that the responses of the extension practitioners showed that 63.7 per cent of them indicated that radio was available and television was available to 57 per cent of them. It also showed that telephone was available to 56.3 per cent of them, multimedia projector to 14.1 per cent of them and

8.1 per cent of the extension personnel indicated that the internet was available to them.

Kabir and Roy (2015) reported that the results of the analysis on the access to ICT tools indicated that majority of the respondents (2.71) had access to cell phone for transferring agricultural information. The second majority of the respondents had access to internet (2.25) and digital camera (2.25) where some respondents had access to print media (2.01), multimedia projector (1.95) and video chatting (1.18). The findings indicated that only few of the respondents (0.80) had access to tablets and hence it got the lowermost position in the rank order.

Raksha *et al.* (2015) conducted a study on e-Readiness in Agricultural Extension System and found that about 93 per cent respondents had personal computers/ laptop. About 84 per cent respondents had personal computer/laptop with internet connection. Cent per cent respondents had mobile phones. With respect to smart phone possession, about 27 per cent respondents possessed smart phone. With the use of internet in mobile phone/ smart phone, it was encouraging finding that about 47 per cent respondents had internet connection to their mobile phones.

2.3.1 Extent of utilization of ICT tools by extension personnel

Aboh (2008) observed that the frequency of use of the identified ICT tools such as CD-ROM, television, internet, web, chatting E-mail, search engines recorded less frequent use. This might be as a result of lack of operational skill, insufficient fund to procure these tools, not enough time because of other domestic and external engagements, especially in the area of CD-ROM where a lot technical skill was required in its operation including search engine.

Agwu *et al.* (2008) reported that on the part of the extension workers, only 4 out of the 24 facilities were frequently used by extension workers and these include

video player ($x = 2.00$), television ($x = 2.10$), radio set ($x = 2.58$) and mobile phones ($x = 2.55$).

Ndag *et al.* (2008) reported that majority (51.43%) of the respondents had a low level ICT use in South-west Nigeria, just below half of the respondents had moderate (43.86%) to high level (48.57%) of ICT use in North-central Nigeria.

Manty (2011) reported that 45.00 per cent of the UASD extension personnel belonged to high categories of overall of utilization of ICT tools followed by equal (27%) belonged to medium and low categories respectively.

Ann (2013) reported that the extent of ICTs application in farm information by the 'extension agents' showed that virtually all information concerning farming were disseminated through ICTs, but at low level. However, the responses viz. physical farm measurement (2.6), how to estimate farm output (2.7), best planting techniques (2.6), use of fertilizer (2.8) and method of keeping livestock (2.6) were areas of high level of application in farm information by the respondents. While quantities of chemical to use (1.0), quantities of seeds/cuttings/stems to use (2.4) among others recorded low application of ICTs.

Tanko *et al.* (2013) conducted a study among the extension workers and asked them how often they used ICT facilities provided by the organization. Their responses showed that about 50 per cent of the respondents utilized about 4 to 6 ICT facilities; about 20% utilized about 7 to 9, while only about 1.7% of the respondents accessed and utilized about 10 to 12 facilities.

Ravikishore(2014) reported that more than half of the respondents were using KAU expert system occasionally followed by rarely (23%) and regularly(17%).

Yekinni and Akinbile (2014) identified that the index of extent of use of ICTs was categorised into two, based on above and below the mean index of 27.95.

Distribution of the respondents according to this categorization showed that 79.5 per cent of the research practitioners fell within the high level category of ICT users, while 38.5 per cent of the extension personnel fell within the high level category of ICT users. The results highlighted the disparity in the level of use of ICTs by the different set of agricultural information managers in the country.

2.3.2 Purpose of utilization of ICT tools by extension personnel

Isiaka *et al.* (2009) reported that about 65.2% of the respondents indicated that they used the telephone devices for sending and receiving agricultural text messages to and from agricultural researchers and fellow extension workers.

Manty (2011) found that for getting the information, extension personnel in North Karnataka used web based search engine (100%) followed by internet (97.5%), web based agricultural information portals (95%), kiosk (87.5%), decision support system (85%), e-newspaper (82.5%), video conferencing (77.5%), television (75%), mobile (72.5%), radio (70%), e-agricultural magazines (67.5%), e-mail (62.5%) and computer (50%). For “transfer of technology” extension personnel used internet (90%), kiosk (80%), mobile (75%), video conferencing (67.5%), television (62.5%), computer (57.5%), video camera (55%), telephone (52.5%), radio and decision support system (50%).

Bhattacharjee and Saravanan (2011) revealed that information related to weather forecasts, package of practices, technological innovations, varieties released, market prices, etc. were mostly coveted by the farming community. Content validity in farmer’s own condition was also very important. Localised information was more welcome in the field condition, specifically in rural areas and to the small and marginal farmers who dominate the agricultural scenario in the developing countries.

Hashemi *et al.* (2013) reported that the statements which the respondents used most were: “typing letters/report” (M=3.24, SD=0.92), and “Prepare and protect file

on process basic agricultural and rural information“(M=2.89, SD=0.87), and “access to the latest agricultural news and information” (M=3.00, SD=0.97). Overall, the result of the Mean (55.45), and Standard Deviation (15.89), indicated that the extension workers in the study approximately used ICT quite a bit.

Adebowale *et al.* (2014) reported that half of the respondents (45.7%) used computer for analysis of data and others used it for type- setting of researcher report (21.7%), data storage (18.9%) and internet browsing (13.7%). This implied that computer had a wider application and it was inevitable in research. Also more than half (60.6%) of the respondents used Geographical Positioning System (GPS) and Geographical Information System (GIS) to develop geographical information on research area location, 24.6% used it to develop maps while 14.9% used it as a tool for classifying soil, based on features such as fertility, and vegetation cover.

Kabir and Roy (2015) in their study on preferences of ICT Tools by the Upazila Agriculture Officers (UAOs) for the Information Exchange in Bangladesh showed that majority of the respondents used ICT to retrieve different information while 63.80% of them used for video chatting. Three-fourth of the respondents used ICT for downloading different videos and more than four-fifth of them communicated through ICTs, where 88.8% of the respondents used ICT for collecting different training materials.

2.3.4 Duration of utilization of ICT tools by extension personnel

Jagboro (2003) concluded that 38.24 per cent of the respondents used internet weekly, 11.76 per cent monthly, 11.76 per cent bi-monthly and 16.17 per cent quarterly. In addition, 25.00 per cent spent an average time of half an hour, 39.71 per cent spent one hour, 19.12 per cent spent two hours, 7.35 per cent spent three hours, and 2.94 per cent spent four hours, while 5.88 per cent spent more than four hours. He also reported that the level of internet use by the students were very low.

Aboh (2008) revealed that 49.10 per cent of the respondents who spent 3 hours in utilizing ICT in a week, 21.10 per cent of the respondents spent between 4-7 hours, 17.50 per cent spent between 8-11 hours in a week while 12.30 per cent of the respondents spent 12-16 hours on ICT in a week. This revealed that majority of the extension agents spent 3 hours on ICT in a week while less number of the extension agents spent 12-16 hours on ICT on a week. This was a result of series of works that holds almost every week, the fortnightly training (FNT), meeting or block meeting (BM) or visitation of the farmers including other follow up activities.

Meera *et al.* (2010) conducted study on Critical analysis of e-learning opportunities and e-readiness in the public extension system: Empirical Evidence from Tamil Nadu and opined that majority of the respondents (55%) were willing to spend thirty minutes to one hour per week for updating their knowledge.

2.4 Training needs of extension personnel in using ICTs

Senthilkumar (2000) revealed that the modern information and communication technologies required more skill to operate.

Adesope *et al.* (2007) reported that one per cent change in training received by respondent lead to 5.7 per cent increase in Information Technology needed. This translated to about 1.23 per cent increase in probability of Information Technology needed, and about 5.8 per cent increased in intensity of Information Technology needed. Implication of this finding was that training in Information Technology increased the need for Information Technology.

Isiaka *et al.* (2009) reported that majority of the respondents, constituting 84.4 per cent, hoped to be trained on computer applications such that they would be able to use it for word processing, documentation of information and graphic design of pictures. About 70.5 per cent of them hoped to be able to use the Power point

component of the computer for information delivery or seminar presentation. Between 73.5 and 76.5 per cent of the respondents wished to know how to use the internet for mailing and browsing information, respectively. However, a few of them, constituting about 31.8 per cent, wished to know how website could be designed and hosted, and how to update the web information content as and when due.

Chauhan (2010) reported that majority (70%) of the respondents from Gujarat expected training on ICTs through government agency, followed by 13.00 per cent expected training by Agricultural University, 11.00 per cent of the respondents by Gram Panchayat. Only 4 and 2 per cent of them expected such training by co-operative society and NGOs.

2.5 Constraints faced by extension personnel in using ICT tools

Punam (2000) identified that major constraints faced by the extension personnel regarding usage of advanced communication media were lack of appropriate training (83.30%), scarcity of physical facilities (82.60%) and low literacy level of end users (81.10%). Important suggestions were to organize proper training (83.30%) and providing softwares in local languages (81.10%).

Balasubramani (2004) in his study reported that cent per cent of the subjects expressed that computer and other accessories were required to utilize expert system. It was followed by 98.33 per cent of the subjects felt as it required regular update, whenever situation changes.

Babu (2006) stated that low e-literacy, lack of awareness about ICT initiatives and low affordability etc as the biggest constraints in using ICTs.

Agwu *et al.* (2008) reported that out of the twenty possible constraints listed in the study, eight were considered to be serious constraints to the use of ICTs in agriculture by researchers. They were lack of communication infrastructure on which ICTs depend ($x = 2.00$), lack of sufficient trained computer personnel ($x = 2.03$),

erratic power supply ($x = 2.55$), poor finance ($x = 2.32$) and lack of internet access in the rural areas ($x = 2.60$). Others included: poor communication network ($x = 2.10$), high cost of ICTs software ($x = 2.00$) and high cost of ICTs hardware ($x = 2.08$).

Salau and Saingbe (2008) in their study on access and utilization of Information and Communication Technologies (ICTs) among agricultural researchers and extension workers identified the factors against the use of ICTs by agricultural researchers and extension workers in the study area. Poor/ lack of electricity supply was rated highest 62.22 per cent and 82.21 per cent by researchers and extension workers respectively. Other constraints following the order of magnitude were inability to operate some ICTs, financial problem, poor access to ICTs and lack of interest.

The findings by Agwu and Uche-Mba (2010) revealed that lack of competence in handling ICT facilities, unavailability of hardware required by modern ICT, poor finance, lack of adequate awareness about ICT, lack of internet access to the rural areas, poor communication network and nature of information provided were considered as serious constraints to the use of ICTs by extension workers.

Al-Shayaa *et al.* (2011) identified that 93.5 per cent workers would like to see the designated period for their trainings to upgrade their skills and 93 per cent workers considered the weak communications infrastructure (network) as an important obstacle that prevented them from using the computers. The interest in learning by the learner was an important factor and about 96 per cent workers also agree that lack of interest in learning computers was an obstacle. Most of the workers (98%) did not find ample opportunities to upgrade the skills through training programs on the use of computers and considered as an obstacle to the use of computers. One of the impediments to the training programs was that they were held

at the inappropriate times. About 90.5 per cent workers view the unsuitable timings as an obstacle to the training programs.

Adhiguru and Vimaladevi (2012) identified lack of infrastructure facility, inadequate internet/phone connectivity, insufficient regional specific information and inadequate subject matter as the prominent constraints experienced by farmers in the major ICT initiatives implemented areas.

Mabe (2012) observed that the constraints related to use of information and communication tools by extension officers in North West Province, South Africa were failure of service (1.56), poor basic infrastructure that encouraged ICT (1.54), inability to maintain the ICT (1.52), too costly (1.43) and non availability of technical personnel (1.47).

Singh and Rani (2013) in their study on access to and socio- economic impact assessment of computer/internet in rural Haryana, India revealed that the major constraints in use of computer/internet were economic dependency (65%), lack of decision making ability (57%), lack of control on use of computers/internet(54%), lack of power supply (53%), poor network (52%) hardware inadequacy and maintenance (50%) lack of time (46%) followed by connectivity (40%) and lack of awareness (39%).

Tanko *et al.* (2013) reported that the most pressing problems faced by respondents in the use of broadcast/audiovisual technology in decreasing magnitude of importance were lack of access roads to move equipment (85.71%), no room for interactive communication (62.86%), high cost of equipment (84.29%), lack of expertise (82.86%) and high charges paid for radio and TV programmes (61.43%). Others included inability to address emerging problems (54.29%) and lack of radio listening groups (52%). The most pressing problems faced by respondents in the use

of telecommunication technology were poor telecommunication network (85.71%), non-popularity of fax and e-mail services (81.43%), high cost of telecommunication services (42.86%) and taking time to get calls through (18.57%).

Adebowale *et al.* (2014) reported that 54.9 per cent of the respondents considered problem of financial support for maintenance of ICT infrastructure as a very serious constraint while other constraints considered as such were irregular power supply (47.4%), unavailability of required modern ICT hardware (46.9%) and poor institutional ICT development policy (46.3%). The findings also showed that insufficient capacity building on ICT application (54.3%), problem of ICT proficiency among researchers (53.1%), high cost of procurement (48.7%), lack of essential ICT software application (46.9%) and poor institutional development of ICT devices (46.3%) were serious constraints facing the use of ICT devices in agricultural research. Other constraints that were indicated as serious included poor accessibility to internet (44.6%), high cost of maintenance (44%), inadequate technical support (41.1%), inadequate awareness on ICT usage in research (40%) and complexity of ICT usage (36.0%).

Hinduja (2014) identified that the major constraint in accessing information kiosk was lack of awareness about ICT tools (85%) and contents related problems were the major constraints for using mobile SMS (93.33%).

Ravikishore (2014) identified that majority of the respondents ranked lack of proper training as the most important constraint.

Kabir and Roy (2015) listed that load shedding problem (2.21), lack of training facilities (2.19) and indifferences of farmers to get information through ICT (2.19) were the major challenges faced by the Upazila Agriculture Officers. The increased prices of the ICT tools (1.98) and sophistication of using ICT (1.68) were the challenges faced by the respondents in using ICT tools.

Research methodology

III. RESEARCH METHODOLOGY

This chapter gives a brief description of the methods and procedures followed in the study. It deals with the methodology of research adopted for the present investigation, which includes research design, sampling procedure, empirical measurement of variables, collection of data and statistical tools used. The research methodology followed is described under the following heads:

- 3.1 Research design
- 3.2 Sampling procedure
- 3.3 Selection of ICT tools
- 3.4 Operationalisation and measurement of variables
- 3.5 Instruments for data collection
- 3.6 Statistical tools used for the study

3.1. Research design

Research design is the plan, structure and strategy to carry out research. According to Kerlinger (1964) research design gives direction to the research and shows how research should be planned and carried out. The research design adopted for this study is *ex post-facto* research design. *Ex-post facto* research is the systematic empirical enquiry in which the scientist does not have any direct control over the independent variables because their manifestations have already occurred or because they are inherently not manipulated.

3.2. Sampling procedure

Multi stage random sampling technique was adopted to select the sample for the study.

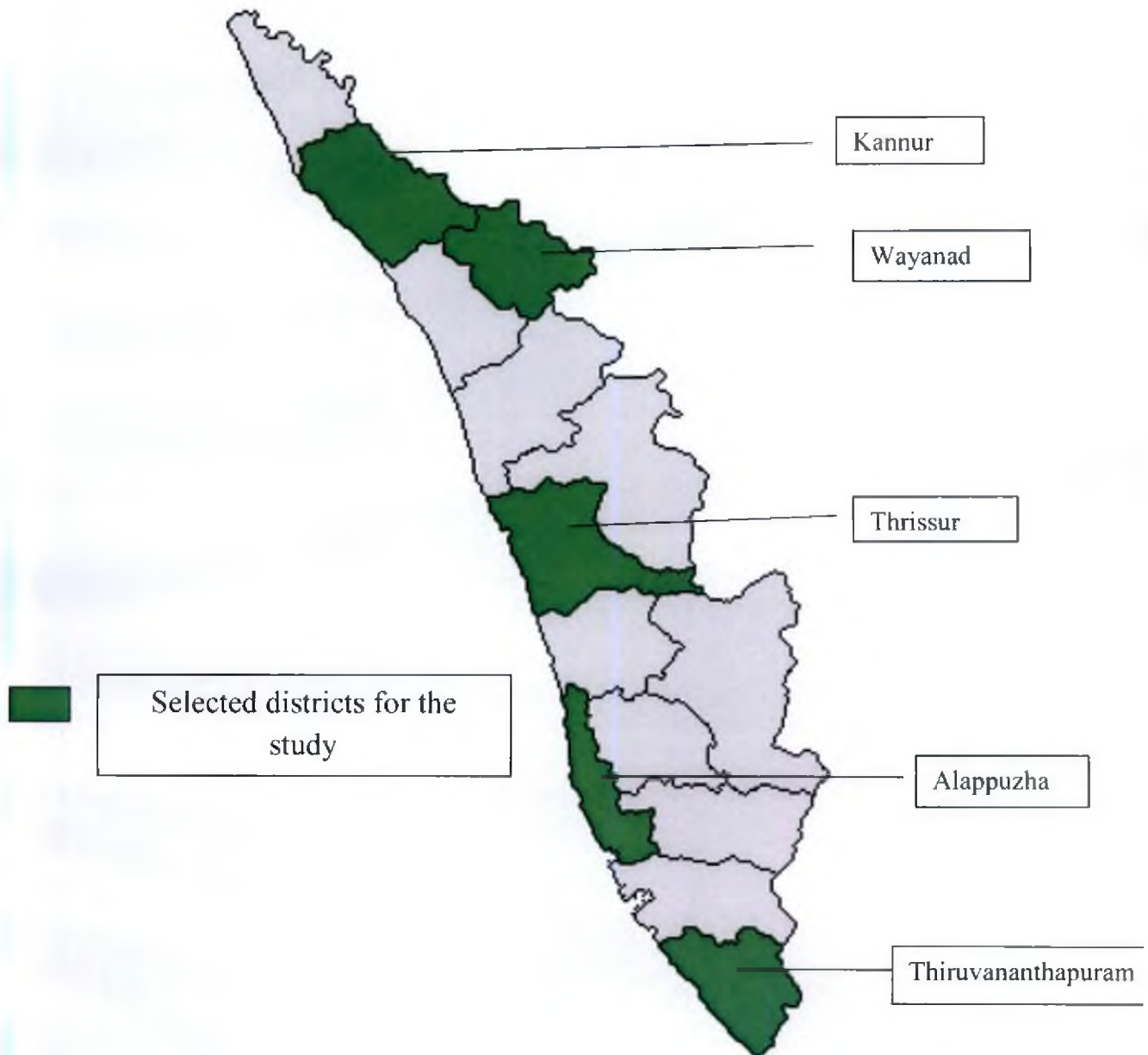


Fig.1 Map showing the study area

3.2.1 Selection of districts

The study was confined to the Kerala state of India. For this study purpose, five districts were randomly selected, one each from the five agro-climatic zones of Kerala. The districts selected were Kannur from the north zone, Wayanad from the high altitude zone, Thrissur from the central zone, Thiruvananthapuram from south zone and Alappuzha from the problem zone. These five districts were selected as representative sample of Kerala (Fig.1).

3.2.2 Selection of respondents

The group of respondents selected for the study was Agricultural Officers from Thiruvananthapuram, Alappuzha, Thrissur, Kannur and Wayanad districts. All the krishi bhavans in Kerala are computerized to utilize the advances in Information and Communication Technologies (ICTs) for the transfer of technologies and administrative purpose. Hence agricultural officers being one of the most important stakeholders of these technologies were selected as respondents. From each district 30 agricultural officers were selected randomly, logically covering agricultural officers from one third of the districts, constituting 150 respondents.

3.3 Selection of ICT tools

A total of 15 ICT tools which have the potential to be used by the extension personnel for extension purpose were selected for the study. The ICT tools includes radio, television, land phone, mobile phone, computer, internet, e-mail, web based search engine, web based agriculture information portals, decision support system, video conferencing, agri kiosks, e- newspaper, e-journals and e-agricultural magazines.

3.4 Operationalisation and measurement of variables

3.4.1 Operationalisation and measurement of independent variables

Based on review of literature and consultation with experts, 10 independent variables were selected for the study, the operational definition and measurement techniques of which are given below. Personal and socio-economic characteristics of extension personnel were measured by using the following methods:

3.4.1.1 Age

It was conceptualized as the chronological age of the respondents in completed years at the time of investigation. The respondents were further categorized into three groups as per GOI (Census, 2011) viz; young (<35 years), middle age (35-45 years) and aged (>45 years).

3.4.1.2 Gender

Gender commonly refers to the set of characteristics that humans perceive as distinguishing between male and female entities. Based on gender the respondents were categorized into 'Female' and 'Male'.

3.4.1.3. Educational status

It is operationalised as the number of years of completed formal education, successfully by the respondents. For each academic qualification, a score was given. The respondents were grouped into different categories based on the level of education as given below: It was measured by adopting the scoring system followed in the socio economic scale of Manty (2011) with modifications.

SI No	Qualification	Score
1	Diploma	1
2	Degree	2
3	Bsc Agriculture	3
4	Msc Agriculture	4
5	PhD	5

3.4.1.4. Experience

Baby (2001) operationalised experience as the number of completed years of service in the field of agricultural research at the time of enquiry. In this study the respondents were categorized based on the method followed by Padmaiah and Ramanjanayulu (2005). The experience of the respondents was accounted as the number of completed years of service in the field of agricultural extension. One score was given to every additional class of experience in their own profession. The respondents were categorized into three classes as low, medium and high experience.

SI No	Category	Range(Score)
1	Low	< Mean – Standard Deviation
2	Medium	Mean ± Standard Deviation
3	High	> Mean + Standard Deviation

3.4.1.5 Trainings received on ICTs

This was operationalised as the number of ICT mediated training programmes attended by the respondents. The scale was developed by Parimala (2003) with modifications was followed for the study. The scores were assigned as given below:

SI No	Trainings undergone	Score
1	Nil	1
2	Once	2

3.4.1.6 Mass media utilization

Mass media utilization is operationalised by considering the exposure and level of participation of an individual to different mass media such as radio, television, farm magazine and newspaper. The respondents were asked to indicate their level of participation in terms of listening, viewing and reading behavior. This variable was quantified by using the procedure as followed by Kikon (2010) with slight modifications.

3.4.1.7 Innovation proneness

Innovation proneness denotes the quality of being innovative. An innovation involves creation of entirely new knowledge as well as an idea perceived as new. Hall (2003) defined innovation proneness as the continuous process of upgrading using new knowledge or the new combination of the existing knowledge that is new to the local area. It is operationally defined as on whom shows interest in seeking new idea and bringing changes in his/her profession. The scale used by George (2005) with slight modifications was followed for the study. The scale consists of eight statements. Innovation proneness score was arrived by summing up scores of entire statement. The responses were collected by giving scores as given below:

SI no	Category	Strongly agree	Agree	Disagree	Strongly disagree
1	Positive statements	4	3	2	1
2	Negative statements	1	2	3	4

Then, based on the total score, the respondents were categorized into 'low', 'medium' and 'high' by considering the mean (\bar{X}) and standard deviation (SD) as measure of check.

Sl no	Category	Range(Score)
1	Low	< Mean – Standard Deviation
2	Medium	Mean \pm Standard Deviation
3	High	> Mean + Standard Deviation

3.4.1.8 Attitude towards ICTs

Attitude towards ICTs in this study was operationalised as the degree of positive or negative mental predisposition of extension professionals towards the ICT tools. Attitude of extension professionals towards ICT tools was measured by Kumar (2008) and adopted for this study with necessary modifications. The scale consists of ten statements of which five are negative and five are positive. The following scoring procedure was followed for measuring the attitude towards ICT tools:

Sl No	Response	Agree	Disagree
1	Positive statements	2	1
2	Negative statements	1	2

Summation of scores of all items gave the score of the respondents on attitude towards ICT tools. Then, based on the total score, the respondents were categorized into 'low', 'medium' and 'high' by considering the mean (\bar{X}) and standard deviation (SD) as measure of check.

SI No	Category	Range(Score)
1	Low	< Mean – Standard Deviation
2	Medium	Mean ± Standard Deviation
3	High	> Mean + Standard Deviation

3.4.1.9. Infrastructure and other resource facilities

This refers to the infrastructure and other resource facilities at the disposal of extension personnel required for performing their duties. For the purpose of measurement, the selected respondents were asked to record the availability of infrastructure facilities such as building, equipments, money, staff/men, repair and maintenance which are essential in transfer of technology and successfully accomplishing their duties through a dichotomous question, 'Yes' or 'No.' For quantification of this variable the procedure followed by Nambiar (1999) was made use with slight modification. Based on total score, the respondents were grouped into three categories as 'low', 'medium' and 'high' by considering the mean (\bar{X}) and standard deviation (SD) as measure of check.

SI No	Category	Range(Score)
1	Low	< Mean – Standard Deviation
2	Medium	Mean ± Standard Deviation
3	High	> Mean + Standard Deviation

3.4.1.10 Accessibility to ICT tools

Accessibility to ICT tools is operationalised as the degree to which the ICT tools are readily available for extension professionals whenever required for finding solutions to the field problems and decision making for the benefit of farming

frequent users, most frequent users by using quartile deviation. In addition to this purpose and duration of utilization of ICTs were also measured.

3.4.2.1.1 Purpose of utilization

The purpose of utilization was classified under following categories: This variable was quantified by using the procedure as followed by Parida (2010) with slight modifications. The respondents were asked to select the purpose for which they mainly use the ICT tools.

SI No	Category
1	For knowledge/recent information
2	For transfer of technology
3	For training/teaching
4	For sharing with concerned organization including input agencies
5	For making and sending reports
6	For organizational communication

3.4.2.1.2 Duration of utilization of ICTs

On the basis of extent of utilization of ICT tools, the duration of utilization of ICT tools was calculated in hours per week. The procedure adopted by Manty (2011) was followed with slight modifications. The respondents were asked to indicate the frequency of use of ICT tools in hours per week.

SI no	Category	Score
1	1-5hrs/week	1
2	5-10hrs/week	2
3	10-15hrs/week	3
4	Above 15 hrs/week	4

community. In order to find out the accessibility, 15 ICT tools were listed and responses were taken as either Yes (ICT tool is accessible) or No (ICT tool is not accessible) and the extent of accessibility was calculated as percentage.

3.4.2 Operationalisation and measurement of dependent variables

The dependent variables selected for the study includes extent of utilization of ICT tools and training needs in ICTs.

3.4.2.1. Extent of utilization of ICT tools

Extent of utilization to ICT (Information Communication and Technology) tools was operationalised as the extent to which the respondents were exposed to Information Communication and Technologies (ICTs) for developing his/her knowledge and skills for the benefit of his/her profession. The scale adopted by Hassan (2008) with some modifications was used in this study. The scoring procedure is represented as follows:

SI No	Category	Score
1	Most frequently	5
2	More frequently	4
3	Frequently	3
4	Less frequently	2
5	Not utilized	1

The possible obtainable scores ranged between 60 and 0 respectively. Based on the total scores, Utilization Index was calculated and the respondents were classified into four categories namely very less frequent users, less frequent users,

frequent users, most frequent users by using quartile deviation. In addition to this purpose and duration of utilization of ICTs were also measured.

3.4.2.1.1 Purpose of utilization

The purpose of utilization was classified under following categories: This variable was quantified by using the procedure as followed by Parida (2010) with slight modifications. The respondents were asked to select the purpose for which they mainly use the ICT tools.

SI No	Category
1	For knowledge/recent information
2	For transfer of technology
3	For training/teaching
4	For sharing with concerned organization including input agencies
5	For making and sending reports
6	For organizational communication

3.4.2.1.2 Duration of utilization of ICTs

On the basis of extent of utilization of ICT tools, the duration of utilization of ICT tools was calculated in hours per week. The procedure adopted by Manty (2011) was followed with slight modifications. The respondents were asked to indicate the frequency of use of ICT tools in hours per week.

SI no	Category	Score
1	1-5hrs/week	1
2	5-10hrs/week	2
3	10-15hrs/week	3
4	Above 15 hrs/week	4

3.4.2.2 Training needs of extension personnel in ICTs

Based on the discussion with agricultural officers, experts of the Agricultural Department and also through review of literature, the expected major subject areas of necessitating trainings were identified. These were listed and included in the questionnaire. Identified subject areas were classified into the subject areas coming under knowledge level and skill level of training. Eight knowledge based subject areas and 22 skill based areas were selected so as to analyse the training needs of agricultural extension personnel in using ICTs. The respondents extension personnel were asked to give their responses on a five point scale viz, most needed, more needed, needed, least needed and not needed with scores 5, 4,3,2,1 respectively. The Training Need Index was calculated based on the total score obtained by the respondents against each subject area.

3.4.3 Constraints in using ICTs

Constraints were operationalised as the reasons that severely restrict the scope/extent/activity experienced by the extension workers from achieving its potential with reference to its goal. Based on discussion with agricultural officers, experts in agricultural department and also through review of literature, the major constraints experienced were identified. These were listed and included in the questionnaire. The major constraints identified by the respondents were verified using Kendall's coefficient of concordance to confirm their agreement among them.

3.5 Instruments for data collection

The instrument used for data collection was mailed questionnaire. A questionnaire was prepared including the items for measuring all the variables selected for the study.

The questionnaire was developed consisting of four parts. Part - I contains the profile characteristics of extension personnel, Part – II deals with the accessibility of

ICT tools by the extension personnel, Part - III contains the statements to elicit utility pattern of ICT tools by extension personnel. Further the utility pattern of ICT Tools was divided into three parts *viz*, extent of utilization, purpose of utilization and duration of utilization of ICT tools. And the part – IV focuses on the problems and training needs and constraints faced by extension personnel while using ICT Tools.

A pilot study was conducted to pre-test the questionnaire and verify the applicability of the items in the questionnaire. Based on the responses the questionnaire was modified by incorporating the relevant and deleting the irrelevant items according to the objectives of the study. Utmost care and special attention was given in finalizing the wording and format of questionnaire to eliminate mistakes and ambiguity regarding the various items.

3.6 Statistical tools used for the study

The data collected from the respondents were scored, tabulated and the following parametric and non-parametric tools were used to analyze the data and draw relevant inferences.

3.6.1. Summary statistics

The respondents were grouped into three categories *viz*; low, medium and high based on mean and standard deviation. After grouping, the percentage of respondents coming under each category was worked out.

3.6.2. Percentage analysis

Percentage distribution of the respondents on all the variables was worked out by dividing the frequency of response in each category with the total number of respondents and multiplying with hundred.

3.6.3 Quartile deviation

The quartile deviation is half the difference between the upper and lower quartiles in a distribution. It is a measure of the spread through the middle half of a distribution. It is useful to classify the data into different quartiles which can lead to categorization of respondents into different categories.

3.6.4 Extent of accessibility

The agricultural extension personnel were asked to give their responses regarding accessibility of various ICT tools by marking Yes (accessible) or No (not accessible) to each of the ICT tool based on the accessibility of ICT tools to them. The scores for each individual was added up and the total score on accessibility of each ICT tool was obtained and the percentage of accessibility was worked out.

$$\text{Extent of accessibility} = \frac{\text{Total scores obtained}}{\text{Total number of respondents}} \times 100$$

3.6.5 Utilization index

For this study a range of questions related to the utilization of ICT tools were identified, selected based on discussion with experts and the responses from the pilot study and the questions were included in the questionnaire. The scores for each ICT tool was added up and the total score on utilization was obtained. Then the individual's total scores were divided by the maximum possible score and expressed in 100.

$$\text{Utilization Index} = \frac{\text{Total scores obtained}}{\text{Total possible score}} \times 100$$

3.6.6 Training Need Index

The scores for training needs of each ICT tool were added up and the total score was obtained. Then the individual's total scores were divided by the maximum possible score and expressed in 100.

$$\text{Training Need Index} = \frac{\text{Total scores obtained}}{\text{Total possible score}} \times 100$$

3.6.7 't' test

The t test of significance (for small sample) for difference in mean was employed to test whether the respondents differed significantly in the utilization of ICTs and training needs on ICTs with respect to their gender, educational status and trainings received on ICTs.

3.6.8 Spearman's rank order correlation

The relative correlation of utilization of various ICT tools and training needs on ICT tools with the educational qualification, experience innovation proneness, mass media utilization and attitude of respondents towards ICTs was assessed by working out the spearman's rank order correlation coefficient (r_s).

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

Where, r_s = Spearman's rank order correlation coefficient

d = difference between two sets of values

n = number of ranks

3.7.9. Kendall's coefficient of concordance

Kendall's coefficient of concordance was used to verify whether there was agreement among the respondents in providing their responses to the study. In this study it is used to check the concordance among extension personnel on the constraints faced by them while using different ICT tools.

$$W = \frac{S}{1/12K^2(N^3-N)}$$

$$S = \sum R_j^2 - (\sum R_j)^2 / N$$

K = Number of sets of ranking

N = Number of individuals or objects ranked

$1/12K^2(N^3-N)$ = Maximum possible sum of the squared deviations the sum S which should occur with perfect agreement among K rankings.

The computed value of 'W' was tested for its significance by using the $X^2 = K(n-1)W$ with $N-1$ degrees of freedom.

Statistical Package for Social Sciences (SPSS version 16) was used to analyze the data and interpreted accordingly.

Results and discussion

IV. RESULTS AND DISCUSSION

Present investigation is planned to study the accessibility and utilization pattern, training needs and the constraints faced by extension personnel for using Information and Communication Technologies. Keeping in view the specific objectives of the study, the empirical evidence obtained in terms of factual data was subjected to appropriate statistical and analytical tests and the findings thus arrived were presented and discussed with suitable interpretations and supporting studies. The findings are presented as follows based on the objectives of the study:

- 4.1 Distribution of respondents according to their personal characteristics.
- 4.2 Availability and accessibility of ICT tools among extension personnel
- 4.3 Utilization pattern of ICT tools among extension personnel
- 4.4 Training needs of extension personnel in using ICTs
- 4.5 Constraints in using ICT tools.
- 4.6 Strategies for capacity building of extension personnel for using ICTs

4.1. Profile characteristics of the extension personnel

To give a cursory look of the profile characteristics of selected extension personnel, an attempt was made to compile their profile and is presented in Table 4.1.

4.1.1. Age

From Table 4.1, it can be observed that nearly half the percentage of the selected extension personnel (48.66%) belonged to the age group between 35-45 years and 34.66 per cent of them were above 45 years. Below one-fifth of them (16.66%) came under the category of below 35 years (Fig.2). The findings are in

agreement with the findings of Sankri (2012), Ravikishore (2014) and Yakubu *et al* (2014).

The recruitment for the past 5-6 years was minimum and hence less number of respondents belonged to young age. The State Agricultural Department may take necessary steps to recruit young extension personnel who are more energetic to reach out to the farmers in the remote villages.

Table 4.1 Distribution of respondents according to their profile characteristics

(n=150)

Sl No	Variable	Frequency	Percentage
1.Age			
i	Below 35 years	25	16.66
ii	35-45years	73	48.66
iii	Above 45 years	52	34.66
2.Gender			
i	Male	51	34.00
ii	Female	99	66.00
3.Educational status			
i	Diploma	9	6.00
ii	Degree	6	4.00
ii	B.Sc. Agriculture	70	46.66
iv	M.Sc.Agriculture	62	41.33
V	PhD	3	2.00
4.Experience			
i	Less (<5.05 years)	33	22.00
ii	Medium(5.05-19.57 years)	93	62.00
iiii	High (>19.57 years)	24	16.00
Mean:12.31		SD:7.26	

5. Trainings received on ICTs			
I	Nil	112	74.66
ii	Yes	38	25.33
6. Mass media utilization			
I	Low (<23.45)	25	16.66
ii	Medium(23.45-30.03)	92	61.33
iii	High (>30.03)	33	22.00
Mean:26.74		SD:3.29	
7. Innovation proneness			
I	Low (<19.42)	21	14.00
ii	Medium(19.42-23.38)	107	71.33
iii	High (>23.38)	22	14.66
8. Attitude towards ICTs			
I	Low (<16.77)	19	12.66
ii	Medium(16.77-19.23)	130	86.66
iii	High (>19.23)	1	0.66
Mean:18		SD:1.23	
9. Infrastructure and other resource facilities			
I	Low (<4.78)	-	-
ii	Medium(4.78-7.7)	114	76.00
iii	High (>7.7)	36	24.00
Mean:6.24		SD:1.46	

4.1.2 Gender

It is noted from Table 4.1, that two-third of the extension personnel (66.7%) in the State Department of Agriculture, Kerala were females and remaining were males (Fig.3). Female extension personnel outnumbered male extension personnel in all the districts. The findings are in line with the findings of Gregg and Irani (2004) but contradicting with the findings of the studies conducted by Agwu *et al* (2008), Salam and Saingbe (2008) and Mabe and Oladale (2012).

This implies that in Kerala, the extension professionals were predominantly females. This may be connected with the high rate of admission of girl students for agricultural graduation in Kerala.

4.1.3. Educational status

From Table 4.1, it can be concluded that most of the extension personnel of Kerala had B.Sc. Agriculture (46.66%) and M.Sc.Agriculture (41.33%) degrees. The remaining extension personnel included diploma holders (6%), degree (4%), and PhD holders (2%) (Fig.4). Similar findings were reported by Sankri (2012) and Ravikishore (2014).

This observation implies that education, which is the means of empowerment for effective performance and requirement for efficient extension service was realized by majority of the extension personnel. This requirement might have stemmed out of the need for extension workers to have the competence for the application and dissemination of technological innovations using ICTs for rural transformation and agricultural development. Without basic education and continuous in-service training, it may be difficult for the extension personnel to make effective use of communication technologies for improved extension service delivery. The minimum essential educational level of entry to the occupation was B.Sc. Agriculture and adding any additional qualification may help them to attain further better positions.

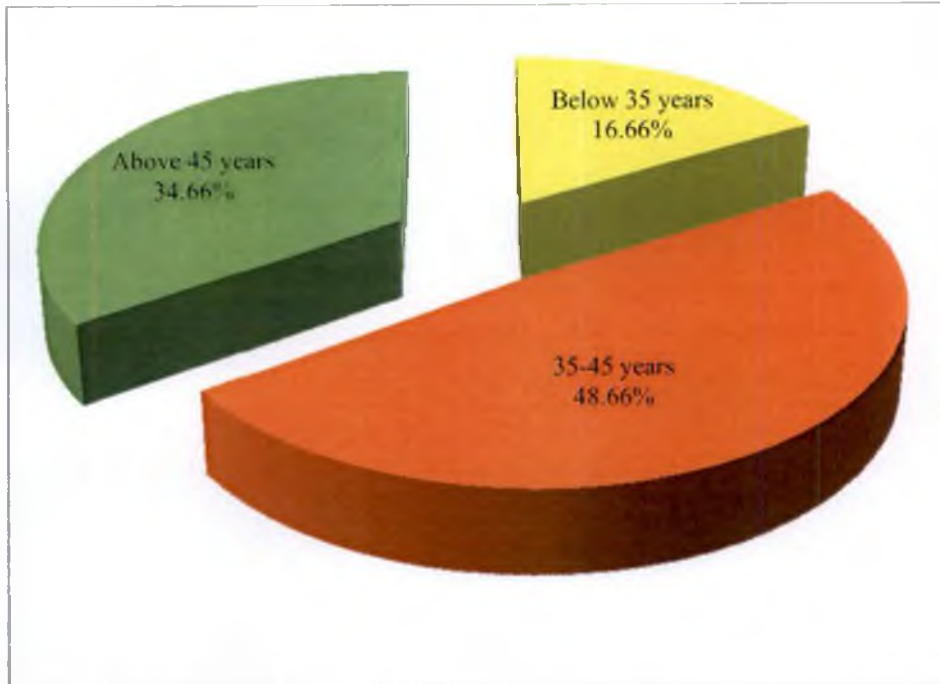


Fig.2 Distribution of respondents according to their age

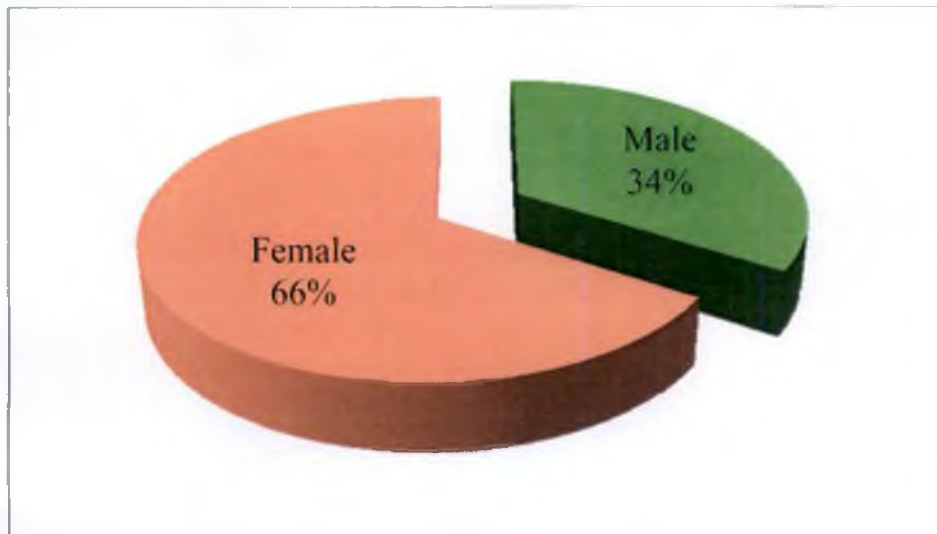


Fig.3 Distribution of respondents according to their gender

4.1.4. Experience

The results in Table 4.1 indicated that majority of the extension workers (62%) were having medium experience in their profession. Only 22 per cent of the extension personnel were highly experienced in their profession followed by 16 per cent less experienced officers (Fig.5).

As mentioned earlier, recruitments to the post of Agricultural Officers in the Department of Agriculture was minimal during the past 5-6 years. So the percentage of extension personnel belonged to the low experience category will be very less. Similarly the percentage of respondents in the high experience category was also comparatively low. This was because; once the extension personnel attained a certain experience they would be promoted to higher positions of administrative nature (Assistant Director of Agriculture).

4.1.5. Trainings received on ICTs

It is clear from Table 4.1 that about 75 per cent of the extension personnel did not attend any training programmes related to ICT (Fig.6). This finding is in line with the findings of Helen (2008). Even after more than seven years same trend of not receiving trainings on ICTs were reported by the extension personnel. The institutions involved in the capacity building of extension personnel must conduct series of training programmes on ICTs for empowering extension personnel of Kerala in the subject areas of ICTs.

Today is an era of ICT and ICT training has not been conducted in the agricultural extension sector is a paradox. Hence sufficient funds are to be earmarked for trainings in ICT enabled agricultural extension.

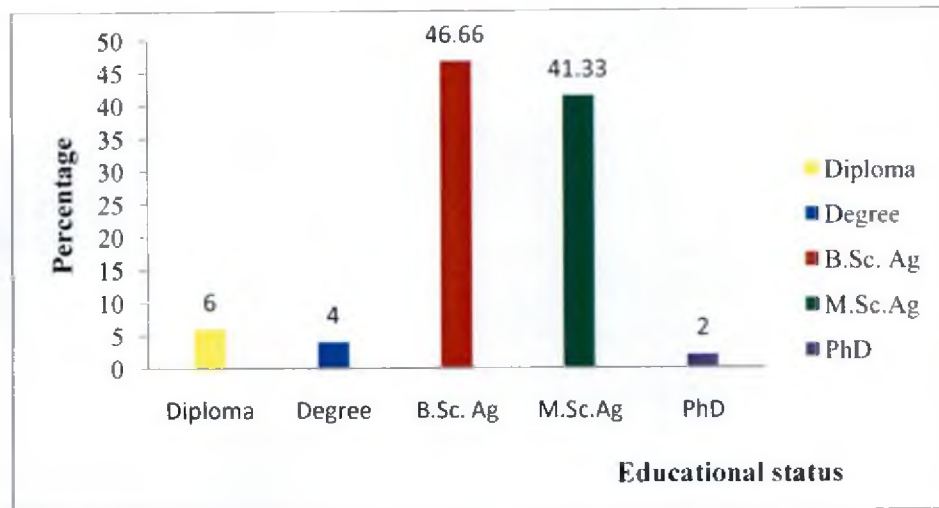


Fig.4 Distribution of respondents according to their educational status

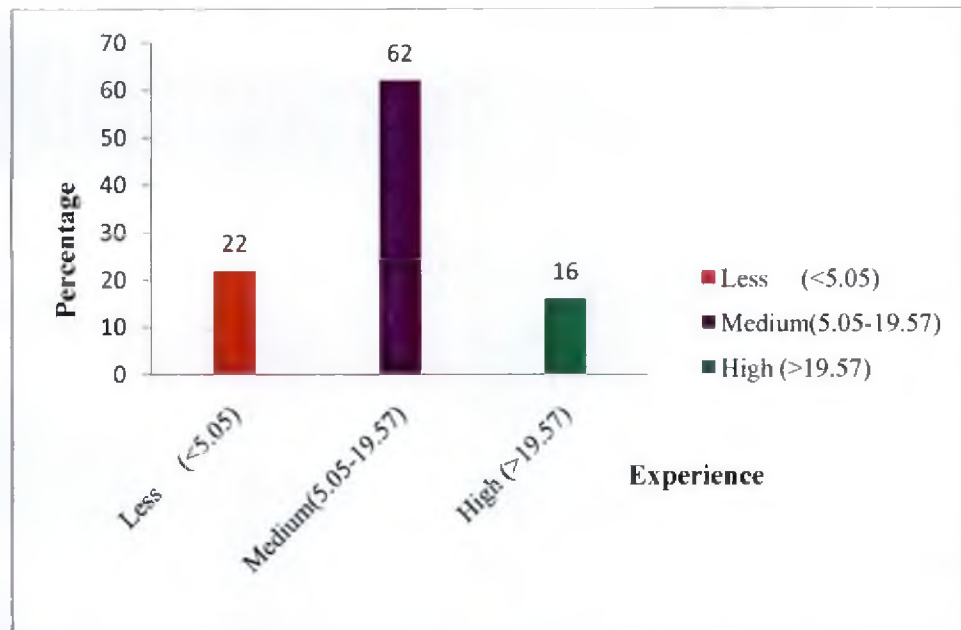


Fig.5 Distribution of respondents according to their experience

4.1.6. Mass media utilization

It can be perceived from Table 4.1 that 61.33 per cent of the respondents were under medium mass media utilization followed by high (22%) and low level (16.66%) of mass media utilization (Fig.7). These findings derived support from the findings of Dhaka and Chayal (2010) and Manty(2011).

The item wise comparison in table 4.2 revealed that more than fifty per cent of the extension professionals used mass media like radio, television, farm magazine and news paper. In the case of radio, 88.67 per cent of the respondents listened agriculture related programmes(Fig.8).

The probable reason might be that radio provided extensive information on diverse subjects such as land and water conservation, sustainable agriculture, biotechnology, integrated pest management in crops, crop insurance schemes, environment protection, disaster management, role of panchayats in rural development. These programmes were produced with the help of subject matter specialists. All India Radio maintains a very close liaison with the Ministries and Departments of Agriculture and Rural Development of central and state governments. The programmes are tailored in regional and local dialects from different stations. Local radio stations also broadcast regular programmes on agricultural and rural development activities.

In the case of television, more than 90 per cent of the respondents were the viewers of news (92%) and agricultural related programmes (90%) followed by entertainment programmes (71.33%) and rural development programmes (46.66%).

The findings further revealed that a good number of extension personnel had the habit of watching TV programmes on agriculture, as this has a visual impact for improving productivity. In Kerala almost all the channels have specific programmes related to agriculture and allied sectors telecast at daily or weekly intervals.

Almost all the extension officers (99.33%) read farm magazines for obtaining recent information and updates in the field of agriculture and rural development. It may be due to the reason that magazine providing information on the latest technique, products, and varieties released and improved package of practices. The location specific information and success stories will help the extension personnel for giving suggestions to improve farm income of their clientele.

Newspaper was read by extension personnel mainly for obtaining agriculture related programmes (96%) and recent news (93.3%), (Fig.11) Majority of them read newspapers for getting authoritative and relevant information. The leading newspapers provide extensive news on agriculture published by experts and the extension agents are able to understand in depth the practices adopted for improving productivity in cultivation and marketing opportunities. The weekly supplement pages of these dailies provide information on farm mechanization, timely application of fertilizers, crop protection and disease, horticulture, animal husbandry, food processing, expert advice for all related queries in local languages and able to follow this regularly. Exposure to the above mass media keep them update on the latest issues in farming sector and support them to find out the latest suitable technologies.

4.1.7. Innovation proneness

It is evident from Table 4.1; more than two-third of the extension personnel (71.33%) had medium level of innovation proneness. High level of innovation proneness was noted among less than one-fourth of the extension personnel (14.66%). High and medium level of innovation proneness can be related to their high level of education and it can be interpreted that these extension personnel will be able to accept and adopt the latest ICTs for the transfer of agricultural technologies. The findings are in conformity with the findings of Senthilkumar (2000), Babu (2006) and Sarala (2008).

Table 4.2 Distribution of respondents according to their mass media utilization

(n=150)

Sl No	Mass media	Frequency*	Percentage
Radio			
1	Agricultural programmes	133	88.67
2	Rural development programmes	53	35.33
3	News	95	63.33
4	Entertainment programmes	64	42.66
Television			
1	Agricultural programmes	135	90.00
2	Rural development programmes	70	46.66
3	News	138	92.00
4	Entertainment programmes	107	71.33
Farm magazine			
1	Agricultural programmes	149	99.33
2	Rural development programmes	149	99.33
3	News	67	44.66
4	Entertainment programmes	37	24.66
News paper			
1	Agricultural programme	144	96.00
2	Rural development programmes	108	72.00
3	News	140	93.33
4	Entertainment programmes	89	59.33

*Multiple responses

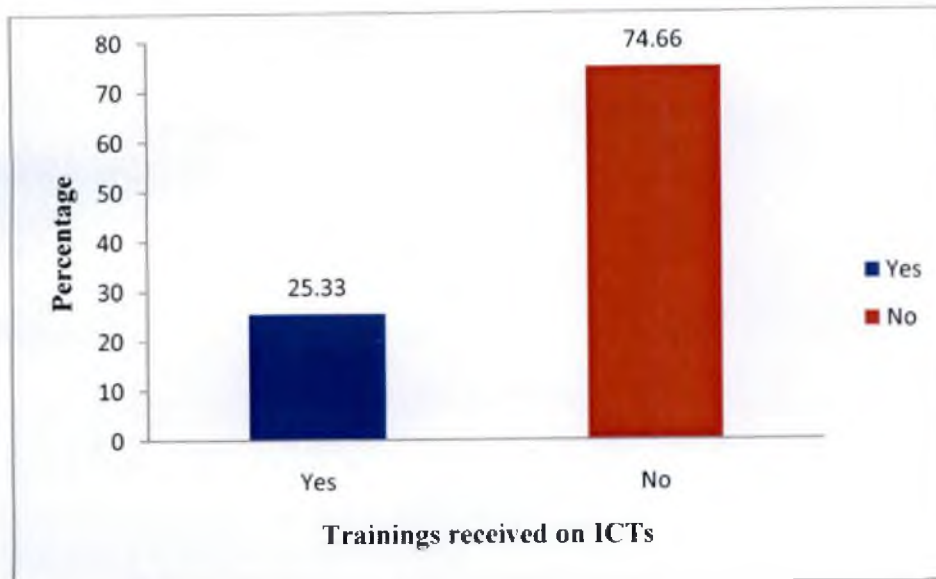


Fig.6 Distribution of respondents according to the trainings received on ICTs

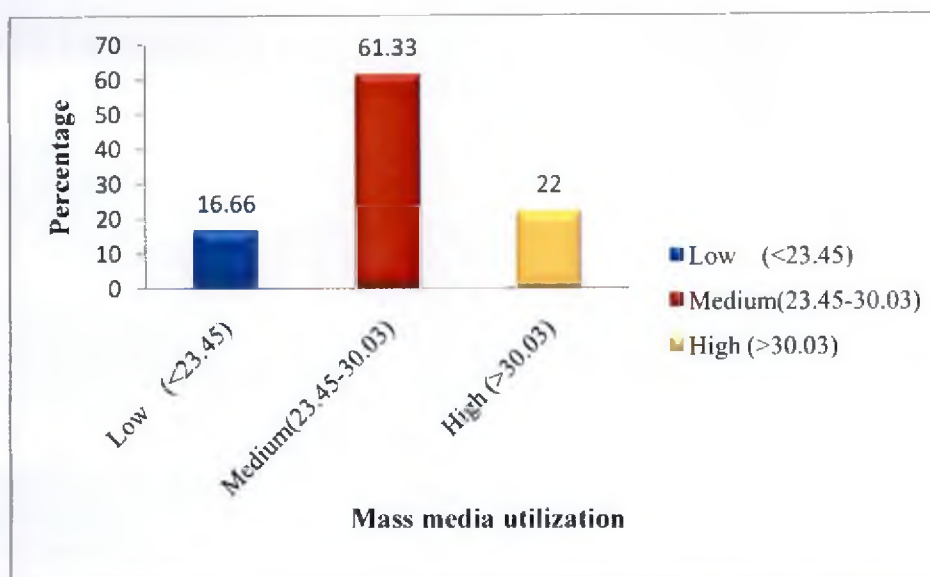


Fig.7 Distribution of respondents according to their mass media utilization categories

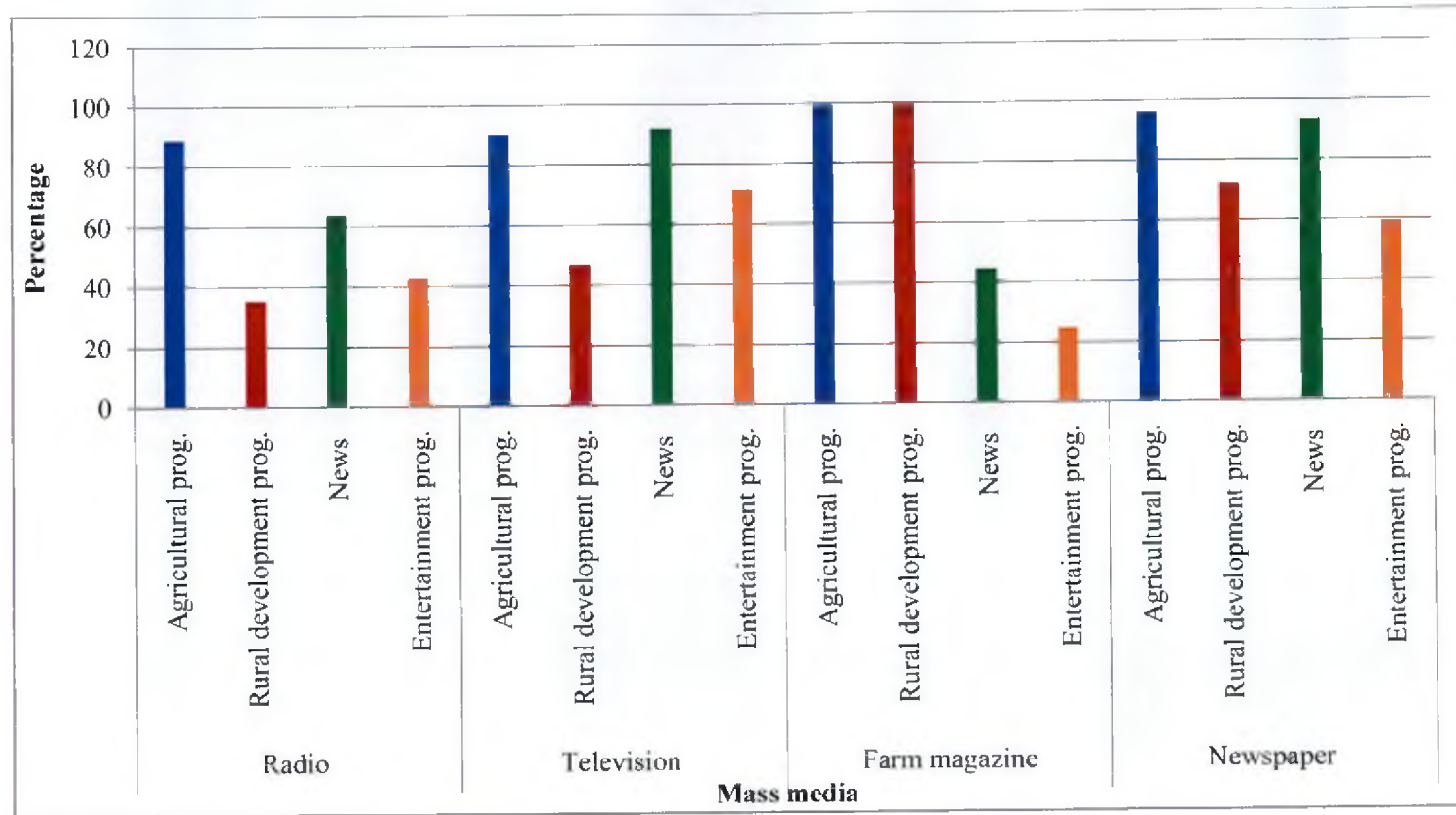


Fig. 8 Distribution of respondents according to their mass media utilization pattern

4.1.8. Attitude towards ICTs

The results in table 4.1 indicate that majority of the extension workers (86.66%) had medium level of attitude towards ICT tools. Detailed perusal of Table 4.3 indicates that the positive statements towards ICTs such as 'ICT application facilitate quick access to current data', 'ICT application improve the quality of services', 'ICT applications help to improve communication', 'ICT makes an integration within the office', 'ICT applications increase job satisfaction of extension personnel' were agreed by most of the extension personnel (more than 80 per cent) and negative statements towards ICTs such as 'ICT applications need additional knowledge and skills of extension', 'ICT applications create confusion in documenting reports', 'ICT disturb routine official work', 'ICT application increases the work load', 'ICT affects the regular budgeting provision' were disagreed by majority of the extension personnel (more than 75 per cent). Therefore it can be concluded that majority of the extension personnel had favorable attitude towards ICTs. The findings of Sarala (2008) and Kabir and Roy (2015) are similar to these findings.

The finding indicates that the respondents were enthusiastic to adopt different ICT tools to disseminate required agricultural information to the farmers. The higher educational status of the extension workers must have helped them to create a positive attitude towards emerging technologies. Extension officers started realizing the power and positive impact of ICT tools in transfer of technology and socio-economic development of the society.

Table 4.3 Distribution of respondents according to their attitude towards ICT tools
(n=150)

Sl no	Statements	Agree		Disagree	
		No	%	No	%
1	ICT applications facilitate quick access to current data	149	99.33	1	0.66
2	ICT applications need additional knowledge and skills of extension	131	87.33	19	12.66
3	ICT applications improve the quality of services	145	96.66	5	3.33
4	ICT applications help to improve communication	138	92.00	12	8.00
5	ICT applications create confusion in documenting reports	32	21.33	118	78.66
6	ICTs affect the regular budgeting provision	26	17.33	124	82.66
7	ICTs make an integration within the office	131	87.33	19	12.66
8	ICT applications increase the work load	21	17.00	129	86.00
9	ICT applications increase job satisfaction of extension personnel	126	84.00	24	16.00
10	ICTs disturb routine official work	27	18.00	123	82.00

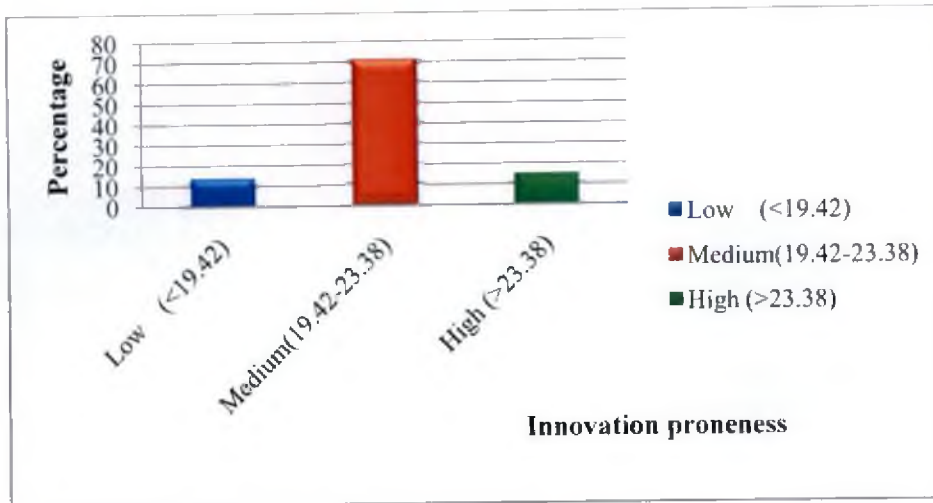


Fig.9 Distribution of respondents according to their innovation proneness

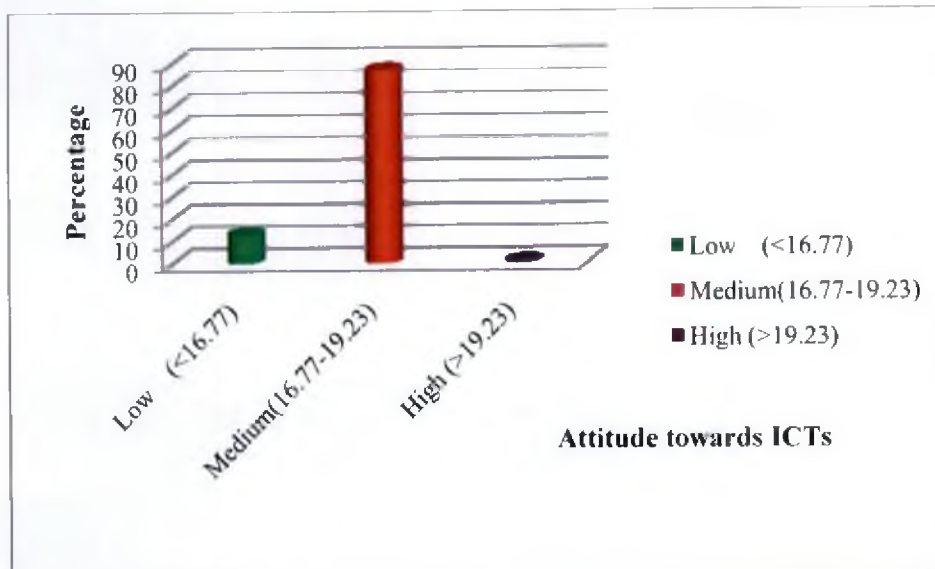


Fig.10 Distribution of respondents according to their attitude towards ICTs

4.1.9 Infrastructure and other resource facilities

From Table 4.1, it can be derived that more than three-fourth (76%) of the extension personnel from the selected districts of Kerala had medium level of infrastructure and other resource facilities and the remaining 24 per cent had high level of infrastructure and other resource facilities

Analysis of the data presented in Table 4.4 showed that the extension officers reported that 41.33 per cent of them had own buildings for their use of ICT tools with proper ventilation, air and light.

Regarding the availability of equipments for the proper use of ICTs, 35.33 per cent of the extension personnel had access to the equipments needed for the use of ICT applications. Only 19.33 per cent of the extension personnel reported that they had enough funds for the use of ICT tools.

It was highly disappointing to note that most of the extension personnel (92%) from all the districts complained that they had no trained sub staff for efficient utilization of ICTs. It was a serious problem felt by majority of the extension personnel.

Regular repair and maintenance of ICT tools was done by nearly one fourth of the extension personnel (26.66%) among all the selected districts. The findings are in conformity with the findings of Manty (2011).

Therefore it can be concluded that extension personnel in Kerala were working with limited infrastructural and other resource facilities. The revolution in ICT sector can be utilized to revamp agricultural production in Kerala. This is, however, depended on its utilization by the agricultural extension service for acquisition of information on improved technologies and dissemination of such technologies to their target farmer clientele. To achieve this objective, a lot still has to be done to enhance the infrastructure and other resource facilities. It is imperative that

public extension organizations require training and deployment of personnel and resources for a sustained agricultural development.

Table 4.4: Distribution of respondents according to their infrastructure and other resource facilities (n=150)

Sl No	Infrastructure facilities	Yes		No	
		Frequency	%	Frequency	%
1	Buildings	62	41.33	88	58.66
2	Equipments	53	35.33	97	64.66
3	Funds	29	19.33	121	80.66
4	Staff	12	8.00	138	92.00
5	Repair and maintenance	40	26.66	110	73.33

4.2. Accessibility of the extension personnel to ICT tools

It is perceived from Table 4.5 that the accessibility of extension personnel to various ICT tools like radio, television, land phone, mobile phone, computer, internet, e-mail, were very high with more than 85 per cent. These findings are in agreement with the findings of Yakubu *et al.* (2013).

The ICT tools with low accessibility were Decision Support System, video conferencing and agri kiosk with a percentage of less than 20 (Fig.11). This implies that there is still a huge gap in the operational knowledge of the extension agents towards certain ICT tools. Hence, adequate training on efficient operation of contemporary ICTs should be organized for the extension workers. It helps them to be aware of emerging ICT applications in their work situation.

Table 4.5: Distribution of respondents according to their accessibility to ICTs

(n=150)

SI No	ICT tools	Accessible		Not accessible	
		No	%	No	%
1	Radio	139	92.66	11	7.303
2	Television	129	86.00	21	14.00
3	Land phone	143	95.30	7	4.70
4	Mobile phone	150	100	-	-
5	Computer	148	98.66	2	1.33
6	Internet	143	95.30	7	4.70
7	e-mail	143	95.30	7	4.70
8	DSS	29	19.33	121	80.66
9	Agri Kiosk	24	16.00	126	84.00
10	Video conferencing	22	14.70	128	85.33

4.3.1 Extent of utilization of ICT tools by extension personnel

It is noted from Table 4.6 that proportion of respondents in the different user categories based on frequency of use was almost similar. More than one fourth of the extension personnel came under the categories like 'very less frequent users' (26%), 'less frequent users' (26%) and 'frequent users' (26%). The percentage of respondents under 'most frequent users' category were 22 per cent only. Even distribution of extension personnel among the four categories of users of ICT tools indicated that extension personnel were diverse in utilizing ICT tools. The user categories of extension personnel such as 'very less frequent users' and 'less frequent users' needed the attention. The State Department of Agriculture should identify these two

categories of users and either they must be deputed for the capacity building programmes organized by different agencies or organize training programmes to empower extension personnel in using ICT tools (Fig.12). These findings derive support from the findings of Manty (2011).

Mobile phones and computers were the frequently used ICT tools by the extension personnel. Familiarity, compatibility and less expensive nature of these ICT tools may be the reasons for their frequent use. Some ICT tools like DSS, kiosk, video conferencing were less utilized because of less accessibility, lack of personal skills, insufficient funds to purchase these tools, busy schedule with other official and personal engagements etc.

Table 4.6 Distribution of respondents according to their utilization pattern of ICT tools (n=150)

Sl No	User categories	Frequency	Percentage
1	Very less frequent users (>59.13)	39	26.00
2	Less frequent users (60-62.60)	39	26.00
3	Frequent users(63.47-67.72)	39	26.00
4	Most frequent users(68.69-94.78)	33	22.00

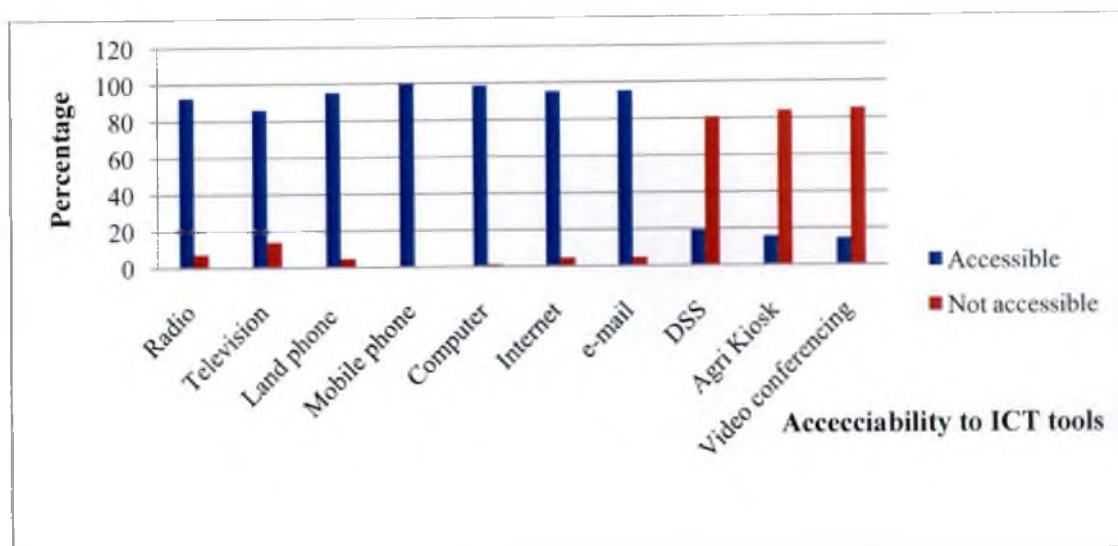


Fig.11 Distribution of respondents according to their accessibility of ICT tools

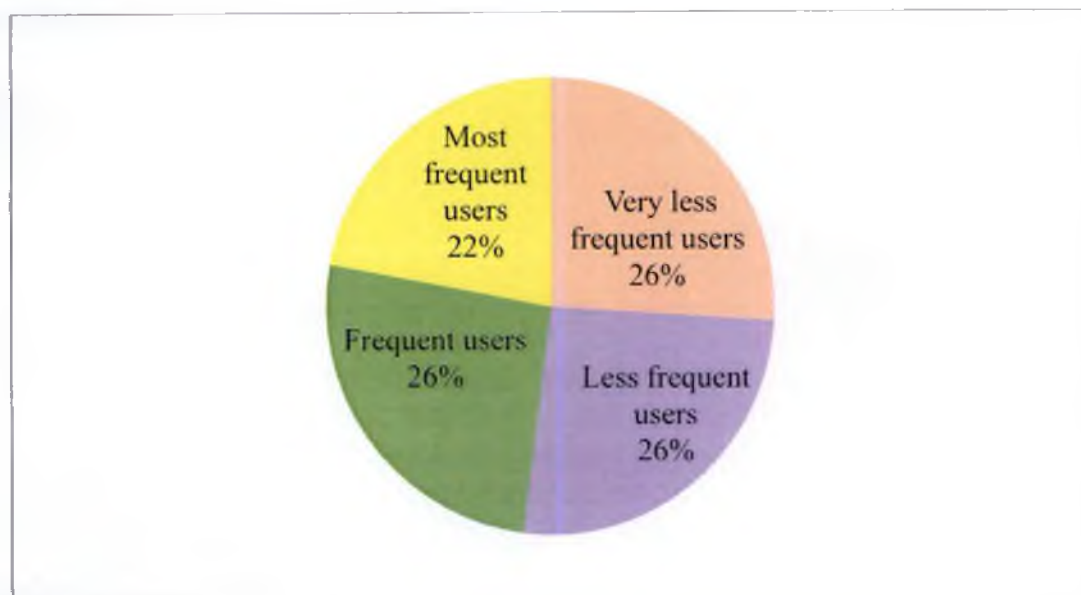


Fig.12 Distribution of respondents according to their utilization pattern of ICT tools

4.3.2 Comparative evaluation of utilization of ICT tools by extension personnel and selected independent variables

A comparative analysis of utilization of ICT tools by the extension personnel and the selected independent variables such as gender, educational status and trainings received on ICTs and the results are presented in Table 4.7 revealed that the trainings received on ICTs showed a significant difference among extension personnel. There was a significant difference in the extent of utilization of ICTs between those who received trainings on ICTs and who did not receive trainings. The extension personnel who received trainings utilized the ICTs more. It is justifiable that the extension personnel who received more trainings related to ICT tools may utilize those technologies more.

It is also shown that there is no significant difference between the two genders of the extension personnel regarding their utilization of ICT tools. Similarly there was no significance difference in utilization based on educational qualification among the extension personnel. This implies that ICT tools have penetration among the agricultural extension personnel of Kerala irrespective of their age and educational qualifications.

Table 4.7 Comparative evaluation of utilization of ICT tools by extension personnel and selected independent variables (n=150)

Sl No.	Independent variables	Mean utilization index	t value
1	Gender		
i	Male	63.93	0.233 ^{NS}
ii	Female	62.09	

2	Educational qualification		
i	B.Sc. Agriculture	63.55	0.107 ^{NS}
ii	M.Sc. Agriculture	60.94	
3	Trainings received on ICTs		
i	Yes	63.50	1.79 ⁺
ii	No	60.46	

NS-Non Significant

+ Significant at 10% level

4.3.3 Correlation between utilization of ICT tools and independent variables among extension personnel

The results of simple correlation analysis were taken into consideration for analyzing the influence of independent variables on the utilization of ICT tools of the extension personnel. The results are represented in table 4.8

The results in Table 4.8 revealed that out of the selected independent variables, only age was found negatively and significantly related with utilization of ICT tools among the extension personnel with a 'r' value of -0.207 at 0.01 level of significance. Table 4.8 also revealed that the coefficient of correlation between utilization of ICT tools and innovation proneness was positively and significantly related with a 'r' value of 0.166 at 0.05 level of significance. Age of extension personnel is an important attribute for the utilization of ICT tools. The probable reason might be that when age of the extension personnel increased utilization of ICT tools decreased and vice versa. Another reason was that the extension personnel who were more than fifty years old did not get an opportunity to use the latest ICT tools when they were undergoing graduation.

Innovation proneness of the extension personnel is an important attribute for the utilization of ICT tools. This might be because most of the extension personnel from state department of agriculture were keen to know about new ICT tools and

always had urge to do new things and attain new achievements which helped them to develop favorable attitude towards ICT tools.

Table 4.8 Correlation between utilization of ICT tools and independent variables

Sl no	Independent variables	Correlation Co-efficient
1	Age	-0.207**
2	Educational status	-0.130
3	Experience	-0.074
4	Innovation proneness	0.166*
5	Mass media utilization	0.107
6	Attitude towards ICTs	0.121

*Significant at 5% level

** Significant at 1% level

4.3.2 Purpose of utilization of ICT tools by extension personnel

From Table 4.9, it was understood that extension personnel used ICT tools for various purposes viz; for gaining knowledge, updating them on latest information, offering farm advisory services, conducting training programmes for farmers or teaching them, preparing or sending reports, organizational communication, knowing the availability of inputs or contacting the input agencies. More than fifty per cent of the extension personnel utilized ICT tools for gaining knowledge or updating themselves on latest information. Web based search engines (94.70%) followed by e-journals (92.70%) were the major tools used by the extension personnel for gaining knowledge in their area of work. Least utilized ICT tools for gaining knowledge by the extension personnel were e-mail (29.30%). Whereas for providing farm advisory

services majority of the extension personnel used mobile phones (64.00%) and land phone (53.30%).

For preparing and sending reports, majority of the extension personnel used e-mails (49.30%) and computers (40.00%). E-mail services (32.20%) and mobile phones (21.30%) were the ICT tools used by the extension personnel for the purpose of organizational communication. Very meager per cent of the extension personnel used ICT tools for other purpose such as training or teaching, knowing the availability of inputs or contacting the input agencies. From the analysis of Table 4.9, it can be concluded that majority of the extension personnel utilized various ICT tools for gaining knowledge or updating themselves on recent information (Fig.13). These findings are in concordance with the findings of Manty (2011).

Generally the extension workers used ICT tools to access latest knowledge and technology that made them competent in their profession. This helped the extension personnel to know more about new crops, plant protection technologies, cultivation practices etc. Internet was considered as the suitable medium for acquiring latest information for teaching farmers. In Kerala, farmers always search for new crops and practices for higher economic yield, which can be satisfied by the extension personnel through the utilization of ICTs.

Table 4.9 Distribution of respondents according to their purpose of utilization of ICT tools

(n=150)

Sl no.	ICT tools	Knowledge/ recent information		Advisory services		Training/ Teaching		Availability of Input/ Input agencies		Preparing /Sending reports		Organizational communication	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	Radio	121	80.70	22	14.70	3	2.00	4	2.70	-	-	-	-
2	Television	126	84.00	17	11.30	4	2.70	3	2.00	-	-	-	-
3	Land phone	34	22.70	80	53.30	-	-	-	-	19	12.70	26	17.00
4	Mobile phone	44	29.30	96	64.00	-	-	-	-	6	4.00	17	11.30
5	Computer	76	50.70	4	2.70	-	-	-	-	60	40.00	-	6.70
6	Internet	123	82.00	6	4.00	-	-	4	2.70	14	9.30	3	2.00
7	e-mail	23	15.30	3	2.00	1	0.70	-	-	74	49.30	49	32.70
8	Web based search engines	142	94.70	3	2.00	5	3.30	-	-	-	-	-	-
9	Web-based agriculture information portals	100	66.70	40	26.70	10	6.70	-	-	-	-	-	-
10	Decision Support System	127	84.70	30	12.00	4	3.30	-	-	-	-	-	-
11	Video conferencing	117	78.00	19	12.7	8	5.30	6	4.00	-	-	-	-
12	Agri Kiosk	122	81.30	10	6.70	18	12.00	-	-	-	-	-	-
13	e-newspaper	126	84.00	15	10.00	8	5.40	1	0.70	-	-	-	-
14	e-journals	139	92.70	11	7.30	-	-	-	-	-	-	-	-
15	e-agricultural magazines	132	88.00	16	10.70	-	-	2	1.30	-	-	-	-

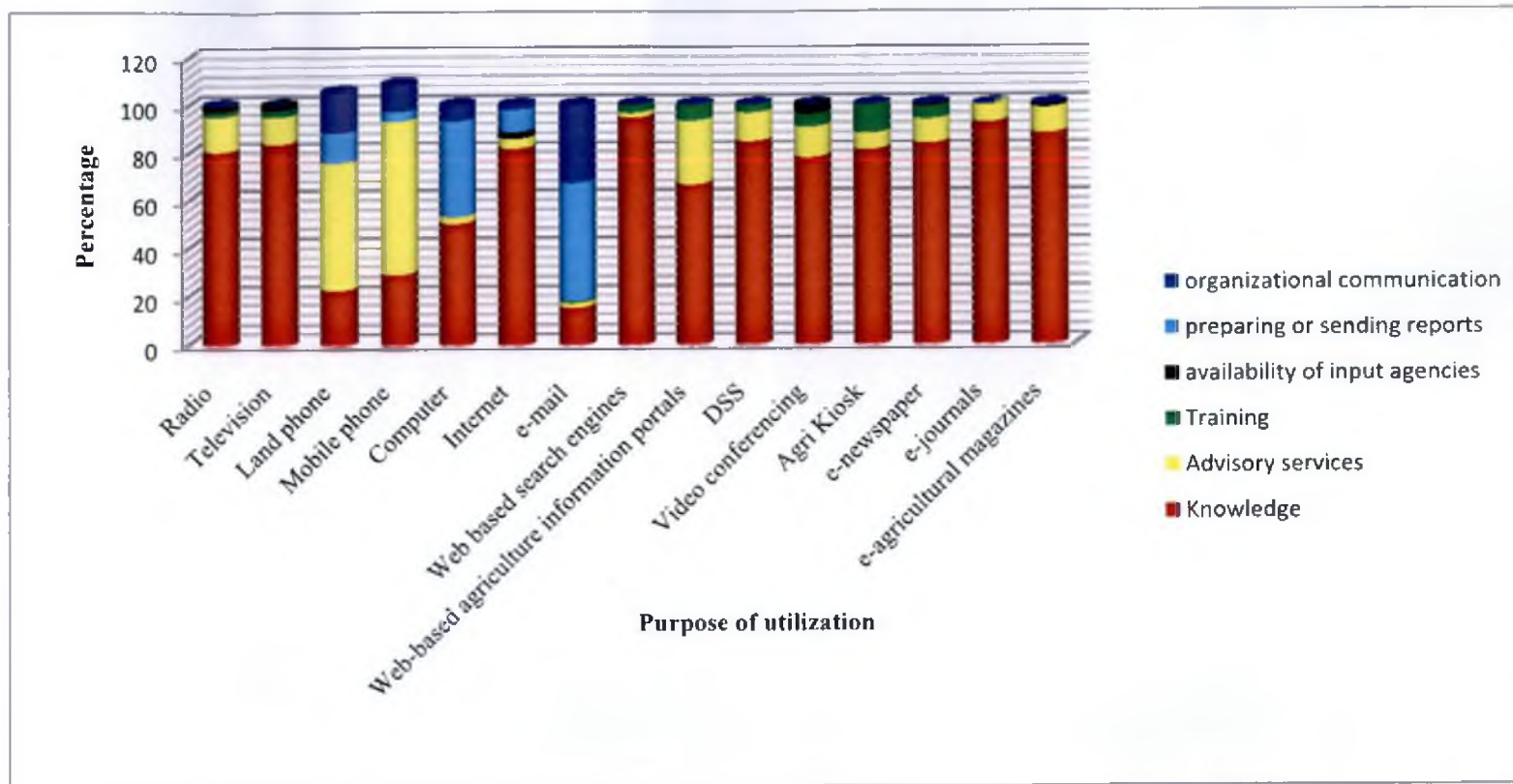


Fig.13 Distribution of respondents according to their purpose of utilization of ICT tools

4.3.3. Duration of utilization of ICT tools by extension personnel

It is revealed from Table 4.10 that more than 70 per cent of the respondents spent 1-5 hrs per week in using various ICT tools. Only less than 40 per cent of the respondents used to spend 5-10 hours per week for accessing ICT applications. A very less per cent of the extension officers used to spend 10-15 hours and above 15 hours per week for ICT related activities. Computer (20.00%), Internet (19.30%) and mobile phones (18.00%) were the major ICT tools used by extension personnel for the duration of more than 15 hours per week (Fig.14). Therefore it can be concluded that computer, internet and mobile phones were the intensively used ICT tools by extension personnel of Kerala for the transfer of technologies.

Table 4.10 Distribution of respondents according to their duration of utilization of ICT tools (n=150)

SI No	ICT Tools	1-5 hrs/week	5-10 hrs/week	10-15 hrs/week	Above 15hrs /week
1	Radio	85.30	8.00	3.30	3.30
2	Television	60.00	24.70	6.70	6.70
3	Land phone	64.70	12.70	9.30	13.30
4	Mobile phone	48.70	20.70	12.70	18.00
5	Computer	41.30	14.00	24.70	20.00
6	Internet	46.70	12.70	21.30	19.30
7	e-mail	54.70	14.00	19.30	12.00
8	Web based search engines	69.30	14.00	10.00	6.70
9	Web-based agriculture information portals	72.00	17.30	8.00	2.70
10	Decision Support System	88.60	3.40	2.70	5.40
11	Video conferencing	92.00	0.70	2.70	4.70
12	Agri kiosk	91.30	1.30	2.70	4.70
13	e-newspaper	86.70	3.30	6.70	3.30
14	e-journals	93.30	2.00	1.30	3.30
15	e-agricultural magazines	89.30	2.00	5.30	3.30

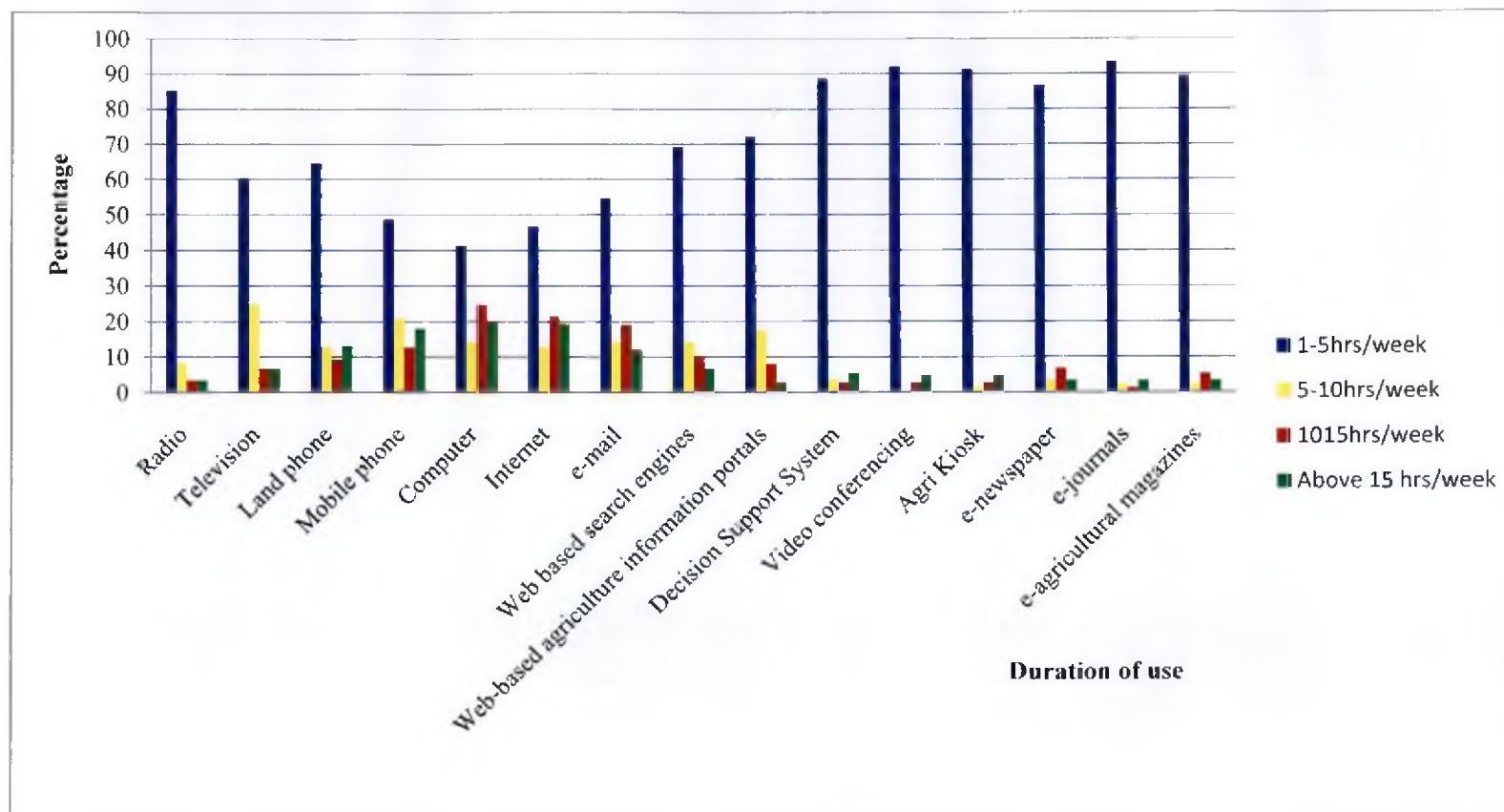


Fig.14 Distribution of respondents according to their duration of utilization of ICT tools

4.4. Training needs of extension personnel in using ICTs

4.4.1 Knowledge level

From Table 4.11 it is noted that the highest Training Need Index for gaining knowledge was obtained for 'availability of agricultural information in different sources' (84.16), 'agricultural related websites' (80) and 'basics of computer hardware and software' (75.16). (Fig.15). Extension personnel might have realized the importance of gaining knowledge on latest technologies. As they lacked knowledge on various available websites, related to farming sector, they might have recorded highest training need index for the 'availability of agricultural information from different sources' and 'agricultural related websites'. The capacity building programme for extension personnel in ICTs must include syllabus on the 'availability of agricultural information from different sources', agricultural related websites, 'application of agricultural expert system', 'techniques on understanding different market information' and 'basics of computer hardware and software'.

4.4.2 Skill level

It is also identified from Table 4.11 that the highest Training Need Index was given to the 'preparation of excel sheets and calculations' (76) followed by 'usage of agri portals' (74.66) and 'fertilizer recommendation systems' (74.16). Least Training Need Index was recorded for the subject areas of skills on 'Blogging (e.g., Twitter, weblogs)' (54.16). Extension personnel might have felt the direct application of blogging accomplished their day to day official duty (Fig.15).

The reason for the highest training need index towards the preparation of excel sheets and calculations might be that majority of the extension personnel were middle and old aged. These categories of extension personnel might not received the exposure on the applications of spreadsheet software during their graduation or

during in in-service trainings. But in practical situation, they might have felt the need for the applications of excel documents during the implementation of various schemes maintaining the files related to financial dealings, supply of inputs to farmers, maintenance of stock and stores etc.

This probable reason behind the second largest training need index towards the use of agri portals might be from the fact that extension professionals who were in direct contact with the farming community had to be equipped and updated themselves on the latest technologies which were readily available in the agri portals maintained by KAU and TNAU.

Table 4.11: Distribution of respondents according to their Training Needs in using ICT tools

(n=150)

Sl. No	Area/topic	TNI
Knowledge level		
1	Availability of agricultural information from different sources	84.16
2	Agricultural related websites	80.00
3	Use of agricultural expert system	75.83
4	Basics of computer hardware and software	75.16
5	Understanding different market information techniques	73.16
6	General idea about the computer	62.33
7	Different Operating systems (Windows, Linux)	62.33
8	Installation and customization of software	60.66

Skill level		
1	Preparation of excel sheets and calculations	76.00
2	Usage of agri portals (eg, KAU agri InfoTech portal, TNAU portal...)	74.66
3	Fertilizer recommendation systems	74.16
4	Sending and checking e-mails	70.66
5	Audio/video sharing/webcasting (e.g., Flickr, Skype, YouTube)	70.33
6	Online market information providers	68.66
7	Email/instant messaging/Chat	68.33
8	Discussion groups (e.g. Google/Yahoo! Groups)	68.33
9	Decision support system usage and applications	68.33
10	Use of videos already captured by other agencies/ by self	67.33
11	Social networking (e.g., Face book, Google+)	67.00
12	To access e-journals	67.66
13	Preparation of good power point presentations	66.50
14	Online publishing of extension work	65.33
15	Group messaging through mobiles	64.83
16	Script writing for television, video	62.00
17	Downloading and copying video clippings from internet	62.00
18	Making word documents of reports	61.00
19	Typing Malayalam reports	60.66
20	Script writing for radio	60.33
21	Making pdf documents of reports	58.83
22	Blogging (e.g., Twitter, weblogs)	54.16

TNI-Training Need Index

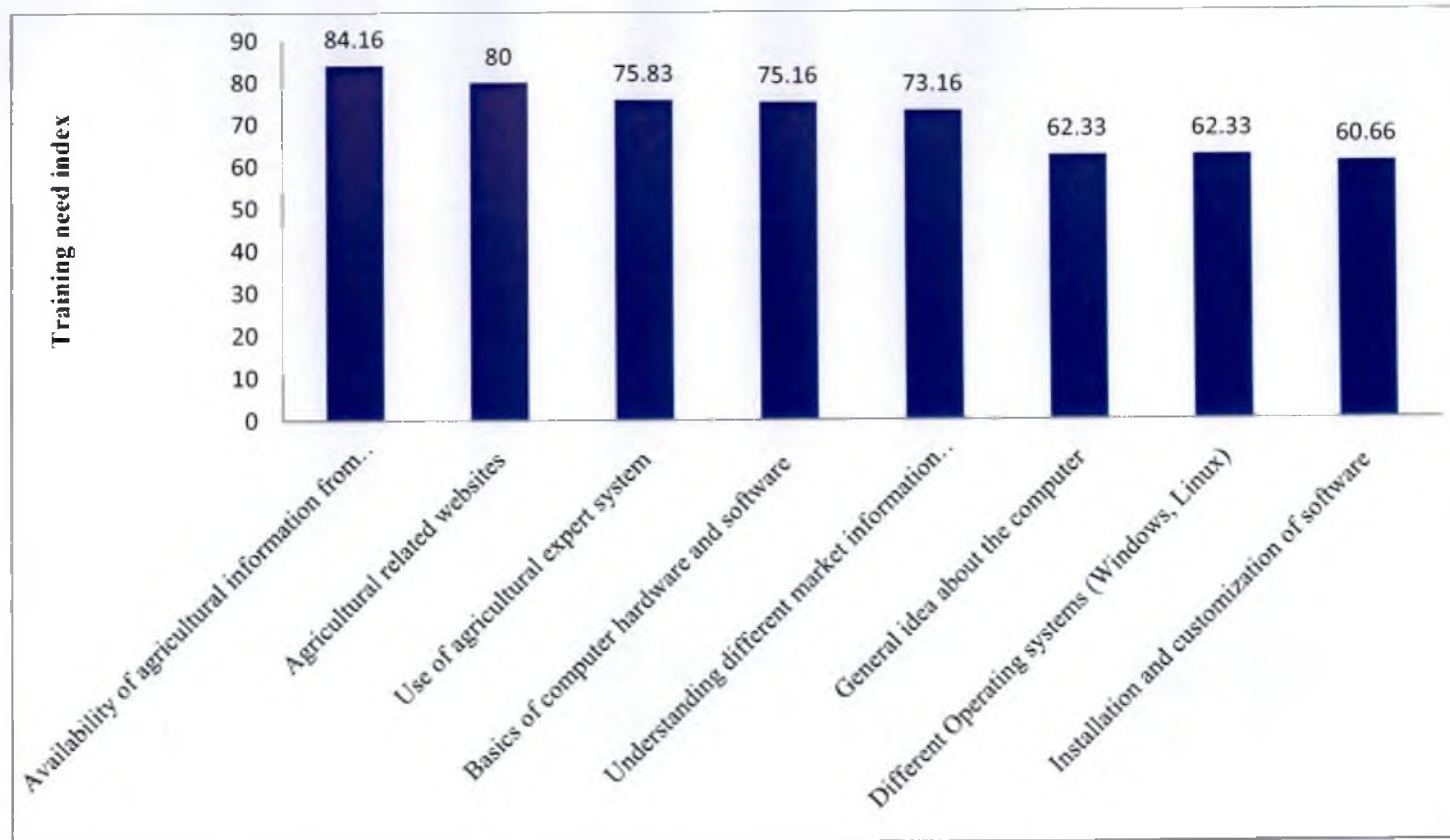


Fig. 15 Distribution of respondents according to their Training needs at knowledge level in using ICT tools

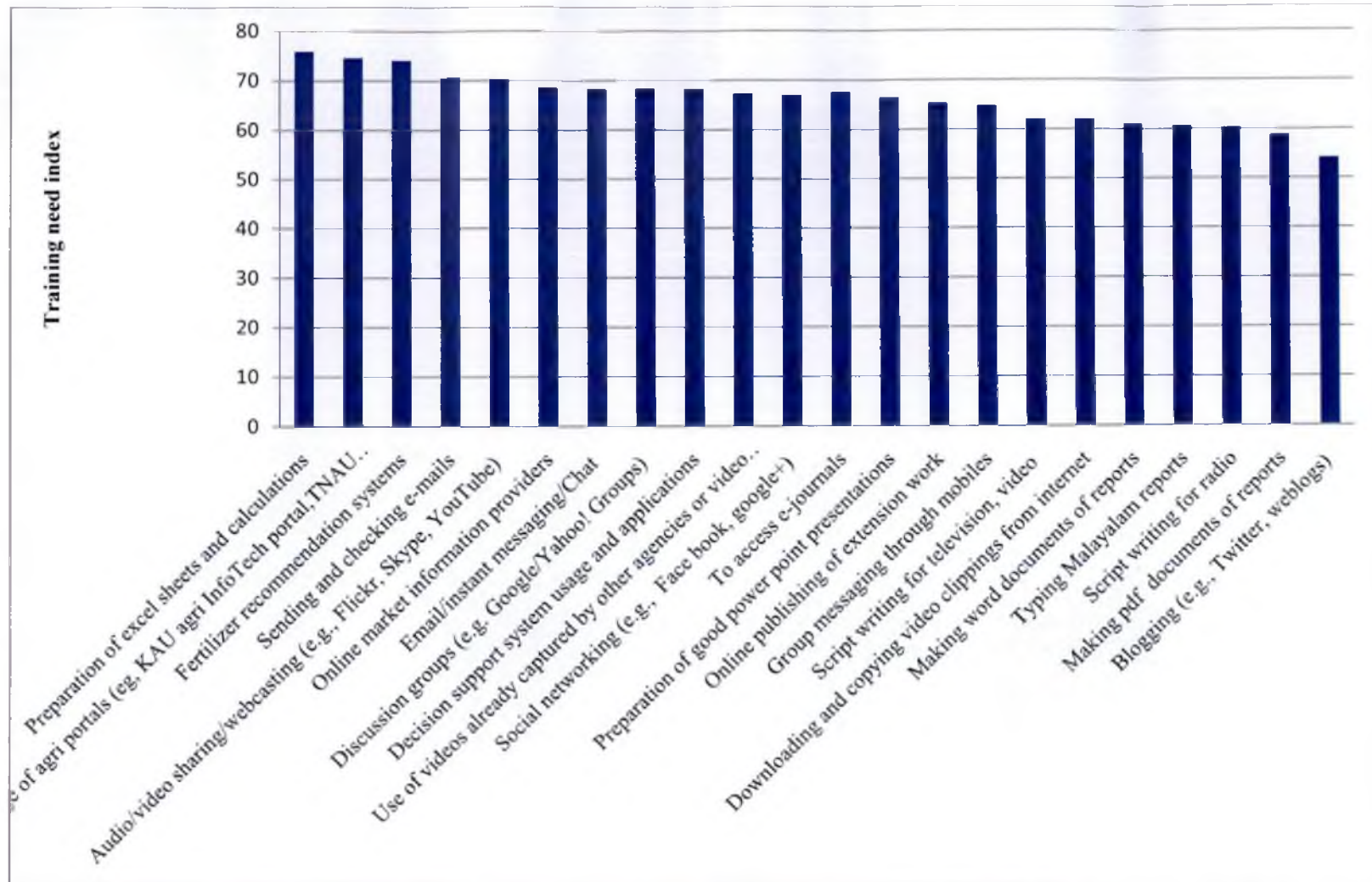


Fig. 16 Distribution of respondents according to their Training needs at skill level in using ICT tools

4.4.3 Comparative evaluation of training needs of extension personnel on ICT tools and selected independent variables

The results of comparative analysis of the training needs of extension personnel on ICT tools and the selected independent variables are shown in Table 4.12. It showed that there was no significant difference among the extension personnel in terms of independent variables such as gender, educational status and even trainings received on ICTs. The training needs of extension personnel on ICTs remained same irrespective of their gender and educational qualification as they received similar kind of exposure during their education as well as their work situation.

It is interesting to note that there was no significant difference between the extension personnel who had already received trainings on ICTs and those who did not receive any training on ICTs. The probable reason might be that the extension personnel who had already received trainings on ICTs demanded further advanced trainings on ICTs. Therefore it is essential to categorise the extension personnel into two groups viz; those who need trainings on basics of ICTs and those who require trainings on advanced ICTs. Separate modules may be prepared for these two groups of extension personnel and training programmes may be organized separately for each group of extension personnel.

Table 4.12 Comparative evaluation of training needs of extension personnel in using ICT tools and selected independent variables

Sl no	Independent variables	Mean Training Need Index	t value
i	Gender		
a	Male	59.84	0.284 ^{NS}
b	Female	60.42	

ii	Educational status		
a	B.Sc . Agriculture	59.94	0.016 ^{NS}
b	M.Sc. Agriculture	59.95	
iii	Trainings received on ICTs		
a	Yes	60.00	-0.42 ^{NS}
b	No	59.73	

NS= Non Significant

4.4.4 Correlation between the training needs of extension personnel on ICT tools and independent variables

The results of simple correlation analysis were taken into consideration for analyzing the influence of independent variables on the training needs of the extension personnel. The results are represented in table 4.13

The results in Table 4.13 revealed that out of the selected independent variables, age and experience were positively and significantly related with training needs on ICT tools among the extension personnel with 'r' values of 0.197 at 0.05 level of significance and 0.152 at 0.10 level of significance respectively.

Age and experience were the important attributes influencing the utilization of ICT tools. It is true that the field of ICTs experiences fast and frequent changes which urge users to readily accept and accommodate themselves to keep pace with the rapid changes. But the aged and experienced extension personnel who neither received exposure on ICTs during their graduation nor received in-service trainings on the latest ICTs. Therefore the extension personnel who were aged and experienced demanded more training on ICTs with hands on experience.

Table 4.13 Correlation between training needs of extension personnel and independent variables

Sl no	Independent variables	Correlation Coefficient
1	Age	0.197*
2	Educational status	0.005
3	Experience	0.152+
4	Innovation proneness	-0.012
5	Mass media utilization	0.018
6	Attitude towards ICTs	-0.060

*Significant at 5% level

+ Significant at 10% level

4.5. Constraints faced by extension personnel in using ICT tools

From Table 4.13 it is evident that lack of proper training facility was recorded as the major constraint with a mean score value of 9.48. This reveals that the need for strengthening training facilities to provide extension personnel with trainings more of hands on experience in using various ICT tools.

The second most challenge identified by the end users were inadequate computer facility (8.82). The major constraints experienced by the extension personnel were poor technical know how and conducting trainings at inappropriate times with a mean score of 8.32 each and lack of financial resources for maintaining the ICT tools with the mean score of 8.03(Fig.17).These findings are in agreement with the findings of Punam(2000), Agwu *et al.*(2008), Ravikishore(2014) and Kabir and Roy(2015).

Extension personnel play an important role in the dissemination of agricultural technologies among the farming community. There is no doubt that tapping the potential of ICTs in agriculture sector will open up new vistas in enhancing agricultural production as well as the income of the farming community. Kerala state is far ahead of introducing the ICTs in all the sectors including agriculture sector. Still a lot more to be done to harness the full potential of ICTs in agriculture sector. Identification of constraints faced by extension personnel in using ICTs will be useful to strengthen the extension system and empower the extension personnel to utilize the maximum potential of ICTs for the development of agriculture sector.

Table 4.14. Distribution of respondents according to the constraints faced by extension personnel in using ICT tools

(n=150)

Sl no	Constraints	Mean rank
a. Infrastructural constraints		
1	Inadequate computer facility	8.82
2	Poor communication infrastructure, network necessary for the usage	8.03
3	Insufficient power supply	7.92
4	Lack of financial resources	8.03
5	Lack of time	5.86
b. Training constraints		
6	Lack of proper training facilities	9.48
7	Poor technical know-how	8.32
8	Conducting training at inappropriate times	8.32
9	Fear of ICT Usage (Technophobia)	4.53
c. Health constraints		
10	Back ache/body pain	7.23
11	Adverse effect on eye sight	5.45
12	Hand /finger pain	5.28
13	Head ache	5.00

4.5.1 Agreement among the extension personnel in ranking the constraints for using ICT tools

The Kendall's coefficient of concordance was found to verify whether there was agreement among the extension professionals in providing their rankings the constraints faced by them for using ICTs. From the table 4.15, it was clear that there was concordance in the ranking of constraints faced by them for using ICT applications by extension personnel at 1 per cent level of significance.

Table 4.15 Consistency among extension personnel in ranking the constraints for using ICT tools

Category	Kendall's co-efficient of concordance	χ^2 value
Extension personnel (n=150)	0.245 **	191.39

**Significant at 1% level

4.6 Strategies for capacity building of extension personnel for using ICTs

The most important utility between the whole of ICT networks and their application is to ultimately benefit the end users who are beneficiaries of these initiatives. In case of ICT initiatives aimed at agricultural and rural development the main stakeholders are farmers. The extension personnel act as the link between farming community and the research system. The overview of the results of investigation indicated that majority of the extension personnel were moderately aware of the recent updates in the field of ICTs. Developing information services by understanding their clientele and their information needs will enhance the efficiency of the information system.

For the effective delivery of ICT based extension services, the following strategies are formulated based on the findings of the study, suggestions offered by extension personnel as well as the observations on the existing conditions of ICT initiatives. It is hoped that the implementation on the following strategies systematically will help the effective delivery of ICT based extension services contributing to the overall development of agriculture.

4.6.1 Target group specific modules

Based on the findings of the study, it is suggested to categorise the extension personnel into two groups viz; those extension personnel who need the basics of ICTs and those extension personnel who require the knowledge on advanced ICTs. Training programmes may be organized separately for those groups with target group specific modules on ICTs.

4.6.1.1 Module for training of extension personnel on the basics of ICT tools

a.Presentation of information using word processing and report preparation

- Creating word files, copy, cut, paste and move text
- Formatting text like bold, italic, underline, justify, change font
- Incorporate tables, images, clip art
- How to make use of document formatting features like headers, footers, bullet points
- How to use mail-merge facilities into a document

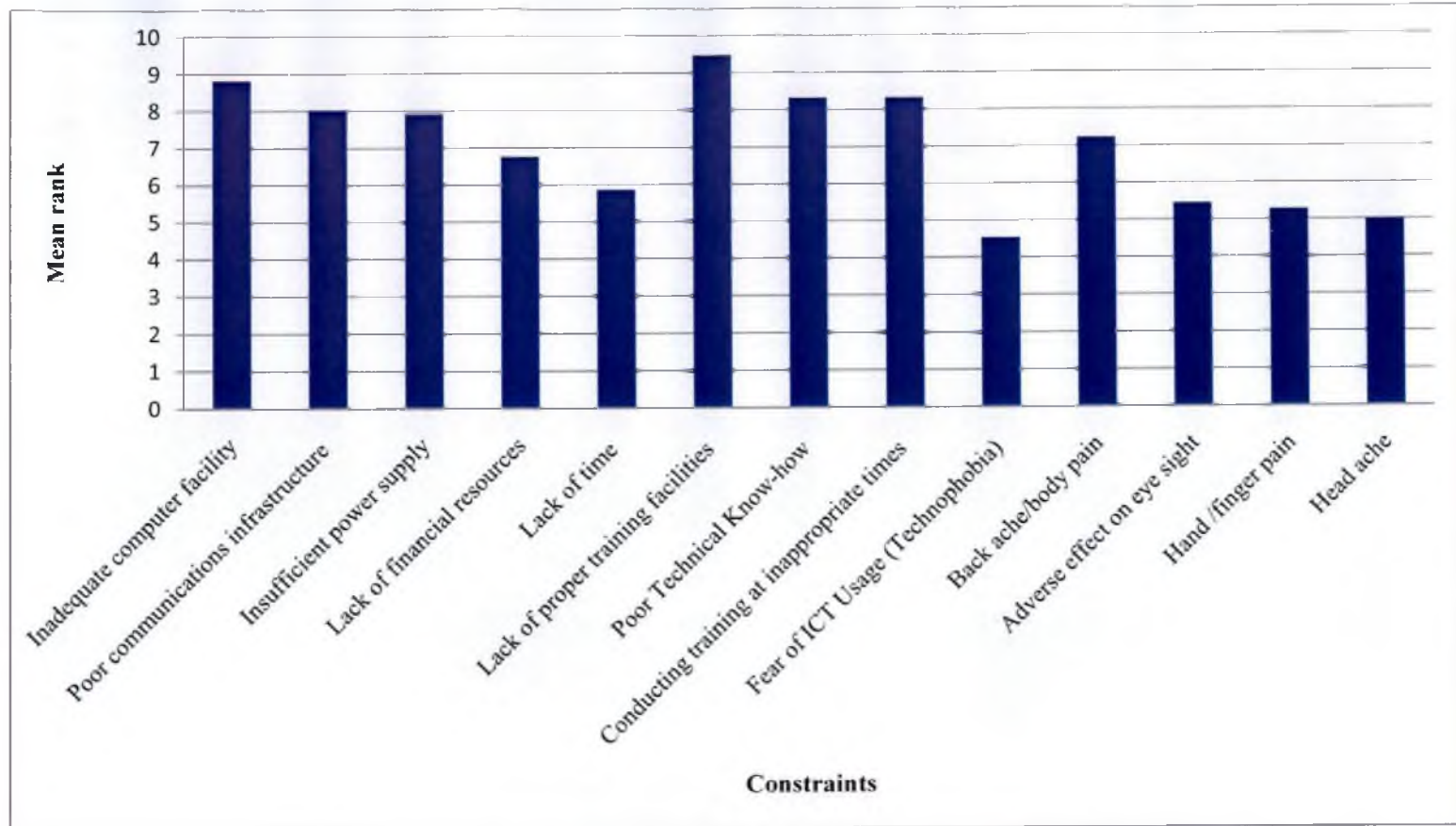


Fig.17 Distribution of respondents according to the constraints faced by them in using ICT tools

b. Organisation and analysis of numerical information using excel sheet

- Formatting cells to match data types
- How to cut, copy, paste and move data between cells, rows and columns
- How to insert and delete rows and columns
- How to enter and replicate formulas
- How to use simple functions like sum, average, standard deviation etc,
- How to produce charts with labels such as axis titles, legends
- How to print selected areas and various options of print

c. Organisation and presentation of information using multimedia software

- Establishing structure and navigation route through the presentation
- Creating components of the presentation with text files, images and sound files
- Producing the individual frames/layers/backgrounds/slides
- Editing the separate components and the final presentation

d. Searching and selection of information using the internet

- Using e-mail for communication between individuals and groups
- Applying the main search principles of internet search engines
- Applying the main features of browser software, such as forward and back buttons, book marking etc

- Capturing and enhancing graphic images, monitoring and recording physical and financial data for analysis and interpretation

e. File management and maintenance of ICT tools

- Keeping information secure from viruses, loss and theft
- Protecting confidentiality and preventing unauthorised access to documents or records
- Respecting copyright and not using the work of others without permission
- Documenting and saving work regularly and use different filenames
- Respecting copyright and not using the work of others without permission
- Documenting and saving work regularly and use different filenames
- Up keeping dated backup copies of files in another location
- Managing effectively appropriate filenames and locations
- Safe handling of accessories

f. Information management through the applications of ICT tools for Technology Transfer

- Techniques of knowledge gathering from related sources
- Storing and retrieving information as and when required
- Utilizing Community Radio, Web-, Tele-, and Video-conferencing, Information kiosks, Multimedia, Mobile technologies, on-line courses, Community radio forums and Knowledge centres for the transfer of technologies

4.6.1.2. Module for training of extension personnel on the advances of ICT tools in agriculture

Applications of ICTs in agricultural development such as

- **Geographical Information System (GIS):** Geographical Information System (GIS) is the most important and useful system for decision making in agricultural sector. GIS will help to ascertain the ground level realities with the help of spatial data obtained from various resources. It would be more appropriate to use GIS applications in agro-based enterprise to ascertain the scope of activities and monitoring of activities.
- **Remote Sensing (RS):** The remote sensing provides various platforms for agricultural survey. Satellite imagery has unique ability to provide the actual synoptic views of large area at a time, which is not possible for conventional survey methods and also the process of data acquisition and analysis are very fast as compared to the conventional methods. The importance of remote sensing applications to agricultural sector involve land use pattern, crop production, crop yield determination, and crop monitoring.
- **e-Governance:** E-governance refers to the use of Information and Communication Technologies (ICTs), particularly web based applications to provide access to and deliver information/ service to the public, business, other agencies and governmental entities faster, cheaper, easier and more efficient way.
- **Cyber Extension:** The on-line information access on research, market demand, input-supply and the latest international know-how on crop-specific issues will help the extension officials to a very great extent. The availability of frequently asked questions (crop-specific, area specific) will help the

officials at district and block level to provide latest information to the farmers with more accuracy and efficiency. The researchers will also get quick feedback on their recommendations and they can plan action research projects on more interactive basis.

4.6.2 Hands on experience

Lack of training facility was the major constraint reported by most of the extension personnel. Even though several training programmes on ICTs were organized by SAMETI, RATTC and MANAGE for the extension personnel, the respondents were of the opinion that those trainings were more of theoretical orientation than practical orientation. Therefore it is suggested to introduce more number of trainings with practical orientation. Each trainee should get hands on experience to get more confidence in using ICT tools.

4.6.3 Establishment and maintenance of infrastructure facilities

For providing hands on experience to the trainees, the training centres should be strengthened with necessary infrastructure and improved connectivity facilities. Infrastructure should be established in such a way that each and every individual extension personnel should get an opportunity to receive the hands on experience. In the same way, recurring funds and the availability of technical personnel should be ensured to maintain and tap the maximum potential of ICT tools.

4.6.4 Computer Based Trainings

As and when changes occur in the applications of ICTs, there should be a mechanism to update the extension personnel continuously. Once the extension personnel are oriented with the basics of ICTs, computer based trainings or e-trainings may be conducted to refresh and update them on the latest technologies. Computer Based Training (CBT) is an interactive method of learning that provides a series of self-paced, hands-on web-based courses.

Summary

V. SUMMARY

Agricultural Extension, in the current scenario of a rapidly changing world, has been recognized as an essential mechanism for delivering information and advice as an input for modern farming and the role of ICT in actualizing so has drawn the interest of practitioners. Information and Communication Technologies (ICTs) in agriculture is an emerging field focusing on the enhancement of agricultural and rural development in many countries.

ICT tools include computer, internet, phone, television, radio, and other offline and online communication devices. ICTs are rapidly consolidating global communication networks and international trade with applications for people in developing countries. ICTs in agriculture promote and distribute new and existing farming information and knowledge which is communicated within the agricultural sector since information is essential for facilitating agricultural and rural development as well as bringing about social and economic changes. There is growing recognition that farmers and members of rural communities have need for information and appropriate learning methods that are not being met. The agriculture sector could leverage the Information and Communication Technologies (ICTs) to disseminate the right information at the right time and right place. The cost factor in traditional information dissemination and the difficulties in reaching the target audiences have necessitated the introduction of ICTs in agriculture.

Various studies on ICTs also reflect that ICTs offer opportunities to reach more people and to carry out various functions within extension systems more effectively and efficiently. It can provide easy access to local or global information and knowledge and are simple channels for two-way communication. The development in telecommunications has enormous impact on the applications of ICTs

and their uses. Telecommunication infrastructures in particular have become the driving forces of ICTs; they have the capability to link various ICT elements together irrespective of locations and to provide a converging platform for these elements.

Extension professionals who become the direct link between farmers and other actors in the extension of agricultural knowledge and information systems are well positioned to make use of ICT to access expert knowledge or other types of information that could facilitate the accomplishment of the farmers' routine activities. It could be understood that in modern times ICTs are the strong linkage between research and extension system and it becomes imperative to study the factors which are determining the attitude of agricultural extension personnel towards the use of ICTs in extension system. With this in view, the present study was framed with the following objectives.

1. To analyze the utilization pattern of Information and Communication Technologies (ICTs) among the agricultural extension personnel of Kerala.
2. To assess the training needs of agricultural extension personnel in using ICT tools.
3. To identify the constraints faced by the extension personnel in using ICTs.
4. To work out strategies for capacity building of agricultural extension personnel in using ICTs for agricultural development in Kerala.

Studies related to access and use of ICT tools by extension personnel in Kerala is very few. Hence the present study was undertaken to study access and use of ICT tools by extension personnel in transfer of technology in Kerala. In this context, extension personnel from five districts of Kerala were selected for detailed study. A total of 150 respondents were selected for the study.

Personal and psychological variables such as age, gender, experience, educational status, trainings received on ICTs, attitude towards ICTs, innovation proneness and mass media utilization were measured based on the procedure followed by the authors of different studies with necessary modifications. The data were collected using a well structured questionnaire (Appendix). A draft questionnaire prepared for the study was pre-tested by conducting a pilot study in a non sample area and suitable modifications were made in the final questionnaire which was then directly mailed to the respondents. Percentage analysis, index, mean and standard deviation, 't' test and Kendall's co-efficient of concordance were employed in the analysis of the data and interpreting the results.

The salient findings of the study are furnished below:

5.1.1 Majority of the extension officials belonged to the age group of 35-45 years (48.66%) followed by the group of above 45 years (34.66%).

5.1.2 Majority of the extension personnel in the State Department of Agriculture in Kerala were females (66%).

5.1.3 Majority of the agricultural officers were BSc agriculture graduates followed by post graduates.

5.1.4 Majority of the respondents had medium level experience (62%) followed by low level of experience (22%) and high level of experience (16%).

5.1.5 Majority of the respondents had medium level mass media utilization (61.33%) followed by high level (22%) and low level of mass media use (16.66%).

5.1.6 Majority of the respondents had medium level innovation proneness (61.33%) followed by high level (14.66%) and low level (14.00%) of innovation proneness.

5.1.7 Majority of the respondents had medium level attitude towards ICTs (86.66%) followed by low level of attitude (12.66%) and high level of (0.66%).

5.1.8 About 76 per cent of the extension personnel had infrastructure and other resource facilities. Whereas, 24 per cent of the extension personnel enjoyed high level of infrastructure and other resources.

5.1.9 About 75 per cent of the extension personnel did not attend any training programmes related to ICT tools. The remaining 25 per cent only received training on ICTs.

5.1.10 The extent of accessibility of radio, television, land phone, mobile phone, computer, internet, e-mail, web based search engine, web-based agriculture information portals, were very high with more than 85 per cent.

5.1.11 The least accessible ICT tools were DSS, video conferencing and agri Kiosk.

5.1.12 More than one fourth of the extension personnel came under the categories like very less frequent users, less frequent users and frequent users with 26 per cent each. The percentage of respondents under most frequent users were 22 only.

5.1.13 More than 50 per cent of the extension officers mainly used the ICT tools for obtaining recent information and updates in their profession. Only less than 20 per cent of the extension professionals used the ICT tools for offering advisory services. Less than 10 per cent of the extension officials utilized the various ICT tools for the purpose of teaching or training the farming community.

5.1.14 More than 70 per cent of the respondents spent 1-5 hrs/week in using various ICT tools. Only less than 25 per cent of the respondents used to spend 5-10 hours for accessing ICT applications. A very less per cent of the extension officers used to spent 10-15 hours and above 15 hours per week for ICT related activities.

5.1.15 The highest Training Need Index at the knowledge level of using ICTs by extension personnel was obtained for 'availability of agricultural information from different sources' (84.16), 'agricultural related websites' (80.00) and 'basics of computer hardware and software' (75.16).

5.1.16 The highest Training Need Index at the skill level of using ICTs by extension personnel was given to the preparation of excels sheets and calculations (76.00) followed by usage of agri portals (74.66) and fertilizer recommendation systems (74.16).

5.1.17 Lack of proper training facility was identified as the major constraint with a mean rank value of 9.48 followed by inadequate computer facility (8.82).

5.1.18 Target specific training modules, hands on experience, well established infrastructure, adequate funds and personnel for repair and maintenance, computer based trainings and advanced circulation of annual training calendars among extension personnel by the training organizations are the suggested strategies for the capacity building of extension personnel of Kerala in using ICTs.

In conclusion, if modern ICT facilities are not adequately built into the mainstream of agricultural extension system, there is likely to be stagnation in the dissemination, utilization and application of scientific agricultural information for purposeful development of the system. Information Communication Technologies access implies not only the physical availability of communication equipment and methods but also the existence of the right conditions for their use in getting

information. These conditions include the ease of use of the technologies, regular electric power supply, adequate funds and ensuring technical personnel for repair and maintenance, availability of spare parts. In this regard, government should take necessary steps to build the basic infrastructural facilities in the rural areas. The study also indicated low level of operational literacy and this has provided a huge gap in the operational knowledge of the extension agents; hence, adequate training on efficient operation of contemporary ICTs should be organised for the extension personnel of the State Department of Agriculture.

5.2 Implications of the study

5.2.1 Results of the study accentuate the need for conducting still more comprehensive explorations among the different categories of users separately regarding the performance of each ICT tools.

5.2.2 Meticulously well structured training should be conducted afford for augmenting the usage of different ICT tools among extension personnel.

5.2.3 The study also pointed out that the application of ICTs has got tremendous scope among the extension officials to update their knowledge, clarify their doubts and provide real time information to the technology users. It could be used as a distance learning tool.

5.2.4 The higher authorities should support the implementation of ICT applications in the Department of Agriculture for effective transfer of technologies.

5.2.5 Majority of extension personnel expressed low infrastructure and other resource facilities. Hence, Kerala State Department of Agriculture needs to provide adequate infrastructure and other required facilities for the effective use of ICT tools.

5.2.6 Proper care and management of utilization of ICT tools is necessary in order to avoid problems.

5.3 Suggestions for future research

5.3.1 As this study was confined to 5 districts of Kerala and similar study may be initiated in other parts of the state.

5.3.2 Comparative studies may be undertaken on the access and use of ICT tools by the extension personnel within the State Department of Agriculture and between the line departments.

5.3.3 The present study considered only few variables for analysing the utilization of ICT tools. Number of other variables, which are likely to affect the ICT usage in agriculture, can also be studied.

5.3.4 Studies on utilization of mobile phone based applications and mobile apps can be studied. Thereby the possibilities of tapping maximum benefits out of mobile applications can also be probed.

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Appendix

Appendix 1

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF HORTICULTURE, VELLANIKKARA
DEPARTMENT OF AGRICULTURAL EXTENSION

Strategies for capacity building of extension personnel for using Information
and Communication Technologies

Questionnaire

Date:

I. General Information

1. Name of the respondent: _____

2. Phone no. : _____

3. Place of work : Panchayath _____

Block _____

District: _____

4. Age: _____ in years

5. Gender: Male Female

6. Professional qualifications: BSc (Ag) MSc (Ag) PhD

If any other additional qualification, please mention _____

7. Designation: _____

8. Experience: _____ in years

9. Training: Any training received on ICT? Yes No

a. If yes, please provide the following information for the last 3 years:

Sl. no.	Name of the training programme	Organization	Duration

b. Have you made use of the received ICT trainings in your job? Yes/No If yes, please mention how they were utilized in your work situation? If no please mention why they were not utilized?

10. Mass Media Utilization

How often you use the following media? Please indicate your response by making a tick (✓) mark to the following statements.

Sl no	Media	Type of Programmes/Information	Purpose
1	Radio	Agricultural programmes	
		Rural development programmes	
		News	
		Entertainment programmes	
2	Television	Agricultural programmes	
		Rural development programmes	
		News	
		Entertainment programmes	
3	Farm magazine	Agricultural programmes	
		Rural development programmes	
		News	
		Entertainment programmes	
4	News paper	Agricultural programmes	
		Rural development programmes	
		News	
		Entertainment programmes	

11. Innovation Proneness

Please indicate your response by making a tick (✓) mark to the following statements

Sl no	Statements	SA	A	DA	SDA
1	I try to keep myself up to date with the information on latest technology(ICT tools) but it does not mean that I try out all the new ICT tools				
2	I feel restless till I try out a new ICT tools that I have heard				
3	I feel the oldest ICT tools(newspaper, TV, radio) is the best among all				
4	From time to time I heard of several new ICT tools and tried almost most of them in the last few years.				
5	New ICT tools are coming nowadays, but who knows whether they are better than the old ones?				
6	I am cautious about trying ICT tools which are new to me				
7	I am very much interested in trying new ICT tools				
8	Often new ICT tools are costly. However, if they are affordable, I would surely like to use them.				

*SA- Strongly Agree A-Agree DA-Disagree SDA-Strongly Disagree

12. Please mention your opinion regarding the application of ICT in your office for data storing, reporting, corresponding, Transfer of Technology etc.

SI No.	Attitude	Agree	Disagree
1	ICT application facilitate quick access to current data		
2	ICT applications need additional knowledge and skills of extension		
3	ICT application improve the quality of services		
4	ICT applications help to improve communication		
5	ICT applications create confusion in documenting reports		
6	ICT affects the regular budgeting provision		
7	ICT makes an integration within the office		
8	ICT application increases the work load		
9	ICT applications increase job satisfaction of extension personnel		
10	ICT disturb routine official work		

13. Availability of infrastructure and other resource facilities

Please indicate your response by making a tick (✓) mark in the appropriate column for the following statements

SI no	Statement	Yes	No
1	Buildings: Do you have the suitable buildings for the use of ICT tools with proper ventilation, air and light etc?		
2	Equipment: Do you have well equipped equipment/materials for proper use of ICT?		
3	Funds: Do you have sufficient money/fund for use of improved ICT tools?		

12	Agri-Kiosk										
13	e-newspaper										
14	e-journals										
15	e-agricultural Magazines										
16	Any other, please mention										

MsF-Most frequently (every day), MrF-More Frequently (Once in 3 days), F- Frequently (once in a week) LF-Less frequently (Once in a month) NU-Not Utilized

15. Please mention your purpose of utilization by making tick mark (✓) against the following ICT tools

Sl no	ICT tools	Purpose of utilization					
		Personal	ToT			Organizational	
		knowledge /recent information	Advisor y services	Training / teaching	For sharing input agencies	Preparin g/ Sending Reports	organizational communication
1	Radio						
2	Television						
3	Telephone						
4	Mobile phone						
5	Computer						
6	Internet						
7	e-mail						

8	Web based search engine						
9	Web-based Agriculture information portals						
10	DSS						
11	Video conferencing						
12	Kiosk						
13	e-newspaper						
14	e-journals						
15	e-agricultural Magazines						
16	Any other, please mention						

16. What are your training needs in ICTs which you think will improve the effectiveness of your extension activities?

Sl. No	Area/topic	Extent of Training needs in ICTs				
		MsN	MrN	LS	N	NN
Knowledge level						
1	General idea about the computer					
2	Different Operating systems (Windows, Linux)					

3	Basics of computer hardware and software					
4	Installation and customization of software					
5	Understanding different market information techniques					
6	Use of agricultural expert system					
7	Availability of agricultural information in different sources					
8	Agricultural related websites					
9	If any other, please mention: a)					
Skill level						
1	Blogging (e.g., Twitter, weblogs)					
2	Audio/video sharing/webcasting (e.g., Flickr, Skype, YouTube)					
3	Email/instant messaging/Chat					
4	Discussion groups (e.g. Google/Yahoo! Groups)					
5	Social networking (e.g., Face book, google+)					
6	Script writing for television, video					
7	Group messaging through mobiles					
8	Script writing for radio					
9	Usage of agri portals (eg, KAU agri InfoTech portal, TNAU portal...)					

10	Use of videos already captured by other agencies or video captured by self					
11	To access e-journals					
12	Decision support system usage and applications					
13	Online publishing of extension work					
14	Online market information providers					
15	Fertilizer recommendation systems					
16	Sending and checking e-mails					
17	Downloading and copying video clippings from internet					
18	Making word documents of reports					
19	Making pdf documents of reports					
20	Typing Malayalam reports					
21	Preparation of good power point presentations					
22	Preparation of excel sheets and calculations					
23	If any other, please mention: a)					

***MsN –Most Needed, MrN –More Needed, N-needed, LN- Less Needed, NN-Not Needed**

17. Constraints faced by you in using ICT tools

Please rank the problems that you have encountered in using ICT tools

Sl no	problems	Yes/No	1	2	3	4	5
a. Infrastructure constraints							
1	Inadequate computer facility						
2	Poor communications infrastructure (network) necessary for the usage						
3	Insufficient power supply						
4	Lack of financial incentives						
5	Lack of time						
	If any other, please mention						
b. Training constraints							
6	Lack of proper training facility						
7	Poor Technical Know-how						
8	The establishment of training at inappropriate times						
9	Fear of ICT Usage						
	If any other, please mention						
c. Health constraints							
10	Adverse effects on eye sight						
11	Back ache						
12	Head ache						
13	Hand pain						
	If any other, please mention:						

18. Can you please list out your suggestions to improve your knowledge and skills in using ICT tools?

**STRATEGIES FOR CAPACITY BUILDING OF EXTENSION
PERSONNEL FOR USING INFORMATION AND
COMMUNICATION TECHNOLOGIES**

By

CHITHRA GANGADHARAN

(2013-11-157)

ABSTRACT OF THE THESIS

*Submitted in partial fulfillment of the
requirement for the degree of*

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Kerala Agricultural University

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR - 680656

KERALA, INDIA

2015

Abstract

Information and Communication Technologies (ICTs) generally refer to expanding assembly of technologies that are used to handle information and aid communication. ICT in agriculture is an emerging field that involves application of innovative ways to use ICTs in the rural domain. The advancements in ICTs can be utilized for providing accurate, timely, relevant information and services to farmers, thereby facilitating an environment for more remunerative agriculture.

The study intended to analyse the utilization pattern of ICTs, training needs and constraints faced by extension personnel, and to work out strategies for capacity building of extension personnel in using ICTs for agricultural development in Kerala.

An *ex-post facto* research design was adopted. Five districts were selected from each agro climatic zone, and from each district, 30 Agricultural Officers were selected randomly, thus constituting a sample size of 150.

It was observed that 66 per cent of the extension personnel were females, more than two-third of the extension personnel (71.33%) had only medium level of innovation proneness. High level of innovation proneness was noted among 14.66 per cent of the extension personnel. Three-fourth of the extension personnel (74.66%) did not receive trainings related to ICTs. With regard to the attitude towards ICTs, majority (86.66%) of the extension workers of all the districts were under medium category.

Further, it is revealed that more than 85 per cent of the extension personnel had access towards ICT tools such as radio, television, land phone, mobile phone, computer, internet, e-mail, web based search engine and web-based agriculture information portals. The ICT tools with low extent of accessibility were Decision Support System, Video camera, Video conferencing and Kiosk, with less than 25 per cent.

With regard to the utilization of ICT tools, the respondents were evenly distributed among the categories of very less frequent users, less frequent users, frequent users and most frequent users with 26 per cent each and most frequent users with 22 per cent only.

More than 50 per cent of the extension officers mainly used various ICT tools for obtaining recent information to update their knowledge. Only less than 20 per cent of the extension professionals utilized majority of the ICT tools for offering advisory services and less than 10 per cent of the extension officials used various ICT tools for the purpose of teaching or training.

More than 70 per cent of the respondents spent 1-5 hrs per week in using various ICT tools. The per cent of extension personnel who spent 5-10 hours per week for using various ICT tools ranged from 0.7 to 24.7. Very less per cent of the respondents spent 10-15 and above 15 hours per week on different ICT tools.

'Sources of web based agricultural information' was perceived as the most important training need related to knowledge level, with an index of 84.66, followed by 'agricultural related websites (80) and basics of computer hardware and software (75.16). Regarding the skill level training needs, highest Training Need Index was obtained for 'preparation of excel sheets and calculations' (76) followed by 'usage of agri portals' with an index of 74.66 and 'fertilizer recommendation systems' (74.16).

The major constraints faced by the extension personnel were lack of proper training facility with a mean score value of 9.48 followed by inadequate computer facility and poor technical knowhow and conducting trainings at inappropriate times with mean score of 8.32 each.

Target specific training modules, hands on experience, well established infrastructure, adequate funds and personnel for repair and maintenance, computer based trainings and circulation of annual training calendars in advance are the suggested strategies for the capacity building of extension personnel of Kerala in using ICTs.

