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Research Article

Utility of Mobile Phone Usage in Agricultural Information Dissemination in Bangladesh

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Abstract: The mobile phone as an enabling tool for communication and accessing information is gaining popularity in many developing countries. The different uses of mobile phones have brought revolutionary changes in agricultural communication. The present review paper mainly focuses on the status of mobile phone scenario in Bangladesh and the different usages and constraints in disseminating agricultural information to farmers. Having observed the positive trend of mobile phone usage, little rural-urban gap and appreciable gender gap found in Bangladesh compared to some other developing countries. Main usages that influence the use of the mobile phone as to weather forecast, access to market information, pest and disease information, consulting with extension workers and financial transactions in many developing countries. The review also points out some challenges such as unavailability of electricity, lack of knowledge and skill, high cost of mobile phones and network problems concerning the usage of mobile phones. These issues need urgent attention to policymakers so that people can fully exploit the use of the mobile phone for better access to agricultural information.

Keywords: Mobile phone, agriculture, information, usages, constraints.

INTRODUCTION

Information and communication technologies (ICT) especially the mobile phone has enormously entered every arena of our life such as education, health, business, commerce, and agriculture. A mobile phone is a portable communication device connected to a wireless network that allows the user to make voice calls, send a text message and run applications (Sharon, 2008). It is one of the most widespread information technology across the world, including in developing countries (Furuholt & Matotay, 2011). The majority of people of these countries have access to mobile phones than to older technologies like telephone landlines, newspapers, and radio (Zewge et al., 2015). Recently, mobile phone-based communication has become the most used communication media among all ICTs. A recent statistics revealed that an estimated 4.68 billion population worldwide already owns a mobile phone (Statista, 2019).

In Bangladesh, according to BTRC (Bangladesh Telecommunication Regulatory Commission.), the total number of mobile phone subscribers has reached 164 million at the end of October 2019. This rapid growth of mobile phones has emerged as a successful communication tool that has transformed the working style of many sectors and also created new professional dimensions in various businesses including agriculture (Sullivan & Omwansa, 2013; Asongu & Asongu, 2018).

Nowadays, agriculture itself is changing and changing the quantity and nature of farmers' information needs. In this changing context, agricultural production can only be increased if appropriate technologies are used by the farmers. An increased agricultural production act as a development engine for rural people might have also contributed to the

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economic development of the country. In connection to this, the adoption of modern technologies by the farmers is essential (Asif et al. 2017). To bring substantial development in the agricultural sector, access to timely, reliable, and relevant agricultural information is critical (Kaske et al., 2018). Information is also regarded as a factor of production such as land, labor, and capital (Rao, 2007). However, the farmer uses a variety of information sources in getting agricultural information whose majority are outmoded, less accurate or from unreliable sources. Due to a lack of access to correct and timely market price information, they are often unable to transport and sell their products at higher prices. In the agricultural context, the mobile phone can help to overcome these information gaps which even available in the remotest locations (Miller et al., 2013).

Additionally, the mobile phone has also empowered the farmers to communicate from local to administrative levels regarding the agricultural trade, information exchange, and marketing of their farm commodities (Ogutu et al., 2014). It also reduces the traveling cost, as well as the production efficiency of the farming communities, living in the remote area. Flexibility, affordability and user-friendly nature as compared to other ICT tools are the main reason for its diffused into underdeveloped farming communities (Osabutey & Jin, 2016). Farm people need to be connected with the greater communication network for increasing their access to "just" and "timely" information for bringing desired socio-economic development.

Usually, farm advisory services through conventional extension methods require a large number of extension agents (Faostat & Production, 2016). However, the current ratio of extension agents cannot satisfy the information needs of the farming communities (Baloch & Thapa, 2014; Aker, 2011). The proportion of extension workers and farmers' families is 1: 2500 in Bangladesh (DAE Manual, 2018). Moreover, the lack of resources and poor infrastructure also creates a huge asymmetry communication between modern agricultural knowledge and farmers (Baloch & Thapa, 2014). The argument that "communication technologies are the future of agricultural extension and countries cannot afford the cost of face to face extension anymore" because the cellular phone has the potential to replace the face to face extension system (Aldosari et al., 2017). Therefore, mobile phones can meet most of the basic needs of farming communities by allowing two-way communication between farmers and service providers (Aker, 2011).

By and large, the widespread expansion of mobile phones into rural areas has created an opportunity for receiving agricultural information by the farmers while they are confronted with many challenges about usage. It is important to note that there are several studies have been conducted on the use of the mobile phone for accessing agricultural information over the world while only a few review work has been done related to this. Therefore, it can be an opportunity for other researchers who will study related to this title as a reference and the university organize document that can serve as a guideline in the future. Also, it can indicate directions and supply information for further research, extension and development efforts for different organizations whose main concern with agricultural information by mobile phone in general. Therefore, given the observed state of affairs in the utility of mobile phone usages in the present paper aims to address the following objectives:

- Overview of the status of mobile phone penetration in Bangladesh
- Explore the usages of mobile phone in accessing agricultural information
- Assess the challenges and constraints faced in mobile phone usage in accessing agricultural information

METHODOLOGY

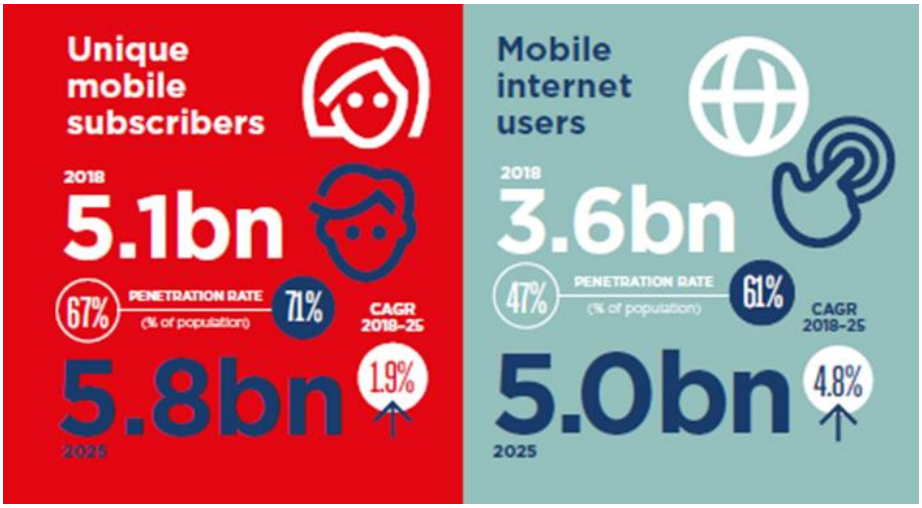
The scientific approach requires a close understanding of the subject matter. This paper mainly depends on secondary information. Different published reports mainly provided input used for this paper. Thus, this paper is completely a review paper. Therefore no specific method has been followed in preparing this paper. It has been prepared by internet search, comprehensive studies of various articles published in the different thesis, journals, books and proceedings available in the libraries of BSMRAU, HSTU in Bangladesh. Several relevant books and articles have been sourced through extensive searches in for example the Google Scholar and advice from my academic supervisor at BSMRAU, Professor Dr. Md. Enamul Haque. Valuable information has also been collected through personal contact with respective resource personnel to enrich the paper. After the collection of all the related information, it was compiled and logically presented in the present form.

REVIEW OF FINDINGS AND DISCUSSION

Status of Mobile phone penetration scenario in Bangladesh

Mobile devices are now a fixture of modern life. People without access to mobile devices are severely limited in their ability to participate in the full spectrum of today's economic and societal activities. In this context, the following figure 1 showed the global unique mobile subscribers and mobile internet users all over the world according to GSMA (Global System for mobile communication Association) intelligence survey 2019. This figure showed that by the end of 2018, 5.1 billion people around the world subscribe to mobile services, accounting the 67% of the global population. But the speed of growth is slowing assuming that an

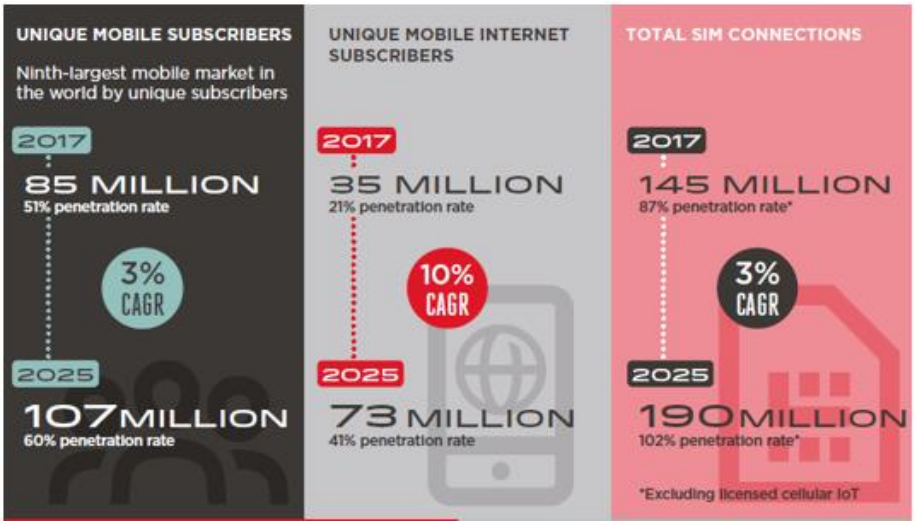
average annual growth rate (CAGR) of 1.9% between 2018 and 2025 will bring the total number of mobile subscribers to 5.8 billion (71% of the population). On the other hand, the connectivity to mobile internet users by the end of 2018, 3.6 billion which will be 5.0 billion in 2025 and the average annual growth rate 4.8% (67% of the population). Findings revealed that the mobile subscriber increasing day by day and mobile internet users' trends shows the stimulating adoption of mobile-based services and solution (for example agriculture, healthcare, education) that aim to improve the livelihood in lower-middle-income countries for sustainable livelihood improvement.



Adapted from: GSMA Intelligence, 2019

Figure 1. Global mobile subscribers and mobile internet users snapshot

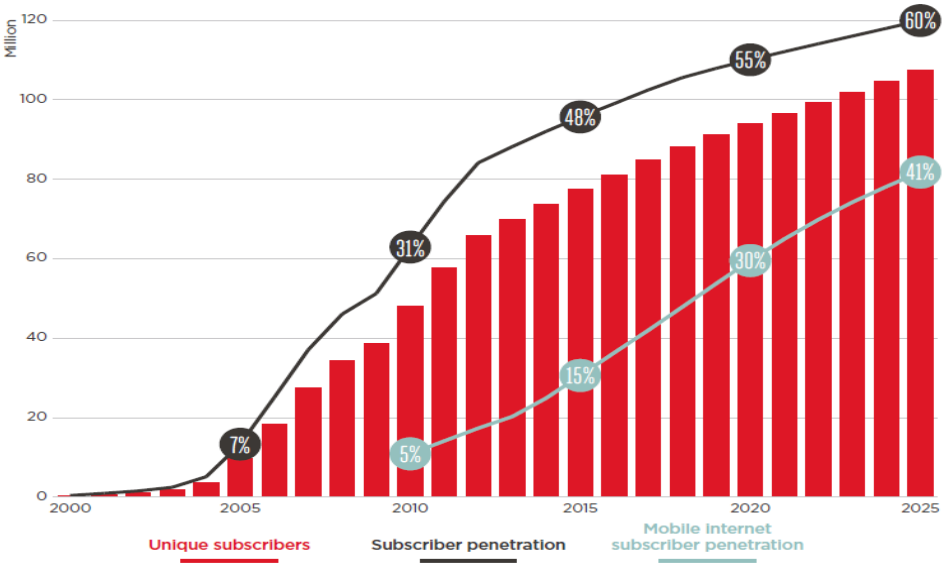
Furthermore, a snapshot of the status of the mobile market in Bangladesh is shown in Figure 2. The research conducted by Mike Rogers 2018 on Country overview: Bangladesh Mobile Industry driving growth and digital inclusion published by GSMA intelligence. Findings reveled that, by the end of 2017, 85 million around the country subscribe to mobile services, accounting the half of the total population. The cumulative annual growth rate of 3% in between 2017 and 2025 will bring the total number of mobile subscriber to 107 million (60% of the population). In addition, the connectivity of mobile internet services by 2017 was 35 million i.e. 21% of the total population. The CAGR of 10% between 2017 and 2025 will bring the total mobile internet subscriber 73 million (41% of the total population). From the finding it is revealed that the increasing rate of adoption is a positive sign of accessing information through mobile phone over the country.



Adapted from: Rogers, M, 2018

Figure 1 Bangladesh: Mobile market snapshot

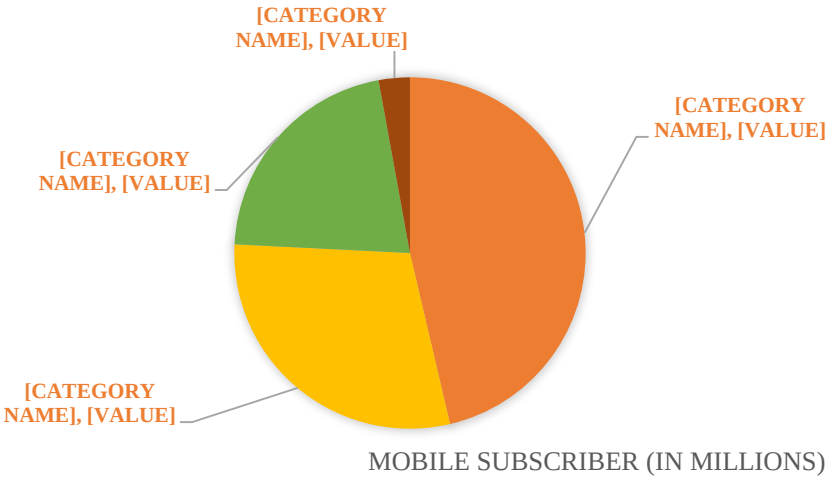
However, the mobile subscriber dynamics are interesting phenomena in Bangladesh which are presenting in Figure 3. The research conducted by Rogers, M (2018) on Country overview: Bangladesh Mobile Industry driving growth and digital inclusion published by GSMA Association. Findings demonstrate in figure 2 shows that the unique subscriber penetration level rising just over 1% in 2003 to more than half of the population at the end of 2018 which is the evidence of the rapid adoption of mobile services in Bangladesh. In 2025, the mobile subscriber will bring the total number of 107 million (60% of the population). In addition, the connectivity of mobile internet services by 2017 was 35 million i.e. 21% of the total population. In 2025 the mobile internet subscriber will bring a total 73 million (41% of the total population). From the finding, it is revealed that mobile phone users increasing dramatically over the country. The positive perception shows that it is a unique communication tool of today's life



Adapted from: Rogers, M, 2018

Figure 2. Mobile subscriber dynamics in Bangladesh

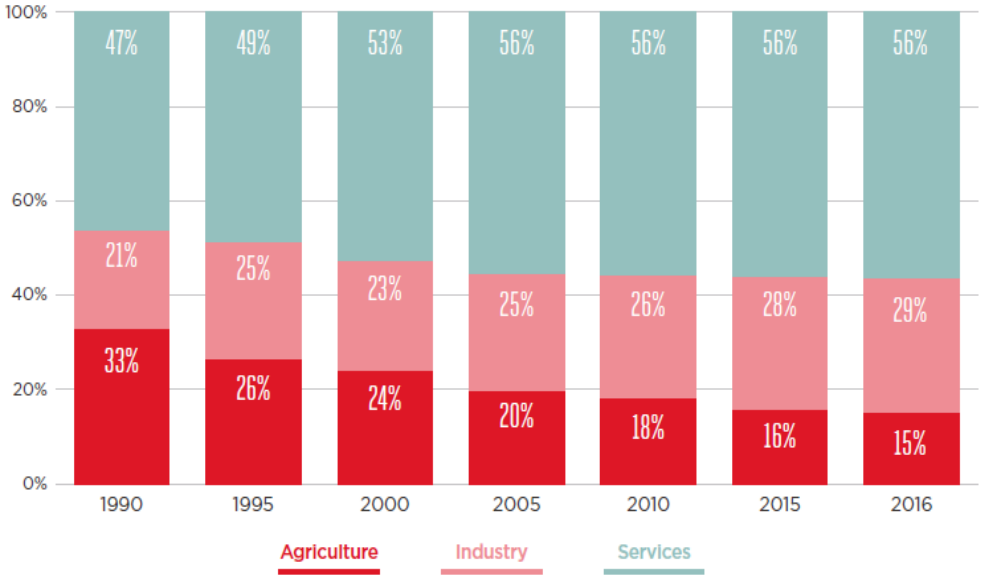
The increasing rate of subscribers shows that people are using a mobile phone for accessing various information in the rural and urban areas for getting useful services provided by different organizations. The subscriber dynamic pattern represent the information accessing through mobile is crucial for future development of Bangladesh. The increasing rate of subscriber shows the people are using mobile phone for accessing various information in rural and urban area for getting useful services provided by different organization. The mobile subscriber increasing rate shows the improvement of different sector like agriculture, industry and services which contribute in national economy of Bangladesh.



Source: BTRC, 2019

Figure 4. Mobile phone operator and subscriber in Bangladesh (Up to October 2019)

According to BTRC (Bangladesh Telecommunication Regulatory Commission.) 2019, the total number of mobile phone subscribers has reached 164.170 Million at the end of October, 2019. Figure 4 indicates that, the mobile operator Grameen Phone has highest subscriber approximately 76% of the total subscriber followed by Robi (48%), Banglalink (35%) and Teletalk (4%). In this finding subscriber means the biometric verified subscribers/subscriptions who have any activity (voice, data, sms etc.) at least once in the preceding 90 days (BTRC, 2019). Though the subscriber is 164.170 million at present here but the one single individual may use three to four SIM card for easy connectivity and to make the call rate cost effective. In this reason the whatever the number of subscriber vary but the increasing rate of subscriber shows the people are using mobile phone for accessing various information in rural and urban area for getting useful services provided by different organization. The mobile subscriber increasing rate shows the improvement of different sector like agriculture, industry and services which contribute in national economy of Bangladesh.



Adapted from: Rogers, M, 2018

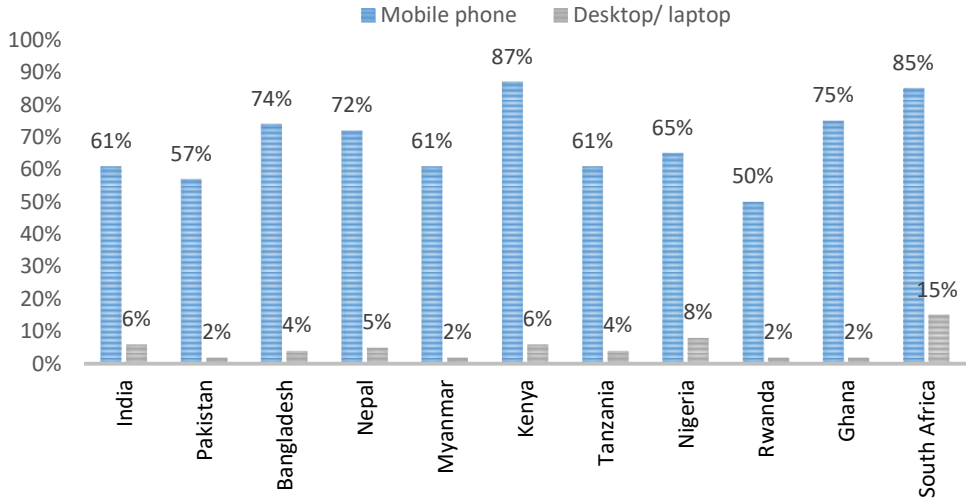
Figure 3. Sector wise contribution of GDP (percentage) in Bangladesh

In fact, from the same study of GSMA conducted by Rogers, M (2018), it is also revealed that the economy of Bangladesh shifting from agriculture to manufacturing and services. Figure 5 shows the sector wise contribution of GDP (Gross domestic product) revealed that the 15% GDP down from 18% in 2010 while in industry sector, 29% of GDP up from 26% in 2010. The services sector contribute 56% of GDP in 2016. Although, the contribution of GDP in agriculture sector decreasing day by day but the country has made good progress in ensuring self-sufficiency in cereal, fish and livestock production which meet the demand of the people. The country has gained significant success in agriculture, achieving third fastest growth in vegetable production, fourth position in rice production, third in fish production from inland water bodies, fifth in aquaculture production and seventh position in mango production in the world. The country is now self-sufficient in rice and fish production. This improvement might be due to the adoption of modern technologies through access of up to date agricultural information from credible sources.

Comparison of mobile phone use status of Bangladesh with some developing countries

A survey conducted by LIRNEasia (Learning Initiatives on Reforms for Network Economies Asia) 2018 and published a report title After Access: ICT access and use in Asia and the Global South. In this series of surveys, they examine how individuals in 18+ countries of the Global South access and use ICTs. Adapted from that report the author himself purposively prepares figure 6 from the reported figure highlighting the status of his country (Bangladesh) comparing with four Asian and six African countries exception Myanmar. Figure 6 shows that mobile phone ownership ranged from the lowest of 57% (Pakistan) to the highest 74% (Bangladesh) among the four Asian countries. At the same time, among the eight African countries the lowest mobile phone ownership in Rwanda (50%), the smallest African countries and highest in Kenya (87%) which is very close to South Africa. In all countries, desktop and laptop computer ownership lagged far behind mobile phone ownership. From the finding, it revealed that presently Bangladesh makes good

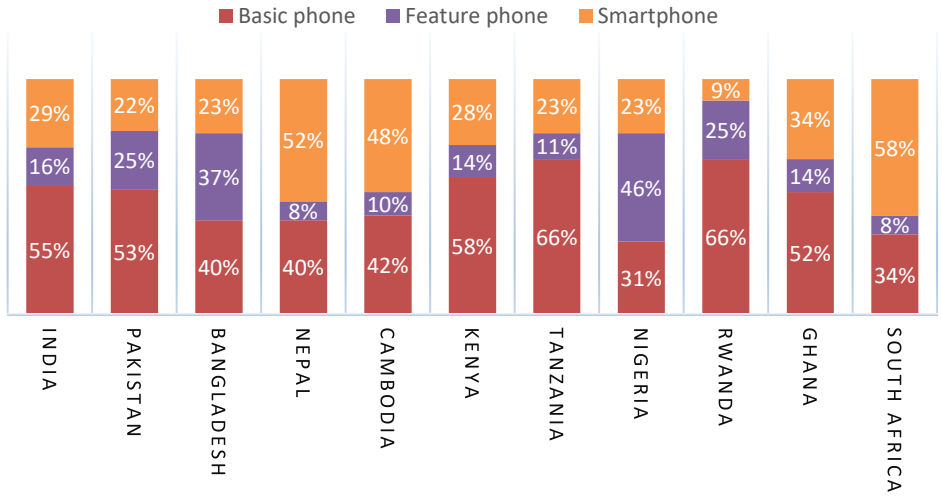
progress in using mobile phones amongst the other countries. This may be due to the political mandate of the government like digital Bangladesh and Vision 2021 of the country. The other reason perhaps the target of UN Sustainable Development Goals (SDGs) for which the government takes several initiatives to achieve those goals through digitalization policies.



Adapted from: LIRNEasia, 2018

Figure 4. Status of mobile phone, Desktop/laptop ownership

From the same study the author make the graph choosing the Asian and African countries on handset type ownership to purposively highlight his country. From the figure 7 shows that there are three types of handset use over the world i.e basic phone, feature phone and smart phone. Among the Asian countries the smart phone user below 30% except Nepal (52%) contrarily the highest smart phone user in South Africa and lowest in Rwanda among the African countries. Figure 7 revealed that the smart phone user is not upto the mark in Bangladesh most probably due the affordability and lack of operating skill and knowledge towards smart phone. Though the mobile based services is still not popular in this country so people are not well acquainted about the efficacy of the smart phone but the 77% people use the feature and basic phone for accessing information.

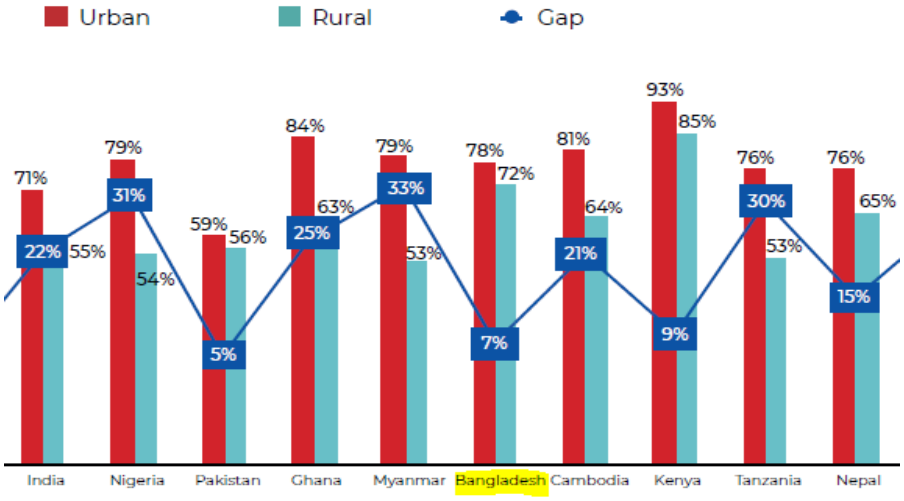


Adapted from: LIRNEasia, 2018

Figure 5. Status of handset type owned in different countries

Moreover, the status of urban and rural mobile ownership and their gap demonstrate in Figure 8 based on the findings of LIRNEasia 2018. The figure indicates that the majority of countries had an urban-rural gap with rural areas of the country lagging behind in mobile penetration (Figure 8). However, Pakistan and Bangladesh had very small gaps, indicating that rural dwellers are almost as likely to own a mobile

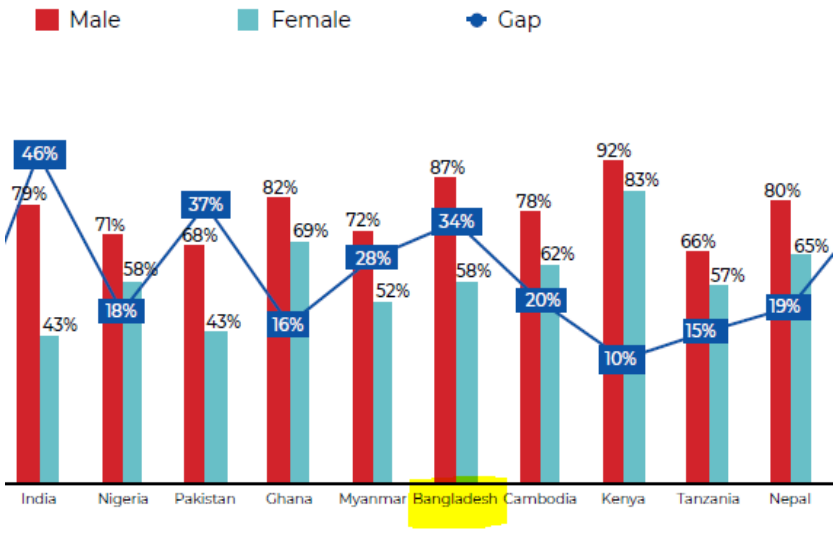
phone as urban dwellers. The other Asian countries had considerable gaps of 15-22%, meaning that, in these countries, rural dwellers were between 15 and 22 percent less likely to own a mobile phone than urban dwellers. From this figure, it is found that there was a little gap between the mobile phone user in rural and urban areas lives in Bangladesh. The rural people are also using mobile as the urban people for receiving useful information from the agricultural source and other purposes for their better livelihood.



Adapted from: LIRNEasia, 2018

Figure 8. Status of urban and rural mobile ownership

Although gender issues are one of the vital parts of development and technology utilization. In the case of mobile phone ownership according to gender, finding revealed that the gender gap was highest in India (46%) among the countries demonstrate. This indicates that women are less likely to own a mobile phone than men (Figure 9). Among the other Asian countries survey reported that the gender gap found in Pakistan (37%), Bangladesh (34%) and Nepal (19%) were followed by Myanmar (28%), Cambodia (20%) and. Gender inequality in mobile phone ownership remained a problem in much of Asia and Africa. Figure 9 exposed that there is ample scope of working with women for using mobile phones for accessing information in Bangladesh.



Adapted from: LIRNEasia, 2018

Figure 9. Mobile phone ownership according to gender

Mobile phone usage in accessing agricultural information

Nowadays, mobile phones are an important and popular means of communication for accessing agricultural information. Looking at the use of mobile phones in agriculture more specifically, Furuholt and Matotay (2011) assessed how farmers took advantage of mobiles throughout the farming cycle. Based on semi-structured interviews with farmers and other informants in Tanzania, they found that mobile phones affected all

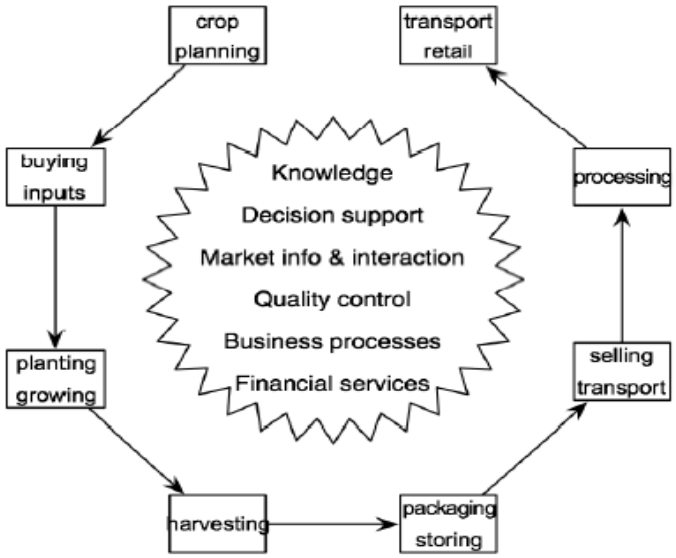
stages of the cycle, including preparations, farming, harvesting and post-harvesting (Table 1). The use of mobile phone in accessing agricultural information throughout the farming is very essential for farmers or enterprise owner.

Table 1. Farmers' response towards the farming activities and use of mobile phones

Period	Activity
Preparations for farming	• Coordinating labor pool (voluntary-based, family members and neighbours) • Collecting weather information • Investigating seeds prices • Preparation kraal manure for planting (mainly used by the farmers in the area during planting)
Farming period	• Pooling of labor for cultivation and weeding • Organizing manure for use during planting • Collecting and exchanging rain information • Hiring/borrowing farming implements (e.g. hand hoes, ox plough, harrows etc.) • Investigating prices of tractors for cultivation • Ordering and hiring of oxen for cultivation • Collecting information about new types of seeds • Ordering seeds • Investigating per labor cost for cultivation and weeding in the neighboring villages • Organizing fertilizer • Collecting information about availability of extension officers and subsidized farm implements from the local authorities • Coordinating information and deliveries of pesticides
Harvesting period	• Organizing and pooling of labour for harvesting • Arranging for storage equipment and warehouses/stores • Arranging for and ordering of preservative chemicals against mice and "scania"
Post-harvesting (Marketing and transport)	• Organizing transport from the farms to warehouses (tractors or ox trailers) • Calling market centers, traders, dealers and check prices and stocks of crops before settings deals with middlemen/agents or deciding to travel to obtain better opportunities. • Calling for and ordering transportation to markets • Selling crops via mobile phone • Contacting distant families/relatives (for decisions and money transfers)

Adapted from: Furuholt and Matotay (2011)

Information is very crucial for farming. Mobile phone facilitates the dissemination of information from research and extension agencies to farmers. According to Brugger, 20111. Looking at the use of mobile phones in agriculture more specifically demonstrate in figure 10.



Adapted from: Brugger, 2011

Figure 10. Farmers' information requirement offering opportunities for mobile phones

Finding in figure 10 revealed that from crop planting to transportation there are a lot of activities mobile phones had helped farmers to make a decision and raise incomes by improving their ability to deal with risks and take advantage of income opportunities. However, several assessments concluded that mobile phones had reduced search times and costs (Bayes et al. 1999; Jagun et al. 2007; Overå 2006). However, Baumüller, H. (2016) conducted a study on Agricultural service delivery through mobile phones: local innovation and technological opportunities in Kenya. It was observed in the study that the author compiled several studies summarized in Table 2 on the utility of mobile phones in agriculture which is self-explanatory. The studies have sought to outline the utility of mobile phones and m-services to support agricultural production and promote rural development (Aker, 2011; Donner, 2009; Qiang et al., 2011; Vodafone Group and Accenture, 2011; World Bank, 2011) (summarized in Table 3). Findings revealed that Better access to information, markets and financial services are among the most commonly cited uses of mobile phones in this sector.

Table 1. Studies on the utility of mobile phones in agriculture

Study	Mobile phones in agriculture
Qiang et al. (2011)	• Accessing markets, disease and climate information • Accessing to extension services • Improving market links and distribution networks • Accessing finance, including credit, insurance and payment methods
Aker (2011)	• Accessing information from private sources or through agricultural extension services • Better management of input and output supply chains • Facilitating the delivery of other services • Increasing the accountability of extension services • Increasing linkages with research systems
Vodafone Group & Accenture (2011)	• Accessing financial services • Obtaining agricultural information • Improving data visibility for supply chain efficiency • Enhancing access to markets
World Bank (2011)	• Enhancing farm-level productivity • Accessing markets and value chains • Improving public services delivery
Donner (2009)	• Mediated agricultural extension • Market information systems • Virtual markets • Financial services • Direct livelihood support

Source: Baumüller, H. (2016)

More specifically, Das et al., 2016 reported that in West Bengal the farmers needed a wide range of information through mobile phones. Table 3 reveals that the farmers mostly needed information on weather forecasts and market price and these were ranked as first opined by the farmers. Further reported that the respondents also needed information on 'Use of inputs', 'Govt. Schemes' and 'Employment opportunities' and they ranked it as 2nd and 3rd respectively. Weather information was found to be crucial for most of the small farmers in her investigation.

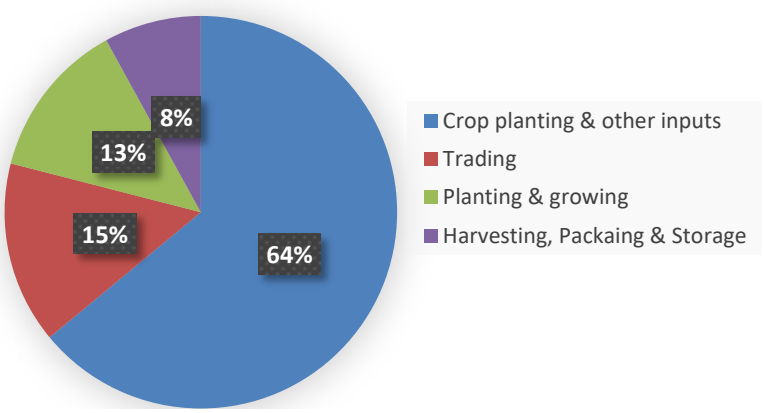
Table 2. Kind of information the farmers valued most through mobile phone in West Bengal

Type of Information	Importance of information						
	Excellent	Very good	Good	Average	Poor	Score	Rank
Weather forecasts	60	0	0	0	0	5	I
Labour	58	0	2	0	0	4.93	IV
Use of inputs	58	2	0	0	0	4.97	II
Harvesting & Storage	55	5	0	0	0	4.92	V
Market Price	60	0	0	0	0	5	I
Animal Husbandary	28	13	10	7	2	3.97	VI
Govt. Schemes	57	3	0	0	0	4.95	III
Cattle health	11	44	4	8	15	3.1	VIII
Vegetable, flower & fruit cultivation	35	4	5	9	7	3.85	VII

Excellent-5; Very good-4; Good-3; Average-2; Poor-1

Adapted From: Das et al., 2016

In another study in India, Mehta, B. S. (2016) conducted a study on the impact of mobile phones on the livelihood of rural People of Bihar (Figure 11). Findings revealed that among the respondents, who were involved in farming activities used their mobile phones for agricultural purposes, mainly for crop planting & other inputs, planting and growing stage of crop, harvesting and trading at later stages. The finding showed that the use of the mobile phone in agriculture purposes for accessing this kind of information is highly appreciable. The mobile phone helps the farmers for collecting useful information regarding agricultural activities and improve their socio-economic conditions.



Source: Mehta, 2016

Figure 6. Usage of Mobile Phones in Agriculture Production in Bihar India

Although, in Selangor, Malaysia, Ramli, et al., 2019 conducted a study on seeking agriculture information through mobile phones among paddy farmers. The findings (Table 4) revealed that among the information items seeking through mobile phone nine items found important. The paddy farmers give equal importance based on the mean value for rice farming except for marketing information. Obviously, pest control information is very crucial for the paddy farmers but in case of marketing information, the finding reported that government organization facilitates farmers in marketing their yields and thus farmers need not worry about marketing information.

Table 3. Important agriculture Information seeking by the paddy farmers of Malaysia

Sl#	Items	Mean	S.D
1	Information on pest control	4.53	0.529
2	Farm safety information	4.52	0.515
3	Information on pesticide / weed	4.5	0.53
4	Information of paddy varieties	4.46	0.533
5	Information on agricultural practices	4.45	0.555
6	Crop production information	4.39	0.659
7	Information on loan / subsidy	4.39	0.565
8	Weather information	4.02	0.873
9	Marketing Information	3.71	1.222

Source: Ramli, et al., 2019

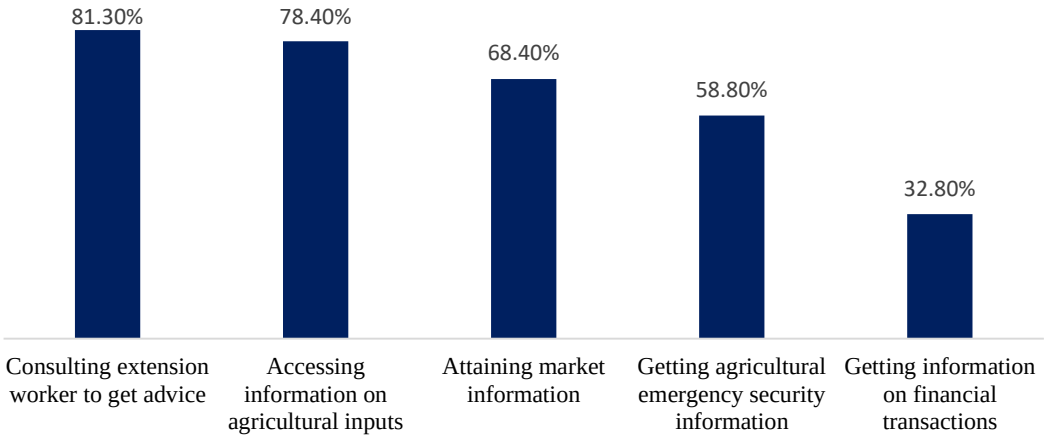
However, a number of studies have been conducted in line with this. For instance, Alibu et al. (2016) found where required information on pest control is ranked first due to production constraint, information about diseases ranked second, and information about weeds ranked third. Furthermore, Babu et al., (2012) found that the important information needs for rice farmers were pest and disease management, pesticide, and fertilizer application. In contrast, in Sub-Sahara Africa, attention is given to mobile phone ownership and usage for social and agricultural purposes. It provides different avenues for the transfer of knowledge and information among stakeholders of Agribusiness. Ogbeide & Ele (2015) conducted a study on Smallholder farmers and mobile phone technology in Sub-Sahara Agriculture and investigates how much farmers have applied this technology and the benefits derived from it. From the study, the author determines the uses of mobile phones for receiving agricultural information in Nigeria presented in table 5. From table 5 the smallholders' tested result on farmers' use of a mobile phone for agricultural purposes indicated that the use of the mobile phone to access market information and use a mobile phone for financial transactions had found significant while the other three uses had found non-significant. This is because the use of a mobile phone to access market information and financial transactions positively increases productivity and facilitates better negotiation among smallholder farmers, input suppliers, consumers and other stakeholders.

Table 4. Uses of mobile phone for receiving agricultural information in Nigeria

Uses of Mobile Phone	Mean	Sd.	t - statistics	P-Value
Use a mobile phone to coordinate access to agricultural inputs	17.384	8.783	16.43	0.594
Use mobile phone to access market information	30.036	5.063	29.485	0.001
Use mobile phone for financial transactions	22.292	7.375	21.487	0.001
Use a mobile phone to seek agriculture emergency assistance	14.573	6.538	13.863	1
Use a mobile phone to obtain expert advice	17.486	8.119	16.602	0.512

Source: Ogbeide & Ele (2015)

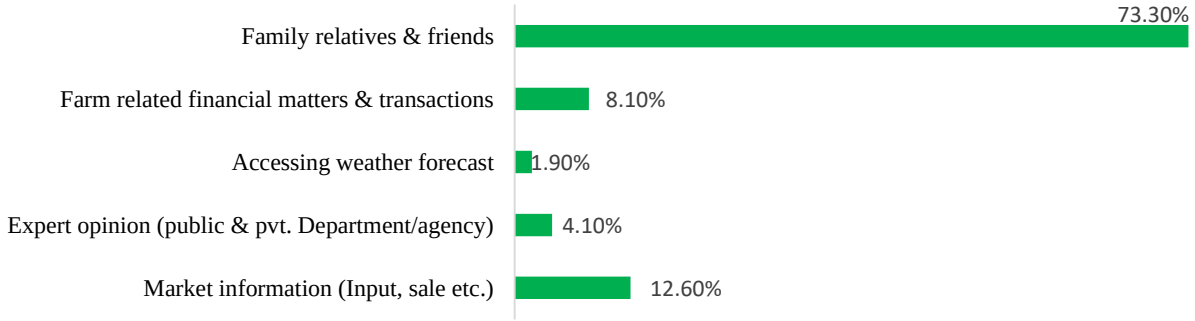
These findings are in line with another similar study which stated that farmers mostly rely on mobile-based communications for their farm-related marketing and financial matters (Masuka et al., 2016). In addition, Kaske et al., (2018) conducted a study on mobile phone usage for accessing agricultural information in Southern Ethiopia.



Source: Kaske et al., 2018

Figure 7. Respondent reason for mobile calling in Ethiopia

The findings (Figure 12) showed that the majority (81.3 percent) of rural household heads made phone calls for consulting with extension workers, followed by 78.4 percent for accessing the information on agricultural inputs, 68.4 percent for seeking market information, 58.8 percent for getting agricultural emergency security information and 32.8 percent for getting information on financial transactions. The overall findings revealed that respondents frequently communicated through mobile phones for getting agriculture-related information. Khan et al. (2019) carried out a study in Punjab, Pakistan where they observed farmers' mobile phone use patterns. The result concluded that a majority of farmers (73.3 percent) uses a mobile phone to contact family relatives and friends rather than the least trend (26.7 percent) towards formal agriculture-related use (Figure 13).



Source: Khan et al., 2019

Figure 8. Farmers' Mobile phone use pattern in Punjab, Pakistan

The higher trend of personal contact usage also indicates that farmers share farm knowledge and experience among their family, fellow farmers and friend's circles. This strong communication within the close circle gives them a sense of security in terms of farm knowledge exchange and access to required information. Use of mobile phones for farm-related purposes in which market information, weather

forecast, expert opinion and market information are exchanged through these mobile phones. From the same study according to Khan et al. (2019), it was also observed that among the agricultural-related information farmers' accessed private agricultural companies and their advisory staff more frequently as compared to public sector advisory services (Figure 14). It was also observed that the government sector's SMS and call helplines and advisory services through extension agents are least accesses by the farmers. This might be due to the lack of interest from the public sector institutions and organizations in the use of ICT in agriculture.

Source: Khan et al., 2019

Figure 9. Agricultural Information sources accessed by farmers using a mobile phone

There are a few numbers of research works conducted on farmer's use of the mobile phone for accessing agricultural information through mobile phones in Bangladesh. Though, some selected works have been presented below: Asif, et al. (2017) conducted a study factor affecting mobile phone usage by the farmers in receiving information on vegetable cultivation in Bangladesh (Table 6). The results indicate that the majority of the respondents (70 percent) belonged low use of mobile phone category followed by the rest 30 percent belonged to the moderate use category while none of the farmers are found under the high use of mobile phone category. The study further reported that though the use of the mobile phone is increasing with each passing day, farmers in the study area have not properly utilized mobile phones for getting information on vegetable cultivation purposes.

Table 5. Overall mobile phone use categories of farmers in Mymensingh district

Characteristics	Farmer's Categories (Scores)	No.	Percent	Mean	Sd.
Use of mobile phone	Low usage (up to 22)	49	70	21.19	2.683
	Moderate usage (23-33)	21	30		
	High usage (above 33)	0	0		
Total		70	100		

Source: Asif, et al., 2017

Another study by Meem (2018) on the role of mobile phone apps in agricultural activities in Nilphamari districts of Bangladesh observed that women farmers use mobile phones in getting various agricultural information (Table 7). From her findings, it has been observed that majority of the women farmers uses the mobile phone to contact with extension worker and a specialist to take advice about climate, disease and insect control measures related suggestion. This might be due to women farmers face problems mostly regarding the disease of crops, livestock and fish culture.

Table 6. Use of mobile phone by the women in agricultural activities in Nilphamari district

Sl. No.	Agricultural activities	RPS	Rank Order
1.	Identification of quality seed	189	4th
2.	Selection of crops	184	6th
3.	Land preparation and management	170	9th
4.	Determination of seed sowing time	191	3rd
5.	Determination of transplanting time	181	7th
6.	Intercultural operation	188	5th
7.	Climate and disease control measures	222	1st
8.	Harmful insect control measures	215	2nd
9.	Rearing of goat	160	10th
10.	Rearing of Cow	171	8th

Source: Meem, 2018 RPS= Role playing score

From the same study, she also observed the various mobile phone apps which are most frequently used by the women farmers. From her study, it also observed that though the women farmers using different apps in their mobile phone means in the study area women farmers using the smartphone for receiving agricultural information

Table 7. Rank order of mobile phone apps frequently used by the women farmers

Frequently used apps	No. of citation	Percent	Rank Order
Vutta (Maize) app	85	100.0	1
Krishoker janala	71	83.5	2
Krishi sheba app	65	76.5	3
Messenger	63	74.1	4
Play store	60	70.6	5
IMO	55	64.7	6
YouTube	48	56.5	7
Facebook	46	54.1	8
E-mail	42	49.4	9
Calculator	38	44.7	10

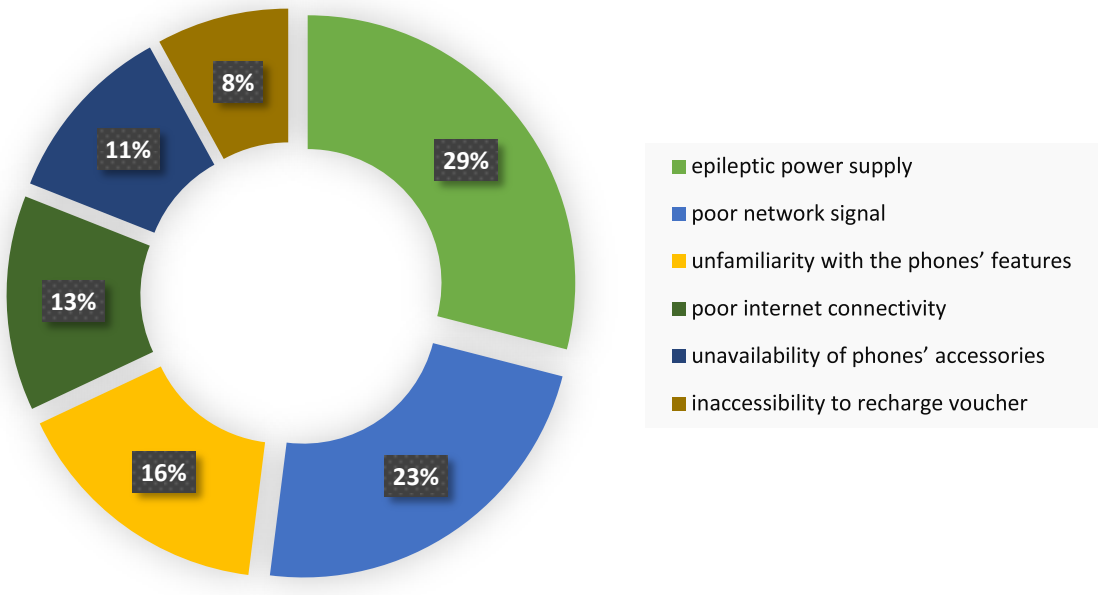
Source: Meem, 2018

From her findings (Table 8) it is seen that the '*Vutta* (Maize) app' (100.0 percent) was found as the most used app and ranked 1st because the respondents are the actual beneficiaries of the project. The Krishoker janala app ranked 2 nd followed by the Krishi sheba app 3 rd and lowest numbers of women farmers opined that they did not use 'Calculator' (44.7 percent) app for calculation they may use another means.

Challenges and constraints faced by the farmers for accessing agricultural information through mobile phone

Mobile phones have emerged as a truly pervasive and affordable Information and Communication Technology (ICT) platform in the last decade all over the world. Though it is an emerging research area that faces a variety of challenges and constraints due to the unique features of the mobile phone as well as the changing context (environmental issues).

Ogunniyi & Ojebuyi (2016) conducted a study on mobile phone use for agribusiness by farmers in Southwest Nigeria (Figure 15).



Source: Ogunniyi & Ojebuyi (2016)

Figure 10. Challenges face while using mobile phones for agribusiness in Nigeria

It was observed from the study that among the challenges farmers faced using mobile phones for agribusiness, epileptic power supply (29%) ranked highest followed by poor network signal (23%) and unfamiliarity with the phones' features (16%). Other challenges were poor internet connectivity (13%); unavailability of phones' accessories (11%) and inaccessibility to recharge vouchers (8%) (Figure 15).

Similar findings also observed from Burrell (2010) on the effective use of mobile phones depends largely on the availability of electricity. In addition, Abebe & Mammo (2019) carried out a study on factors affecting the use of information and communication technologies for cereal marketing in Ethiopia. Findings (Table 9) revealed that the highest number of farmers face difficulty in charging and repairing mobile phones due to the unavailability of electric power. The secondary challenge was the cost of a mobile phone (cards, charging and repairing). Other challenges included a lack of knowledge and skills for operating mobile phone applications also faced by the farmers for retrieving information.

Table 8. Challenges in using mobile phone for cereal marketing in Ethiopia

Challenges in using mobile phone	Number	Percent
Mobile network problems	52	34.7
Lack of knowledge and skill for operating mobile phone applications	71	47.3
Language barriers	33	22
Poor quality battery	14	9.3
Lack of availability of electrical power	82	54.7
Cost of mobile phone(cards, charging)	79	52.6
Economically unable to buy a mobile phone	18	12

Source: Abebe & Mammo (2019)

However, it was revealed in the study (Table 10) carried out by Nyamba (2017) that poor connections between stakeholders limiting the use of mobile phones to communicate agricultural information in Tanzania which is some extent different from the previous findings. The findings are in line with reported by Shaffril et al. (2010) and Samah et al. (2011) that lack of linkage among stakeholders has made farmers reluctant to use advanced technology in accessing agricultural information.

Table 9. Constraints of using mobile phones to communicate agricultural information

Response	Frequency	Percent
Poor linkages among knowledge intermediaries	230	95.8
High mobile phone purchase and running cost	195	81.5
Lack of awareness	80	33.5
Inappropriate subject content	45	18.8
lack of access to information sources	44	18.3
Low digital literacy among mobile phone users	43	17.9
Lack of trust in SMSs	35	14.6
Poor network signals	26	10.8
Poor rural electrification	13	5.4

Source: Nyamba, (2017)

Further, findings of the research conducted by Khan et al., 2019 also reported certain interesting limitations in the use of mobile phones among the farmers in Punjab (Table 11). It was shown that two major constraints "problems in understanding the information through robocalls" and "limited aptitude of cell phone use (calls only) which contain the highest mean value of 4.02 & 4.12. These findings are in line with the other studies which have also indicated digital illiteracy among the major constraints of mobile use among the farmers (Osabutey & Jin, 2016; Surabhi & Mamta, 2016; Saroj et al., 2017). The other constraints in using cell phones found similar to the previous study.

Table 10. Constraints in the use of cell phone among the farmers in Punjab

Constraints	Mean	SD
Problems in understanding information through robocalls (no clarification if any doubt arises)	4.02	2.23
Limited aptitude of cell phone use (calls only)	4.12	1.93
lack of electricity supply for charging mobile	3.27	2.14
Non-availability of area-specific information from private/public (helplines, call centers, etc.)	3.04	2.01
Lack of financial resources to spend money on phone calls	2.21	1.87
High charges on internet services	1.73	1.63
Poor network access	1.3	1.03

Source: Khan et al., 2019

In the case of Bangladesh, Huda et al. (2017) conducted a study on the effect of mobile phone technology in small farm productivity in Nilphamari districts (Table 12). He observed the different problems faced by the women farmers in using mobile phones.

Table 11. Problems faced by the farmers in using mobile phone in Nilphamari District

Problems in using mobile phone	**Respondents**	
	number	**percent**
Lack of adequate training about internet browsing	26	52
Lack of proper knowledge regarding mobile operation	20	40
Less availability of electricity facilities	15	30
Call rate is higher	12	24

Adapted from: Huda, et al. 2017

The study revealed that a majority of the women (52 percent) found lack of adequate training about internet browsing followed by (40 percent) women faced lack of proper knowledge regarding mobile operation and (30 percent) women had less availability to electricity facilities and (24 percent) women opined that the call rate was higher. However, Asif, et al. (2017) also conducted a study on factors affecting mobile usages by the farmers in receiving information on vegetable cultivation in Bangladesh (Table 13). From the findings, it is seen that a lack of servicing center is a severe problem and ranked first because it makes difficult for the user to repair or if they face any problem using a mobile phone. They further reported that most of the servicing centers are located in the city and far from the rural area. Expensive mobile set and electricity problems are also found 2nd and 3rd ranking problems opined by the farmers in that area. Network problem. The technical problems of the phone and unexpected calls are seen as less problematic to farmers.

Table 12. Constraints of using mobile phone by the vegetable farmers in Bangladesh

Constraints	**Number of respondents indicating constraints**				**PCS**	**Rank order**
	High	Moderate	Low	Not at all		
Lack of servicing center	38	32	0	0	178	1
Expensive mobile set	15	47	8	0	147	2
Electricity problem	19	30	21	0	138	3
High cost of repairing	8	48	14	0	134	4
Mobile phone operating problem	9	31	27	3	116	5
Short length of battery charge	7	28	35	0	112	6
Network problem	0	33	35	2	101	7
Technical problem of phone	0	31	36	3	98	8
Unexpected calls	0	5	30	35	40	9

Source: Asif, et al., 2017 PCS= Problem confrontation score

CONCLUSIONS

Based on the findings and their logical harmonization the present paper makes the following conclusions:

1. The mobile phone has become a widely accepted means of delivering information in developing countries. In Bangladesh, mobile phone ownership is in a positive trend, the rural and urban usage is appreciable while the gender gap is quite satisfactory compared to some other Asian and African countries. With the increasing trends of mobile phone users globally, the lower number of mobile internet users is lagging far behind from the advantages of mobile-based services and solutions.

2. Farmers use mobile phones for many reasons in accessing agricultural information. The common usages of mobile phones for the weather forecast, access to agricultural inputs, pest and disease control, access to market information, consulting with extension workers and financial transactions have been highly welcomed by the farming populace in many developing countries.

3. There are some constraints and challenges that farmers confronted in using mobile phones. These are commonly ranged from the unavailability of electricity, lack of operational knowledge and skill, high cost of mobile phone and network coverage problem in most of the developing countries. In Bangladesh, particularly the rural people have been mostly reported to encounter difficulties in internet browsing, higher call rate and electricity facilities.

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