TOOLS AND SERVICES FOR m-EXTENSION: PROBLEMS AND PROSPECTS

By

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(2014-11-164)

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THESIS

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2016

DECLARATION

I, hereby declare that the thesis entitled **"Tools and services for m-extension: problems and prospects"** is a bonafide record of research work done by me during the course of research and the thesis has not been previously formed the basis for the award to me any degree, diploma, fellowship or other similar title, of any other University or Society.

Place: Vellanikkara

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CERTIFICATE

Certified that thesis entitled **"Tools and services for m-extension: problems and prospects"** is a bonafide record of research work done independently by **Ms. NAGAM KUSUMA KUMARI (2014-11-164)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship or fellowship to her.

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CERTIFICATE

We, the undersigned members of the advisory committee of **Ms. NAGAM KUSUMA KUMARI (2014-11-164)**, a candidate for the degree of **Master of Science in Agriculture**, with major field in **Agricultural Extension**, agree that the thesis entitled **"Tools and services for m-extension: problems and prospects"** may be submitted by **Ms. NAGAM KUSUMA KUMARI (2014-11-164)**, in partial fulfillment of the requirement for the degree.

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Nannaku Prematho Ankitham……..

Affectionately dedicated to my beloved father
Sri. N. Nageswara Rao

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Introduction

1. INTRODUCTION

Indian economy largely depends on agriculture as it is the primary occupation for majority of the people. These days agriculture is getting towards market oriented and information intensive attempt. Information gap is the unanswered question in developing countries like India where farmers are not aware of market demands. Information is the mere requirement on both the sides *i.e.* farmers and markets. An escalation in mobile phones in India showed an answer for bridging this information gap even among poor sections of the society. India is ranked as the second highest country in the world after China with more than 960 cellular phone subscriptions (Mittal and Mehar, 2012). Technology is the driving force for development which is evident from the mobile technology and its role in new era which is facilitated with the aid of Information and Communication Technology (ICT).

In the last few decades, enormous opportunities were provided by Information and Communication Technologies (ICTs) for the development of rural people especially towards social and economic activities whereas certain technologies have excelled over others. One such notable technology is the mobile telephony which showed a remarkable growth in the past few years. Developing countries showed vast increase in the subscription rate from 22 per 100 inhabitants in 2005 to 91 per 100 inhabitants in 2015 (Saravanan and Suchiradipta, 2015). Mobile telephony had overcome geographic, economic, social and cultural barriers which unveiled the new 3G and 4G technologies. As per the World Bank report, with an increase in 10 per cent of mobile and broadband penetration, the per capita GDP will enhance by 0.81 per cent and 1.38 per cent respectively in the developing countries (Gururaj *et al*., 2016). Mobile phones are the devices that provide easy access for creating, storing and sharing any information from anywhere at any time. This device when lined-up with extension and advisory services improves the livelihood of rural people by providing need based information at affordable price. This so called mobile-based extension and advisory services (m-extension) empowers value-added services

such as mobile agro-services and machine to machine services (Stryjak *et al.*, 2015) that help farmers in tracking their crops and farm machinery using mobile phones.

The average annual growth rate of GDP in agriculture and allied sectors is recorded as 3.3 during the eleventh five year plan (2007-2012). For further improvement in GDP there is a need for vivid, vital and revolutionary/inventive approach to be undertaken by the agricultural extension personnel in order to attain the targeted growth rate and for the well-being of the farmers. Further, natural resources like land and water are diminishing day by day reaching their limits; as a result of that attaining food security is highly dependent on "Knowledge Resource" (Saravanan, 2014).

According to the reports of NSSO, 2005 majority (60%) of the farmers did not have any access for the source of information about advances in agricultural technology which stood as a barrier that created adoption gap. It is estimated that in India there are nearly 120 million farm holdings. If one village extension officer is allotted to 800-1000 farm families the requirement of officers ranges from 1.3 to 1.5 million whereas the availability of officers is only 0.1 million (GOI, 2007). Estimates revealed that on an average an extension worker spent 40 minutes for each farmer per year (Dileepkumar, 2012). In this context, integration of ICTs in delivering agricultural services acts as a driving force to agricultural sector and replaces the traditional extension system for "Knowledge Resource" outreach to a large number of farmers (Saravanan, 2010). Among all the available ICT tools, mobile phone showed a remarkable penetration in the developing countries by improving information access to all sectors of society including rural and urban people regarding a wide variety of aspects ranging from agricultural information to personal communication process (Colle, 2011).

Being an affordable and easily accessible tool rural people understood the role of mobile phone in promoting economic opportunities and strengthens the social networks. Mobile phone is not a simple audio tool for the purpose of

communication it also serves many integrated functions by providing easy access for sharing and getting information and knowledge within the reach of people by reducing the distance between individuals and institutions. Mobile phones can undoubtedly be called as the modern ICT tools that bridged the rural digital divide bringing the benefits to the extent possible for the weaker sections of the society.

ITU (2014) reported that there were 95.5 mobile phone subscriptions per 100 inhabitants, 40.4 individuals were using internet, 32.0 individuals fixed telephone subscriptions, 15.8 individuals have active mobile-broadband subscriptions and 9.8 individuals had fixed-broadband subscriptions.

As per the 2011 census report, the usage of ICT tools in India showed an increasing trend when compared to 2001 census report in the case of telephone the usage increased from 9.1 per cent to 63.2 per cent. Similarly in Kerala also 2011 census report showed an increase in ICT usage particularly an increase in the usage of telephone from 19.1 per cent to 89.7 per cent.

The Telecom Regulatory Authority of India (TRAI) estimates showed that as on May 2014, there were 904.51 million wireless and 28.49 million fixed land line telephone subscribers and 60.87 million broadband subscribers which together accounted for a total of 933.87 million telephone subscribers. Tele-density refers to the number of telephone subscribers per 100 individuals which showed an increasing trend from 36.98 in March 2009 to 75.23 in March 2014.

Mobile phone based ICT services for agriculture

The primary extension services that one can get using a mobile phone are voice calls and text messages. Text based services include Unstructured Supplementary Service Data (USSD), Push and Pull SMS services. Voice based services include Kisan Call Centre (KCC) and Interactive Voice Response System (IVRS).

Mobile applications (m-apps) in agriculture are the other services availed by extension personnel and farmers for attaining information on agriculture and

allied sectors. The various types of information provided by m-apps include data logging and management, location specific information (Weather, market price), agriculture specific calculations and news and information specific apps.

There are many mobile phone applications and services available for agriculture and rural development. For example, the Nutrient Manager for Rice Mobile (NMRice Mobile) designed by IRRI, Philippines to give fertilizer guidelines is now available via smart phones with android operating systems. Some mobile applications available with the m-kisan portal of Governmnet of India are m-kisan app, seed availability app, farm-o-pedia, digital mandi India etc. Keeping the needs of Indian farmers in mind, various applications and services have been deployed by different projects. It includes aAqua mini, Fisher Friend, mKrishi, Reuters Market Light (RML), IFFCO Kisan Sanchar, Life Tools and CERES. Some other applications/services available in India include Life lines, Behtar Zindagi, Mandi Bhav, KRIBHCO, Reliance Kisan Limited, m-Agri, Avaaj otalo (voikiosk), Nano Ganesh, SMS ONE, Green peace India- SMS lead Generation, Babajob, MILLEE, Question Box/ Open Question, Ekagon CAM, Self Help MIS, Zero(ZMF), Gaon ki Awaaz, CG NET, Dialog Trade Net, Data agro and the like. Kerala Agricultural University is also providing Mobile based services through a few research centers, KVKs and ATIC.

Utilizing such new applications and services on mobile phones helps the extension agents for speedy, accurate and timely supply of information to the farmers in various aspects related to agriculture and allied sectors. Hence a study in this line is worthwhile to understand the problems and prospects of m-extension in Kerala and to formulate strategies for effective m-extension. In this background the study was conducted with the following objectives.

Objectives of the study

1. To analyse the awareness of extension personnel on m-tools.
2. To analyse the extent of knowledge of extension personnel on m-tools.

3. To analyse the extent of use of m-tools by the extension personnel.
4. To identify the constraints faced by the extension personnel in using m-tools.
5. To formulate strategies for effective m-extension.

Scope and importance of the study

The study has systematically catalogued the mobile applications that are currently available for agricultural extension, which is a rich source of data for the agricultural extension personnel and farmers of Kerala. This database can effectively be utilized by the e-extension tool developing agencies, including the Centre for e-learning of Kerala Agricultural University for developing appropriate m-extension tools. Most importantly, the study results related to awareness, utilization, constraints and the strategies would give necessary background information for the planners and policy makers in evolving policy decisions for effective m- extension in Kerala and thereby expediting agricultural growth.

Limitations of the study

M-extension is the evolving aspect of Information and Communication Technology (ICT). So the first and foremost limitation was the dearth of relevant literature on m-extension tools in agriculture. Since the data were collected using ex-post-facto research design, the personal opinions of the respondents were to be taken into count. So there may be a chance of personal bias to some extent. The researcher had taken care to convince them to get relevant information and make the study objective.

Organisation of the thesis

This thesis is presented under five chapters. The first chapter covers the introduction part which includes objectives, scope, importance and limitations of the study. The second chapter includes a systematic review of literature considering the variables of the study. The third chapter deals with the detailed methodology followed for measuring the variables included in the study. The

fourth chapter comprises of results and discussion. The fifth chapter summarizes the findings of the study followed by reference citation, appendices and abstract of the thesis.

Review of Literature

2. REVIEW OF LITERATURE

In order to develop a proper understanding of research problem and to develop a conceptual framework to conduct the study, it is very essential on the part of the researcher to review the efforts made by the earlier researchers. A systematic review of past literature helps the researcher to have mental frame work of their research work which provides comprehensive information on methods and procedures forms the basis for interpretation of findings. It guides the researcher throughout the investigation period.

Though the availability of related literature on m-tools in agriculture was limited, a sincere effort was made to review the available literature having direct or indirect relevance to the study. The relevant literature reviewed for the study is presented under the following headings.

2.1. Profile of the extension personnel

2.2. Awareness on m-tools

2.3. Extent of knowledge on m-tools

2.4. Extent of utilisation of m-tools

2.5. Constraints in using m-tools

2.1. Profile of the extension personnel

2.1.1. Age

Nagalakshmi (2008) reported that majority of extension personnel (52.94%) belonged to old age category, 26.7 per cent of the extension personnel belonged to middle aged category and 20.59 per cent of them were under young age category.

Ahmadpour *et al*. (2010) revealed that the average age of extension personnel was 39.66 years.

Meera *et al*. (2010) revealed that nearly half of the extension personnel (46%) were young aged followed by middle (32%) and old (22%) aged respectively.

Manty (2011) reported that majority of the extension personnel (77.5%) belonged to middle age group followed by old (20%) and young (2.5%) age groups respectively.

Ravikishore (2014) found that majority of the extension professionals of Kerala (82.5%) were under middle age category followed by 10 per cent and 7.5 per cent under old and young age categories respectively.

Chitra (2015) reported that nearly half of the agricultural extension personnel of Kerala (48.66%) belonged to middle age group.

2.1.2. Gender

Salau and Saingbe (2008) found that majority of the researchers (86.66%) and 66.66 per cent of extension workers were males.

Chitra (2015) found that majority (66.7%) of the agricultural extension personnel of Kerala were female followed by 33.3 per cent male respondents.

Raksha and Meera (2015) reported that majority (64.44%) of the extension personnel in Tamil Nadu were male followed by 35.56 per cent female.

2.1.3. Educational Status

Rao (2000) found that SSLC was the educational status of majority of the Agricultural Assistants of Karnataka State Department of Agriculture (40%) followed by pre-university qualification (33.33%), graduation (23.33%) and diploma in agriculture (3.33%).

Meera *et al*. (2010) revealed that more than half of the extension personnel (63%) had Master's degree in agriculture.

Manty (2011) found that 35 per cent of the extension personnel had educational status of SSLC followed by 30 per cent B.Sc (Ag/H.Sc) holders, 17.5 per cent with Pre-university Course (PUC) and 17.5 per cent with M.Sc (Ag/H.Sc).

Ravikishore (2014) reported that 50 per cent of the extension professionals of Kerala were M.Sc. holders followed by graduates (24%) and doctoral degree holders (26%).

Chitra (2015) reported that majority (46.66%) of the agricultural extension personnel of Kerala were graduates in agricultural sciences followed by 41.33 per cent post graduates in agricultural sciences, 6 per cent diploma holders, 4 per cent degree holders and 2 per cent doctorate holders.

Raksha and Meera (2015) found that more than half of the extension agents (60.56%) were post-graduates followed by doctorates (21.11%) and graduates (18.33%).

2.1.4. Experience

Rao (2000) revealed that more than half of the Agricultural Assistants of Karnataka State Department of Agriculture (65%) were highly experienced followed by low (25%) and medium (10%) levels of experience.

Helen (2008) found that majority of the agricultural extension personnel of Kerala (40.56%) had working experience of 10 years followed by 11 to 12 years (40%) and more than 21 years (14.44%) of working experience.

Meera *et al*. (2010 reported that the working experience of extension personnel varied from five years (31%) to more than 20 years (28%).

Manty (2011) revealed that majority (65%) of the extension personnel were highly experienced followed by medium (25%) and low (10%) levels of experience.

Chitra (2015) revealed that majority (62%) of the respondents had medium experience as extension personnel followed by 22 per cent with high and 16 per cent with low experience respectively.

2.1.5. e-literacy and m-literacy trainings

Frempong *et al*. (2006) revealed that 23.7 per cent of the extension personnel had undertaken professional courses related to ICTs whereas 29.2 per cent of them attended ICT trainings on their own at community learning centres.

Adesope *et al*. (2007) found that 70.4 per cent of extensionists and 68.9 per cent of the researchers had attended trainings on ICTs with 4.5 years as mean exposure period.

Bhagat *et al*. (2007) reported that nearly 90 per cent of the extension personnel had not attended any training on e-literacy.

According to Helen (2008) majority of the agricultural extension personnel of Kerala (56.6%) had low level of exposure to trainings on ICTs followed by medium (33.33%) and low (10.7%) level of exposure.

Manty (2011) revealed that 17.5 per cent of the extension personnel attended ICT trainings for duration of one to three days followed by five per cent who attended the trainings that lasted for duration of four to six days. Whereas the trainings lasted for duration of seven to 14 days and more than 21 days were attended by 2.5 per cent each. And the rest (72.5%) had not attended any of the ICT training.

Swafah (2011) found that majority (72%) of the extensionists of Palakkad district had received e-literacy trainings followed by 65 per cent of respondents of Thrissur district.

Karanja (2014) reported that 60.4 per cent of the rural agricultural extension personnel had not attended any training on ICTs.

Ravikishore (2014) revealed that majority (80%) of the extension professionals of Kerala had received trainings lasted for one to three days followed by very low per cent of respondents who received trainings lasted for more than three days.

Samansiri and Wanigasundera (2014) reported that majority (44.3%) of the extension officers attended in-service training on ICTs which lasted for only one day followed by two to four days (14.8%), five to seven days (13.9%), more than 7 days (4.3%) and 22.6 per cent of them had not attended any of the trainings related to ICTs.

Chitra (2015) revealed that majority (75%) of the agricultural extension personnel in Kerala had not undergone any training on ICTs whereas only 25 per cent of the respondents had undergone such trainings.

2.1.6. Frequency of use of gadgets

Aboh (2008) reported that the agricultural extension agents were using mobile phone and computer frequently.

Agwu *et al*. (2008) found that, of all the 24 ICT tools provided to the respondents the extension workers were using 14 tools frequently which include mobile phone, computer, internet, radio, television, UPS, e-mail, camera, printer, scanner, slide projector, photo copier, diskette and video recorder.

Manty (2011) found that there were 30 per cent very frequent users, 40 per cent frequent users and 25 per cent less frequent users of mobile phones among the extension personnel.

Agwu and Ogbonnah (2014) found that 73.7 per cent of the women staff of public extension service were using internet twice a week and 26.3 per cent of them were using once in a month.

2.1.7. Innovativeness

Babu (2005) reported that 52.5 per cent of the beneficiaries of the ICT project, Akshaya were under medium category of innovativeness similarly 62.5 per cent of them showed medium category of innovativeness towards KISSAN Kerala, an ICT project in agriculture by the Govt. of Kerala.

Gracesarala (2008) revealed that majority (80%) of the agricultural officers were moderately innovative whereas 12.63 per cent of them were less innovative and 7.37 per cent were highly innovative.

Manty (2011) reported that majority (50%) of the extension personnel from University of Agricultural Sciences, Dharwad were highly innovative whereas majority (45%) of the extension personnel from Karnataka State Department of Agriculture were comparatively less innovative.

Ravikishore (2014) revealed that majority (44%) of the extension professionals in Kerala were moderately innovative whereas 37 per cent of them were highly innovative followed by 20 per cent with low innovative attitude.

2.1.8. Attitude towards m-tools

Chetsumon (2005) found that the extension agent's attitude towards POSOP, a rice disease diagnosis and management expert system and the evaluation of expected outcomes from it were reported as positive.

Grace Sarala (2008) revealed that 85.3 per cent of the agricultural officer's attitude towards computer mediated communication was favourable and the rest (14.7%) showed an unfavourable attitude.

Chou and Shieh (2010) reported that the unemployed adult population with high education showed highly favourable attitude towards computers.

Hashemi *et al*. (2013) reported that the extension workers were having positive attitude towards ICT use with a mean of 4.31.

Samansiri and Wanigasundera (2014) revealed that majority of the extension officers showed positive attitude towards ICTs by informing their views towards the utility of ICTs for attaining required information.

Kabir and Roy (2015) reported that 93.7 per cent of the agricultural officers showed highly favourable attitude towards ICT tools whereas remaining 6.3 per cent showing moderate attitude towards ICT tools.

2.1.9. Access to basic requirements

Adesope *et al*. (2007) revealed that 62.10 per cent of the extension managers and supervisors had access to ICT whereas 37.90 per cent of them did not have.

Wims (2007) revealed that out of the 56 per cent of the farm familes owning a personal computer at home only 48 per cent of them had access to internet facility.

Agwu *et al*. (2008) revealed that 56 per cent of the extension workers had access to ICT facilities.

Salu and Saingbe (2008) reported that 66 per cent of the extension workers had access to ICT facilities.

Oladosu (2008) found that nearly 80 per cent of the extension workers had access to internet whereas only 7 per cent of them were using it on regular basis.

Okwusi and Ekumankama (2010) found that the use of internet was influenced by ICT accessibility.

Manty (2011) found that cent per cent of the extension personnel had access to mobile phone and television followed by telephone (97.5%), radio (92.5%) and computer (82.5%).

Ann (2013) found that majority (98.33%) of the extension agents had access to ICT tools like radio followed by television (85.83%) and mobile phone (81.67%).

Karanja (2014) found that majority of the agricultural extension personnel had access to mobile phone (86.1%) followed by digital camera (65.1%) and internet (59.5%) at the place of work.

Rebekka and Saravanan (2015) found that 100 per cent of the respondents had access to mobile phone where only a few per cent had access to internet (12.5%), e-mail (6.6%) and computer (5.8%).

2.1.10. Occupational commitment

Sobhana (1990) reported that majority (76.11%) of the agricultural assistants in Kerala (grass root level agricultural functionaries in Kerala) had medium level of occupational commitment followed by 13.33 per cent having low and 10.56 per cent having high commitment towards their occupation.

Jahagirdar and Sethurao (1996) revealed that majority (55%) of the Subject Matter Specialists were in the high category of occupational commitment followed by 45 per cent in the low category.

Rao (2000) found that 40 per cent of the agricultural assistants of Karnataka State Department of Agriculture showed medium level of job commitment whereas 31.66 per cent of them were in low category followed by 28.33 per cent highly committed to their job.

Manty (2011) reported that 50 per cent of the extension personnel of University of Agricultural Sciences, Dharwad were in the medium category of job commitment followed by 30 per cent in high and 20 per cent in low categories. Whereas 37.5 per cent of the extension personnel of Karnataka State Department of Agriculture showed high level of job commitment followed by 35 per cent in medium and 27.5 per cent in low categories.

2.2. Awareness on m-tools

Murali and Venkataramaiah (2008) reported that with an increase in innovativeness there would be an increase in their exposure to agricultural websites.

Beena and Mathur (2012) found that male respondents were comparatively more aware of ICT tools than female respondents.

Ann (2013) reported that 96 per cent of the extension agents were aware of using ICT facilities like radio while 86 per cent of them were aware of using mobile phone as an e-extension tool.

Khamoushi and Gupta (2014) found that only 38.31 per cent of the respondents were aware of economic, facilitating, social, psychological and technical factors that influenced the use of ICT tools.

Koshy *et al*. (2015) revealed that only 14 per cent of farmers of Kerala were aware of the Kisan Call Centre.

Dhanavandan *et al*. (2016) found that among the library professionals of Tamilnadu, majority of the female respondents were aware of communication tools when compared to male respondents.

2.3. Extent of knowledge on m-tools

Ndag *et al*. (2008) found that agricultural extension workers from North-central part of Nigeria had slightly higher (57.14%) knowledge on computer usage than those from South-west (55.71%) part of Nigera.

Okwusi and Ekumankama (2010) affirmed that basic knowledge to use ICT tools would enhance its usage to a greater extent.

Manty (2011) reported that the extent of knowledge of extension personnel towards ICT tools was very high (100%) in case of telephone followed by 75 per cent towards radio, television and computer. It accounted for 67.5 per

cent in case of e-mail and 65 per cent in case of mobile phones and web based search engines.

Ann (2013) reported that majority of the extension agents were using radio (with a mean of 3.0) followed by mobile phone (mean=2.8) to a large extent than any of other ICT tools.

2.4. Extent of utilisation of m-tools

Inyang *et al*. (2004) found that extent of utilization of ICT tools by the extension personnel was low (36.6%).

Manty (2011) found that 90 per cent of the extension personnel used mobile phone for the purpose of gaining knowledge and updated information.

Mabe and Oladele (2012) reported that majority of the extension officers were using ICT for accessing market information and getting information about new technologies.

Agwu and Ogbonnah (2014) reported that radio (a mean score of 3.70) was the ICT tool used to a greater extent followed by mobile phone (a mean score of 3.49).

Rebekka and Saravanan (2015) found that 45 per cent of the tribal farmers used mobile phone for getting information on marketing of produce followed by quality of inputs (35%), pest and disease management (30%) and other purposes that include social communications and contacting experts for agri-related advices.

Dhanavandan *et al*. (2016) found that among the library professionals of Tamilnadu, majority of them were using e-mail (94%) followed by mobile phone (92%).

Kafura *et al*. (2016) found that the extent of use of ICT tools was very low among farmers as majority (81%) of them were not using.

2.5. Constraints in using m-tools

Okwusi (2010) found that ignorance, lack of ICT resources and high accessing costs were the important constraints faced in using ICT tools.

Manty (2011) identified that inadequate availability of computers and supply of power as the important constraints faced by the extension personnel in accessing ICTs followed by lack of proper training, knowledge on ICTs and poor internet connectivity.

Oye *et al*. (2012) reported that lack of time, technical support and training were the major barriers preventing access to ICT use.

Mabe (2012) revealed that poor ICT infrastructure and lack of technical personnel to maintain ICT were the major constraints stated by majority of the extension officers.

Agwu and Ogbonnah (2014) identified lack of technical know-how, lack of access to ICTs and inadequate ICT facilities as the limiting factors for using ICTs.

Khamoushi and Gupta (2014) identified the major constraints experienced by the agricultural extension scientists for effective use of ICT tools include lack of grants for purchasing ICTs, lack of sufficient ICT tools and lack of familiarity and expertise.

Pradhan and Afrad (2014) revealed that majority of the agricultural extension workers encountered organizational barriers followed by personal barriers in accessing and using ICT tools.

Verma *et al*. (2014) reported that nearly 70 per cent of the respondents faced medium to higher level of constraints while using ICTs for getting information in agriculture.

Rebekka and Saravanan (2015 reported that irregular power supply, poor network connectivity, low e-literacy, lack of confidence in operating ICTs were the major constraints.

Hinduja (2014) found that lack of awareness about ICT tools and content related problems were the major constraints experienced by the farmers.

Ravikishore (2014) reported lack of proper training as the major constraint faced by the extension professionals in Kerala.

Kabir and Roy (2015) reported that problem in loading data files, lack of ICT trainings and increased prices for using ICT tools were the major constraints.

Saravanan and Suchiradipta (2015) found that lack of popularity among people for attaining agricultural information through mobile phone, technical illiteracy among extension personnel, minimum use of smart phones, high maintainance cost for internet connectivity and limited delivery of content were the constraints in using m-tools.

Materials and Methods

3. MATERIALS AND METHODS

Research methodology is a systematic way of finding solutions for a research problem. In general, it is a blue print of procedure for conducting research. The methodology followed for the present study is discussed in this chapter under the following headings.

3.1 Research design

3.2 Locale of the study

3.3 Selection of respondents

3.4 Selection of variables for the study

3.5 Operationalization and measurement of independent variables

3.6 Operationalization and measurement of dependent variables

3.7 Tools used for data collection

3.8 Statistical methods employed for data analysis

3.1 Research design

Ex-post facto research design was followed for conducting the present study since the events under study took place already. According to Singh (2013), "Ex-post facto research is the empirical investigation in which the investigator draws the inference regarding the relationship between variables on the basis of such independent variables, whose manifestations have already occurred". As the events already took place at certain point of time the researcher has no direct control over the independent variables in this type of research.

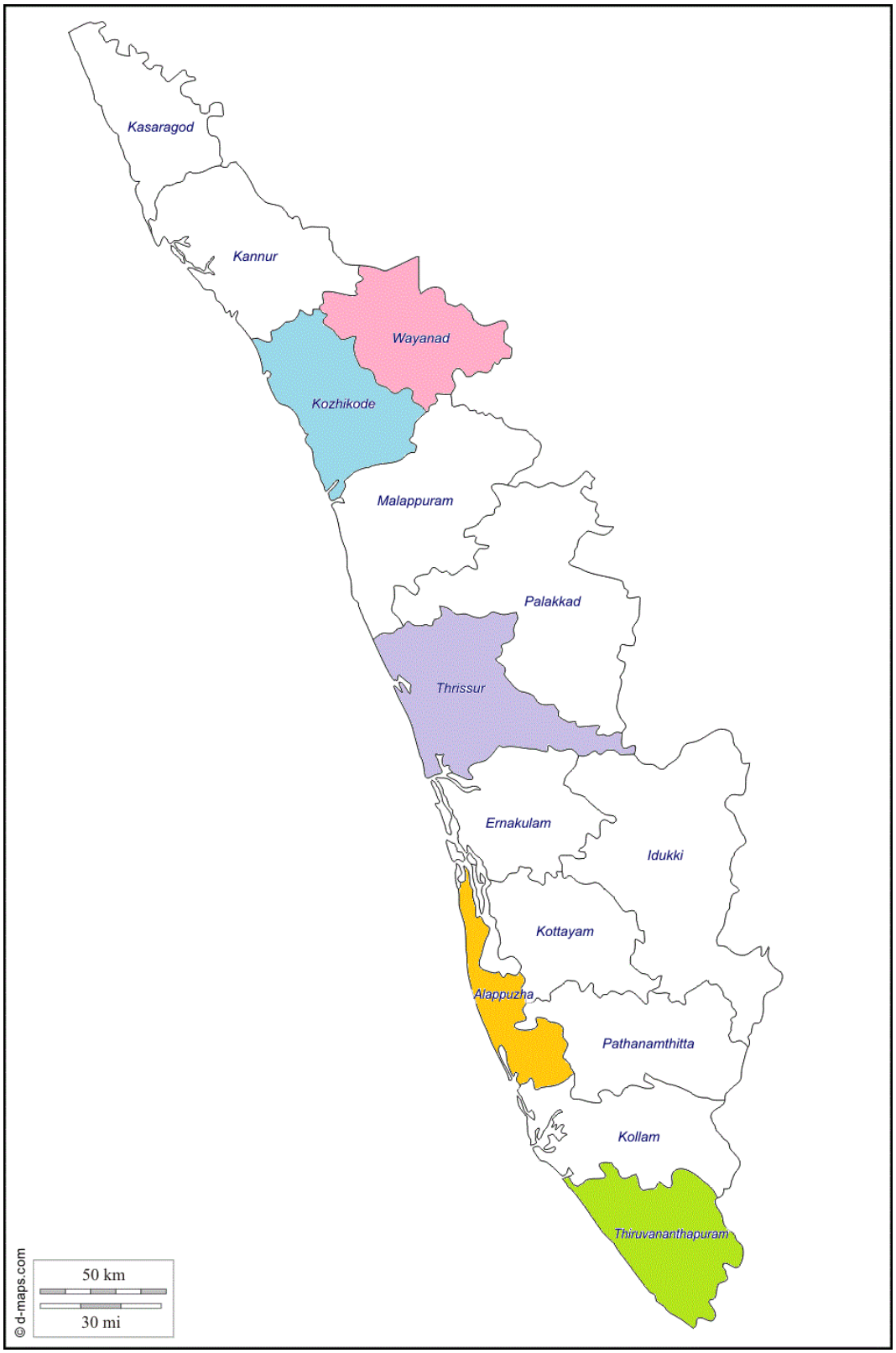

Plate 1. Map showing the study area in Kerala

3.2 Locale of the study

The study was conducted in the state of Kerala. Five districts, one each representing each agro-climatic zone in Kerala, were selected randomly as follows:

Agro-climatic Zone	Selected District
Northern zone	Kozhikode
Southern zone	Trivandrum
Central zone	Thrissur
High altitude zone	Wyanad
Problem area zone	Alappuzha (Kuttanad tract)

3.3 Selection of respondents

Agricultural Extension Personnel comprising Agriculture Officers (AOs) and Agricultural Assistants (AAs) from Krishi bhavans (grass root level agricultural development offices in Kerala) were selected as the respondents of the study. From each of the above five districts, 15 Krishi bhavans were randomly selected and from each Krishi bhavan the AO and one among the AAs were selected. Thus a total of 75 AOs and 75 AAs were identified, thus constituting a sample of 150 Agricultural Extension Personnel. (Plates 2 to 6)

3.4 Selection of variables for the study

Variables under the study were classified into independent variables and dependent variables

3.4.1 Independent variables

The independent variables found relevant to the study were selected based on thorough review of literature and discussion with experts in the field. The independent variables of the study consisted of age, gender, educational status, experience, e-literacy trainings, m-literacy trainings, frequency of use of

Plate 2. Interviewing the Agricultural Officer, Pulinkunnu Krishibhavan, Alappuzha

Plate 3. Interviewing the Agricultural Officer, Peruvayal Krishibhavan, Kozhikode

Plate 4. Interviewing the Agricultural Officer, Moorkanikkara Krishibhavan, Thrissur

Plate 5. Interviewing the Agricultural Officer, Thiruvallam Krishibhavan, Trivandrum

Plate 6. Interviewing the Agricultural Officer, Poothady Krishibhavan, Wayanad

gadgets, innovativeness, attitude towards m-tools, access to basic requirements and occupational commitment.

3.4.2 Dependent variables

The objectives of the study necessitated the following dependent variables for the study:

- Awareness on m-tools
- Extent of knowledge on m-tools
- Extent of utilisation of m-tools
- Satisfaction towards m-tools

The detailed procedure for measurement of the selected independent and dependent variables along with their operational definitions are given in subsequent pages. In addition to these variables the two major observations made in the study includes contemporary mobile applications in agricultre and the constraints in using m-tools.

3.4.3 Contemporary mobile apps and services in agriculture

Contemporary mobile apps and services in agriculture refer to various mobile phone based apps and services providing information in the field of agriculture and allied sectors. A smart phone display analysis as well as computer desktop analysis was undertaken to identify few such good apps and services among all the available apps. The m-apps were downloaded on mobile phone and analysed their content coverage and relevance in the field of agriculture using the method of observation. Accordingly certain m-apps in agriculture were selected and discussed in the study.

3.4.4 Constraints in using m-tools

Constraints were operationally defined as the limitations or restrictions faced by the respondents in accessing and using various m-tools and services in

agriculture. Through gathering relevant literature, discussion with scientists and non-sample extension personnel, a list of 17 constraints were prepared and administered to the respondents.

For measuring this variable the scoring procedure followed by Ravikishore (2014) was adopted, in which the importance of constraints were measured on a five point scale ranging from very important to not important. The possible highest score was 85 and the least possible score was 17. The scoring procedure was as follows:

Response	**Very Important**	**Important**	**Less important**	**Least Important**	**Not Important**
	Scores				
Statement	5	4	3	2	1

3.5 Operationalization and measurement of independent variables

3.5.1 Age

Age was operationally defined as the number of years completed by the respondents at the time of investigation. This was measured as the total number of years completed by the extension personnel at the time of interview. The scale followed by Chitra (2015) was adopted for the study. Based on the age the respondents were categorised as follows:

Category	**Years**	**Score**
Young	<35	1
Middle aged	35-45	2
Old aged	>45	3

3.5.2 Gender

Gender was operationally defined as the state of being male or female based on social and cultural difference. The respondents in this study were classified into two categories as follows:

Category	Code
Male	1
Female	2

3.5.3 Educational status

In this study education was operationally defined as the number of years of formal schooling obtained by the agricultural extension personnel. The respondents were classified on two dimensions *i.e* agricultural education and general education as follows:

General education

Educational status	Score
SSLC	1
Plus two or equivalent	2
Degree	3
Post-graduation	4
Ph.D	5

Agricultural education

Educational status	Score
Certificate Course in Agriculture	1
VHSE (Agriculture)	2
Diploma (Agriculture)	3
B.Sc. (Ag/Horti)	4
M.Sc. (Ag/Horti)	5
Ph.D (Ag/Horti)	6

3.5.4 e-literacy trainings

In this study e-literacy training refers to the ICT related trainings attended by the respondents. Each training the respondents have undergone was given a score of one, as per the procedure followed by Chitra (2015).

No. of trainings attended	Score
No trainings	0
One training	1
Two trainings	2

3.5.5 m-literacy trainings

m-literacy training was operationalized as the trainings attended by the respondents on mobile phone usage and its application in their work environment. Each training the respondents have undergone was given a score of one, as done for the independent variable on e-literacy trainings.

3.5.6 Experience

Experience was operationally defined as the number of years the respondent has been working as an extension personnel. The respondents were classified as follows:

Experience in years	Score
<5	1
5-10	2
11-15	3
>15	4

3.5.7 Frequency of use of gadgets

Frequency of use of gadgets was operationally defined as the number of times a respondent made use of the gadgets that were owned by him/her as well as other gadgets used for both personal and official purposes. The scoring procedure followed was as follows:

Frequency	Score
Frequently in a day	6
1-2 times in a day	5
Once in 2-3 days	4
Weekly	3
Monthly	2
Very rarely	1

3.5.8 Innovativeness

Innovativeness was operationally defined as the degree to which the respondents were relatively early in adopting new technologies. The procedure followed by Priya (2014) was adopted for measuring this variable with slight

modifications. A question was asked as when the respondent would like to adopt an improved technology. The scoring procedure employed was as follows:

Response	Score
As soon as it is brought to my knowledge	3
After I had seen the success of it when tried by others	2
I prefer to wait and take my own time	1
I am not interested in adopting new technologies	0

3.5.9 Attitude towards m-tools

Attitude in this study was operationally defined as the positive or negative responses of the respondents towards m-tools.

An arbitrary scale was developed for measuring the attitude of extension personnel towards m-tools, through thorough literature review. The scale consisted of 10 statements of which five statements were positive and five statements were negative. The respondents were asked to rate these statements on a four point scale which ranged from strongly agree to strongly disagree. Summing up the scores obtained for all the statements gave the score of the respondent's attitude towards m-tools. The scoring procedure was as follows:

Responses	Strongly Agree	Agree	Disagree	Strongly Disagree
	Scores			
Positive statements	4	3	2	1
Negative statements	1	2	3	4

The maximum possible score was 40 and minimum score was 10. Considering the summated score of the respondents they were divided into three categories such as 'low', 'medium' and 'high' by calculating the Mean and Standard Deviation (SD) which were considered as a measure of check.

Category	Range of scores
Low	Below (Mean-SD)
Medium	Between (Mean±SD)
High	Above (Mean+SD)

3.5.10 Access to basic requirements in using m-tools

It refers to the availability of minimum facilities to the respondents for easy use of m-tools. The scoring procedure followed by Ravikishore (2014) was adopted for the present study with slight modifications. Four basic requirements *viz*. internet connectivity, English language proficiency, techsavvy and knowledge on m-tools/m-apps were listed and their access to these basic requirements for using m-tools was measured using a five point scale as follows:

Category	Score
Very low	1
Low	2
Medium	3
High	4
Very high	5

3.5.11 Occupational commitment

Occupational commitment was operationally defined as the sincerity and responsibility from the part of respondents towards their occupation and their positive involvement in performing the occupational tasks effectively. For measuring this variable the scale developed by Blau *et al*., (1993) was adopted with slight modifications. It included 11 statements which were rated on a four point scale ranging from strongly agree to strongly disagree. Summing up the scores of all the statements gave the score of the respondent's commitment towards their occupation. The scoring procedure was as follows:

Response	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
	Scores			
Statement	4	3	2	1

The maximum possible score was 44 and minimum score was 11. Considering the summated score, the respondents were divided into three categories *viz*. 'low', 'medium' and 'high' by calculating the Mean and Standard Deviation (SD) which are considered as a measure of check.

Category	**Score**
Low	Below (Mean-SD)
Medium	Between (Mean±SD)
High	Above (Mean+SD)

3.6 Operationalization and measurement of dependent variables

3.6.1 Awareness on m-tools

It was operationally defined as the level of awareness of agricultural extension personnel about various m-tools. For this the respondents were asked

whether they were aware of four different categories of m-tools *viz*. mobile apps in agriculture, Kisan Call Centre, mobile group messaging services in agriculture and mobile discussion groups in agriculture, if they were aware of the m-tools they were asked to list a few m-tools. A score of one was given to the respondents who were aware of each m-tool related to agriculture. A score of zero indicates that the respondents are unaware of m-apps in agriculture.

m-tools	Aware (1)	Unaware (0)

Since there were four categories of m-tools *viz*. mobile apps in agriculture, Kisan Call centre, mobile group messaging services in agriculture and mobile discussion groups in agriculture, the possible score ranged from 0-4.

3.6.2 Extent of knowledge on m-tools

Knowledge is defined as a body of understood information possessed by an individual or by a culture. (English and English, 1961). Knowledge in this study is operationally defined as the quantum of basic information known to the respondents about m-tools.

A teacher made test was developed to assess the extent of knowledge of extension personnel on m-tools. For the purpose, 30 knowledge items representing the basic information/knowledge about m-tools were identified. These identified knowledge items were administered on 30 non- sample respondents for assessing the difficulty and discrimination power of each item. The respondents were asked to indicate their answers to each item (question) and for each correct answer a score of one was given and for each incorrect answer a score of zero was given. The knowledge score for each item was calculated by summing up the score obtained for the item by all the respondents. Based on these scores the difficulty index and discrimination index were calculated following the item analysis procedure given by Sagar (1983).

Difficulty index indicates the extent to which an item is difficult. The items selected for knowledge test should not be too easy so that everyone could answer, similarly they should not be too difficult so that no one could answer. Difficulty index was calculated using the formula as followed by Smitha and Anilkumar (2011).

$$P = NC \div N \times 100$$

P = Difficulty index

NC = No. of respondents who gave correct answers

N= Total no. of respondents

The value of "P" ranges from 0 to 100 per cent. Higher the value of "P" easier is the item. Items having "P" value higher than 80 were considered as easy and lesser than 20 were considered difficult. A "P" value of 50 was considered as the optimum level of difficulty. So items within the range of 20-80 were selected for the study.

Item discrimination (or) the discriminating power of a test item refers to the degree to which success (or) failure of an item indicates possession of the ability being measured (Singh, 2013). Discrimination index was calculated using the formula

$$E^{1/3} = (S_1) - (S_3) \div N/3$$

E = Discrimination index

S1 = Frequency of correct response to the items in upper group of respondents

S2 = Frequency of correct response to the items in lower group of respondents

"E" value ranges between -1.00 and +1.00. Higher "E" value indicates higher discrimination of the item. Items having negative discrimination were

rejected. Items with “E” value above 0.10 were selected for the study as followed by Barman and Kumar (2010).

Accordingly 14 items were selected to construct the final knowledge test which was included in the final interview schedule (See Appendix- I).

The knowledge test so constructed was administered to the agricultural extension personnel to assess their knowledge on m-tools. The answers given by the respondents were noted down. The answers to the questions were quantified by giving a score of one to every correct answer and zero for incorrect answer. Thus the maximum score that one could attain was 14 and minimum was zero.

Based on the scores obtained, the respondents were categorized into low, medium and high categories as follows:

Category	**Score obtained**
Low	1-5
Medium	6-9
High	10-14

The knowledge indices were calculated for the 14 items that were included in the study. It was calculated by considering the total number of correct answers given by all the respondents to each of the item and the maximum score possible. Knowledge index was calculated using the formula

$$\text{Knowledge Index (KI)of an item} = \frac{\text{Score obtained}}{\text{Maximum score possible}} \times 100$$

3.6.3 Extent of utilisation of m-tools

Extent of utilisation of m-tools in the study was operationalized as the frequency of use of selected m-tools such as mobile apps in agriculture, Kisan Call Centre of Govt. of India, mobile group messaging services and mobile

discussion groups in agriculture by the respondents. The scoring procedure followed by Hassan (2008) was adopted for the study which was as follows:

Frequency of use	Score
Frequently	4
Occasionally	3
Sometimes	2
Rarely	1

3.6.4 Satisfaction towards m-tools

Satisfaction towards m-tools was operationally defined in the study as the extent to which the respondents were satisfied with accessing and using various m-tools. The satisfaction level of the respondents was a measure ranging between highly satisfied to highly unsatisfied. Based on the level of satisfaction gained by the respondents a score of five was assigned to higher level of satisfaction and a score of one was assigned to the lower level of satisfaction. The respondents were asked to give their satisfaction level towards the four categories of m-tools they were using, on a five point scale ranging from highly satisfied to highly unsatisfied. Summing up the scores obtained by the respondent in each category gave the score of the respondent's level of satisfaction towards m-tools.

Satisfaction level	Highly Satisfied	Satisfied	Neutral	Unsatisfied	Highly unsatisfied
m-tools	5	4	3	2	1

The satisfaction indices of the agricultural extension personnel towards m-tools were calculated using the formula

$$\text{Satisfaction Index(SI)} = \frac{\text{Summated score obtained for the four m} - \text{tools}}{\text{Maximum possible score}} \times 100$$

From the satisfaction indices obtained, the agricultural extension personnel were categorised as follows

Category	Satisfaction Index
Very Low	< 20
Low	20-39
Average	40-59
Good	60-79
Very Good/Excellent	>80

3.7 Tools used for data collection

The data were collected from the agricultural extension personnel using a structured pre-tested interview schedule. A series of stages were employed in this process.

3.7.1. Pre-testing of interview schedule

An interview schedule was prepared by consulting experts and thorough review of relevant literature. This schedule was then administered to 30 non-sample respondents for pre-testing. Necessary corrections and modifications were made after pre-testing to develop the final interview schedule used for the study (See Appendix- II & III).

3.7.2. Administration of the interview schedule

The final interview schedule was used for interviewing the respondents. Agricultural Extension Personnel were interviewed using the schedule independently by the researcher at Krishi Bhavans of different districts selected for the study.

3.8 Statistical methods employed for data analysis

The data collected were given scoring initially and then analysed and tabulated using statistical tools like Percentage analysis, Spearman's rank correlation, Mann-Whitney U test and Linear discriminant analysis using SPSS package 16.0 version.

3.8.1 Percentage analysis

Percentage distribution of respondents in relation to the variables was calculated by dividing the frequency of respondents in each category with total number of respondents and multiplied by 100. This is the simplest method of analysing the data.

3.8.2 Spearman's rank correlation

Spearman rank correlation was employed to test the significance of the relationship of independent variables with the dependent variables. The correlation coefficient ranges from +1 to -1. A perfect positive relation between the variables is indicated by +1 whereas a perfect negative relation is indicated by -1. Zero indicates that there is no relation between the variables.

3.8.3 Mann-Whitney U test

Mann-Whitney U test was used to test whether there is a significant relation between the two groups *viz*. Agricultural Officers and the Agricultural Assistants. Higher the difference between the mean ranks of the two groups, lesser the significant relation between the two groups and lower the difference between the mean rank values of the two groups there exists a significant relation between the two groups.

3.8.4 Linear discriminant analysis

Linear discriminant analysis was used to find out the extent to which the variables are discriminating the two groups *viz*. Agricultural Officers and Agricultural Assistants. The larger the standardised coefficient, the greater is the

contribution of the respective variable to the discrimination between the groups. For getting a clear interpretation cross tabulation was employed and bar charts were prepared for the variables showing the greater standardised coefficients.

Results and Discussion

4. RESULTS AND DISCUSSION

Results of the study are presented and discussed in detail in this chapter under the following headings according to the objectives of the study.

4.1 Contemporary mobile apps and services in agriculture

4.2 Personal profile of the agricultural extension personnel

4.3 ICT profile of the agricultural extension personnel

4.4 Awareness on m-tools

4.5 Extent of knowledge on m-tools

4.6 Extent of utilisation of m-tools

4.7 Satisfaction towards m-tools

4.8 Relationship between profile characteristics of respondents with dependent variables

4.9 Comparison of Agricultural Officers and Agricultural Assistants with respect to selected independent and dependent variables

4.10 Constraints perceived by the extension personnel in using m-tools

4.11 Information required by the extension personnel

4.12 Strategies for effective m-extension in Kerala

4.13 Prospects for effective m-extension in Kerala

4.1Contemporary mobile apps and services in agriculture

Even though mobile apps are not new these days, many are unaware about the existence of such apps in the field of agriculture and allied sectors providing varied information. Hence an attempt has been made here to identify

and catalogue some important apps in agriculture, as mentioned in the methodology.

Table 1 Contemporary mobile apps and services in agriculture

Sl. No.	Name of the mobile app	Developed by	Downloads	Rating	Category	Supported languages
1.	Karshakan	Spring lab technologies	1000	4.8	News and magazines	Malayalam
2.	Farming matters	Primesoft	1000	4.8	News and magazines	English
3.	Sreshta krishi	Prakruthi & Technopark	1000	4.6	News and magazines	English
4.	Karshikavivara sanketham	Department of Agricultural development & farmer's welfare	5000	4.6	Productivity	Malayalam English
5.	Agriland	Agriland media	5000	4.6	News and magazines	English
6.	Krishi	Philosan technologies	10,000	4.5	Health & fitness	Malayalam
7.	IFFCO Kisan	IFFCO Kisan	10,000	4.5	News and magazines	10 languages
8.	ZBSF	Smart City App	50,000	4.5	Business	Hindi
9.	Krushi Dhan CropMandiPrices	Creators Corporation	10,000	4.4	News and magazines	English
10.	my RML for farmers	RMLISPL	100,000	4.3	News and magazines	English

11.	GPS Fields Area Measure	Studio Noframe	5,000	4.3	Productivity	English
12.	Kheti-Badi	Kheti-Badi app	5,000	4.3	Education	4 languages
13.	Totheself	Agrotypos S.A.	1000	4.3	Business	English
14.	Kisan Suvidha	Mobile Seva	100,000	4.3	Social	English
15.	Modern kheti agricultural farm	Gurupreet Khattra	1000	4.3	News and magazines	English
16.	Harvest loss calculator	Ag Phd	10,000	4.3	Business	English
17.	Learn AgriEngineering	WAGmob	10,000	4.2	Books and references	English
18.	Fertilizer Calculator 4India	Dr. Vishwanat Koti	10,000	4.2	Productivity	English
19.	Hoosier Ag Today	Loadout	1000	4.2	News and magazines	English
20.	Brownfield Mobile	Brownfield Ag news	5000	4.2	News and magazines	English
21.	Deficiencies	Ag PhD	10,000	4.1	Books and references	English
22.	Gram seva	metalwihen (Neil Mathew)	5000	4.1	Travel and local	English
23.	Agriculture Dictionary	ERMILOGIC	10,000	4.1	Books and references	English
24.	Agri-Precision-Agriculture	LEONARDO OM	50,000	4.1	Tools	English
25.	Farming Calculator PRO	SamF	50,000	4.0	Tools	English

26.	Fertilizer removal by crop	Ag PhD	10,000	4.0	Books and references	English
27.	Horticulture	Nikhilredyy Gujjula	10,000	4.0	Books and references	English
28.	Krishi gyan	ISAP India	10,000	4.0	Communication	Hindi
29.	Agriculture Forum	Freshvine	1000	4.0	Communication	English
30.	Digital mandi India	Appkiddo	10,000	3.9	News and magazines	English
31.	FEM @ Mobile	KAU -KVK, Malappuram	1000	3.9	News and events	English
32.	Ag Weed ID	Penton	10,000	3.8	Tools	English
33.	Karshika Keralam	Department of Agricultural development & farmers' welfare	500	3.7	Productivity	Malayalam English
34.	Appgro	Appgro solutions	5000	3.7	Tools	English
35.	Bazar ke Bhav	Reallyyours.com	5,000	3.6	News and magazines	English

(Data as on the month of March, 2016; the number of downloads and ratings are liable to change on course of time)

Of the m-apps listed here, *Karshakan* and *Farming matters* were the highly rated apps with a rating 4.8, followed by *Sreshta krishi, Karshikavivara sanketham*, and *Agriland* which had a rating of 4.6 each. The Malayalam app, *Krishi*, the app of *IFFCO Kisan*, and the *ZBSF app* had a rating of 4.5 each. Of

the 35 apps, 29 apps were having a rating of 4 and above, showing the effectiveness of these apps rated by its users.

The m-apps in agriculture available in the local language (Malayalam) includes *Karshakan* (rating of 4.8), *Karshika vivara sanketham* (4.6) *Krishi* (4.5), *IFFCO Kisan* (4.5) and *Karshika Keralam* (3.7). Of these, *Karshakan* is an app that provides price information. *Karshika vivara sanketham* (4.6), *IFFCO Kisan* (4.5) and *Karshika Keralam* (3.7) are apps developed by governmental/public sector organisations. *Kisan Suvidha* and *FEM @ mobile* were also developed by governmental/public sector organisations. Information provided through governmental/public sector organisations will be more authentic.

As can be seen from Fig. 1, Out of the 35 apps listed (Table 1) majority (54%) of the apps were providing information on price of agricultural commodities, weather related information and advisory services followed by 23 per cent of the apps providing technical information that included soil and water management, plant protection measures and IPM. Nine per cent of the apps were providing information related to organic farming. Eight per cent of the apps were providing input related information such as seed rate, number of plants per unit area and fertilizer recommendations. Three per cent each of the apps were providing information related to nutrient deficiency symptoms in various crops, its control measures and harvest loss calculations. Thus it is clear that, the currently available m-apps mainly focus on price information, weather information and advisory services.

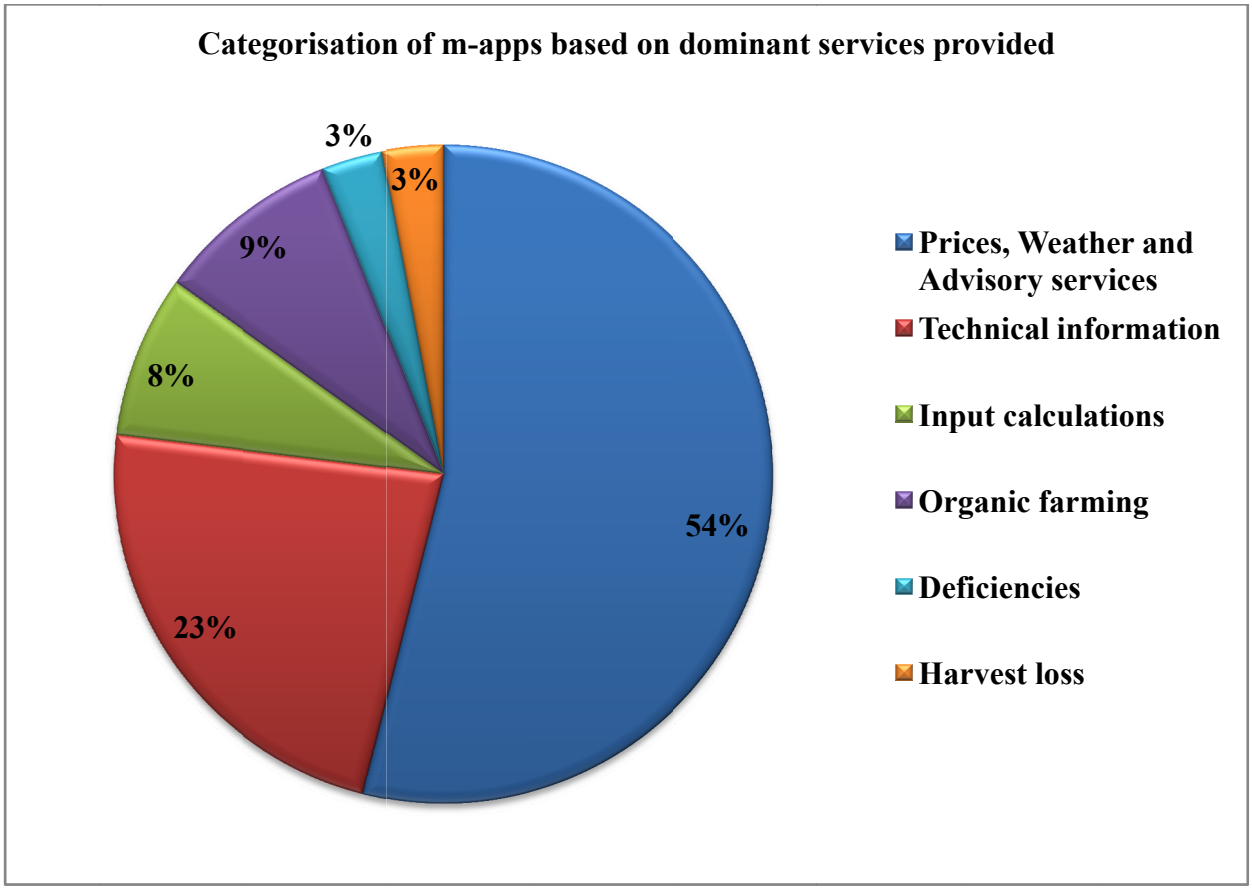

Fig. 1 Categorisation of m-apps based on dominant services provided

The features and specialities of the mobile apps related to agriculture and allied sector, listed in Table 1 are briefed here:

1. Karshakan

This app provides daily market prices of agricultural commodities. This app provides the updated price information to farmers in the form of push notifications.

2. Farming matters(ILEIA)

This app provides knowledge and updated information on small-scale agriculture in Netherlands. Previously this information was provided through quarterly magazine published by ILEIA which took the form of an app for easy access among users.

3. Sreshta krishi

This app was developed with the intention of exploring the Information Technology among farming community to the extent possible.

4. Karshika vivara sanketham

This is the Malayalam app suited to Kerala conditions which promote the online purchasing and selling of agricultural commodities. In addition to this the app also helps in clearing the queries raised by farmers with the help of experts.

5. Agriland

This is the popular farming app in Ireland. It is the source for providing updated information on farming, agricultural news and technical farm content. It also provides agribusiness related information. It covers information on agriculture and allied sectors like animal husbandry, machinery, grassland management and farm news of European Union.

6. Krishi

This app provides information specific to organic cultivation of fruits and vegetables. The special feature of this app is providing the detailed procedure for preparing organic manures.

7. IFFCO Kisan

This app provides need based agricultural information in 10 Indian languages. It gives information on mandi prices, weather forecast, expert advice

on agriculture and allied sectors and government schemes. Provides agriculture advisory service in the form of audio clip for easy access to farmers.

8. ZBSF

This app was developed by Mr. Subash Palekar to promote zero budget farming practices among farmers by providing relevant information. It is called zero budget natural farming.

9. Krushi Dhan Crop Mandi Prices

The app provides information on mandi prices of various agricultural commodities in India. It provides minimum, maximum and model price of commodities at different districts of different states. It provides live prices of commodities from more than 3000 markets.

10. myRML for Farmers

It is a comprehensive agri info app that provides information on prices of various commodities, weather forecast, news on government announcements, policy decisions and market intelligence in the form of bulletin, advisory and messaging services as per their location and in preferred language. It provides access to information specific to 450 crop varieties from 1300 markets and 3500 weather locations across 50,000 villages and 17 states of India.

11. GPS Fields Area Measure

This app is helpful for taking quick measurement of area, distance and perimeter of field for the purpose of land survey, field pasture area measure, garden and farm work planning, area records, agricultural fencing and solar panel installation in smart and super accurate mode. An auto link will be generated with boundaries/ directions/ route of selected area and can be shared with others which can be accessed through Google map.

12. Kheti-Badi (Organic farming app)

This is a social initiative app that aims at promoting and supporting organic farming and farmer related issues in India. This app helps farmers to make informed decisions to convert their chemical oriented farming to organic oriented farming thereby improving their livelihoods.

13. Totheshelf

This app enables all the members involved in the supply chain *i.e* from producers to consumers to post their buy or sell items, search for required items either from local or global markets and facilitate direct contact of seller or buyer of their interest. It helps farmers to contact traders and consumers easily, while helps traders and consumers to get quality products directly from farm.

14. Kisan suvidha

This app gives information on weather, plant protection, IPM practices, agro-advisory and market prices. Uniqueness of the app includes weather alerts, market price of commodity in the nearest market and maximum price of the commodity at state level.

15. Modern kheti agricultural farm

This app provides information related to agriculture and dairy farm. Provides agricultural directory and yellow pages for agriculture for anyone who is willing to include the details of their own products as an advertisement at free of cost. Also publishes research articles.

16. Harvest loss calculator

This app helps in determining how much of the crop is being left in field after harvest. The user needs to select the crop and give the number of seeds that can be counted on ground in a unit area. The app in turn calculates the harvest loss.

17. Learn Agricultural Engineering

The app provides access to limited content for free installations; for access to detailed contents the user has to pay. It provides summary of the essential concepts in Agricultural Engineering in a concise form covering various topics like principles of agriculture and horticulture, levelling and surveying, environmental impact, soil mechanics, agri business and biotechnology.

18. Fertilizer calculator 4 India

This app acts as calculator for estimating the required amount of fertilizer so as to meet the requirement of essential elements like N, P, K required by crops.

The required quantity of N, P, K is to be entered and this app gives nearly 11 combinations of fertilizers supplying the required amounts of N, P and K.

19. Hoosier Ag Today

This app provides information on agriculture news, commodity market information, weather forecast that helps Indian farm and agri-business community. It also enables the users to listen to agricultural radio programs on their mobiles.

20. Brownfield Mobile

This app provides information on latest agricultural news, markets and live weather. It also provides audio reports on daily agri-news.

21. Deficiencies

The app helps in determining the crop deficiencies and soil fertility issues. It provides complete information about various nutrient deficiencies where the user can browse the images of deficiency symptoms crop wise.

22. Gram seva

This app provides information from government servers http://data.gov.in that help villagers (farmers) and traders to trace the market price of their commodities. The special features of this app include offline storage, auto synchronizing, backup and storage of commodity prices. The installer can share price details with others using SMS and email. It also provides free alerts according to user's interests.

23. Agriculture Dictionary

This is an online app available in English, which provides information on agriculture and allied sectors. It also provides European Union policies, Information and Communication Technologies aiming to help farmers, agronomists and students of agriculture.

24. Agri-Precision-Agriculture

This app is useful for farmers practicing precision agriculture. It helps in calculating field area, exports border and sample grid information to softwares of PC that controls the practices of precision agriculture.

25. Farming Calculator PRO

For freely installed app the user has restricted access only. This app helps in calculating seed rate, dosage of fertilizers and number of plants per unit area. The results and values of required content can be saved as e-mail.

26. Fertilizer removal by crop

This app guides farmer in planning the dosage of fertilizer application on farm. It provides the required amounts of vital nutrients based on the crop and expected yield.

27. Horticulture

This app provides information on cultivation practices, soil and water management, weather forecast and planting methods for crops such as apple, mango, jasmine, tuberose and some vegetables.

28. Krishi Gyan

This app provides agricultural information. The app is meant for rural farmers and is supported in only one language *i.e*, Hindi. It enables farmers to contact Krishi Gyan experts directly to clear their doubts related to farming practices.

29. Agriculture Forum

This app provides the platform for farmers and Agri professionals for discussions, interactions, sharing ideas and finding out solutions for agriculture related problems. This app is popular in Canada.

30. Digital Mandi India

Digital mandi provides price information for Indian commodities from 1117 mandis covering 211commodities from 27 states. In Kerala 46 places were covered providing price information for various commodities. It synchronizes the data from the Indian Government portal Agmarknet.nic.in – powered by NIC.

31. FEM@ Mobile

This app provides technical information on nearly 100 crops covering planting operations, variety details, fertilizer information, after care, harvest and storage, with special reference to Kerala conditions.

32. Ag Weed ID

This app helps in identifying weeds in crops like sorghum, corn, wheat, cotton, soybeans and rice. It provides images and detailed information about 75 weeds and their control measures. The user can narrow down his search by choosing crop, season, location and type of weed (broad leaved / grass). It provides the facility for user to upload an image from field and compare it with existing images.

33. Karshika Keralam

This app acts as a platform for the agricultural officers and farmers for attaining information on agri-business and modern methods of agriculture. Help the officers in clearing quieries of farmers without any delay.

34. Appgro

This app provides field information under three modules *viz*. monitoring, tillage and harvest.

35. Bazar ke Bhav

This app is meant for providing market information on various agricultural commodities in India.

After having a thorough analysis of the mobile apps in agriculture and allied sectors, it can be concluded that they were providing need based and location specific information in almost all the South Indian languages (Telugu, Tamil, Malayalam and Kannada) in addition to Hindi and English about cultivation practices of various crops, market information, weather information, agricultural technical information, organic farming, fertilizer dosages, pest and disease management, weed management and so on. Making use of these services will help the agricultural extension personnel to guide the farmers in a better way.

4.2 Personal profile of the respondents

The personal profile characteristics of the agricultural extension personnel selected for the study *viz*. age, gender, educational status, experience,

innovativeness and attitude towards using m-tools and occupational commitment are discussed here under separate headings.

4.2.1 Age

Table 2 indicates that 53.30 per cent of the agricultural extension personnel belonged to middle age category followed by 26.70 per cent young aged and 20 per cent old aged.

Table 2. Distribution of respondents based on their age (n=150)

Sl. No.	Category	No. of respondents	Percentage
1.	Young (<35 years)	40	26.70
2.	Middle aged (35-45 years)	80	53.30
3.	Aged (>45 years)	30	20.00

Thus it is clear that majority of the agricultural extension personnel were middle aged. The probable reason may be the time lapse in the recruitment of agricultural extension personnel by the Kerala State Department of Agriculture. The finding of the study is in line with those of Manty (2011), Ann (2013), Albert (2014) and Chitra (2015).

4.2.2 Gender

From Table 3, it is clear that more than half *i.e* 63.30 per cent of the agricultural extension personnel were females followed by 36.70 per cent males.

Table 3. Distribution of respondents based on gender (n=150)

Sl. No.	Category	No. of respondents	Percentage
1.	Male	55	36.70
2.	Female	95	63.30

Thus Table 3 clearly indicates that majority of the extension personnel in Kerala were females. It was due to the higher number of female students in the field of agriculture, as evident from the very high percentage of girl students in State Agricultural Universities (SAUs). The finding of the study is in accordance with the findings of Gregg and Irani (2004) and Chitra (2015).

4.2.3 Educational status

Educational status of the agricultural extension personnel were analysed based on two dimensions *i.e* the agricultural education and general education.

4.2.3.1 *General education*

Table 4. Distribution of respondents based on general education (n=150)

Sl. No.	Category	No. of respondents	Percentage
1.	SSLC	30	20.00
2.	Plus two or equivalent	4	2.70
3.	Degree	84	56.00
4.	Post-graduation	29	19.30
5.	Ph.D	3	2.00

It is clear from Table 4 that 56 per cent of the agricultural extension personnel possessed degree alone, while 19.30 per cent possessed an additional post-graduation and 2 per cent a Ph.D. graduation respectively. Very few respondents had only plus two or equivalent (2.7%), whereas 20 per cent had Secondary School Leaving Certificate (SSLC) alone. Of them only two agricultural assistants had undergone Post Graduate Diploma in Computer

Applications (PGDCA) course. Overall, 77.30 per cent of the agricultural extension personnel were degree holders.

4.2.3.2 *Agricultural education*

Table 5. Distribution of respondents based on agricultural education (n=150)

Sl. No.	Category	No. of respondents	Percentage
1.	Certificate Course in Agriculture	48	32.00
2.	VHSE (Agriculture)	29	19.40
3.	Diploma (Agriculture)	3	2.00
4.	B.Sc. (Ag/Horti)	47	31.30
5.	M.Sc. (Ag/Horti)	20	13.30
6.	Ph.D (Ag/Horti)	3	2.00

It is evident from Table 5 that 32 per cent of the agricultural extension personnel completed a certificate course in agriculture followed by 31.30 per cent who had graduation in agriculture/horticulture. Whereas 19.40 per cent possessed VHSE in agriculture as their educational status followed by 13.30 per cent of post- graduates in agriculture/horticulture. Diploma and Ph.D. holders accounted 3 per cent each. Altogether 46.60 per cent were B.Sc (Ag/Horti) degree holders, which was the basic qualification for getting the job as agricultural extension officer. The rest (53.40%) were having Diploma/VHSE/Certificate course in agriculture which was needed for getting the job of agricultural assistants in the Kerala State Department of Agriculture.

4.2.4 Experience

From Table 6 it is clear that 72 per cent of the respondents had more than five years of experience as agricultural extension personnel while 54 per cent had more than 10 years of experience. There were 31.40 per cent of the agricultural extension personnel who had more than 15 years of experience.

Table 6. Distribution of respondents based on their experience (n=150)

Experience in years	No. of respondents	Percentage
<5	42	28.00
5-10	27	18.00
11-15	34	22.60
>15	47	31.40

It is evident that the agricultural extension personnel under study were having good experience at field level agricultural extension. The findings are in line with the findings of Mabe (2012), Yakubu *et al*. (2013), Sumanasiri and Wanigasundera (2014).

4.2.5 Innovativeness

With regard to the innovativeness of agricultural extension personnel, the results are presented in Table 7.

Table 7. Distribution of respondents based on their innovativeness (n=150)

Sl. No.	Statement (category)	No. of respondents	Percentage
1.	As soon as it is brought to my notice (Innovator)	19	12.70
2.	After I had seen the success of it when tried by others (Imitator)	60	40.00
3.	I prefer to wait and take my own time (Fabian)	58	38.60
4.	I am not interested in adopting new technologies (Drone)	13	8.70

Majority (40%) of the agricultural extension personnel were imitators in case of adopting new technologies followed by 38.60 per cent fabians and 12.70 per cent and 8.70 per cent innovators and drones respectively. The probable reason may be that the extension personnel were not ready to accept new technologies without considering its pros and cons and they preferred to take time for accepting any new innovation.

4.2.6 Attitude towards m-tools

With regard to the attitude of agricultural extension personnel towards m-tools the results are presented in Table 8.

Table 8. Distribution of respondents based on their attitude towards m-tools (n=150)

Sl. No.	Category	No. of respondents	Percentage
1.	Low	20	13.30
2.	Medium	116	77.40
3.	High	14	9.30

Majority (77.40%) of the agricultural extension personnel showed medium level of attitude towards m-tools followed by 13.30 per cent and 9.30 per cent of them having low and high levels of attitude respectively towards m-tools. Even though they knew about m-tools, many of them did not have much idea and knowledge about using many m-tools and its advantages as their knowledge was superficial.

4.2.7 Occupational commitment

With regard to occupational commitment of respondents as agricultural extension personnel, the results are presented in Table 9

Table 9. Distribution of respondents based on their occupational commitment (n=150)

Sl. No.	Category	No. of respondents	Percentage
1.	Low	15	10.00
2.	Medium	107	71.30
3.	High	28	18.70

Table 9 shows that 71.30 per cent of the agricultural extension personnel belonged to medium category in the case of commitment towards their occupation, whereas 18.70 per cent had high level of occupational commitment followed by 10 per cent having low level of commitment. Thus it can be seen that the agricultural extension personnel in general, were with medium occupational commitment.

4.3 ICT profile of the respondents

The ICT profile of the agricultural extension personnel represents their exposure towards Information and Communication Technology and different ICT tools. It is explained in terms of number of e-literacy trainings attended, number of m-literacy trainings attended, gadgets owned, used and the frequency of use of gadgets.

4.3.1 E-literacy trainings attended

The trainings attended by the agricultural extension personnel related to e-literacy/e-education are presented in Table 10.

Table 10. Distribution of respondents based on the number of trainings attended related to e-literacy/e-education (n=150)

Sl. No.	Category	No. of respondents	Percentage
1.	No trainings	97	64.70
2.	One training	35	23.30
3.	Two trainings	18	12.00

From Table 10, we can see that majority (64.70%) of the agricultural extension personnel had not attended any e-literacy training, whereas 23.30 per cent and 12.00 per cent of them attended one and two trainings respectively. The findings are in accordance with the findings of Karanja (2014), Chitra (2015) and Kafura *et al*. (2016). Even though this is an era of ICTs, most of the extension personnel had not been exposed to trainings on ICTs. It may be either due to the lack of awareness of extension personnel about the importance of ICT enabled extension and such trainings or due to the lack of enough ICT related trainings

conducted by the State Department of Agriculture and other agencies, for the benefit of agricultural extension personnel.

4.3.2 m-literacy trainings

The results with regard to the trainings attended by the agricultural extension personnel related to m-literacy/m-education are presented in Table 11

Table 11. Distribution of respondents based on the number of trainings attended related to m-literacy/m-education (n=150)

Category	No. of respondents	Percentage
No trainings	150	100.0

Table 11 shows that 100 per cent of the agricultural extension personnel had not attended any trainings related to m-extension/m-tools/m-literacy/m-education/m-learning, which means so far not even a single training program had been conducted for extension personnel by the Department of Agriculture to improve their skills in using mobile phone for accessing information specific to agricultural aspects as well as mobile phone enabled technology transfer.

4.3.3 Gadgets owned and used

With regard to the gadgets owned and used by the agricultural extension personnel, the results are presented in Table 12.

Table 12. Distribution of respondents based on the gadgets owned and used (n=150)

Sl. No.	Gadget/device	Owned		Used	
		No. of respondents	Percentage	No. of respondents	Percentage
1.	Mobile phone	150	100.00	150	100.00
2.	Laptop/desktop	57	38.00	115	76.70
3.	Tablets	19	12.70	43	28.70
4.	Dongle/datacard	7	4.60	21	14.00
5.	Pendrive	86	57.30	105	70.00
6.	Scanner	12	8.00	116	77.30
7.	Printer	21	14.00	114	76.00
8.	External harddrive	8	5.30	19	12.70

Table 12 reveals that 100 per cent of the agricultural extension personnel had mobile phones of their own and were using it. On the other side only 5.30 per cent and 4.60 per cent of them were having external harddrive and dongle/datacard respectively on their own. As known to us, mobile phone is the most popular among the various gadgets. The use of scanner (77.30%), laptop/desktop (76.70%) and pendrive (76.00%) was also common among the agricultural extension personnel. On the other side only 14 per cent and 12.70 per cent of them were using dongle/datacard and external harddrive respectively.

4.3.4 Frequency of use of gadgets

The frequency of use of gadgets by the agricultural extension personnel is presented in Table 13.

Table 13. Distribution of respondents based on the frequency of use of gadgets (n=150)

Sl. No	Gadget/device	Frequently in a day	Twice in a day	Once in 2-3 days	Weekly	Monthly	Very rarely	Not using
1.	Mobile phone	92.00	8.00	-	-	-	-	-
2.	Laptop/desktop	12.40	32.00	30.3	9.3	1.3	8.7	6.00
3.	Tablet	4.70	3.30	10.70	5.30	2.70	2.00	71.30
4.	Dongle/datacard	6.00	1.30	4.00	-	-	2.70	86.00
5.	Pendrive	12.70	14.70	30.70	7.30	2.70	2.00	30.00
6.	Scanner	13.30	8.70	41.30	11.30	0.70	2.00	22.70
7.	Printer	29.30	12.70	46.00	4.00	-	0.70	7.30
8.	External harddrive	1.30	0.70	2.70	0.70	-	7.30	87.30

Table 13 shows that majority (92%) of the extension personnel were using mobile phone frequently in a day whereas external hard drive (87.30%), dongle/datacard (86%) and tablet (71.30%) were not used by majority of the extension personnel. Laptop/desktop was used by 32 per cent of the extension personnel twice daily. Comparatively higher percentage of extension personnel were using printer (46%), scanner (41.3%) and pendrive (30.7%) once in 2-3 days.

The comparative position in the use of various gadgets based on the mean scores can be seen in Table 14.

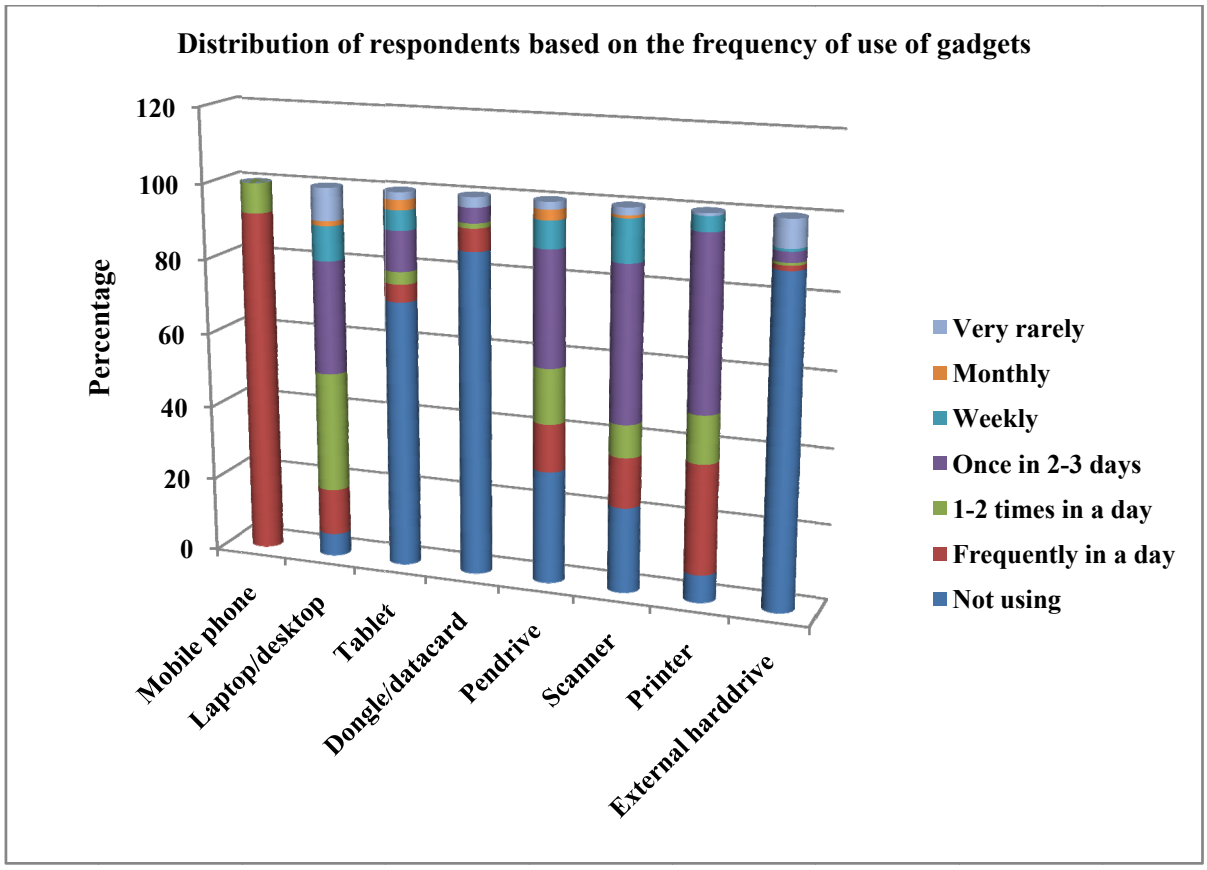

Fig. 2 Distribution of respondents based on the frequency of use of gadgets

Table 14. Mean scores of the frequency of use of gadgets by the respondents (n=150)

Gadget/device	Mean
Mobile phone	5.92
Laptop/desktop	3.32
Scanner	3.25
Printer	3.07
Pendrive	3.01
Tablets	1.12
Dongle/datacard	0.61
External hard drive	0.31

Table 14 shows that among all the gadgets/devices used, the most frequently used gadget was mobile phone with a mean value of 5.92 followed by laptop/desktop (Mean=3.32), scanner (Mean=3.25), printer (Mean=3.07), and pendrive (Mean=3.01). Whereas tablets (Mean=1.12), dongle/datacard (0.61) and external harddrive (0.31) were found as less frequently used devices by the agricultural extension personnel. Mobile phone is the frequently used device because these days it became the basic source for generating, sharing and accessing any information within the reach with a single touch.

4.3.5 Access to basic requirements

With regard to the access to basic requirements for use of m-tools by the agricultural extension personnel, the results are presented in Table 15.

Table 15. Access to basic requirements for using m-tools by the respondents (n=113)

Sl.No	Basic requirement	Very Low	Low	Medium	High	Very High
1.	Internet connectivity	3.30	10.00	30.70	41.30	14.70
2.	English language proficiency	0.70	4.00	74.70	16.70	4.00
3.	Techsavvy	1.30	11.30	63.30	20.00	4.00
4.	Knowledge on m-tools	8.30	42.00	25.70	21.30	2.70

Table 15 shows that majority (41.30%) of the extension personnel had high access to mobile internet connectivity, while 14.7 per cent had very high access. Altogether, a vast majority of the extension personnel had medium to very high access to mobile internet connectivity. The English language proficiency (74.70%) and techsavvy nature (63.30%) were noticed as medium. However, their knowledge about m-tools (42%) was low. The mean scores obtained for the existence of these basic requirements, as perceived by the extensionists are furnished in Table 16.

Table 16. Mean scores and ranks showing access to basic requirements by the respondents (n=113)

Basic requirement	Score	Mean	Rank
Internet connectivity	531	3.54	1
English language proficiency	479	3.19	2
Techsavy	471	3.14	3
Knowledge about m-apps/m-tools	444	2.96	4

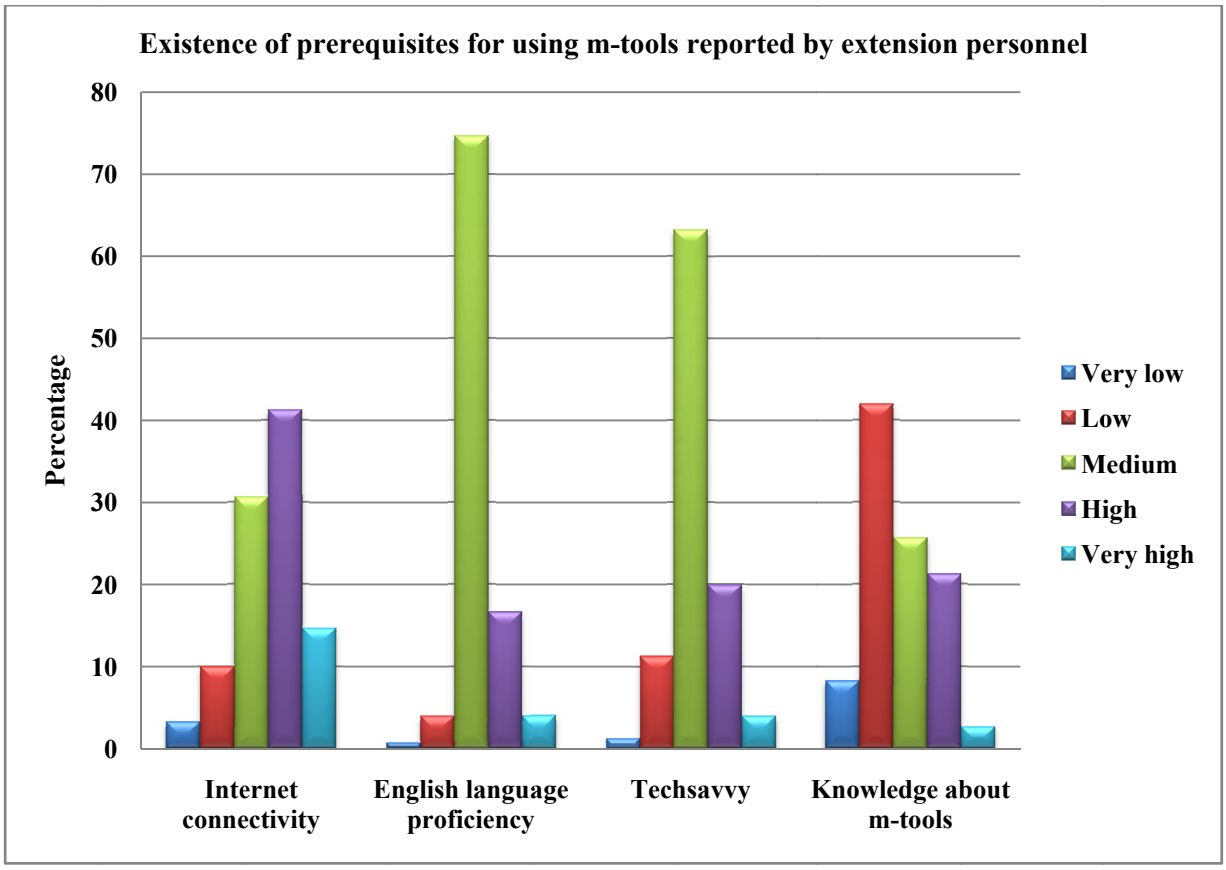

Fig. 3 Existence of prerequisites for using m-tools reported by extension personnel

Among various requirements, the internet connectivity (Mean=3.54) was ranked first showing that the internet connectivity was good and sufficient for accessing m-tools. This is surely because of the wide coverage and mobile networks in Kerala by many service providers. The English language proficiency (Mean=3.19) and techsavvy (Mean=3.14) of the agricultural extension personnel were found to be just above average which was also sufficient to access and use various m-tools. However the knowledge about m-apps/m-tools (Mean=2.96) was found comparatively less, adversely affecting access of various m-apps/m-tools which have to be addressed by the Department of Agriculture for transfer of technology through m-extension, for which relevant trainings have to be organised for the extension personnel.

4.4 Awareness on m-tools

The awareness of the agricultural extension personnel on m-tools were analysed and the findings are presented in Table 17.

Table 17. Distribution of respondents based on their awareness on m-tools (n=150)

m-tools in agriculture	Aware		Unaware	
	No. of respondents	Percentage	No. of respondents	Percentage
Mobile apps in agriculture	52	34.70	98	65.30
Kisan Call Centre – Govt. of India	126	84.00	24	16.00
Mobile group messaging services in agriculture	102	68.00	48	32.00
Mobile discussion groups in agriculture	78	52.00	72	48.00

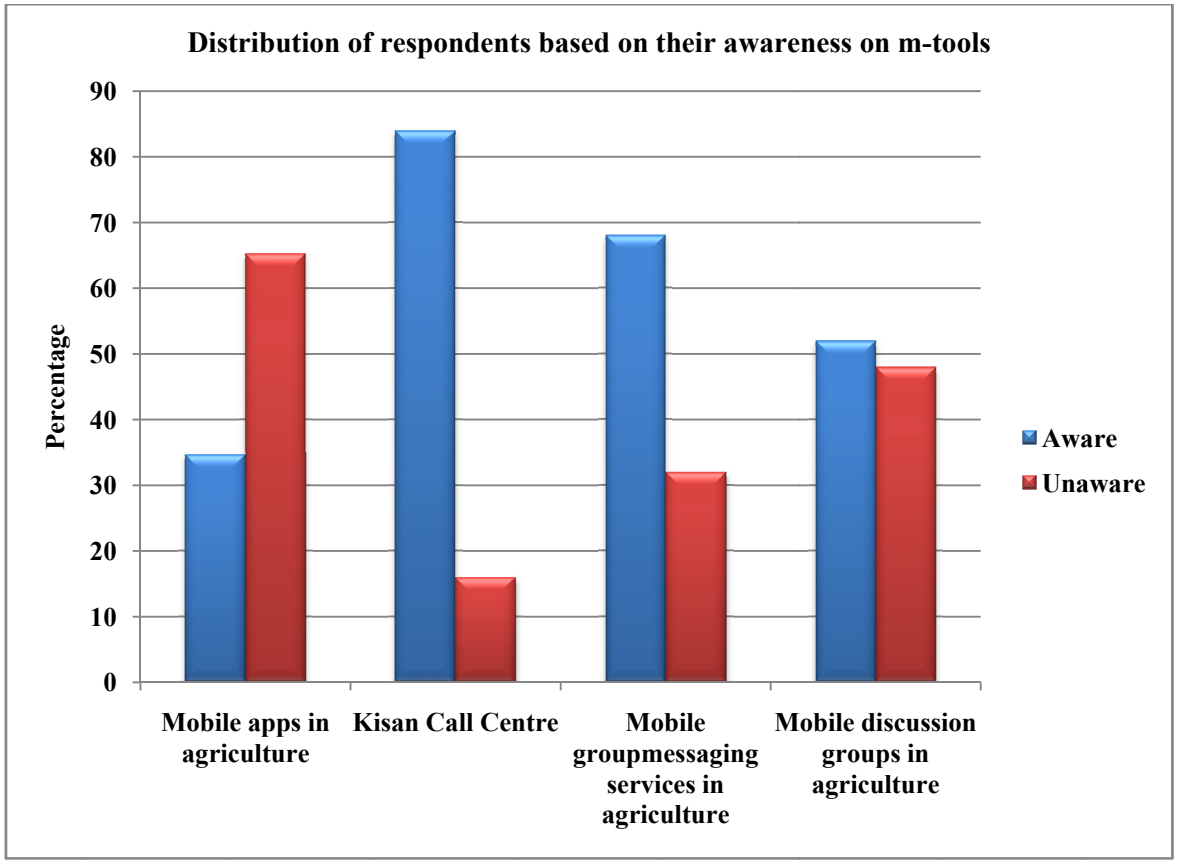

Fig. 4 Distribution of respondents based on their awareness on m-tools

Among all the m-tools, 84 per cent of the agricultural extension personnel were aware of Kisan Call Centre (KCC). KCC is a facility meant mainly for farmers, now available almost all over India. Though good awareness about KCC was reported among the extension personnel, there exists an extension gap in creating awareness about KCC among farmers as evident from the very low level of awareness reported by Koshy *et al*., 2015.

Exactly 68 per cent of the extension personnel were aware of mobile group messaging services in agriculture which may be because of the popularity of the social messaging mobile app, Whatsapp. At the same time 52 per cent of the agricultural extension personnel were aware of mobile discussion groups in agriculture while 34.70 per cent were aware of mobile apps in agriculture. These days, social media is playing a significant role in information sharing which paved a way for various services like mobile group discussion and group chatting which keeps the individuals in touch at any point of time for easy access to information on a large scale.

The m-apps in agriculture that the respondents were aware of are Kisan suvidha, Krishi, IFFCO Kisan, Kisan mitra, Agriapp, Karshikavivarasanketham, Fertilizer calculator, Crop pest surveillance, FEM@ mobile, Agri-precision, Karshakan, Agridictionary, Organic farming, m-Kisan, Agrimarket, Apni mandi, Srestha krishi.

4.5 Extent of knowledge on m-tools

The results with regard to the extent of knowledge of agricultural extension personnel on m-tools are presented in Table 18.

Table 18. Distribution of respondents based on their extent of knowledge on m-tools (n=150)

Category	No. of respondents	Percentage
Low	104	69.30
Medium	42	28.00
High	4	2.70

As it can be seen from Table 18, more than half (69.30%) of the respondents had low level of knowledge on m-tools, whereas 28 per cent had medium level of knowledge on m-tools. It is to be noted that only 2.70 per cent of the agricultural extension personnel had high level of knowledge on m-tools. Thus it is evident that even though majority of the respondents were using smart phones for various purposes, most of them had only a low level of knowledge on m-apps in agriculture.

So as to get a detailed picture in this regard, the item wise knowledge indices are presented in Table 19.

Table 19. Level of knowledge of respondents on various items (n=150)

Sl.No	Item	Knowledge Index (KI)
1.	One m-app that provides technical information on agriculture	16.67
2.	One m-app that provides weather information	20.00
3.	One m-app that provides market price information of agricultural commodities	10.67
4.	The toll free number for Kisan Call Centre of Govt. of India	72.67
5.	Mode of information delivery through m-kisan	21.33
6.	There are no m-apps in Malayalam language Y/N	42.67

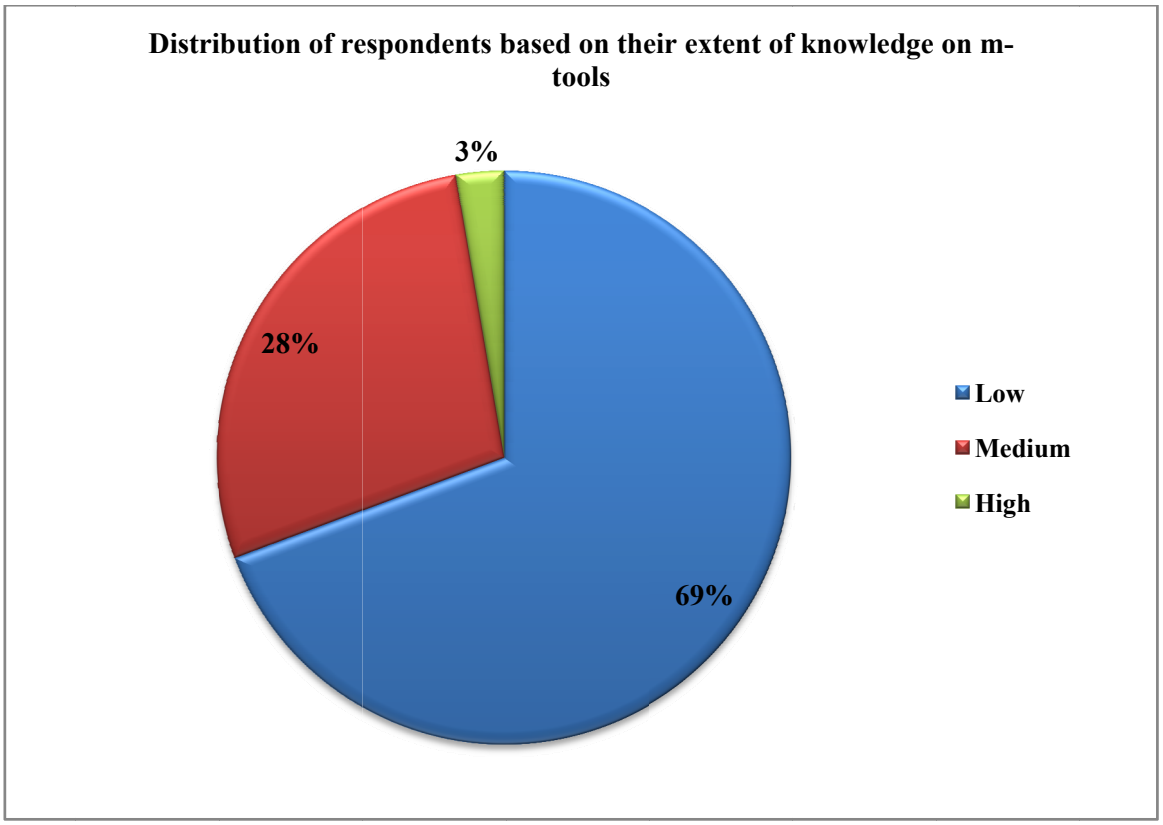

Fig. 5 Distribution of respondents based on their extent of knowledge on m-tools

7.	Queries can be sent to Kisan Kerala through SMS service T/F	52.67
8.	All m-apps are location specific Y/N	33.33
9.	IVRS provides visual and graphical information Y/N	28.67
10.	Google play store is the only app store for all types of mobiles Y/N	41.33
11.	Accepting the terms and conditions is compulsory for installing an app T/F	53.33
12.	Once an app is installed it automatically collects location data Y/N	18.00
13.	Apps providing daily market prices of agricultural commodities a) Digital mandi b) my RML c) Gram seva d) All the above	15.33
14.	Web portal that provide mobile SMS service in agriculture	25.33
	Mean	32.28

Results furnished in Table 19 reveals that the toll free number for Kisan Call Centre - Govt. of India was answered by majority (KI-72.67) of the respondents followed by item 11 (KI- 53.33) and item seven (KI- 52.67) whereas item number three (KI- 10.67) was the one answered by very few respondents. This reveals that the knowledge of agricultural extension personnel on different m-tools varies. It can be seen that most of the extension personnel were having knowledge about the Kisan Call Centre of Govt. of India. It may be because, they might have either used this service or have advised the farmers to utilise the service. A mean score of 32.28 indicates that the knowledge of extension personnel on m-apps was found to be comparatively very low. Most of the agricultural extension personnel were unable to name atleast one m-app in agriculture be it in the case of m-app that provides technical information in

agriculture/weather information/market information. Altogether it can be inferred that the knowledge of extension personnel on m-tools was low.

4.6 Extent of utilisation of m-tools

Extent of utilisation of m-tools in terms of type of mobile phone used by the agricultural extension personnel, the m-tools in agriculture used by them, frequency of using the m-tools and other important apps used by them on their mobile are discussed here.

4.6.1 Type of mobile phone used

The type of mobile phone possessed by the agricultural extension personnel was found to differ from individual to individual. Their access to m-tools may also vary.

Table 20. Distribution of respondents based on the type of mobile phone used (n=150)

Sl. No.	Type of mobile phone used	No. of respondents	Percentage
1.	Ordinary cellular phone	37	24.70
2.	Smart phone	113	75.30
	Android	100	66.60
	Windows	8	5.30
	Apple	5	3.40

It is evident from Table 20, that 66.60 per cent of the agricultural extension personnel were using android phones followed by 5.30 per cent using windows phone and 3.4 per cent using apple phone. Altogether, 75.30 per cent of the agricultural extension personnel studied were using smart phones. There were still 24.7 per cent of agricultural extension personnel who were using ordinary

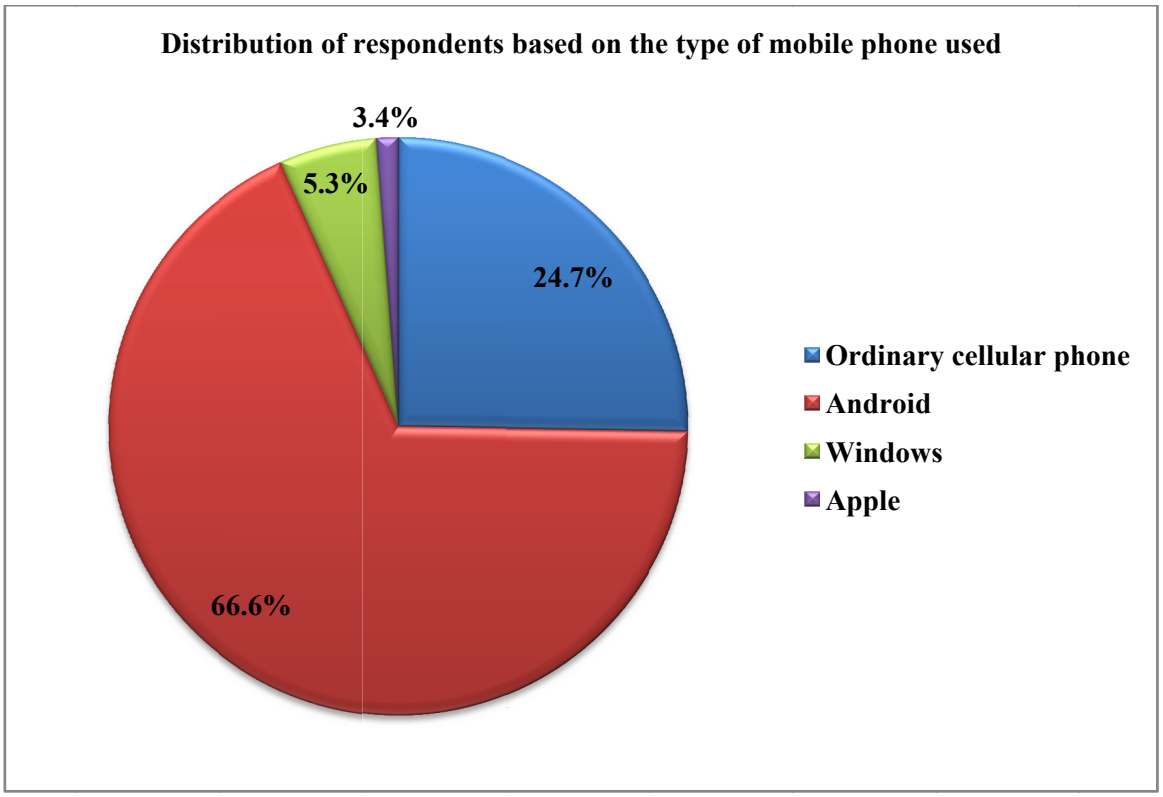

Fig. 6 Distribution of respondents based on the type of mobile phone used

cellular phone. The reason behind the predominant use of android mobile was its user friendliness and lesser cost as compared to windows and apple phones.

4.6.2 Important apps on mobile phone

Various m-apps available in the mobile phones and accessed by the agricultural extension personnel are presented in the Table 21

Table 21. Distribution of respondents according to the important apps available on their mobile phone (n=113)

Name of the app	No. of respondents	Percentage
Whatsapp	110	97.30
Gmail	108	95.50
YouTube	70	61.90
Facebook messenger	41	36.20
IMO	38	33.60
Amazon	37	32.70
Google map	35	30.90
Google chrome	26	23.00
Xender	24	21.20
Wechat	20	17.60
Hike	18	15.90
Newshunt	18	15.90
Hangouts	16	14.10
Google plus	15	13.20
Twitter	14	12.30
Skype	14	12.30
Yahoo mail	13	11.50
Shareit	12	10.60
OLX (OnLine eXchange)	12	10.60

Flipkart	11	9.70
Snapdeal	10	8.80
Google talk	9	7.90

At present, Whatsapp is the leading m- app for information sharing used by almost all the individuals who own a smartphone. It holds good in the case of the agricultural extension personnel, which is evident from the result that 97.30 per cent of them were using Whatsapp. Gmail (95.50) was the most predominantly used mailing service app by the extension personnel. The probable reason for this is majority (66.6%) of them were using android phone (See Table 20) the Operating System (OS) of which was developed by Google that provides inbuilt Google services such as Gmail, Google chrome, Google map *etc*. You Tube was used by 61.90 per cent of the extension personnel as it was the most widely used video sharing platform worldwide. IMO was used by 33.60 per cent of the extension personnel because of the free video call facility of that app. Of all the available e-commerce apps majority (32.70%) of the extension personnel were using amazon which was the largest online shopping platform. Similarly of all the other apps used for sharing files, majority (21.20%) of the extension personnel preferred to use Xender as it was easy to share large volume of files. Some of the other important apps available in the mobile phones of the agricultural extension personnel include Wechat (17.60%) for instant messaging, Hike (15.90%) for messaging and sharing images, audio and video files, Newshunt (15.90%) for updated news, Hangouts (14.10%) for messaging and video calling, Google plus (13.20%) for connecting with people of their interest, Twitter (12.30%) for making tweets (messages limited to 140 characters), Skype (12.30%) for making video calls, Yahoo mail (11.50%) for mailing services, Shareit (10.60%) for easy file transfer, OLX (10.60%) for online selling and purchasing of goods.

4.6.3 Purpose wise use of major apps

The soft wares/ apps used by the agricultural extension personnel for various purposes and the distribution of the respondents using the app are presented in Table 22

Table 22. Distribution of respondents based on the soft wares used on their mobile for various purposes

Purpose	App	No. of respondents	Percentage	% of respondents sharing Agri-information
Group messaging (n=105, 70%)	Whatsapp	95	90.40	86.60
	Facebook messenger	41	39.00	
Group discussion/group chat (n=80, 53.3%)	Whatsapp	77	96.20	88.70
	Facebook messenger	36	45.00	
e-mail (n=113, 75.3%)	Gmail	108	95.50	89.30
	Yahoo mail	13	11.50	
	Rediff	1	0.80	
Scanning (n=4)	CamScanner	3	75.00	Nil
	MD scannlite	1	25.00	
Agricultural market information	Nil	Nil	Nil	Nil
Agricultural technology	Nil	Nil	Nil	Nil
Weather information (n=11)	Accuweather	5	45.40	Nil
	Google weather	3	27.20	

	Weather app (Inbuilt in mobile)	2	18.10	
	News and weather	1	9.00	
Product/service information	Nil	Nil	Nil	Nil

From Table 22, it can be observed that only 70 per cent of the agricultural extension personnel were using group messaging services, out of which majority (90.40%) of them were using Whatsapp followed by Facebook messenger (39%) for this purpose. Likewise only 53.30 per cent of the agricultural extension personnel were using group discussion/group chat services, where Whatsapp (96.20%) was used by majority of them followed by Facebook messenger (45%). Similarly 75.30 per cent of the agricultural extension personnel were using e-mail, of which Gmail was used by majority (95.50%) of them followed by yahoo (11.50%). Of the 11 persons using m-apps for weather information, five persons were using Accuweather to get the weather updates. Only four persons were using m-apps for the purpose of scanning the documents out of which three of them were using CamScanner and the other person was using MD scannlite. Other agricultural extension personnel reported that they were sharing the documents by taking pictures even if it is not that clear as the scanned documents. They preferred this as an easy way for sharing the documents. None of the extension personnel were using any of the apps/softwares for getting information on agricultural marketing, agricultural technology and product/service information.

Among the extension personnel who were using these apps, 86.60 per cent were sharing agricultural information through group messaging followed by group discussion/group chat (88.70%) while 89.30 per cent of them were sharing agri-related information through Gmail.

4.6.4 Frequency of using m-tools

The frequency of use of m-tools by the agricultural extension personnel is presented in Table 23.

Table 23. Distribution of respondents based on the frequency of use of m-tools (n=150)

m-tools in agriculture	Frequency of use									
	Frequently		Occasionally		Sometimes		Rarely		Not using	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mobile apps in agriculture	9	6.0	16	10.7	10	6.7	11	7.3	104	69.3
Kisan Call Centre - Govt. of India	4	2.7	14	9.3	7	4.7	16	10.7	109	72.6
Mobile group messaging services in agriculture	30	20.0	32	21.3	13	8.7	11	7.3	64	42.7
Mobile discussion groups in agriculture	17	11.3	22	14.7	16	10.7	9	6.0	86	57.3

Table 23 reveals that most of the agricultural extension personnel were not using any of the selected m-tools. More than half (69.3%) of the agricultural extension personnel were not using mobile apps in agriculture. However, 10.7 per cent of them were using it occasionally while 7.3 per cent of them were using them rarely. Likewise 72.6 per cent of the extension personnel were not using Kisan Call Centre – Govt. of India whereas 10.7 per cent and 9.3 per cent of them

respectively were using it rarely and occasionally. Similarly 42.7 per cent of the agricultural extension personnel were not using mobile group messaging services in agriculture whereas 21.3 per cent were using it sometimes and 20.0 per cent of them were using it occasionally. While 57.3 per cent of the agricultural extension personnel were not using mobile discussion groups in agriculture 14.7 per cent and 11.3 per cent respectively were using it on occasional and frequent basis.

Thus, it can be inferred that majority of the agricultural extension personnel were not using mobile apps in agriculture, Kisan Call Centre and mobile discussion groups in agriculture. Time was the major limiting factor for making use of these mobile services /tools on frequent basis as expressed by the agricultural extension personnel.

4.7 Satisfaction towards m-tools in agriculture

The extent of satisfaction of agricultural extension personnel in respect of various m-tools are presented in Table 24

Table 24. Satisfaction indices of respondents towards selected categories of m-tools

m-tools in agriculture	Satisfaction index
Mobile apps in agriculture (n=46)	73.9
Kisan Call Centre - Govt. of India (n=41)	74.7
Mobile group messaging services in agriculture (n=86)	75.4
Mobile discussion groups in agriculture (n=64)	74.0

Table 24 shows that the satisfaction level of agricultural extension personnel towards selected categories of m-tools was found to be good. Of the 52 extension personnel who were aware of mobile apps in agriculture, 88.4 per cent were using them and showed a satisfaction index of 73.9 which may be because of

their choice towards user friendly apps providing need based information. Extension personnel showed a good satisfaction level (SI-74.7) towards Kisan Call Centre also may be because it provides access to the information and clears doubts at any point of time unlike other information sources. Mobile group messaging services in agriculture registered a satisfaction index of 75.4 and mobile discussion groups in agriculture registered a satisfaction index of 74.0. Majority of the agricultural extension personnel were found using these two tools as a mechanism for transferring information. Still they did not record the excellent category of satisfaction index may be because of the pumping of irrelevant information along with the required information.

4.8 Relationship between profile characteristics of respondents with dependent variables

Relationship between profile characteristics of the respondents with dependent variables *viz*; awareness on m-tools, extent of knowledge on m-tools, extent of utilisation and satisfaction towards m-tools is presented in Table 25.

Table 25. Correlation between profile characteristics of the respondents and dependent variables (n=150)

Sl. No.	Variable	r values			
		Awareness on m-tools	Extent of knowledge on m-tools	Extent of utilisation of m-tools	Satisfaction towards m-tools
1.	Age	0.058	0.065	0.019	0.121
2.	Agricultural education	-0.059	0.157	0.028	0.113
3.	General education	-0.147	0.124	0.097	0.068
4.	Experience	0.008	0.071	0.030	0.112
5.	e-literacy training	-0.029	0.052	-0.044	0.001
6.	m-literacy training	-	-	-	-

7.	Type of mobile phone used	0.076	-0.075	0.019	0.147
8.	Gadgets owned	0.263**	0.207*	0.255**	0.354**
9.	Gadgets used	0.306**	0.228**	0.207*	0.335**
10.	Frequency of use of gadgets	0.276**	0.273**	0.235**	0.339**
11.	Innovativeness	0.146	0.454**	0.339**	0.281**
12.	Attitude towards m-tools	0.149	0.248**	0.220**	0.188*
13.	Occupational commitment	-0.250**	-0.084	-0.224**	-0.130

** Significant at the 0.01 level

* Significant at the 0.05 level

Table 25 shows that the variables *viz.* gadgets owned, gadgets used and frequency of their use of gadgets showed a positive correlation with respect to the awareness of agricultural extension personnel on m-tools, extent of knowledge on m-tools, extent of utilisation of m-tools and satisfaction towards m-tools. Those who own gadgets will generally use them and their frequency of use depends on the purpose of use which enables them to be aware of various new technologies and improves their knowledge in that aspect. If they felt that a particular technology they were aware of is providing useful information, their extent of utilization would be more resulting in good satisfaction level.

Similarly innovativeness and attitude towards m-tools showed positive correlation with respect to the extent of knowledge on m-tools, extent of utilisation of m-tools and satisfaction towards m-tools. This may be because those who feel enthusiastic towards new technologies will adopt them and develop a better knowledge towards that technology. Likewise, if they are interested in adopting new technologies their extent of utilisation and satisfaction would be comparatively high. Occupational commitment showed negative correlation with respect to the variables such as awareness on m-tools and extent of utilisation of

m-tools, the probable reason may be lack of enough time from the part of agricultural extension personnel because of their high commitment towards their work which might have resulted in absence of updation about the advances in e-tools and m-tools.

4.9. Comparison of Agricultural Officers and Agricultural Assistants

4.9.1 Comparison of Agricultural Officers and Agricultural Assistants with respect to the dependent variables

Comparison of two groups *i.e* Agricultural officers (AOs) and Agricultural Assistants (AAs) with dependent variables *viz*; awareness on m-tools, extent of knowledge on m-tools, extent of utilisation and satisfaction towards m-tools is presented in Table 26.

Table 26. Comparison of Agricultural Officers and Agricultural Assistants with respect to the dependent variables (n=150)

Ranks and test statistics	**Awareness on m-tools**		**Extent of knowledge on m-tools**		**Extent of utilization of m-tools**		**Satisfaction towards m-tools**	
Category	**AO**	**AA**	**AO**	**AA**	**AO**	**AA**	**AO**	**AA**
Mean rank	76.41	74.59	80.31	70.69	81.53	69.47	85.03	65.97
Sum of ranks	5730.50	5594.50	6023.00	5302.00	6114.50	5210.50	6377.00	4948.00
Mann-Whitney U value	2744.500		2452.000		2360.500		2098.000	
Z value	-.266		-1.365		-1.711		-2.711	
Asymp.sig. (2-tailed)	.791		.172		.087*		0.007**	

** Significance at 0.01 level

*Significance at 0.1 level

The results from Table 26 shows that the mean ranks of the two groups for the dependent variables *i.e.* extent of utilisation of m-tools (AOs-81.53, AAs-69.47) and satisfaction towards m-tools (AOs-85.03, AAs-65.97) showed a significant difference. Thus it can be inferred that the Agricultural Officers and the Agricultural Assistants significantly varied with regard to extent of utilisation of m-tools and satisfaction. In both the cases Agricultural Officers stood higher than Agricultural Assistants. The assumption that there was no significant difference between mean ranks of the two groups holds good for the other two dependent variables *i.e.* awareness on m-tools (AOs-76.41, AAs-74.59) and extent of knowledge on m-tools (AOs-80.31, AAs-70.69). The reason for the significant difference between the two groups towards extent of utilisation and satisfaction towards m-tools may be that the Agricultural Officers were highly educated and proficient in English language which might have enabled them to make use of the new technologies without much difficulty. The other probable reason is that the Agricultural Officers are technically more qualified when compared to the Agricultural Assistants which might have prompted them to use new agricultural extension services.

4.9.2 Comparison of Agricultural Officers and Agricultural Assistants with respect to selected independent and dependent variables

Linear discriminant function analysis was used to differentiate the two groups of personnel namely Agricultural Officers (AOs) and Agricultural Assistants (AAs). The variables considered for linear discriminant function analysis were age, agricultural education, general education, experience, e-literacy, m-literacy, type of mobile phone used, gadgets owned, gadgets used, frequency of usage of gadgets, innovativeness, attitude towards m-tools, occupational commitment, awareness on m-tools, extent of knowledge on m-tools, extent of utilization of m-tools and satisfaction of using m-tools. The analysis resulted in a single linear discriminant function that could discriminate the variation between the two groups. The 16 standard canonical discriminant functions when assessed based on their relative contribution gave more emphasis

to the following sub set of variables. The sub set comprised of age, agricultural education, general education, gadgets owned, gadgets used, frequency of use of gadgets, innovativeness, occupational commitment and extent of knowledge on m-tools. The related results are presented in Table 24.

Table 27. Comparison of Agricultural Officers and Agricultural Assistants with respect to selected dependent and independent variables (n=150)

Sl. No	Variables	Standardized canonical discriminant function coefficients
1.	Age	0.686
2.	Agricultural education	0.811
3.	General education	0.353
4.	Experience	-0.020
5.	e-literacy training	0.141
6.	Type of mobile phone used	-0.113
7.	Gadgets owned	0.434
8.	Gadgets used	-0.429
9.	Frequency of use of gadgets	0.357
10.	Innovativeness	0.431
11.	Attitude towards m-tools	0.040
12.	Occupational commitment	-0.330
13.	Awareness on m-tools	-0.195
14.	Extent of knowledge on m-tools	-0.406
15.	Extent of utilization of m-tools	0.077
16.	Satisfaction towards m-tools	0.271

A brief look into the discriminating function coefficients furnished in Table 26 reveals the following facts: With regards to the age, all the AOs fall in a relatively higher age group the possible reason might be a delay in the new recruitments.

As regard to agricultural education, it is natural that AOs were more educated than AAs. In the case of general education also more or less the same phenomenon could be read.

With regards to the gadgets owned, AOs possessed more. The reason may be the multifarious roles of their job. Same reason applies to gadgets used and also frequency of usage of gadgets.

When innovativeness towards m-tools was considered, AOs were in better touch with the same because of their superiority platform officially. This might be the driving force for innovativeness towards m-tools.

With regards to the occupational commitment, reversal of the state could be seen mainly because of the unsatisfaction towards the working climate. The AAs might not be having any other forage area whereas AOs especially possessing a post graduate degree were in search of better job opportunities.

As regards to knowledge on m-tools, a special feature existed in knowledge on m-tools that most of the AOs and AAs had medium level of knowledge on m-tools whereas a few AOs had somewhat better knowledge on m-tools.

4.10 Constraints perceived by extension personnel in using m-tools

Constraints are the limitations or restrictions faced by the agricultural extension personnel in accessing m-tools. The constraints perceived by them are presented in Table 28 as follows

Table 28. Constraints perceived by extension personnel in using m-tools (n=150)

Sl.No.	Constraints	Score	Mean	Rank
1.	Non-availability of Malayalam interface	634	4.22	I
2.	Non-availability of mobile phone networks in remote areas	630	4.20	II
3.	Non-availability of user friendly m-apps	627	4.18	III
4.	Lack of exposure to m-education among extension personnel	623	4.15	IV
5.	Low level of e-readiness by extension personnel/organizations	614	4.09	V
6.	Non-availability of mobile phones supported audio-video files on agricultural technologies	593	3.95	VI
7.	Lack of awareness of various options available in the mobile phone	583	3.88	VII
8.	Poor ICT infrastructural development	569	3.79	VIII
9.	Policy inconsistencies by government in both telecommunication and agricultural sectors	568	3.78	IX
10.	Difficulty in loading of data files on mobile phone	544	3.62	X
11.	Limited access to worldwide databases	534	3.56	XI
12.	Certain soft wares are difficult to learn and use	531	3.54	XII

Of all the constraints listed, majority of the respondents felt non-availability of Malayalam interface as the important constraint with mean value of 4.22. Malayalam being the local language was preferred by most of the extension personnel for easiness in understanding the content. Unfortunately, m-tools available in Malayalam were very limited.

Non-availability of mobile phone networks in remote areas (4.20) was ranked as the second most important constraint. Though Kerala is blessed with good coverage of networks, some interior remote areas are there where signal tower is not nearby and was with poor connectivity.

Non-availability of the user friendly m-apps (4.18) was the other difficulty faced by the extension personnel which was because of the complexity with the existing apps which were not providing need based and location specific information.

Lack of exposure to m-education and low level of e-readiness by extension personnel/organizations was the next major constraint, as this may be because of lack of relevant trainings conducted for the staff of the Department of Agriculture. All types of mobile phones will not support multimedia files like videos. The compatibility and version of the mobile phone matters in this case, which may be the reason why the extension personnel mentioned non-availability of mobile phone supported audio video files. Some of the extension personnel were still reluctant to use smart phones as they felt that it was difficult to handle smart phones and they mentioned that they use mobile phone only for the purpose of telephone calling. Other constraints include poor ICT infrastructural development and policy inconsistencies by government in both telecommunication and agricultural sectors, difficulty in loading of data files on mobile phone, limited access to worldwide databases and certain softwares are difficult to learn and use.

4.11 Information required by the extension personnel

In this study, an attempt was made to know what are the specific categories of information required by the extension personnel. Majority (82.0%) of the extension personnel opined that m-apps are necessary for effective extension work and the information required/expected by them through m-tools and services, as opined/suggested by them are given in Table 26.

Table 29. Information required by the extension personnel

Sl.No.	Information	Frequency	Rank
1.	Pest and disease identification and control measures	55	I
2.	Mobile apps in local language (Malayalam)	48	II
3.	Weather related information	44	III
4.	Marketing aspects and updates	42	IV
5.	Availability of quality inputs	30	V
6.	Soil health condition and fertilizer recommendations	17	VI
7.	Location specific recommendations	16	VII
8.	Availability of new generation pesticides	15	VIII
9.	Detailed cultivation practices	13	IX
10.	Timely information from research centres	11	X
11.	Organic farming related information	11	XI
12.	Agriculture calendar of operations	2	XII

Table 29 shows that majority of the extension personnel felt that there is a need to provide crop specific pest and disease management measures through m-apps. They opined that it would be more advantageous if Malayalam apps in agriculture will be developed. Accurate and updated information on weather and market aspects specific to a location will help the extension personnel in providing recommendations to farmers. These days many private input dealers are providing low quality seeds, planting material and fertilizers, farmers who do not know these things will purchase those low quality inputs which ultimately results in low quality produce which brings loss to the farmers. So extension personnel felt that, if trustworthy app providing information about the availability of quality inputs is developed, farmers will be more benefited. They also felt that there is a need to develop an m-app that provides fertilizer recommendations specific to location. Extension personnel expressed that apps specific to certain other

information like package of practices of various crops, organic farming, timely information from nearby research centres, agricultural calendar of operations *etc*. are developed it will be more helpful to them in guiding farmers.

4.12Prospects of effective m-extension in Kerala

M-tools have the potential to change the mode of agricultural extension, as it can act as an effective aid to all the stakeholders engaged in agricultural extension system. They have added personal touch to the digital gadgets through voice calls, made understanding easier through pictures or photographs or videos and promise direct communication with agricultural experts anytime anywhere. In the near future, mobile based applications are likely to be integrated with ongoing agricultural extension programmes to enhance the speed of dissemination of technologies and hence the m-extension will become an integral part of agricultural extension.

However, the awareness and knowledge of agricultural extension personnel on various m-tools, especially about the m-apps in agriculture was very low. On the other hand, those extensionists who were using different m-tools were found satisfied with their use. So, if measures could be adopted to create awareness and generate knowledge about these tools and apps, they will be utilised by majority, as opined by them, which in turn would result in speedier and more effective technology dissemination. This is possible in the context of good basic qualification of extension personnel in agriculture. Skill development among extension personnel through capacity building programmes on effective use of m-tools will enhance the utilisation of alerts, latest news, management measures on pest and disease outbreak, weather forecast, and updates on prices of commodities through mobile apps will support all the stakeholders in meeting the contingent situations.

In addition, farmers should be encouraged to depend on mobile based advisory services for their information needs, which in turn would urge extension

personnel to become very familiar in utilizing all the available m-tools. Through this, the waiting period for FAS (Farm Advisory Services) can be reduced to greater extent since immediate solution for field problems are possible as photos/videos of the field problem can be shot or recorded and send to experts and get back the solutions instantaneously. Thereby the delayed and distorted information and the loss of yield due to occurrence of problems in farmers' fields can be reduced.

Though the availability of Malayalam apps was very limited, this was not a barrier for majority of the extension personnel, due to their fluency in English, the language in which most of the apps were made. However, many of the agricultural assistants were not having good fluency in English language and they demanded for apps in the local language, Malayalam. It is to be noted that the extensionists affirmed that, in this era of ICT, m-tools are necessary for effective extension, and they would definitely make use of it, provided tools/apps are available based on their information needs. If apps could be made available, based on the information needs of the extensionists as listed in this study, it would be highly useful to the agricultural extension system, as a whole. If measures are taken, as suggested in the study, m-tools have good prospects in the agricultural extension sector of Kerala. Thus, a major transformation in agricultural sector can be expected through the application of m-extension.

4.13 Strategies for effective m-extension in Kerala

1. Majority of the agricultural extension personnel were not having exposure to e-extension and m-extension. Similarly, most (65.3%) of them were not even aware of mobile apps in agriculture, as evident from Table 16. It is further revealed (See Table 23) that the agricultural extension personnel who were using m-tools showed a good satisfaction level. This clearly indicates that lack of m-tools was not the reason, but lack of awareness and knowledge, and the consequent lack of utilisation of m-tools prevented effective m-extension. So there is an urgent necessity for conducting relevant e-literacy and m-literacy

trainings to extensionists by the State Department of Agriculture, Kerala in collaboration with various training institutions.

2. The present study also revealed that 77.4 per cent of the agricultural extension personnel showed a medium level of attitude towards m-tools (Table 7) and in case of adopting a new technology 40 per cent of them were under imitator category (Table 6). Further, attitude towards m-tools and innovativeness of the extension personnel were found positively correlated with the extent of knowledge on m-tools and extent of utilisation of m-tools. In the light of these findings, the training programmes on m-extension should focus on

- Scope, importance and potential of m-tools in agricultural extension and transfer of technology
- Creating awareness and generating knowledge on m-tools among the extension personnel with special reference to m-apps in agriculture
- Skill development and Capacity building of extensionists in the use of m-tools
- Developing positive attitude towards m-tools, and making them innovative to adopt new technologies

3. As per the Government Order No: 14409/R2/2011/P& ARD, Govt. of Kerala has restricted the use of mobile phone during work hours in government offices. Though the G.O restricts the use of mobile phones for personal purpose only, during office hours, this makes the extension personnel reluctant to make use of their mobile phones, especially various apps including the group messaging and group discussion tools during office hours, may be due to fear of allegation. For m-extension the mobile phone may have to be used extensively including various apps like Gmail, Whatsapp, Facebook messenger and so on. Similarly an extension worker has to build good personal rapport with his farmers and other stake holders and hence we cannot clearly demarcate official contacts and personal contacts in many cases. This being the reality, the agricultural extension personnel should be exempted from the purview of this order in contacting with various stake holders in agriculture.

4. Even though Whatsapp and Facebook messenger were the popular social networking apps, there were some extension personnel who were not using these apps. Of the extension personnel who were using them only a few were sharing agricultural information (Table 21). Therefore extension personnel may be motivated to form farmer discussion groups on mobile, specific to their location so as to provide information on time where ever the members may be.
5. As suggested by majority of the extension personnel, services like mobile voice messages to language minorities should be provided which benefits the people in rural areas. It facilitates the individuals those who are not aware of operating smart phones.
6. Instead of text messaging services, videos showing relevant information should be made available to farmers for their easy understanding. This helps the farmers to understand the intended information without any distortion on their part.
7. Non-availability of sufficient Malayalam interface and user friendly m-apps are the major constraints identified in the study (Table 27). This might have prevented many of the extension personnel in using m-tools even though a number of mobile based services in agricultural sector are available. Such services can be made within the reach of people by providing information in local languages which can be easily understood by everyone. Not only the farmers but also majority of the Agricultural Assistants were not so proficient in English language. Providing m-tools in Malayalam language would also help the extension personnel in understanding the information and its relevance. Hence the tool developing centres can focus on user friendly m-apps in Malayalam language.
8. Even though majority (75.3%) of the extension personnel were using smart phones, there were still 24.7 per cent of them who were using ordinary cellular phone. Hence Government of Kerala may think of providing official smart phones for promoting m-extension in Kerala.
9. Low level of e-readiness by extension personnel and organisations was found as one of the limiting factors preventing effective m-extension. Policy level

decisions from the Government should be made to provide exposure to m-tools, m-education and m-extension so as to make them e-ready. Schemes on m-extension could also be thought of.

10. User friendly m-apps refer to the m-apps that are easy to handle and that should provide information based on the needs of the user. Majority of the extension personnel (82.0 %) felt that m-apps were ideal for effective extension work for which information on pest and disease identification and control measures, weather related and marketing updates, availability of quality inputs, fertilizer recommendations based on soil health and location specific information have to be provided. The developers of m-tools should focus on these areas.
11. Instead of pumping irrelevant information all the time, need based information is to be provided for better use of m-tools in agriculture. Similarly, instead of providing generalised information, location specific information is to be provided through m-tools.
12. The agricultural extension personnel of the Kerala State Department of Agriculture (Krishi bhavans) have to do a lot of clerical works and other non-technical works, as reported by them. High commitment to these official works acts as a hindrance in getting acquainted with new technologies as evident from the negative correlation of occupational commitment with awareness and utilisation of m-tools. Policy level intervention is required to redefine agricultural extension efforts to be undertaken by the Krishi bhavans in Kerala.

Summary and Conclusion

5. SUMMARY

Mobile phones have revolutionized the communication process and have become all-in-one magical devices to create, store, access and share information anytime and anywhere. It has become such an integral part of everyday life that its present estimated 7 billion subscriptions (ITU, 2106) almost equal the 95 per cent of the world's population.

Rapid growth of mobile telephony and the introduction of mobile enabled information services provide ways to improve information dissemination to the knowledge intensive agriculture sector and also help to overcome information asymmetry existing among the group of farmers. The development of mobile phone applications offers uses that extend well beyond voice and text communications, which can effectively be utilized by the agricultural extension personnel for information dissemination and transfer of technology. Thus mobile telephone services and applications could provide the most economic, practical, and accessible routes to information, markets, governance and finance for millions of people who have been excluded from their use.

There are many mobile phone applications and services available for agriculture and rural development. Kerala Agricultural University is also providing Mobile based services through a few research centers, KVKs and ATIC.

Utilizing such new applications and services on mobile phones helps the extension agents for speedy, accurate and timely supply of information to the farmers in various aspects related to agriculture and allied sectors. So far there were no research studies conducted on m-extension in Kerala. Hence a study in this line is worthwhile to understand the problems and prospects of m-extension in Kerala and to formulate strategies for effective m-extension. This study was undertaken with the following major objectives.

1. To analyse the awareness of extension personnel on m-tools.
2. To analyse the extent of knowledge of extension personnel on m-tools.

3. To analyse the extent of use of m-tools by the extension personnel.
4. To identify the constraints faced by the extension personnel in using m-tools.
5. To formulate strategies for effective m-extension.

The study was conducted in Kerala state, selecting one district each randomly from five agro-climatic zones of Kerala. From each district 15 krishi bhavans were selected randomly and from each krishi bhavan the Agricultural Officer and one among the Agricultural Assistants were selected randomly forming a total of 150 sample for the study.

Based on the thorough literature review and discussion with the experts the variables suited for the study were selected. It includes personal profile of the extension personnel such as age, gender, experience, educational status, innovativeness, attitude towards m-tools and occupational commitment. The ICT profile of the extension personnel studied includes e-literacy trainings attended, m-literacy trainings attended, the gadgets owned, gadgets used, frequency of use of gadgets and access to basic requirements. The dependent variables selected for the study were awareness on m-tools, extent of knowledge on m-tools, extent of utilisation of m-tools and satisfaction towards m-tools. The data were collected using a structured pre-tested interview schedule. Statistical tools like Percentage analysis, Spearman's rank correlation, Mann-Whitney U test and Linear discriminant analysis were employed for analysing the data and interpreting the results.

5.1 The salient findings of the study are

1. Majority of the agricultural extension personnel belonged to middle age category (53.3%) ranging from 35 to 45 years.
2. Most of the agricultural extension personnel of the State Department of Agriculture in Kerala were female (63.3%).

3. With regard to agricultural education, majority of the extension personnel (32.0%) did a certificate course in agriculture followed by 31.3 per cent B.Sc (Ag/Horti). In case of general education, more than half (56.0%) of the respondents were degree holders.
4. Most of the agricultural extension personnel (72.0%) had more than five years of experience. Similarly 54 per cent and 31.4 per cent of them with more than 10 and 15 years of experience respectively.
5. In case of adopting new technologies, majority of the agricultural extension personnel (40%) were imitators followed by 38.6 per cent fabians, 12.7 per cent innovators and 8.7 per cent drones. In case of adopting new technologies
6. About 77.4 per cent of the agricultural extension personnel showed medium level attitude towards m-tools followed by 13.3 per cent and 9.3 per cent of them with low and high levels of attitudes respectively.
7. About 71.3 per cent of the agricultural extension personnel belonged to medium category in the case of commitment towards their occupation, whereas 18.7 per cent and 10 per cent were having high and low levels of occupational commitment respectively.
8. More than half of the agricultural extension personnel (64.7%) had not attended any e-literacy training, whereas 23.3 per cent and 12.0 per cent of them attended one and two trainings respectively.
9. Cent per cent of the agricultural extension personnel had not attended any m-literacy training.
10. Cent per cent of the agricultural extension personnel had mobile phones of their own and were using it. The use of scanner (77.3%), laptop/desktop (76.7%) and pendrive (76.0%) were common among them.On the other side only 5.3 per cent and 4.6 per cent of them had external harddrive and dongle/datacard respectively on their own whereas 14 per cent and 12.7 per cent of them were using the gadets.
11. Mobile phone was the most frequently used device among the agricultural extension personnel with a mean score of 5.92 followed by laptop/desktop

(Mean=3.32), scanner (Mean=3.25), printer (Mean=3.07) and pendrive (Mean=3.01). Whereas tablets (Mean=1.12), dongle/datacard (Mean=0.61) and external harddrive (Mean=0.31) were found as the less frequently used devices.

12. Internet connectivity with highest mean score (3.54) was ranked first showing that the internet connectivity was good and sufficient for accessing m-tools. Th English language proficiency (Mean=3.19), tecsaviness (Mean=3.14) of the agricultural extension personnel were just above average, whereas knowledge about m-apps/m-tools (Mean=2.96) was found completely less.
13. About 84.0 per cent of the agricultural extension personnel were aware of Kisan Call Centre followed by more than half (68.0%) of them who were aware of mobile group messaging services in agriculture, whereas 52.0 per cent and 34.7 per cent of them were aware of mobile discussion groups and mobile apps in agriculture.
14. Majority of the agricultural extension personnel (69.3%) were having low level of knowledge on m-tools, whereas 28.0 per cent and 2.7 per cent of them were having medium and high levels of knowledge on m-tools.
15. About 75.3 per cent of the agricultural extension personnel were using smart phones whereas rest of the 24.7 per cent were using ordinary cellular phone.
16. Majority of the agricultural extension personnel were not using m-tools. About 72.6 per cent of them were not using Kisan Call Centre followed by 69.3 per cent of them who were not using mobile apps in agriculture. Similarly 57.3 per cent and 42.7 per cent of them were not using mobile discussion groups and mobile group messaging services in agriculture respectively.
17. The agricultural extension personnel who were using m-tools, showed a satisfaction index of 75.4 for mobile group messaging services in agriculture followed by 74.7, 74.0 and 73.9 for Kisan Call centre, mobile discussion groups and mobile apps in agriculture respectively.

18. Unavailabilty of Malayalam interface was ranked as the first important constraint with a mean value of 4.22 followed by non-availability of mobile phone networks in remote areas (Mean=4.20).

5.2 Implications of the study

1. Kerala State Department of Agriculture should take an initiative for conducting trainings on m-extension, as cent per cent of the agricultural extension personnel had not undergone any such training till now.
2. There is a need to improve the innovativeness of the extension personnel for adopting new technology as majority of them were under imitator and fabian categories.
3. Mobile phone was the most frequently used gadget by almost all the extension personnel, the role played by mobile phone in transfer of technology and its importance should me made known to the agricultural extension personnel.
4. Majority of the extension personnel had low level of knowledge on m-tools which can be improved by creating awareness on various m-tools and the role of them in information dissemination.
5. The agricultural extension personnel who were using m-tools showed a good satisfaction level. This clearly indicates that lack of m-tools was not the reason but lack of utilisation of m-tools prevented for an effective m-extension.
6. Unavailability of Malayalam interface and user friendly m-apps were identified as the important constraints. Hence the tool developing centres can focus on user friendly m-apps in Malayalam language.
7. Majority of the extension personnel (82.0 %) felt that m-apps were necessary for effective extension work provided if accurate and updated information were made available.

In conclusion, if new technologies 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 development of the system. Many Extension personnel were not using m-tools, not because of lack of m-tools but because of lack of awareness. Therefore training programmess should be organised to make them aware of m-tools and to develop a positive attitude among them as well as to promote their innovativeness. The study also indicated a low level of e-readiness and lack of exposure to e-education/m-education among the extension personnel; hence, adequate capacity building programmes should be organised for the extension personnel of the State Department of Agriculture to make them e-ready. User friendly m-apps are to be developed for gaining better prospects and tapping the full potential for m-extension.

5.3 Future line of work

1. The present study has focused on m-extension tools used by the agricultural extension personnel of Kerala. Studies can be undertaken to analyse the extent to which farmers are aware of and utilizing m-tools in agriculture.
2. Similar studies can be conducted among other categories of agricultural extension personnel including other extension units such as Agricultural Technology Management Agency (ATMA), Kerala State Horticultural Products Development Corporation (Horticorp), Krishi Vigyan Kendras (KVKs), State Horticulture Mission and Vegetable and Fruit Promoting Council Keralam (VFPCK). Similar studies can also be undertaken in the agricultural extension system of other states.
3. A detailed information need analysis of farmers and extension workers can be done so as to identify the information to be made available through m-tools

4. Studies may be undertaken so as to analyse the effectiveness of different m-apps in agriculture among various categories of stakeholders.

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Appendices

Appendix – I

Item analysis for Knowledge test

S.No	Item	Difficulty index	Discriminat-ion index
1.	Name one m-app that provides weather information_____(Any app providing weather information)	26.67*	0.1*
2.	Name one m-app that provides market price information of agricultural commodities _____(Any app providing market price)	56.67*	0.7*
3.	There are m-apps that provide agricultural technology information also. Yes/No (Yes)	93.40	0.2
4.	Updating the already installed app on mobile is a paid service.Yes/No (No)	90.00	0.1
5.	The toll free number for Kisan Call Centre of Government of India is _____(1800-180-1551)	34.61*	0.2*
6.	m-apps can be given a rating on 5-star scale. True/False (True)	100.00	0
7.	What is the mode of information delivery through m-kisan? _____(SMS,IVRS, Mobile app)	60.00*	0.7*
8.	As of now there are no m-apps in local (Malayalam) language. Yes/No (No)	56.62*	0.2*
9.	The mobile app developed by KVK, Malappuram _____(FEM@Mobile)	84.00	0.4
10.	The term “App” is the shortening of the term _____ (Application)	100	0
11.	All m-apps available in agriculture are paid services. Yes/No. (No)	86.67	0.4
12.	There is a chance that some apps can be malwares. Yes/No (Yes)	83.34	0.1
13.	Queries can be sent to kisan kerala through SMS service. True/False. (True)	70.00*	0.4*

14.	All the available m-apps are location specific. Yes/No (No)	70.00*	0.8*
15.	IVRS is one of the modes through which m-apps provide visuals and graphics. Yes/No (No)	43.34*	0.7*
16.	Agriculture related banking services are not possible through m-apps True/False (False)	61.54	-0.1
17.	The m-app once installed can be uninstalled easily. Yes/No (Yes)	93.34	-0.1
18.	Google play store is the only app store for all types of mobiles. Yes/No (No)	66.67*	0.3*
19.	Mobile apps are software programs that one can download and access directly using a phone. Yes/No (Yes)	96.67	0.1
20.	For installing an app from app store it is not compulsory to accept the terms and conditions provided. True/False (False)	70.00*	0.4*
21.	Guest user facility is available for using m-apps. True/False (True)	66.67	-0.1
22.	Once an app is installed on mobile it automatically collects location data. Yes/No (No)	36.67*	0.5*
23.	Name one m-app that provides technical information on agriculture _____(Any app that provides technical agricultural information)	79.62*	0.3*
24.	Which of the following provides daily market price of agricultural commodities? a) Digital mandi b) my RML c) Gram seva d) All the above. Ans: (d)	36.67*	0.1*
25.	There is a provision for providing reviews/comments about the usefulness/improvement of the app. Yes/no (Yes)	100.00	0
26.	An m-app can provide information on one particular aspect only. Yes/No (No)	70.00	-0.2

27.	Information about last update of each app is available. Yes/No (Yes)	70.00	-0.6
28.	Which of the following web portal provides mobile SMS service in agriculture? a) m-kisangov.in b) kissankerala.net c) celkau.in d) Both a&b Ans: (d)	40.00*	0.1*
29.	The information content in m-apps is available in English only. Yes/No (No)	60.00	-0.1
30.	As of now, there are no m-apps that promote organic agriculture. Yes/No (No)	16.67	-0.1

Appendix - II

Respondent n ☐

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

Tools and services for m-extension: problems and prospects

Interview Schedule

(For Academic purpose only)

1. Name of the respondent: _____

2. Phone no : _____

3. Place of work : Panchayath _____

Block _____

District _____

4. Age: _____ in years

5. Gender: Male ☐ Female ☐

6. Education: _____

7. Designation: _____

8. Experience: _____ in years

9. Training: Any training received on e-literacy/ e-education? **Yes** ☐ **No** ☐

a) If yes, please provide the following information for the last 5 years:

S.No	Name of the training programme	Content of training	Organization	Duration (in days)

b) Have you made use of the e-literacy/ e-education trainings undergone by you in your job? **Yes / No**

c) If Yes, please give the following details.

Work component	Mode of utilisation

d) If No, please mention why they were not utilized?

_____

_____

e) Have you undergone any training on m-education/m-literacy? **Yes / No**

f) If Yes, give details

_____

_____

10. Details of gadgets

Please put a tick (✓) mark for the gadgets you own and use among the following

*****Frequently in a day-**6;** 1-2 times in a day-**5**; Once in 2-3 days-**4**;
Weekly-**3;** Monthly-2**;** Very rarely-1

S.No	Gadget / Device	Owned	Used	Frequency of use (1-6)*	Purpose of use
1.	Mobile phone				
2.	Laptop				
3.	Tablets				
4.	Dongle / Datacard				
5.	Pendrive				
6.	Scanner				
7.	Printer				
8.	External harddrive				
9.	Others (specify)				

11. Type of mobile phone used

i. Ordinary cellular phone ☐

ii. Smart phone – Android ☐

Windows ☐

Apple ☐

Others ☐

12. Awareness and extent of utilization of m-tools

Please put a tick (✓) mark in the appropriate column

***A**- Aware; **UA**- Unaware

****F**- Frequently; **O**- Occasionally; **ST**- Sometimes; **R**- Rarely

*****HS**- Highly Satisfied; **S**- Satisfied; **N**- Neutral; **US**- Unsatisfied;

HUS- Highly Unsatisfied

S.No	m-tools	Aware *		Frequency of use**				Purpose of use	Satisfaction in using m-tools***				
		A	UA	F	O	ST	R		HS	S	N	US	HUS
1.	**Mobile apps in agriculture**												
	Mention the apps you are aware of												
	i.												
	ii.												
	iii.												
	iv.												
	v.												
2.	**Kisan Call Centre**												
	Govt. of India												
	KISSAN Kerala												
3.	Mobile group messaging services in agriculture												
4.	Mobile discussion groups in agriculture												

13. What motivated you to use m-tools?

_____

14. a) Details about softwares/apps used in your mobile phone

S.No	Purpose	Software/app used	Whether agriculture content is shared/generated
1.	Group messaging		
2.	Group discussion/ Group chat		
3.	e-Mail		
4.	Scanning		
5.	Agricultural market information		
6.	Agricultural technology		
7.	Weather information		
8.	Product information/ service information		
9.	Others		

b) What are the other important softwares/apps on your mobile?

1._____ **2. _____** **3. _____**

4._____ **5. _____**

14. Level of knowledge on m-tools

1. Name one m-app that provides technical information on agriculture **_____**
2. Name one m-app that provides weather information**_____**
3. Name one m-app that provides market price information of agricultural commodities**_____**
4. The toll free number for Kisan Call Centre of Government Of India is
   a)9400353216 b)1800-180-1551 c)9496852114 d)180-151-1800
5. What is the mode of information delivery through m-kisan?
   a)SMS b)IVRS c)Mobile app d)All the above
6. As of now, there are no m-apps in our local language (Malayalam). Yes / No
7. Queries can be sent to kissan kerala through SMS service. True / False
8. All the available m-apps are location specific. Yes / No

9. IVRS is one of the modes through which m-apps provide visuals and graphics. Yes / No
10. Google play store is the only app store for all types of mobiles. Yes / No
11. For installing an app from app store it is not compulsory to accept the terms and conditions provided. True / False
12. Once an app is installed on mobile it automatically collects location data. Yes / No
13. Which of the following provides daily market price of agricultural commodities?
    a)Digital mandi b)myRML c)Gram seva d)All the above
14. Which of the following web portal provide mobile SMS service in agriculture?
    a)m-kisan gov.in b)kissan kerala.net c)celkau.in d)Both a&b

15. Innovativeness

Q. When would you like to adopt an improved technology (m-tools)?

S.No	Statement	Tick
1.	As soon as it is brought to my knowledge	
2.	After I had seen the success of it when tried by others	
3.	I prefer to wait and take my own time	
4.	I am not interested in adopting new technologies	

16. Attitude towards m- tools

Please put a tick (✓) mark in the appropriate column

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

S.No	Statement	*SA	A	DA	SDA
1.*	Use of m-tools is a difficult process				
2.*	m-tools are not useful in agriculture				
3.	It is easy to understand agricultural technologies through m-tools				
4.	m-tools help to reduce workload in office				
5.	Our extension system will be very effective by introducing m-tools				
6.*	m-tools mediated communication is not an effective means of communication				
7.*	m-tools cannot provide need based information				
8.*	m-tools are not effective as that of web based tools				

9.	m-tools have important role to play in agricultural development process				
10.	m-tools will provide accurate and updated information				

17. Access to basic requirements for using m-tools

Please put a tick (✓) mark in the appropriate column

S.No	Basic requirement	Very low	Low	Medium	High	Very high
1.	Internet connectivity					
2.	English language proficiency					
3.	Techsavvy					
4.	Knowledge about m-apps/tools					

18. Occupational commitment

Please put a tick (✓) mark in the appropriate column

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

S.No	Statement	SA	A	DA	SDA
1.	If could, I would go into a different occupation other than that of Agricultural Extension Officer(AEO)				
2.	I can stick to my job as AEO for many years				
3.	My occupational choice as an AEO is a good decision				
4.	If could I would not have chosen this occupation				
5.	Even though money is a need, still I could continue in this occupation				
6.	Sometimes I am dissatisfied with this occupation				
7.	I liked this occupation too well to give up				
8.	I won't need any training for this occupation				
9.	I felt this as an ideal occupation for life work				
10.	I wish to choose different occupation other than that of an AEO				
11.	I am disappointed that, I entered this occupation				

19. Constraints perceived by extension personnel in using m-apps/tools in Agriculture:

Please put a tick (✓) mark in the appropriate column

VI- Very Important; **I-** Important; **L**- Less important; **LI**- Least Important; **NI**- Not Important

S.No	Constraint	VI	I	L	LI	NI
1.	Difficulty in loading of data files on mobile phone					
2.	Lack of awareness of various options available in the mobile phones					
3.	Mobile services are paid services					
4.	Lack of awareness about m-apps					
5.	Non-availability of useful m-apps					
6.	Non-availability of user friendly m-apps					
7.	Non-availability of Malayalam interface					
8.	Certain softwares are difficult to learn and use					
9.	m-tools are changing too fast to continue with current apps					
10.	Low level of e-readiness by extension personnel/organizations					
11.	Commercialization of m-extension tools					
12.	Limited access to worldwide databases					
13.	Lack of exposure to m-education among extension personnel					
14.	Policy inconsistencies by government in both telecommunication and agricultural sectors					
15.	Poor ICT infrastructural development					
16.	Non-availability of mobile phone supported audio-video files on agricultural technologies					
17.	Non-availability of mobile phone networks in remote areas					
18.	Any other					

20. a) Do you feel that m-apps are necessary for effective extension work? **Yes/ No**

b) If Yes, what is the specific type of information you expect to be provided through m-apps/ m-tools? (Name some specific apps (purpose) you expect)

i. _____

ii. _____

iii. _____

iv. _____

v. _____

21. Are there any other apps you would suggest or any improvements for existing apps?

i. _____

ii. _____

iii. _____

iv. _____

v. _____

കേരള കാർഷിക സർവ്വകലാശാല

കോളേജ് ഓഫ് ഹോർട്ടികൾച്ചർ, വെള്ളാനിക്കര

ഡിപ്പാർട്ട്മെന്റ് ഓഫ് അഗ്രികൾച്ചറൽ എക്സ്റ്റൻഷൻ

മൊബൈൽ എക്സ്റ്റൻഷൻ ഉപകരണങ്ങളും സങ്കേതങ്ങളും – പ്രശ്നങ്ങൾ, സാധ്യതകൾ

ചോദ്യാവലി

1. പേര് :
2. ഫോൺ :
3. ജോലിസ്ഥലം : പഞ്ചായത്ത് :
   ബ്ലോക്ക് :
   ജില്ല :
4. വയസ്സ് : വർഷം
5. സ്ത്രീ / പുരുഷൻ :
6. വിദ്യാഭ്യാസ യോഗ്യത :
7. ഉദ്യോഗപദവി :
8. പ്രവൃത്തി പരിചയം : വർഷം
9. ഇ-സാക്ഷരത / ഇ-വിദ്യാഭ്യാസം / ഇ-എക്സ്റ്റൻഷനിൽ പരിശീലനം ലഭിച്ചിട്ടു ോ?

   ഉ ് ☐ ഇല്ല ☐

   (എ) ഉ ങ്കിൽ താഴെ പറയുന്ന വിവരങ്ങൾ നൽകുക. (കഴിഞ്ഞ 5 വർഷത്തിനിടയിൽ)

ക്രമ നമ്പർ	പരിശീലന പരിപാടിയുടെ പേര്	പരിശീലനത്തിന്റെ ഉള്ളടക്കം	പരിശീലന സ്ഥാപനം	കാലയളവ് (ദിവസം)
1				
2				

☐ ☐

(ബി) ഇ-സാക്ഷരത / ഇ-വിദ്യാഭ്യാസം / ഇ-എസ്റ്റൻഷൻ പരിശീലന പരിപാടിയിൽ ലഭിച്ച അിറവുകൾ താങ്കളുടെ ജോലിയിൽ ഉപയോഗപ്പെടുത്തിയിട്ടു ോ?

ഉ ് ഇല്ല

(സി) ഉ ങ്കിൽ താഴെ പറയുന്ന വിവരങ്ങൾ നൽകുക.

ഉപയോഗിച്ച ഘടകം (എവിടെ ഉപയോഗിച്ചു)	**എങ്ങനെ ഉപയോഗിച്ചു**

(ഡി) ഉപയോഗപ്പെടുത്തിയിട്ടു ങ്കിൽ എന്തുകൊ ന്ന് വ്യക്തമാക്കുക.

(ഇ) മൊബൈൽ സാക്ഷരത / മൊബൈൽ വിദ്യാഭ്യാസം / മൊബൈൽ എക്സ്റ്റൻഷൻ എന്നിവയിൽ പരിശീലനം ലഭിച്ചിട്ടു ോ?

ഉ ങ്കിൽ വിവരങ്ങൾ നൽകുക

10. ഉപകരണങ്ങളുടെ വിവരങ്ങൾ

താഴെ പറയുന്നവയിൽ താങ്കൾക്ക് ഉള്ളതും താങ്കൾ ഉപയോഗിക്കുന്നതുമായ ഉപകരണങ്ങളുടെ വിവരങ്ങൾ അന്യയോജ്യമായ കോളത്തിൽ ടിക് (***) ചെയ്യുക.

1. ഒരു ദിവസത്തിൽ കൂടെക്കൂടെ
2. ദിവസത്തിൽ 1-2 പ്രാവശ്യം
3. 2-3 ദിവസത്തിൽ ഒരിക്കൽ
4. ആഴ്ചയിലൊരിക്കൽ
5. മാസത്തിലൊരിക്കൽ
6. വളരെ അപൂർവ്വമായി

ക്രമ നമ്പർ	**ഉപകരണം**	**സ്വന്തമായുള്ളത്**	**ഉപയോഗിച്ചത് / ഉപയോഗിക്കുന്നത്**	**ഉപയോഗത്തിന്റെ ആവൃത്തി**	**ഏത് ആവശ്യത്തിന് ഉപയോഗിച്ചു**
1	മൊബൈൽ ഫോൺ				
2	ലാപ്പ്ടോപ്പ്				
3	ടാബ്ലറ്റ്				
4	ഡോഗിൾ / ഡാറ്റാ കാർഡ്				
5	പെൻഡ്രൈവ്				
6	സ്കാനർ				
7	പ്രിന്റർ				
8	എക്സേറ്റണൽ ഹാർഡ്				

	ഡ്രൈവ്				
9	മറ്റുള്ളവ (വ്യക്തമാക്കുക)				

11. ഏതുതരം മൊബൈൽ ഫോൺ ആണ് ഉപയോഗിക്കുന്നത്?

(എ) സാധാരണ സെല്ലുലാർ ഫോൺ

(ബി) സ്മാർട്ട് ഫോൺ

ആൻഡ്രോയ്ഡ് ☐ വിൻഡോസ് ☐

ആപ്പിൾ ☐ മറ്റുള്ളവ ☐

12. മൊബൈൽ ഉപകരണങ്ങളെക്കുറിച്ചുള്ള അിറവും അതിന്റെ ഉപയോഗവും.

(താഴെ പറയുന്നവയിൽ ഉചിതമായ കോളത്തിൽ ടിക് (**) മാർക്ക് ചെയ്യുക).

* അിറയാം (A) അിറയില്ല (UA)

** മിക്കപ്പോഴും (F) കൂടെക്കൂടെ (O)

ചിലപ്പോൾ (ST) അപൂർവ്വമായി (R)

*** പൂർണ്ണ സംതൃപ്തി (HS) സംതൃപ്തി (S) കുഴപ്പമില്ല (N)

സംതൃപ്തിയില്ല (US) തീരെ സംതൃപ്തിയില്ല (HUS)

ക്രമ നമ്പർ	മൊബൈൽ ഉപകരണങ്ങൾ	അവ ബോധം		ഉപയോഗത്തിന്റെ ആവൃത്തി				ഉപ യോഗ ത്തിന്റെ ഉദ്ദേശം	മൊബൈൽ ഉപകരണങ്ങൾ ഉപയോഗിക്കുമ്പോഴുള്ള സംതൃപ്തി				
1	കാർഷിക മേഖലയിലെ മൊബൈൽ ആപ്പുകൾ												
	താങ്കൾക്കറിയാവുന്ന ആപ്പുകൾ ഏതെല്ലാം												
	i.												
	ii.												
	iii.												
	iv.												
	v.												

2	കിസാൻ കോൾ സെന്റർ ഭാരത സർക്കാർ കിസാൻ കേരള												
3	കാർഷിക മേഖല യിലെ ഗ്രൂപ്പ് മെസേജ് സർവ്വീസു കൾ												
4	കാർഷിക മേഖല യിലെ മൊബൈൽ ചർച്ച കൂട്ടാ യ്മകൾ												

13. മൊബൈൽ ഉപകരണങ്ങൾ, സവിശേഷതകൾ

മൊബൈൽ ഉപകരണങ്ങൾ ഉപയോഗിക്കാൻ നിങ്ങൾക്കുള്ള പ്രചോദനം എന്താണ്?

14. (എ) താങ്കളുടെ മൊബൈലിൽ ഉള്ള സോഫ്റ്റ്വെയർ/ആപ്പുകൾ

ക്രമനമ്പർ	**ഉദ്ദേശം**	**സോഫ്റ്റ്വെയർ/ആപ്പ്**	**കാർഷിക വിവര ങ്ങൾ ഷെയർ ചെയ്യാറുേ ാ?**
1	ഗ്രൂപ്പ് മെസേജിംഗ്		
2	ഗ്രൂപ്പ് ചർച്ച / ഗ്രൂപ്പ് ചാറ്റ്		
3	ഇ-മെയിൽ		
4	സ്കാനിംഗ്		
5	കൃഷി മാർക്കറ്റ് വിവരങ്ങൾ		
6	കൃഷി സാങ്കേതിവിദ്യ		
7	കാലാവസ്ഥ വിവരങ്ങൾ		
8	ഉത്പന്ന/സേവന വിവരങ്ങൾ		
9	മറ്റുള്ളവ		

(ബി) നിങ്ങളുടെ മൊബൈലിലെ പ്രധാന സോഫ്റ്റ്വെയർ / ആപ്പ്

1. 2. 3.

4. 5.

15. മൊബൈൽ ഉപകരണങ്ങളിലുള്ള അറിവ്

1. കൃഷി സാങ്കേതിക വിവരങ്ങൾ ലഭിക്കുന്ന ഒരു ആപ്പ്

2. കാലാവസ്ഥ വിവരങ്ങൾ ലഭിക്കുന്ന ഒരു ആപ്പ്

3. കാർഷിക ഉത്പന്നങ്ങളുടെ വിപണി/വിലനിലവാരം നൽകുന്ന ഒരു ആപ്പ്

4. ഭാരതസർക്കാരിന്റെ കീഴിലുള്ള കിസാൻ കോൾ സെന്ററിന്റെ ടോൾ ഫ്രീ നമ്പർ

എ) 9400353216 ബി) 180-1800-1551 സി) 9496852114 ഡി) 180-151-1800

5. എം-കിസാൻ വഴി കൃഷി വിവരങ്ങൾ നൽകുന്നത് താഴെപറയുന്ന ഏത് രീതി ഉപയോഗിച്ചാണ്?

6. പ്രാദേശിക ഭാഷയിൽ ഇതുവരെ മൊബൈൽ ആപ്പുകൾ ഇല്ല

ശരി / തെറ്റ്

7. എസ്.എം.എസ്. വഴി കിസാൻ കേരളയിലേക്ക് ചോദ്യങ്ങൾ ചോദിക്കാം.

ശരി / തെറ്റ്

8. ലഭ്യമായിട്ടുള്ള മൊബൈൽ ആപ്പുകളെല്ലാം പ്രാദേശികാടിസ്ഥാനത്തിലുള്ളതാണ്.

ശരി / തെറ്റ്

9. മൊബൈൽ ആപ്പുകൾ ചിത്രങ്ങളും ഗ്രാഫിക്സുകളും കൈമാറുന്ന ഒരു രീതിയാണ് ഐ.വി.ആർ.എസ്.

ശരി / തെറ്റ്

10. എല്ലാ മൊബൈലുകൾക്കും ഉള്ള ഒരേയൊരു ആപ്പ്സ്റ്റോറാണ് ഗൂഗിൾ പ്ലേ സ്റ്റോർ.

ശരി / തെറ്റ്

11. ആപ്പ് സ്റ്റോറുകളിൽ നിന്നും ആപ്പ് ഡൗൺലോഡ് ചെയ്യുന്നതിന് അവരുടെ വ്യവസ്ഥകൾ അംഗീകരിക്കേ കാര്യമില്ല.

ശരി / തെറ്റ്

12. ഒരു മൊബൈൽ ആപ്പ് ഡൗൺലോഡ് ചെയ്താൽ ലൊക്കേഷനെ സംബന്ധിച്ച വിവരങ്ങൾ ആപ്പ് സ്വയം ഡൗൺലോഡ് ചെയ്യും.

ശരി / തെറ്റ്

13. താഴെ പറയുന്നവയിൽ കാർഷിക ഉത്പന്നങ്ങളുടെ അതാത് ദിവസത്തെ വിപ ണിവില വിവരങ്ങൾ നൽകുന്ന ആപ്പുകൾ ഏതെല്ലാം?

14. കാർഷിക മേഖലയിൽ മൊബൈൽ എസ്.എം.എസ്. സർവ്വീസ് പ്രദാനം ചെയ്യുന്ന വെബ് പോർട്ടൽ ഏതാണ്?

എ) സികായൻ ഗവ. ഇൻ ബി) കിസാൻ കേരള നെറ്റ്

സി) സെൽ കെഎയു.ഇൻ ഡി) എയും ബിയും

15. ഇ+നൂതനത്യം

ക്രമനമ്പർ	പ്രസ്താവന	ടിക്
1	അവയെക്കുറിച്ചുള്ള വിവരം ലഭിക്കു മ്പോൾതന്നെ	
2	മറ്റുള്ളവർ അത് ഉപയോഗിച്ച് വിജയം ക തിനുശേഷം	
3	ഞാൻ എന്റേതായ സമയം എടുക്കും	
4	ഞാൻ പുതിയ സങ്കേതങ്ങൾ സ്വീകരിക്കുന്ന തിൽ തത്പരനല്ല	

16. മൊബൈൽ ഉപകരണങ്ങളോടുള്ള മനോഭാവം (അനുയോജ്യമായ കോളത്തിൽ ടിക് ** മാർക്ക് ഇടുക)

SA - ശക്തമായി യോജിക്കുന്നു A - യോജിക്കുന്നു

DA - വിയോജിക്കുന്നു SDA - ശക്തമായി വിയോജിക്കുന്നു

ക്രമന മ്പർ	പ്രസ്താവന	SA	A	DA	SDA
1	മൊബൈൽ ഉപകരണങ്ങളുടെ ഉപ യോഗം പ്രയാസമേറിയതാണ്.				
2	മൊബൈൽ ഉപകരണങ്ങൾ കൃഷി യിൽ ഉപയോഗപ്രദമല്ല				
3	കാർഷിക സാങ്കേതിക വിവരങ്ങൾ മൊബൈൽ ഉപകരണങ്ങളിലൂടെ എളുപ്പത്തിൽ മനസ്സിലാക്കാം				
4	ജോലിഭാരം കുറയ്ക്കാന്				

	മൊബൈൽ ഉപകരണങ്ങൾ സഹായിക്കുന്നു.				
5	മൊബൈൽ ഉപകരണങ്ങൾ വഴി എക്സറ്റൻഷൻ സംവിധാനത്തെ കൂടുതൽ ഫലപ്രദമാക്കാൻ സാധിക്കും.				
6	മൊബൈൽ ഉപകരണങ്ങൾ മുഖേനയുള്ള ആശയവിനിമയം ഫലപ്രദമല്ല				
7	ആവശ്യാനുസൃതമായ വിവരങ്ങൾ നൽകാൻ മൊബൈൽ ഉപകരണങ്ങൾക്ക് കഴിയില്ല.				
8	മൊബൈൽ ഉപകരണങ്ങൾ വെബ് അധിഷ്ഠിതമായ സർവ്വീസുകളുടെയത്ര ഫലപ്രദമല്ല				
9	കാർഷിക വികസനത്തിൽ പ്രധാനമായ പങ്കുവഹിക്കാൻ മൊബൈൽ ഉപകരണങ്ങൾക്ക് കഴിയും.				
10	കൃത്യവും കാലാനുസൃതവുമായ വിവരങ്ങൾ മൊബൈൽ ഉപകരണങ്ങൾ നൽകുന്നു.				

17. മൊബൈൽ ഉപകരണങ്ങൾ ഉപയോഗിക്കുന്നതിനുവേ അടിസ്ഥാനെ സൗകര്യങ്ങൾ

(അനുയോജ്യമായ കോളത്തിൽ ടിക് ** മാർക്ക് ഇടുക)

ക്രമനമ്പർ	അടിസ്ഥാന സൗകര്യം	വളരെ കുറവ്	കുറവ്	മീഡിയം	കൂടുതൽ	വളരെ കൂടുതൽ
1	ഇന്റർനെറ്റ് കണക്ടിവിറ്റി					
2	ഇംഗ്ലീഷ് ഭാഷാപ്രാവീണ്യം					
3	നൂതന ഉപകരണങ്ങൾ ഉപയോഗിക്കാനുള്ള കഴിവ്					
4	മൊബൈൽ ആപ്പ് ഉപകരണങ്ങളെ					

	ക്കുറിച്ചുള്ള അിറവ്					

18. ജോലിയോടുള്ള ആത്മാർത്ഥത

അനുയോജ്യമായ കോളത്തിൽ ടിക് ** മാർക്ക് ഇടുക.

SA – ശക്തമായി യോജിക്കുന്നു A – യോജിക്കുന്നു

DA – വിയോജിക്കുന്നു SDA – ശക്തമായി വിയോജിക്കുന്നു

ക്രമനമ്പർ	പ്രസ്താവന	SA	A	DA	SDA
1	സാധ്യമെങ്കിൽ ഞാൻ ഈ ജോലി (അഗ്രികൾച്ചർ എക്സ്റ്റൻഷൻ ഓഫീസർ) ഉപേക്ഷിച്ച് മറ്റു ജോലികൾ സ്വീകരിക്കും.				
2	കുറേനാൾ ഈ ജോലിയിൽ എക്സ്റ്റൻഷൻ വർക്കറായി തുടരാൻ എനിക്ക് ആഗ്രഹമു ്				
3	ഈ ജോലി എന്റെ നല്ല തീരുമാനമാണ്.				
4	എനിക്ക് പറ്റുമായിരുന്നെങ്കിൽ ഞാൻ ഈ ജോലി തിരഞ്ഞെടുക്കുമായിരുന്നില്ല				
5	പണം ഒരു പ്രധാന ഘടകമാണെങ്കിലും ഈ ജോലിയിൽ തുടരാൻ ഞാനിഷ്ടപ്പെടുന്നു.				
6	ചില സമയങ്ങളിൽ എനിക്ക് ഈ ജോലിയോട് അസംതൃപ്തി തോന്നാറു ്.				
7	ഉപേക്ഷിക്കാൻ കഴിയാത്തവിധം ഞാൻ ഈ ജോലി ഇഷ്ടപ്പെടുന്നു				
8	ഈ ജോലിക്ക് എനിക്ക് ഒരു പരിശീലനത്തിന്റെയും ആവശ്യമില്ല				
9	ജീവിത സാഫല്യത്തിന് ഇത് ഉത്തമമായ ഒരു തൊഴിലാണെന്ന് ഞാൻ കരുതുന്നു.				
10	എ.ഇ.ഒ.യുടെ ജോലിയല്ലാതെ മറ്റേതെങ്കിലും ജോലി തെരഞ്ഞെടുക്കാൻ ഞാൻ ആഗ്രഹിക്കുന്നു.				
11	ഈ ജോലിയിൽ ഞാൻ നിരാശനാണ്.				

19. കാർഷിക രംഗത്ത് മൊബൈൽ ഉപകരണങ്ങളുടെ / ആപ്പുകൾ ഉപയോഗിക്കുന്നതിൽ എക്സ്റ്റൻഷൻ ഏജന്റ് നേരിടുന്ന ബുദ്ധിമുട്ടുകൾ അനുയോജ്യമായ കോളത്തിൽ ടിക് മാർക്ക് ഇടുക.

- വളരെ പ്രധാനപ്പെട്ടത് - പ്രധാനപ്പെട്ടത്

- പ്രാധാന്യം കുറഞ്ഞത് - തീരെ പ്രാധാന്യം കുറഞ്ഞത്

- അപ്രധാനം

ക്രമ നമ്പർ	ബുദ്ധിമുട്ടുകൾ	VI	I	L	LI	NI
1	ഡാറ്റ ഫയലുകൾ മൊബൈലിൽ ലോഡ് ചെയ്യുന്നതിനുള്ള ബുദ്ധിമുട്ടച					
2	മൊബൈലിൽ ലഭ്യമായ വിവിധ ഓപ്ഷനെക്കുറിച്ചുള്ള അിറവില്ലായ്മ					
3	മൊബൈൽ ആപ്പുകളെക്കുറിച്ചുള്ള അിറവില്ലായ്മ					
4	മൊബൈൽ സേവനങ്ങൾക്ക് പണം ചിലവാക്കേ ിവരുന്നു					
5	ഉപകാരപ്രദമായ മൊബൈൽ ആപ്പുകളുടെ ദൗർലഭ്യം					
6	ഉപഭോക്തൃ സൗഹാർദ്ദപരമായ മൊബൈൽ ആപ്പുകളുടെ ലഭ്യത					
7	മലയാളം ഇന്റർഫേസിന്റെ ലഭ്യതയില്ലായ്മ					
8	ചില സോഫ്റ്റ്വെയറുകൾ പഠിക്കാനും ഉപയോഗിക്കാനും ബുദ്ധിമുട്ടാണ്.					
9	മൊബൈൽ ആപ്പുകൾ വളരെവേഗം മാറ്റങ്ങൾക്ക് വിധേയമാകുന്നു.					
10	എക്സ്റ്റൻഷൻ ഏജന്റിന്റെ / സംവിധാനങ്ങളുടെ ഇ-സാങ്കേതികവിദ്യയോടുള്ള വൈമുഖ്യം					
11	എം-എക്സ്റ്റൻഷൻ ഉപകരണങ്ങളുടെ വാണിജ്യവൽക്കരണം					
12	വേൾഡ് വൈഡ് ഡാറ്റ ബേസുകളുടെ കുറഞ്ഞ ലഭ്യത					
13	എക്സ്റ്റൻഷൻ ഏജന്റുമാരുടെ മൊബൈൽ നിരക്ഷരത					
14	കാർഷികരംഗത്തും ടെലി കമ്മ്യൂണിക്കേഷൻ രംഗത്തുമുള്ള ഗവൺമെന്റ് നയങ്ങളുടെ അസ്ഥിരത					
15	ഐ.സി.ടി. (വിവര വിനിമയ സാങ്കേതിക വിദ്യ) അടിസ്ഥാന സൗകര്യ വികസന കുറവ്					
16	കാർഷികരംഗത്ത് മൊബൈൽ ഫോൺ സപ്പോർട്ട് ചെയ്യുന്ന ഓഡിയോ-വീഡിയോ ഫയലുകളുടെ ലഭ്യതയില്ലായ്മ					
17	ഉൾപ്രദേശങ്ങളിലെ മൊബൈൽ നെറ്റ്വർക്ക് സേവന ലഭ്യതക്കുറവ്					
18	മറ്റെന്തെങ്കിലും					

20. എ) മൊബൈൽ ആപ്പുകൾ ഫലപ്രദമായ എക്സ്റ്റൻഷൻ സേവനങ്ങൾക്ക് അത്യാവശ്യമാണ് എന്ന് നിങ്ങൾക്ക് തോന്നുന്നുേ ാ?

ഉ ് / ഇല്ല

ബി) ഉെ ങ്കിൽ ഏതുതരം വിവരങ്ങളാണ് മൊബൈൽ ആപ്പുകളിലൂടെ പ്രദാനം ചെയ്യാൻ നിങ്ങൾ ആഗ്രഹിക്കുന്നത്. (നിങ്ങൾ പ്രതീക്ഷിക്കുന്ന ആപ്പുകൾ / നിങ്ങളുടെ ഏത് ആവശ്യത്തിനുള്ള മൊബൈൽ ആപ്പുകൾ ഏതെല്ലാമാണ്)

1)

2)

3)

4)

5)

21. കൃഷിയിൽ ഉപയോഗിക്കാൻ സാധിക്കുന്ന മറ്റേതെങ്കിലും ആപ്പുകൾ നിങ്ങൾക്ക് നിർദ്ദേശിക്കാൻ ഉേ ാ? നിലവിലുള്ള ആപ്പുകളിൽ ഏതെങ്കിലും മാറ്റങ്ങൾ നിങ്ങൾക്ക് നിർദ്ദേശിക്കാൻ ഉേ ാ?

1)

2)

3)

4)

5)

TOOLS AND SERVICES FOR m-EXTENSION: PROBLEMS AND PROSPECTS

By

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ABSTRACT OF THE THESIS

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ABSTRACT

Information and Communication Technology (ICT) has now become an integral part of the development process. Mobile phones added speed to the ICT revolution by converging the services to create, store, access and share information anytime and anywhere making them all-in-one magical device. It has become such an integral part of everyday life that it estimated 7 billion subscriptions (International Telecommunication Union, 2016) *i.e.* 95 per cent of the world's population. Rapid growth of mobile telephony and the development of mobile phone applications offer services to users that extend well beyond voice and text communications, which can effectively be utilized by the extension personnel for information dissemination and transfer of technology. Utilizing such new applications and services on mobile phones helps the extension personnel for speedy, accurate and timely supply of information to the farmers in various aspects related to agriculture and allied sectors.

The present study attempted to analyse the awareness, extent of knowledge, extent of utilization and satisfaction of extension personnel on m-tools. It also explored the constraints perceived by the agricultural extension personnel in using m-tools and formulated strategies for effective m-extension in Kerala. The study was conducted among 150 agricultural extension personnel selected randomly from five districts; which were selected from five agro-climatic zones of Kerala. Data were collected by using pre tested-structured interview schedule.

Contemporary mobile apps in agriculture suited to Indian conditions were identified based on ratings, and after downloading them, they were analysed for its contents on the specific information provided by them. Accordingly they were catalogued.

The personal profile of the agricultural extension personnel revealed that 53.3 per cent were under middle age category ranging from 35-45 years. It was found that a greater proportion (63.3%) of the respondents were female. With regards to their educational status, more than half (56%) of them possessed a degree as their basic education whereas with reference to agricultural education, 32 per cent had done a certificate course in agriculture followed by 31.3 per cent with B.Sc. (Ag/Horti) graduation. Exactly 31.4 per cent of them had more than 15 years of experience as extension personnel in the State Department of Agriculture. In case of adopting new technologies majority (40%) of the extension personnel were found as imitators, which revealed that they preferred to take their own time to adopt new technologies. Majority of the extension personnel showed medium level of attitude towards m-tools (77.4%) and medium level of occupational commitment (71.3%).

The ICT profile of the extension personnel revealed that 64.7 per cent of them had not attended any e-literacy training programmes whereas cent per cent had not attended m-literacy trainings. Mobile phone was the most frequently used gadget as it was owned by cent per cent of the extension personnel. Internet connectivity was good and sufficient for accessing various m-tools which secured a mean score of 3.54. Most (84%) of the extension personnel were aware of Kisan Call Centre when compared to other m-tools. In case of extent of utilisation, most of the respondents were not making use of m-tools but those who were making use of them showed a good satisfaction level.

Among the constraints perceived by the extension personnel in using m-tools, unavailability of user friendly m-apps in Malayalam language was identified as the major constraint followed by non-availability of mobile phone networks in rural areas, lack of exposure to m-education among extension personnel, low level of e-readiness by the extension personnel/organizations and so on.

Majority (82%) of the extension personnel opined that m-apps were necessary for effective extension work and the information required by them through m-tools comprised of information on pest and disease identification and control measures, location specific weather and marketing aspects, availability of quality inputs and so on.

In order to facilitate effective m-extension in Kerala, there is urgent necessity for organising e-literacy and m-literacy training programmes. Similarly there is a need to modify the G.O. No. 14409/R2/2011/P& ARD which stated a restriction on the use of mobile phone in work place. Mobile voice messages to language minorities focus on developing user friendly apps in Malayalam, providing official smart phones to extension personnel, exposure of extension personnel on m-education and policy level decisions to make the agricultural extension organisations e-ready are some of the strategies to be considered for effective m-extension in Kerala.