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A Review of Role of Mobile Based Advisory System for Transfer of Technologies for Sustainable Agricultural Development

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Authors' contributions

This work was carried out in collaboration between both authors. Author PR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript and managed the overall analyses of the study. Author NS managed the review of literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Mobile phones have established itself in the rural areas and are becoming quite popular both with farmer and farm women. These powerful electronic machines that were a farmer's dream earlier have become a reality as the farmer's can immediately make use of them to address their field problems and other farm difficulties. The Government gifted Kisan Call Centres (KCC) are functioning the all over India which give answers to the farmer queries in local languages to this toll free number 1800-180-1551. Grameen Phone is a commercial operation providing cellular services in both urban and rural areas of India, with approximately 40,000 customers. A pilot programme of Grameen Phone, through the Grameen Bank and a wholly owned subsidiary called Grameen Telecom, is enabling women members of the Grameen Bank's revolving credit system to retail cellular phone services in rural areas. This instrument is more than a means of communication and it is being used as a weapon for empowerment and fight poverty. Mobile advisory system have been

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developed and utilized for transfer of agricultural technologies for sustainable development across the world. The findings of the different mobile based studies conducted across the world have reviewed and presented for replicating the suitable models in similar situation for effective dissemination of the technologies. It is concluded that mobile platform is only tool to reach the last mile connectivity especially in rural areas for delivering need based technologies in time.

Keywords: Agriculture; mobile phone; farmers; organizations and mass media.

1. INTRODUCTION

The mobile phone introduced in India 1995, it has been gradual and drastic changes in the use of the mobile phones users in India. It is reported that the India's telecommunication market is the second largest in the globe. Nowadays the mobile phones are available to the people right from the age of 10 years. The current scenario of mobile phone technology is brought into closer in the world. It provides the greater communication tool among the peoples by way of either calling or texting in the transfer of technology. Now, the mobile phones are growing up with the plenty of facets starts from e mail, surfing, recreations, internet access, education and social networking sites and the overall majority of the mobile phone users in the age group of 18 - 25. Even though the mobile phone provides the many merits, whereas, it is also provide the some harmful effects in the mobile users but mobile phones plays pivotal role in agriculture in order to transfer of technology dissemination and communication to the farmers. The farmers can access the information by sitting place like market price, available fertilizer stock, subsidy scheme, seed stock position, weather advisory, organic products, crop insurance, line departments officers, Farmer Producer Organization product, pest and disease monitoring, Agricultural Technology Management Agency training, demonstration, agricultural news etc., Keeping these in view, the present study entitled "A Review of Role of Mobile Based Advisory System for Transfer of Technologies for Sustainable Agricultural Development" has been taken up for the study.

1.1 m-Agriculture

mAgriculture is a subset of e - Agriculture, referring to the delivery of agriculture-related services via mobile communications technology. Mobile communication technology includes all kinds of portable devices like basic mobile phones, smart phones, PDAs or tablet devices (e.g. iPad).

mAgriculture can also involve gathering relevant data through mobile technologies like automated weather stations (AWS) or systems and sensors for location based collection.

Short Message Service (SMS) is the text communication service component of phone, web or mobile communication systems, using standardized communications protocols that allow the exchange of short text messages between fixed line or mobile phone devices. SMS text messaging is the most widely used data application in the world, with billion active users, or 74 per cent of all mobile phone subscribers. The term SMS is used as a synonym for all types of short text messaging as well as the user activity itself in many parts of the world. SMS as used on modern handsets was originated from radio telegraphy in radio memo pagers using standardized phone protocols and later defined as part of the Global System for Mobile Communications (GSM) series of standards in 1985 as a means of sending messages of up to 160 characters, to and from GSM mobile handsets. Since then, support for the service has expanded to include other mobile technologies such as ANSI CDMA networks and Digital AMPS, as well as satellite and landline networks. Most SMS messages are mobile to mobile text messages though the standard supports other types of broadcast messaging as well.

2. REVIEW OF FINDINGS OF MOBILE PHONE

Butt and Raider [1] stated that people who are networked do better than those who are not because society is like a market place whereby people exchange goods and ideas to serve their own interests. Farmers operate as social networks and utilize various media and to exchange ideas to improve production and minimize loss. Thus, the importance of interactions in innovation processes has long been recognized.

Aminuzzaman et al. [2] found that both phone operators (predominantly female) and users of the services offered (predominantly male) were more likely to be traders and entrepreneurs than farmers, and only 4 percent of users were illiterate (compared with an 80 percent illiteracy rate nationally at the time).

Coyle [3] indicated that the mobile phone is one of the most exciting forms of ICTs, which has the potential to allow countries to leapfrog older technologies and begin converging with the rest of the world in terms of economic performance. It significantly reduces communication and information costs for the rural poor on agricultural technologies.

Souter et al. [4] reported that the potential of mobile phones, in reducing vulnerability to information discrepancies lies in their ability to obtain information that allows them to deal with seasonal factors (e.g. weather information), to reduce the imbalance between themselves and those they trade with (e.g. price information) and to respond more quickly and effectively to shocks.

The lack of knowledge was also a big problem among rural communities and farmers in use of ICT, while another study indicated in the context of Malaysia that the level of ICT usage among rural community especially farmers were low due lack knowledge and skills. The illiteracy was also a cause of use ICT among farmers because famers could not contact with related officers and department and get information about market price, weather or pesticides even farmers was not knowledge about use of mobile phone to contact with their family and friends due to illiteracy Samuel et al. [5].

May and Hearn [6] the web based system could use to disseminate information among farming communities via Short Message Service (SMS) and keep alert to farmers about weather, price and pesticides. In this context the mobile phone is one of the best sources to disseminate related information among the farmers. This method could benefit to farmers because farmer can purchase mobile phone easily than other communication tools. Mobile phone is a good medium to disseminate information to different layers of the society.

The importance of access, accurate and timely information could provide a good benefit and enhance the capacity of the farmers Asaba et al. [7]. In the terms of community development mobile phone has played a positive impact on poor farmers and their communities and mobile phone strengthen their position in the market chain. Mobile phone has provided access to facilitate active citizen participation in development HRCA, [8].

Donner [9] suggested that mobile phones are considered important for development because they offer benefits such as mobility and security to owners.

Oladele [10] Information is crucial in increasing agricultural production and improving marketing and it is one of the distribution strategies. The significance to expanding agricultural production eventually lies with the country's capacity to disseminate important information to the farming community to facilitate effective adoption of new production techniques, use of farming information sources, decision making on markets, costs, techniques of conserving water, soil, and vegetable resources.

ITU [11] in recent years, there has been a rapid growth of mobile phone networks in developing countries. Currently mobile telephony is the predominant mode of communication. Africa achieved the impressive growth rate of 46.2 percent of the mobile subscriber between 2001 and 2005.

Smale and Tushemereiruwe [12] revealed that the mobile phones could help the farmers as well as traders to sell their fresh product in market quickly to avoid waste. This technology has also provided new approach and chance to farmers decide whether to accept the price offered by buyers by obtaining price information from other sources. Farmers' rate is expected to increase as information flow increases due to mobile phone network coverage and the size of the impact is larger in remote areas.

Lightfoot et al. [13] the study was conducted in Tanzania where the organization deployed the farmers which was called market spies near cities to inform about the latest price of the product and its availability in market by mobile phone. This strategy improved the market access and provided a good profit to the farmers. Such kind of awareness were changed the market trends and given a new opportunities to farmers.

Zakar [14] reported that knowledge and information regarding land preparation,

intermixture of cropping, water management, harvesting and so many farm related activities. This information could transfer by use of information communication technology such as mobile phone radio and television to farmers.

Veeraraghavan et al. [15] assess the Warana Unwired project that involved switching from a PC based to an SMS based system to transmit information to and from members of a sugarcane cooperative in India. Farmers could request information through their mobile phone or by using a phone in the village kiosks that also housed the PCs. Kiosk owners collected information on fertilizer and water use.

Gakuru et al. [16] stated that the mobile phones provide other uses as recording tools, listening devices and catalysts for dialogue. Community radio stations are incorporating mobile phone technology into programming for advisory services in agriculture.

Murthy [17] said that the mobile phones have provided new approaches and thinking to the farmers forgets the information and sell their product in market with any bargaining to brokers. Before the mobile phones mostly farmers were depend on broadcasting media such as radio and television to get knowledge and information about crops. This time mobile phone technology has given quick communication and approach to community with their community. The educated farmers use short service message (SMS) to get latest update agricultural information such as marketing information that facilitate the farmer about making logical decisions.

Muto and Yamano [18] from analysis of data collected between 2003 and 2005 in Uganda found that mobile network expansion (from 41 to 87 percent coverage) had positive effects on market participation. The effects were found to be more beneficial for farmers in remote areas and particularly for those producing perishable crops such as bananas.

Avgerou [19] Understanding that the use of mobile phones to aid agricultural development requires an adequate knowledge of the technology and the perceived impacts, as well as an assessment of the opportunities and barriers reinforced by the local social structure of the user communities.

Patel et al. [20] revealed that the mobile phone has also given a good benefit to dealers for getting better market information when negotiating with farmers over the price of their produce. The adoption of mobile phones has increased among farmers.

Okello et al. [21] found that 79 percent of rural market traders used mobile phones in their trading activities, with 77 percent preferring to use voice rather than 2.00 percent that used SMS. This was because traders preferred a system that allowed interaction with the broad range of participants in any given produce value chain including agents, brokers, assemblers, wholesalers and final purchasers and voice best facilitates.

Masuki et al. [22] highlighting how differences in the cultural and social make up of different parishes within the same district of Uganda gave rise to different needs for information, as well capabilities to make use of information.

De Silva and Ratnadiwakara [23] who randomly sampled 300 farming households in Sri Lanka across four traded vegetable markets and attempted to understand information search costs for core operations along the agricultural farmer value chain. They found that 70 percent of all transaction costs related to information search costs (the transaction costs themselves were recorded as 15 percent of the total costs incurred). Costs were accounted for both in direct financial expenditure and the opportunity costs of time expended.

Kameswari et al. [24] reported that poor remote area with difficult terrain shows relatively high adoption rates by poor farmers such as an 80 percent ownership rate within the sample for the Indian Himalayan region.

Beuermann [25] a study in Peru observes that the introduction of mobile pay phones in selected Peruvian villages had raised agricultural profitability by 19.5 percent by increasing the value that farmers received for each kilogram of agricultural production by 16percent and reducing agricultural costs by 23.7 percent.

Egyir et al. [26] identified mobile phones as the predominant communication technology amongst farmers in Ghana, measuring an increased speed of price transmission in maize markets but no market decrease in transaction costs in markets exchanges were dominated by traders that lack literacy and rely heavily on visual inspection.

Fafchamps and Minten [27] gauged the benefits that Indian farmers derive from market and weather information delivered to their mobile phones via a commercial service called Reuters Market Light (RML). A robust estimation technique was used to generate findings for treatment and non treatment groups comprising 933 farmers across 100 villages (20 in each of 5 villages) in the Maharashtra region. There was some evidence that use of RML positively impacted upon spatial arbitrage and crop grading, although the effect was small.

LMIS [28] found that the livelihood of a vast majority of people in East Africa is highly dependent on income from agricultural products. Therefore, the success to reliable and timely market information is vital for agricultural development in the region and provides a basis for producers and traders to make informed marketing decisions.

Fu and Akter [29] who investigated how mobile phones impacted upon pre existing extension networks in India where phones were carried and used by assistants to agricultural specialists travelling between villages. The study takes a randomized population (treatment and control group) and measures proxies for adoption, knowledge generation, attitude and awareness amongst a sample of 698 farmers (where there existed a 50 percent illiteracy rate) measuring before and after intervention differences.

Hanumankar [30] asserts that there is considerable interest and acceptance among farmers for ICT based agricultural extension services. The study has shown that farmers in the age group of 29 to 48 years are the biggest user group of KCC helpline. In terms of academic background, farmers with a minimum exposure of six to seven years to formal schooling (86 per cent) seek to utilize the KCC support and relatively inexperienced farmers with less than 10 years of experience are more likely (47.5 per cent) to call the KCC. Analysis of satisfied farmers by the demographic profile suggests that younger farmers below 38 years of age with post matriculate academic background, and less than 10 years' of farming experience expressed the highest levels of satisfaction. Where the farmers were dissatisfied the common reasons were found to be the impracticality of advice provided by KCC agents at level -1 due to their obsolete knowledge and inability to comprehend local accents and dialects. Delayed access to Level -2 experts was also found to be an irritant by the farmers.

Bachhav [31] indicated that the different ways through which information is helping farmers improve their agricultural productivity, including obtaining information on weather trends, best practice in farming, timely access to market information, helping farmer make correct decisions about which crops to plant or where to buy inputs from and where to sell their products.

Ansari and Pandey [32] revealed that 83.34 percent farmers owned a mobile for more than 2 years and 72.33 percent received information related to agriculture from fellow farmers. All the respondents interviewed said that they would like to subscribe if Pantnagar University starts mobile based advisory service, although only 45 percent said that they would be willing to pay a nominal of fee 100 per month.

Nakasone [33] finds no impacts on marketing outcomes among households in the same village that did not have access to the price information services.

Mtega and Benard [34] reported farmers to have been using agricultural extension, posters, televisions, radio, newspapers, journals, bulletins, community leaders, and famer groups as their sources of their information.

Baumuller [35] found that male farmers share price information they receive via SMS with other farmers within and even more frequently outside their farmers' group (38 and 62.00 percent respectively).

Mittal [36] shows that almost all farmers share price information with other farmers, often on a weekly or even daily basis.

The government of India and private sector organizations developed number of mobile applications for the benefit of farmers. These apps available free of cost from the Google play store and website (e.g. mkisan web site). Farmers can easily download it and use for agriculture purpose Annonymous, [37,38].

Abdul Razaque Chhachhar and Bashir Memon [39] reported that 97.30 percentage of the respondents own their personal mobile phone and 64.50 percentage of the respondents call to the market directly for seeking crop information and farmers make use of mobile phones to keep current with the market, contact buyers and very limited 7.90 percentage of the respondents get weather information, communication technology

disseminates information rapidly around the world to the benefit of many communities.

Abdul Razaque Chhachhar and Bashir Memon [39] stated that respondents were also asked if they monitor the market through mobile phone use, and 42.80 percentage of respondents said they communicate with shopkeepers and obtain market information about different crops such as cotton and wheat, another 33 percentage of the respondents occasionally call retailers for information about vegetables, rice and other crops.

Radhakrishnan [40] reported that more than 75 percentage of rural youths using the internet to access the Twitter, Face book, Whatsapp and Instagram. Accessing the social media is one of the foremost significant phenomena for rural youths to access the internet. In fact many youths accessing the internet for the first time, social media was the prime and peculiar reason. Across India there are 143 million users of social media. Urban areas witnessed a growth of 35 percentages with 118 million users as of April 2015. On the other side, the number rural areas 25 million. Whatsapp and instagram emerged the leading social media tools with 96 percentage of urban users assessing it, followed by face book (80 percentage), Twitter (62 percentage) Instagram (43 percentage) and LinkedIn (25.00 percentage). The largest segment of users was college going students (34 percentage) followed by young men (27 percentage) and school children constitute (12 percentage).

3. SOURCE OF INFORMATION AND IMPACT OF AGRO ADVISORY SERVICE OF FARMERS

The details of various possible source of agricultural and horticultural information to the farmers were given below (Table 1). The primary data was collected from through mobile phone interview and presented the results as given below;

With respect to mobile phone agro advisory services (97.50 percent) of the respondents were collecting the source of information in farming activities followed by Kisan Call Centre (92.50 percent) of the respondents knowing the details of inputs and fertilizers, Krishi Vigyan Kendra (89.16 percent) of the respondents are getting the information for agricultural practices, Agro clinic dealers / input dealers (84.16 percent) of the respondents are gathering the source of information related to farming, Farmers interest group (81.66 percent) of the respondents are collecting the necessary activities of farming.

Nowadays, mobile phone is playing a vital role in farming activities. Most of the farmers were gathering and exchanging their information by using mobile phone in home and farm field itself. With respect to Kisan Call Centre 92.50 percent of the respondents were getting the information by using the toll free number 1800-180-1551 regularly. The proficient experts attend the calls and to providing the information related to their problems. 89.16 percent of the respondents frequently visited the Krishi Vigyan Kendra to their nearby places and to getting the trainings, demonstrations, field visits etc., Around 84.16 percent of the respondents are having good rapport with agri clinic dealers / input dealers in order to getting the fertilizer through need basis and 81.66 percent of the respondents are having good contact with the farmer interest group activities and getting the benefits in time bound manner.

From above the (Table 1) 68.33 percent of the respondents are expressed that we are getting the details from farmer producer company to sell our farm produce in whole sale price, and uzhavar sandy market without any middleman interference and to get remunerative income. Around 62.50 percent of the respondents are revealed that the commodity interest group various sectors viz., small cotton farmers estates, small farmer horticulture estates, small farmer poultry estates and medicinal plants estates will help to combining the advantages of decentralized production, services, post harvest management, values addition and marketing linkages to facilitate the direct farmer consumer linkage. With respect to agriculture and horticulture line department around 55 percent of the respondents are regularly visiting the line departments to getting the benefits of schemes, subsidy, fertilizer, demonstration and training etc., 50.83 percent of the respondents are having extension agency contact with extension officer regularly and getting the details of the emerging agricultural transfer of technology of various crops, programmes and schemes etc., 41.66 percent of the respondents expressed that we are having good rapport with Non Government Organization receiving the various benefits followed by various mass media like television, radio and newspaper to watching the various agricultural programmes at Pothigai TV, Makkal

TV and Puthiyathalaimurai and listening the radio programmes in various technology in agriculture and reading the newspaper in agriculture and allied news in various newspaper in respectively.

3.1 Model for Potential Information of Mobile Phone in Agriculture (MPIMPA)

The farmers can access the following information by home and farm field conditions. The details are given in Fig. 1. (Source: e-Governance in Tamil Nadu: 2018).

4. MERITS OF MOBILE PHONE SHOULD ALSO BE BASED ON THE REVIEW OF ARTICLES OR FINDINGS

1. Sharing and receiving the knowledge

Mobile phone plays a vital role in transfer of technology dissemination in agriculture and allied departments. The farmers, extension officers, line department officers, other officials and public peoples are getting benefits or exchanging their knowledge or information through mobile phone and it will their save time, cost, transport and others activities.

Table 1. Source of information and impact of agro advisory service of farmers (N=120)*

S. No	Source of information	Respondents	Percentage
1.	Mobile phone	117	97.50
2.	Kisan Call Centre	111	92.50
3.	Krishi Vigyan Kendra	107	89.16
4.	Agro clinic dealers / input dealers	101	84.16
5.	Farmers Interest Group	98	81.66
6.	Farmer Producer Company	82	68.33
7.	Commodity Interest Group	75	62.50
8.	Agri. / Horti. Line Departments	66	55.00
9.	Extension Agency Contact	61	50.83
10.	Non Government Organization	50	41.66
11.	Other Progressive Farmer	43	35.83
12.	Television	36	30.00
13.	Newspaper	22	18.33
14.	Radio	09	7.50

*Multiple response**

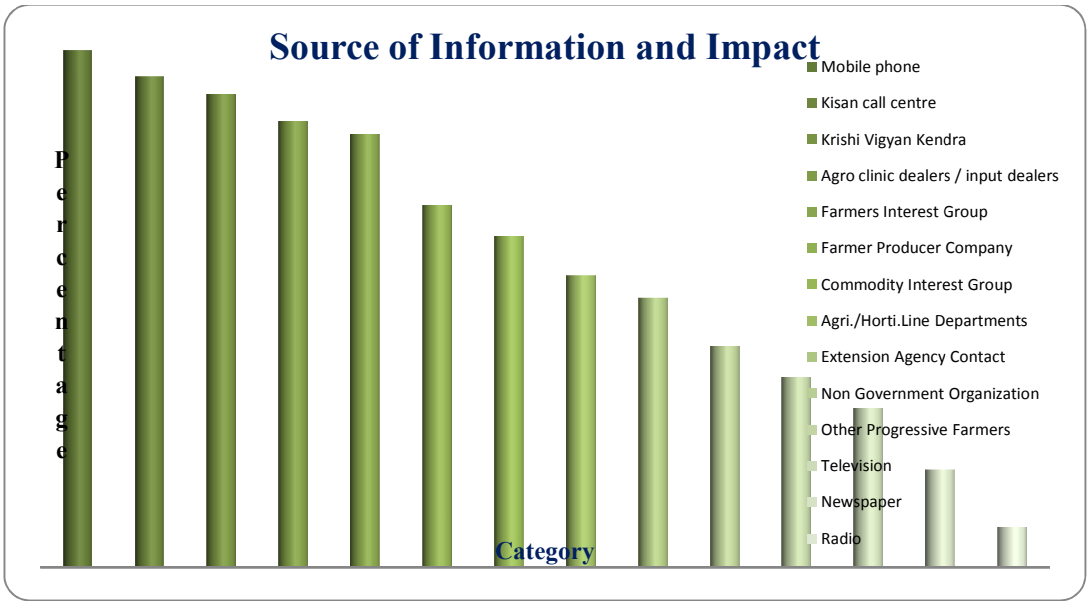

Fig. 1. Source of information and impact

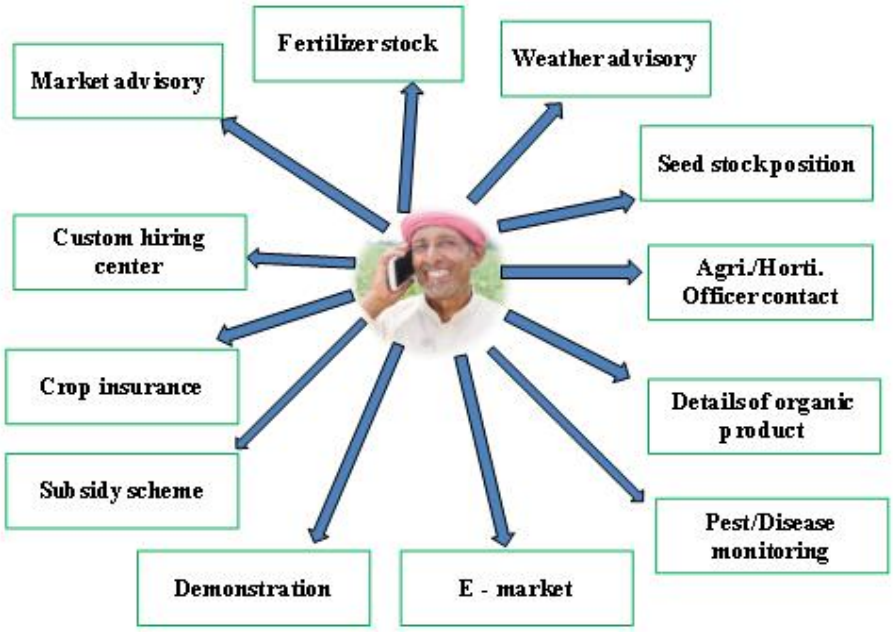

Fig. 2. Model for potential information of mobile phone in agriculture

2. Skipping the middle man

Olden days the peasants are want to sell their produce and buy the commodities in market, really it will be typical task because of the middle man interference but nowadays the farmers having handy information wherever the commodities which are available in the market they can access and buy it easily without any traders / commission agent activities.

3. Identify the pest and disease

The farmer's crop is affected by pest and diseases in field condition, immediately the farmers can take a snap and send it to the respective subject matter specialist (Scientist) in various field of specialization. The scientist is recommending the inputs or advice to the farmers promptly.

4. Better accessibility

Because of the mobile phone the peoples or farmers are receiving the timely information based on the need basis from various field of specialization scientist respectively.

5. Reduce the financial transaction

The famers are facing the plenty of financial problems to sell their produce in market and other places by using the public transport and separate vehicle but once the farmers can used to access the daily market information and the details are available in mobile phones it will save the financial problems and very useful tool to their produce in remunerative price at market level. The farmers are having various contact / network nowadays and getting the benefits.

6. Obtaining the functional expert advice

The farmers are getting the multi benefits from the various research station, krishi vigyan kendra, agricultural colleges etc., by getting the different type of trainings, field exposure visits, demonstrations, farmers tours, agricultural / horticultural index and cultivation best practices. With this, the functional expert are giving the inputs in field conditions either on campus - off campus of various aspect of advices in different crops. Farmers can get those kinds of advices / benefits from the concerned scientist; it will solve the field problems because of the mobile phone.

7. Market price for agricultural product

All the agricultural commodities of the farmers to sell their produce in remunerative price, the mobile phone is essential by accessing the information or updating the market price in field condition and home itself. The Uzhavan

application is more useful tool for them. It will provide the local market price, whole sale market and market demand in different commodity in various districts.

8. Easy, quick access and timely information

More than fifty percentage of the farmers they can able to accessing the information, diagnose the pest and diseases problems in field conditions by using various tools especially mobile phone and farm crop management system and getting the functional expert advices in different circumstances and timely information in field levels.

9. Weather advisory services

Due to the natural calamity the farmers can assess the weather advisory services easily by using the mobile phones during the rabi and kharif season respectively. Based on the weather report in a day the farmers can devise to have sowing the seeds in different crops and readily available information in mobile phone.

5. DEMERITS OF MOBILE PHONE SHOULD ALSO BE BASED ON THE REVIEW OF ARTICLES OR FINDINGS

Even though there is plenty of merits in mobile phones but there might be more number of demerits by usage of mobile phones among the public and farmers. Mobile phone creates high level of electronic wastage and problems, social disruptive, cause many accident while riding two wheelers and driving the four wheelers, some of the android mobile phones are very expensive, mobile phone technologies can create addictive tendencies among the public peoples, health problems, cheating, technical error while using the mobile phone, battery powers keeps running out and dangerous, vicarious living of others, mobile phone can create significant distraction for people and crime etc.,

6. CONCLUSION

This study has been provided the potential of mobile phone in agricultural sectors. The implementation of mobile phone also poses a plenty of challenges in Indian farmers due to lack of mobile friendly and locally relevant digital content, rural mobile infrastructure limitations including networks, electrical and signal problems, illiteracy and more number of local languages. Mobile based applications need to be integrated with ongoing agricultural extension programmes and various training methods. The mobile agro advisory services for farmers will be encouraged from various international agencies ad collaboration with private agricultural sectors. Despite of that, the farmers need assessment, location and farmer specific information need to be generated in various multimedia content format for technology dissemination among the farm families but mobile phone penetration throughout India continuous to increase among the farming community and information services continue to adapt and proliferate, sufficient potential information exists for a much deeper rural productivity and impact in future agriculture. The benefits of mobile phone such as portability, flexible content of message delivery of information, two way communication and deliver low cost but highly customized solutions. The early stage of mobile phone revolution Indian agriculture the study has been reported that agricultural productivity improvements an impact which is enhanced by the new mobile phone enabled service information. Information and Communication Technology might be play as important role in building the competency and self confidence required to influence the adoption of new mindsets and actions by small farmers. Increase the public and private investments will be necessary to bridge the critical infrastructure to identify the gaps, the policy changes may also needed to encourage the better access to high quality of inputs and credits for small and marginal farmers, increased extension services and training and development efforts can complement information dissemination by using mobile phone services to accelerate to adoption of new techniques.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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