



## Farmers' use of mobile phone for accessing agricultural information in Pakistan: a case of Punjab province

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**ABSTRACT:** Agriculture is considered as the main driving force in Pakistan's economy employing 45% of the country's labor force and generating 20% of national GDP. Agriculture sector of Pakistan is facing numerous challenges including non-adoption of agricultural technology at the farm level, due to farmers' lack of access to the latest information. In this context, the current study focusses on the use of the mobile phone in accessing agricultural information among the farmers of the district Muzaffargarh, Punjab, Pakistan. A multistage sampling technique was used to collect data from the two tehsils (cities/sub-districts) of Muzaffargarh formulating a total sample of 180 farmers. SPSS computer-based Software was used for analyzing the data. Results revealed that 91.2% of the farmers indicated mobile phone ownership. It was further reported that 87.20% of the farmers used private sectors advisory staff to obtain agriculture information. Market information was ranked as the highest accessed information among the rest of farm-related use. Easy access to updated information and connectivity with stakeholders were reported as the highest perceived benefits of mobile phone use (4.63 & 4.72 mean). Findings reported that farmers' limited aptitude of Mobile phone usage and lack of awareness of information sources as major constraints in farm-related use of the Mobile phone. On the basis of findings, the current study provided recommendations and policy implications for utilizing the true potential of these ICT-enabled solutions in agriculture.

**Key words:** mobile phone, ICT, information transfer, e-extension, farmers, agriculture, Punjab, Pakistan.

## Papel do celular para entrega de informações agrícolas em um distrito carente da província de Punjab, Paquistão

**RESUMO:** A agricultura é considerada como a principal força motriz na economia do Paquistão, empregando 45% da força de trabalho do país e gerando 20% do PIB nacional. O setor agrícola dos paquistaneses enfrenta inúmeros desafios, incluindo a não-adaptação da tecnologia agrícola entre os agricultores, devido a falta de acesso dos agricultores às informações agrícolas mais recentes. Neste contexto, o estudo atual enfoca o papel do telefone celular na disseminação de informações agrícolas entre os agricultores do distrito Muzaffargarh, Punjab, Paquistão. Uma técnica de amostragem em múltiplos estágios foi usada para coletar dados dos dois tehsils (cidades / sub-distritos) de Muzaffargarh, formulando uma amostra total de 180 agricultores. O software baseado em computador SPSS foi usado para analisar os dados. Os resultados mostraram que 91,2% dos agricultores tinham propriedade de telefones celulares. Verificou-se ainda que 87,20% dos agricultores contataram o pessoal consultivo do setor privado para obter informações sobre a agricultura. As informações de mercado foram classificadas como as mais acessadas entre os demais usos relacionados à fazenda (média de 4,63). O acesso fácil a informações atualizadas e a conectividade com as partes interessadas são relatados como os maiores benefícios percebidos do uso de telefones celulares entre os agricultores com valores médios de 4,63 e 4,72, respectivamente. Os resultados relataram que a capacidade limitada dos agricultores de usar o telefone celular e a falta de conhecimento das fontes de informação como principais restrições ao uso do telefone celular relacionado à fazenda. Com base nos resultados, recomenda-se a realização de sessões de treinamento com as comunidades agrícolas para criar conscientização e educá-las sobre o uso do telefone celular.

**Palavras-chave:** Telemóvel, TIC, Transferência de informação, Extensão E, Agricultores, Agricultura, Punjab, Paquistão.

### 1 INTRODUCTION

2  
3 Information and communication  
4 technologies (ICT) particularly the mobile phone  
5 has immensely penetrated every field of life like  
6 education, business, commerce, and agriculture.  
7 Mobile phone-based communication has rapidly  
8 grown in the recent past and became the most used  
9 communication tool among all ICTs of the current

age. Recent statistics showed that 62.9 percent of the  
1 population worldwide already own a mobile phone  
2 with 4.68 billion users on the planet (STATISTA,  
3 2019). This trend is also similar in Pakistan as the  
4 country has seen an abrupt rise in mobile phone users  
5 from 88 million in 2008 to 152 million in 2018 (PTA,  
6 2018). This rapid growth of Mobile telephony has  
7 emerged as a successful communication tool which  
8 has not only transformed the working style of many  
9

1 sectors but also created new professional dimensions  
2 in various businesses including agriculture  
3 (SULLIVAN & OMWANSA, 2013; ASONGU &  
4 ASONGU, 2018). In the agriculture sector, smooth  
5 exchange on information is a key to the successful  
6 adoption of farm innovation needed for the agricultural  
7 development but due to lack of resources and poor  
8 infrastructure in many developing countries, a huge  
9 communication asymmetry exists between the latest  
10 agricultural knowledge and farmers (BALOCH &  
11 THAPA, 2014). In this scenario ICT, particularly the  
12 mobile phone has shown a great potential to facilitate  
13 communication by enabling the smooth exchange  
14 of knowledge between the various stakeholders in  
15 agriculture (AKER, 2011).

16 In the agricultural context, the cellular  
17 phone has empowered the farmers to communicate  
18 from local to administrative levels regarding the  
19 agricultural trade, information exchange, and buying  
20 and selling inputs and farm commodities (OGUTU  
21 et al., 2014). This has reduced the cost of traveling  
22 and improved the production efficiency of farming  
23 communities living in remote areas. The mobile  
24 phone has tremendously been diffused even into  
25 the marginalized and underdeveloped farming  
26 communities because of its flexibility, affordability  
27 and user-friendly nature as compared to other  
28 ICT tools (OSABUTEY & JIN, 2016). Another  
29 dimension of mobile phone application in agriculture  
30 is “e-extension” that has simplified the mode of  
31 extension and advisory services by its effective role  
32 in communication between the farming communities  
33 and research organizations (AKER & KSOLL, 2016).

34 Generally, farm advisory services in many  
35 countries are delivered through conventional extension  
36 methods; e.g., farmers meeting, personal visits, mass  
37 discussions, etc. (FAOSTAT & PRODUCTION,  
38 2016). But unfortunately, the current ratio of extension  
39 agents to farmers cannot satisfy the information needs  
40 of the farming communities (BALOCH & THAPA,  
41 2014). For instance, in many developing countries  
42 the existing agriculture extension system is unable  
43 to fulfill the information needs of the farmers due  
44 to limited resources (AKER, 2011). In this regard,  
45 the emerging trend of using ICTs for extension and  
46 advisory services is commonly prevailing in many  
47 developed as well as developing countries (AKER &  
48 KSOLL, 2016). The argument that “communication  
49 technologies are the future of agricultural extension  
50 and countries cannot afford the cost of face to face  
51 extension anymore” is commonly prevailed because  
52 the cellular phone has a potential to replace the face  
53 to face extension system (ALDOSARI et al., 2017).

In this context, mobile phone’s role becomes very  
crucial for the agriculture sector of many developing  
countries like Pakistan which are facing extreme  
challenges due to lack of adoption of latest agricultural  
technologies by the farmers due to the poor access to  
the latest farm knowledge (REHMAN et al., 2015).  
This is an alarming situation for a highly agricultural  
based country like Pakistan.

In Pakistan agriculture sector generates  
nearly 20% of national GDP by employing 45% of the  
country’s labor force (GOP, 2016). An overwhelming  
majority of Pakistan’ population lives in rural areas  
and is engaged in farming and related businesses.  
Despite the abundance of the labor force in agriculture,  
Pakistan still lags behind in term of achieving its  
productivity potential as compared to other countries  
of the world (REHMAN et al., 2015). For the matter  
of fact, the agriculture sector of Pakistan faces a huge  
production gap between the actual and potential yield  
of various crops (MUDDASSIR et al., 2016; NOOR  
et al., 2016). Many studies in Pakistan identified  
several challenges to existing yield gap including  
non-adoption of latest farm technology (REHMAN et  
al., 2015). The reason behind the lack of adoption of  
agricultural innovation is because of farmers’ lack of  
information access regarding new farm technologies  
(AHMAD et al., 2016). Since many years in Pakistan,  
the farmers have been accessing agricultural  
information through conventional extension methods  
but due to the increasing population of farmers with  
respect to extension agents led to the failure of effective  
extension services in the country (BALOCH &  
THAPA, 2014). In Pakistan, the case of marginalized  
communities is even more worst where extension  
system does not exist at all or if it does, is biased  
towards the big landlords and influential farmers  
(ABID et al., 2015). In this situation, communication  
tools like mobile phone provide effective answers to  
farmers’ problems to ease communication between  
the various stakeholders of the agriculture sector.

During the past few years in Pakistan,  
many mobile phone-based initiatives in agricultural  
extension have been taken by various governmental  
and non-governmental agencies to assist the farming  
communities in the country (Figure 5). Use of  
mobile-based farm advisory services (FAS) was  
initially started in the developed countries and was  
later conceived by the developing countries including  
Pakistan (AKER, 2011). In fact, the application of  
such models has many success as most of the farmers  
in developed countries are resourceful and literate.  
But for a different setting like in Pakistan where a  
significant majority of the farmers is illiterate the use

1 and adoption of such models need to be explored.  
 2 Considering the rationale, this study was conducted  
 3 in a marginalized region of Pakistan to evaluate  
 4 the role of mobile phone in agricultural knowledge  
 5 dissemination purposes among those farmers who are  
 6 away from the mainstream. Moreover to the authors'  
 7 best knowledge, the independent evaluations of these  
 8 initiatives in Pakistan, particularly in the case of  
 9 marginalized regions have not yet been taken. Hence  
 10 this study provided pioneer evidence from these  
 11 initiatives in Pakistan.

12 Previously numerous studies have been  
 13 globally conducted regarding the effectiveness of  
 14 mobile phone and its use in the dissemination of  
 15 agricultural information to the farmers (SURABHI &  
 16 MAMTA, 2016; NEHA et al., 2018). But for the case  
 17 of marginalized communities as in the current study,  
 18 thin literature is available globally regarding the use of  
 19 the mobile phone for agricultural knowledge transfer;  
 20 to fill this knowledge gap and reach the literature  
 21 in that context the current study was designed with  
 22 the following research objectives. 1) assess farmers'  
 23 mobile phone use and related attributes in the study  
 24 area 3) To identify the farmers' use of various mobile  
 25 phone-based agricultural information sources and 2)  
 26 To explore the farmers' experiences regarding the  
 27 farm-related use of the mobile phone.

## 29 MATERIALS AND METHODS

30  
 31 This section outlined the methods which  
 32 are used in the current study. The methodology  
 33 includes study area selection, data collection methods,  
 34 sample size, sampling approach, and data analysis.  
 35 The description of the materials and methods used in  
 36 the study area is explained below.

### 38 *Study area*

39 The study was conducted in the  
 40 Muzaffargarh district of Punjab Pakistan.  
 41 Muzaffargarh was chosen because the study aimed to  
 42 explore the role of mobile phone for farm knowledge  
 43 transfer in the marginalized area and Muzaffargarh  
 44 lies in one of the most underprivileged regions in the  
 45 country (NAVEED et al., 2016). The study district is  
 46 located in the south of the Punjab province situated on  
 47 the bank of head Panjnad (junction of all five rivers of  
 48 the province). The district Muzaffargarh is comprised  
 49 of four tehsils occupying a total area of 0.84 m ha. The  
 50 population of the district is about 4 million, of which  
 51 majority of the population is rural (87%), relying on  
 52 agriculture and related businesses (GOP, 2017). Wheat,  
 53 sugarcane, and cotton are the main crops grown in

the area. The major mobile phone-based agricultural  
 information sources available in the study area  
 include government agriculture officers/extension  
 agents, private agricultural companies dealers/staff,  
 private helplines for farming solutions, government.  
 agriculture department helplines and government.  
 agriculture, livestock department helplines and SMS  
 services. The present study considered the use of the  
 mobile phone for information transfer in the context  
 of these available agricultural information sources in  
 the study area. Figure 1 shows the map of the study  
 area on the map of Punjab Pakistan.

### 39 *Data collection and sampling procedure*

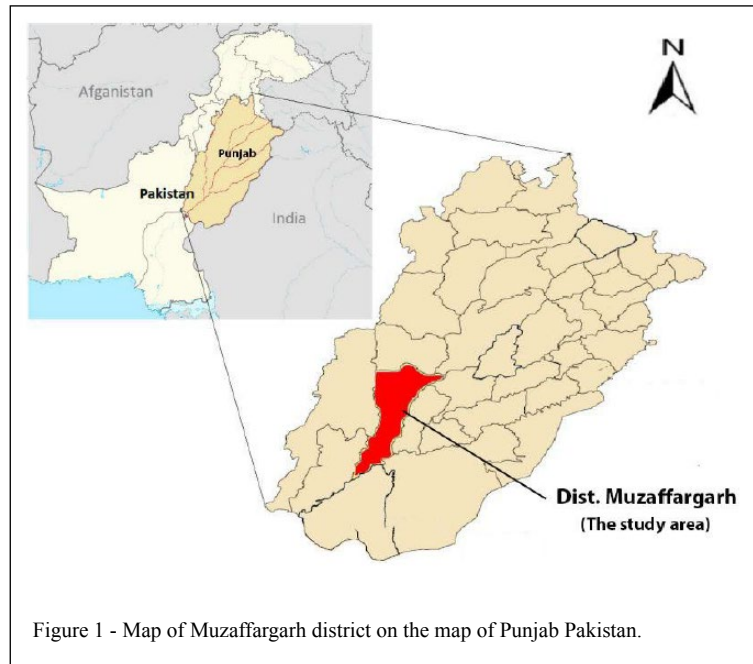
40 The data collection was carried out in the  
 41 two tehsils (sub-district) of Muzaffargarh district  
 42 between the month of February and March 2017.  
 43 Initially, Muzaffargarh district was purposively  
 44 selected as the study area and then a multistage  
 45 sampling technique was used to collect data. In the  
 46 first stage, Muzaffargarh District was selected, in the  
 47 second stage, two tehsils were randomly selected  
 48 among the four tehsils of the district. In the third stage,  
 49 two rural union councils were randomly chosen (one  
 50 from each tehsil). In the fourth stage, three villages  
 51 were chosen at random (one from each union council)  
 52 using Pakistan Village Statistics (GOP, 1998). In the  
 53 final stage, thirty farmers were selected from each  
 village (based on the farmer's list obtained from the  
 District Agriculture Department). Union councils are  
 a subsection of city government (sub-district/tehsil)  
 in the local government system of Pakistan and rural  
 union council may consist of various villages (GOP,  
 1998). Hence a total sample of 180 farmers was  
 generated. The data were collected by a predesigned  
 structured questionnaire. The questionnaire was pre-  
 tested on 20 respondents (out of sample) to check the  
 validity and reliability. The data collection was done  
 at Farmers' convenient places in their local language  
 and then converted into English. The collected  
 data were then managed and analyzed using SPSS  
 (Statistical package for social sciences) (Figure 2).

## 43 RESULTS

44 Results presented in the study are  
 45 comprised of the descriptive statistics of the surveyed  
 46 respondents. Out of the targeted 180 respondents, 164  
 47 of them possessed a mobile phone and were used for  
 48 data analysis.

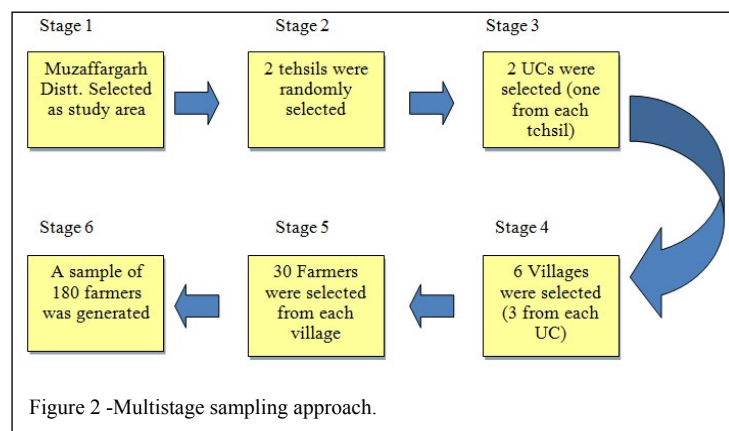
### 50 *Farmers attributes regarding mobile phone use*

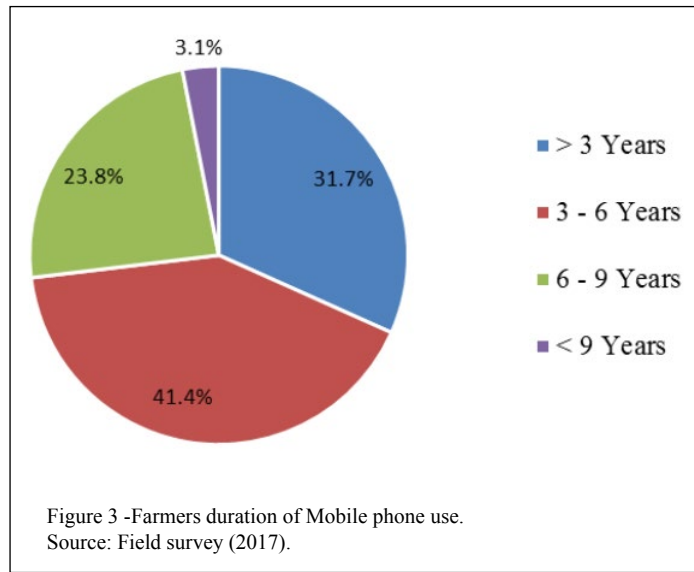
51 Farmer's characteristics like possession  
 52 duration and their aptitude of mobile phone play a  
 53



1 pivotal role in understanding its farm-related use  
 2 and factors associated with its adoption. It is argued  
 3 that farmers possessing mobile phone for a long time  
 4 have better skills of various operations i.e. making  
 5 calls, SMS and internet-based mobile and hence  
 6 increases the mobile phone adoption and use for  
 7 agricultural purposes (AKER & KSOLL, 2016). In  
 8 this regard, Farmers' mobile use related to attributes  
 9 like possession duration and aptitude of its use were  
 10 initially assessed.

Results presented in figure 3 showed  
 that the majority (68.3%) of the farmers reported  
 mobile phone use for more than three years, which  
 is a probability of farmers' better understanding  
 regarding basic operations of the cell phone. Findings  
 also indicated certain challenges for the feasibility of  
 e-extension as a large proportion of farmers indicated  
 possession duration less than three years that can  
 negatively affect their awareness regarding various  
 mobile-based information sources.



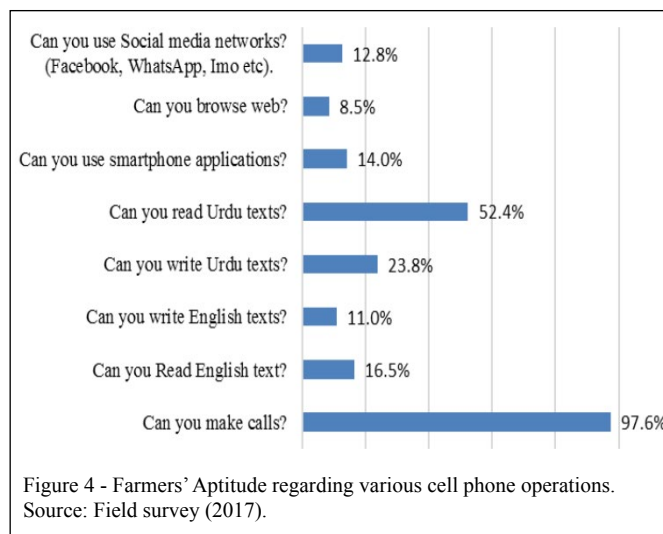


1 Similarly, farmers' aptitude of mobile  
 2 phone use was also identified by incorporating  
 3 various questions regarding their skills of various  
 4 types of mobile phone uses. Results (Figure 4)  
 5 showed that a significant majority of the farmers  
 6 was only aware of the basic operation of mobile  
 7 phones. Less than one-fourth (23.8%) of the farmers  
 8 indicated SMS writing ability in Urdu language  
 9 (National Language). Similarly, very few of them  
 10 indicated the ability to read (16.5%) and write (11%)  
 11 SMS in the English language. While in terms of  
 12 advanced operating skills less than 12% of farmers

(on average) indicated the use of smartphone  
 applications and other internet-based use of the  
 mobile phone. Farmers' aptitude of various mobile  
 phone operations is shown in detail in figure 4.

*Farm related use of mobile phone*  
*Farmers' mobile phone use pattern*

Mobile phone use pattern shows the  
 farmers' behaviors regarding the various type of  
 communication. In this regard, farmers' mobile  
 phone use pattern was assessed by documenting their  
 monthly mobile phone expenditures with respect to



1 the various use purposes. The findings presented in  
 2 figure 5 revealed that nearly three-fourths of phone  
 3 bills were spent for personal and domestic use, while  
 4 the rest one-fourth of the phone bills were reportedly  
 5 spent on various agricultural related purposes.  
 6 “market information” represents the highest share of  
 7 mobile phone bills among the all farm-related uses,  
 8 while the least proportion of mobile bills was reported  
 9 for accessing weather forecast. Farmers mobile use  
 10 pattern is shown in figure 5.

#### 11 12 *Farmers’ use of various Mobile phone-based* 13 *agricultural information sources*

14 Results shown in figure 6 described the  
 15 agriculture information sources being used by farmers  
 16 in the study area. Farmers were asked about the use  
 17 of the various mobile phone-based farm information  
 18 sources available in the study area. According to  
 19 the findings “private sector companies and input  
 20 suppliers” reported the highest used (87.2%)  
 21 of information source as compared to the other  
 22 information sources agricultural department SMS  
 23 service, call service, livestock department helpline,  
 24 and private helplines. These responses indicated the  
 25 farmers’ inclination towards private enterprises and  
 26 farm input suppliers. Moreover, extension agents’  
 27 mobile-based communication showed a higher use as  
 28 compared to the governmental officials call and SMS  
 29 helplines, which indicated their inefficiency.

#### 30 *Farmers’ perceptions regarding the benefits of farm-* 31 *related use of mobile phone*

32 The farmers’ perceptions regarding the  
 33 benefits of mobile phone use were also explored

by incorporating a list of various benefits of mobile  
 phone use in accessing farm related information.  
 In the following statistics (Table 1) a mean value  
 above 3 represents the farmers’ agreement while  
 a mean value below 3 shows the disagreement of a  
 farmer with the particular benefit of mobile phone  
 use. The findings revealed that farmers agreed to  
 all the benefits of using a mobile phone except the  
 usefulness of weather forecast and expert opinion.  
 Detailed responses are shown in table 1.

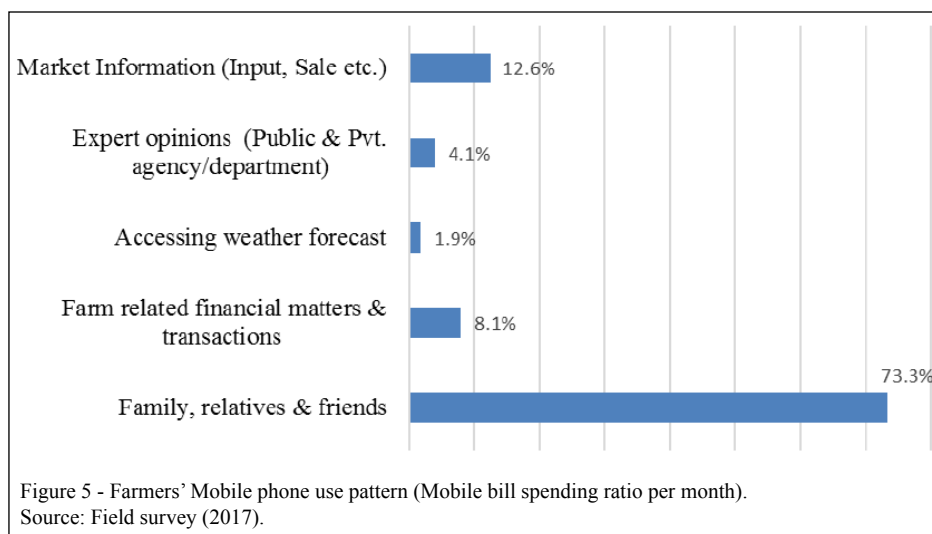
#### *Constraints in farm-related use of mobile phone*

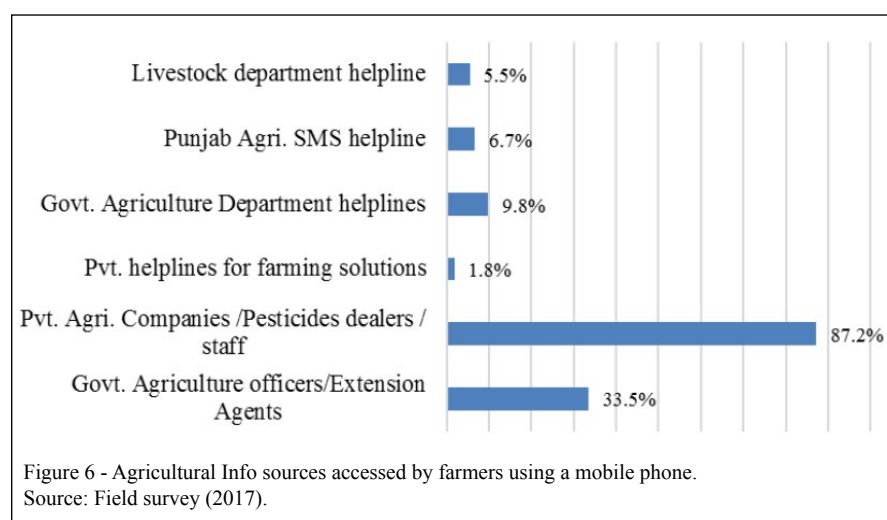
Constraints that limit the farmers’ use of  
 the mobile phone to access farm related information  
 were also identified in the current study. Farmers  
 were asked to recognize the limitations that hinder  
 the effective utilization of mobile phone in accessing  
 agricultural information from various information  
 sources available in the study area. According to  
 the findings (Table 2), Farmers reported two major  
 constraints to attain the successful utilization of  
 mobile phone for agricultural purposes. These  
 constraints included problems in understanding the  
 information through robocalls and limited aptitude  
 of cell phone use (to calls only) which indicated a  
 lack of education and mobile operating skills of the  
 farmers in the study area.

## DISCUSSION

#### *Farmers attributes regarding mobile phone use*

In the literature is evident that farmers’  
 characteristics of mobile phone use such as their





1 possession duration and skills and aptitude are  
2 closely linked with its adoption and use in agriculture  
3 (QIANG et al., 2012). Farmer 's understandings  
4 and their basic skills regarding mobile phone  
5 use are also considered as mandatory factors for  
6 its successful utilizing, as the higher aptitude of  
7 mobile phone use increase tendency of accessing  
8 agricultural information and hence the farmer's  
9 efficiency (VERMA et al., 2014). Our study in this  
10 regard has identified the mobile phone usage related  
11 characteristics , which included farmers ownership  
12 duration and aptitude of the mobile phone. Results  
13 (Figure 3) of our study revealed that that majority of  
14 the farmers possessed mobile phone for more than  
15 three years these findings are parallel with the study  
16 of TADESSE and BAHIGWA (2015) who indicated

a greater probability of farm-related use among these  
farmers. Similarly, our findings further reported that  
the majority of the mobile phone users had very  
limited mobile phone aptitude (calls only) and a  
significant proportion was unable to read and write  
text messages (Figure 4). The literature proved that  
SMS (short message service) possess a huge potential  
for the delivery of farm advisory services, but lack of  
education, awareness, and training poses hampers in  
the way of successful utilization (ALDOSARI et al.,  
2017; NEHA et al., 2018). Similar is the case of the  
present study, where the majority of farmers lacked in  
reading and writing the text messages (Figure 4). Aside  
from the basic mobile phone operations, the advanced  
use of the mobile phone in the form of the Android-  
based smartphone holds a huge potential as many

Table 1 - Perceived Benefits of cell phone usage in Farm related matters.

Perceived Benefits of Cell phone usage	Mean	S. D	Min	Max
Access to updated information (price, availability)	4.632	0.878	1	5
Increased connectivity with stakeholders (consumers, traders etc.)	4.721	0.578	1	5
Reduced the travel hours and cost	3.323	1.293	1	5
Shirked the local markets to accessibility	3.459	1.117	1	5
Facilitated local market chains	3.972	1.146	1	5
Enabled to make the informed decisions	3.168	1.735	1	5
Access to weather forecast t	3.354	2.486	1	5
Usefulness of weather forecast	1.743	2.764	1	5
Usefulness of expert opinions	1.935	2.012	1	5

Source: Field survey (2017).

Table 2 - Constraints in the use of cell phone among the farmers.

Constraints	Mean	S.D	Min.	Max.
Problems in understanding information through robocalls (no clarification if any doubt arises)	4.02	2.23	1	5
Limited aptitude of cell phone use (calls only)	4.12	1.93	1	5
lack of electricity supply for charging mobile	3.27	2.14	1	5
Non-availability of area-specific information from private/public (helplines, call centers etc.)	3.04	2.01	1	5
Lack of financial resources to spend money on phone calls	2.21	1.87	1	5
High charges on internet services	1.73	1.63	1	5
Poor network access	1.30	1.03	1	5

Source: Field survey (2017).

1 agricultural related applications, web portals, and  
 2 social media have more authentic information sources  
 3 (MANJUPRAKASH et al., 2016). But unluckily  
 4 farmers in the study area lacked in advanced operating  
 5 skills to utilize them effectively which highlighted the  
 6 need for farmers training the use of the mobile phone  
 7 to access these information sources.

8

#### 9 *Farm related use of mobile phone*

10 Farmers' use pattern of the cell phone has  
 11 also been identified in the current study. Findings  
 12 (Figure 5) indicated most of the cellular phone use  
 13 as personal (73.3%), parallel with another similar  
 14 study in India (MEHTA, 2016). This pattern depicts  
 15 that farmers have the least trend towards formal  
 16 agriculture-related use. Moreover, the higher trend of  
 17 domestic and personal use also indicated that farmers  
 18 may share farm knowledge and experience with  
 19 their family, fellow farmers and friend's circles. This  
 20 strong communication within the close circle gives  
 21 them a sense of security in terms of farm knowledge  
 22 exchange and access to required information. For  
 23 the case of the current study, 26.7% of mobile  
 24 phone usage has been solely reported for farm-  
 25 related purposes in which Market information and  
 26 discussion on farm-related financial matters ranked as  
 27 the highest accessed agriculture information with the  
 28 proportion of 12.6% and 8.1% of total mobile phone  
 29 use (47.2% and 30.3% of farm-related use). These  
 30 findings are in line with another similar study which  
 31 stated that farmers mostly rely on the mobile-based  
 32 communications for their farm-related marketing and  
 33 financial matters (MASUKA et al., 2016).

34 Higher use of market information also  
 35 represents its usefulness for farming activities as  
 36 literature has also endorsed a positive impact of  
 37 market information on the crop productivity and

farm income (KIKULWE et al., 2014; GICHUKI &  
 MULU-MUTUKU, 2018). It is further argued that use  
 of the mobile phone for accessing market information  
 increased because generally in many rural societies  
 the markets are distant from the farms so farmers use  
 a mobile phone to communicate with local markets  
 and traders (MASUKA et al., 2016). Similarly, 30%  
 of farm-related use of the mobile phone was for  
 "Financial matter", which showed the farmers reliance  
 on mobile phone-based interaction for their money  
 lending matters and credit services. Farmers in the  
 remote areas use a cell phone for management of their  
 financial transaction; for example, when they need  
 a loan to buy inputs and they may access the credit  
 institutions and the fellow farmers to meet their need.

Our study has also identified farmers' use  
 of various agricultural information sources available  
 in the study area (Figure 5). Results of our study  
 reported that farmers accessed private agricultural  
 companies and their advisory staff more frequently  
 (87.2%) as compared to public sectors advisory  
 services. These findings are parallel with another  
 similar study reported in India (VERMA et al.,  
 2014) which reported that farmers prefer to consult  
 the private sector's agents as they also provided the  
 required inputs in addition to the advisory services.  
 In this way, the private sector's dealers and suppliers  
 remain connected through the cell phone because  
 of selling their products. While the government  
 sector's advisory services are solely for information  
 delivery and are reported to be less responsive and  
 the extension agents of the private sector's input suppliers  
 like fertilizers, seeds, pesticides, and other farm-  
 related companies are generally very responsive in  
 terms of their advisory services (OSABUTEY & JIN,  
 2016; SAROJ et al., 2017). Similar is the case of our  
 study where the government sector's SMS and call



1 helplines and advisory services through extension  
2 agents are least accesses by the farmers. These  
3 findings indicated the lack of interest from the public  
4 sector institutions and organization in use of ICT in  
5 agriculture and highlighted the need for consideration  
6 from the higher authorities in its application in  
7 agricultural extension.

#### 9 *Farmers' perceptions regarding the benefits of farm- 10 related use of mobile phone*

11 The findings of our study showed that  
12 farmers agreed to various benefits of the mobile  
13 phone (table 1) and indicated "Access to updated  
14 information" and "increased connectivity with  
15 stakeholders" as the highest perceived benefits. These  
16 results revealed that access to updated information  
17 has significantly helped the farming communities.  
18 It is argued that the mobile phone has enabled the  
19 farmers to negotiate the local markets in order to  
20 sell their products with higher profits (TADESSE  
21 & BAHIGWA, 2015). Similarly, while purchasing  
22 the inputs and various farm equipment, smallholders  
23 communicate with markets to check the availability,  
24 quantity, quality and the prices of the required item.  
25 This also reduced transportation cost as they fix the  
26 deal with local commission markets prior to transport  
27 their commodities. Findings of our study are parallel  
28 with the other studies which stated that access to  
29 the latest information has significantly improved  
30 farmers income (KIKULWE et al., 2014; GICHUKI  
31 & MULU-MUTUKU, 2018). Moreover, "increased  
32 connectivity with stakeholders" indicated that the  
33 mobile phone by penetrating the local demographics  
34 has significantly strengthened the connectivity of  
35 farming communities and positively impacted their  
36 agriculture and related businesses. The literature  
37 stated that mobile phone has equipped the farmers  
38 to establish a network with various stakeholders  
39 in agriculture like traders, consumers and many  
40 institutions (MASUKA et al., 2016). Results hence  
41 proved cell phone technology as an effective ICT  
42 tool which made farmer to farmer communications  
43 more flexible and easier. Farmers now are no more  
44 away from the mainstream and can actively engage  
45 themselves in any kind of local cooperation, business  
46 and can make informed decisions.

47 Our study has also reported farmers'  
48 disagreement with benefits of the mobile phone  
49 which included "usefulness of weather forecast"  
50 and usefulness of expert opinions". Here expert  
51 opinion referred as the emergency assistance or help  
52 being provided by farm advisory institutions and  
53 organization (through call helplines or SMS services)

1 to the farmers in the study area while weather  
2 forecast means delivery of weather updates and rain  
3 predictions provided to the farmers. Disagreement  
4 with the benefits of experts' opinion indicated  
5 the farmers' incompatibility with the provided  
6 information. This showed that farmers may not get  
7 information according to their actual requirement  
8 i.e. financial situation and contextual feasibility.  
9 Similarly, disagreement with the usefulness of  
10 weather forecast indicated certain hampers and  
11 constraints as a reason which needs to be explored  
12 and addressed. These constraints can be in the form  
13 of un-authentic and unreliable weather forecast  
14 resources in the study area due to which farmers find  
15 these services useful. Literature in this regard has  
16 also indicated another reason due to which farmers  
17 may find weather forecast un-useful because of their  
18 more reliance on traditional beliefs and knowledge  
19 of local climate. For example, farmers in many  
20 traditional societies and regions predict the arrival of  
21 any drought or rainy season by the changing pattern  
22 of winds, so they rely more on their local knowledge  
23 (FITCHETT & EBHUOMA, 2018).

#### 25 *Constraints in farm-related use of mobile phone*

26 Findings of the current study have also  
27 reported certain limitations in the use of mobile phone  
28 among the farmers (Table 2). According to the results,  
29 farmers indicated two major constraints "problems in  
30 understanding the information through robocalls" and  
31 "limited aptitude of cell phone use (calls only) (4.02  
32 & 4.12 mean). The limited aptitude of the cell phone  
33 use indicated farmers' very basic knowledge of cell  
34 phone use limited to making and receiving the calls  
35 only which has already been identified in the previous  
36 section (Figure 4). These findings are in line with  
37 the other studies which have also indicated digital  
38 illiteracy among the major constraints of mobile  
39 use among the farmers (OSABUTEY & JIN, 2016;  
40 SURABHI & MAMTA, 2016; SAROJ et al., 2017).  
41 Currently, most of the agricultural knowledge lies in  
42 sources like websites, e-magazines, internet portals,  
43 and mobile phone android apps (MANJUPRAKASH  
44 et al., 2016). Similarly in Pakistan various ICT-  
45 based agricultural information sources like Cyber  
46 extension, ICT-enabled community center, Bakhabar  
47 Kissan (The well aware farmer), and UAF-clinic, etc.  
48 have also been launched in order to provide farming  
49 solutions to the Pakistani farmers (JALLO, 2016;  
50 JAZZ, 2018). These multiple sources of information  
51 need internet access and advanced operating skills  
52 which unfortunately farmers lack in the study area  
53 (Figure 4). Likewise, farmers indicated the problems

1 in understanding the information through the  
2 robocalls because in some cases, these pre-recorded  
3 voice calls-based information services do not satisfy  
4 the information needs of farmers in a way that there  
5 is no clarification if any unclear information or doubt  
6 arises. Similar findings have been reported in India  
7 (SHANKARAIHAH & SWAMY, 2012).

## 9 CONCLUSION

10  
11 In the scenario of extreme challenges in  
12 the transfer of knowledge to the farmers in Pakistan,  
13 cellular phone-based advisory services have emerged  
14 as an effective alternative which has transformed  
15 the conventional extension methods of information  
16 exchange. The current study in this regard focused  
17 on the use of mobile phone-based agricultural  
18 information sources between the farmers and the  
19 extension agencies.

20 Initially, the current study identified  
21 mobile adoption rate and farmers aptitude regarding  
22 its use as it was prerequisite to further explore its  
23 farm-related use. The findings reported that majority  
24 of the farmers had mobile phone possession but  
25 indicated very basic operating skills limited to call  
26 only. Due to this limited aptitude of mobile phone  
27 farmers were unable to access information from  
28 various Internet-based information sources like web  
29 portals and android applications. This may pose a  
30 huge challenge as most of the authentic information  
31 lies over these web-based sources and social media  
32 forums which need advanced operating skill. This  
33 urges the need for training and educating the farmers  
34 regarding the use of these available information  
35 sources to utilize the true potential of mobile phone.  
36 The current study also recommends the practitioners  
37 in the field of e-extension to consider the farmers'  
38 digital literacy prior to starting ICT-based initiatives  
39 in such communities. Moreover, there is a need  
40 to implement capacity building programmes that  
41 will lead to the acquisition of the required skills for  
42 enhanced utilization of the delivered content.

43 Despite many mobile-based information  
44 sources most of the farmers do not utilize it, as only  
45 one-fourth of the mobile phone use was reported for  
46 agricultural related communications. This indicates  
47 farmers' lack of awareness about the available  
48 information sources and seeks the attention from  
49 the policymakers to mainstream these initiatives.  
50 This could be attained by organizing awareness  
51 campaigns by the concern departments among the  
52 farmers which are the key target of these projects.  
53 Moreover, it was reported that among all the available

1 agriculture information sources, the private sector's  
2 farm advisory services were highly accessed as  
3 compared to the public sector mobile-based services.  
4 These findings indicated the lack of interest from  
5 government institutions and concerned authorities  
6 in the promotion and use of ICT-based information  
7 services in agriculture. Conversely, this also indicated  
8 the huge potential of the private sector in terms of  
9 its service delivery to which public sector institutions  
10 can acquire a lesson. In this regard, serious efforts  
11 are required from the public sector's institutions and  
12 policymakers to pay attention to these ICT based  
13 initiatives as these are the contemporary mode of  
14 extension and countries like Pakistan cannot afford  
15 the cost of face to face extension.

16 Market information and financial matters  
17 which were reported as the most accessed agricultural  
18 information indicated the farmers' reliance on mobile-  
19 based communication in rural areas. This further  
20 indicated that easy access to market information and  
21 financial transaction through mobile phone has made the  
22 farmers more connected to the mainstream. According  
23 to the farmers' experience with the farm-related use  
24 of mobile phone, access to updated information and  
25 easy connectivity with stakeholders were identified  
26 as the highest perceived benefits in terms of service  
27 delivery and timeliness. While in term of provided  
28 content weather forecast was perceived as the least  
29 effective among the farmers. This highlighted an  
30 immediate need of attention from the weather agencies  
31 and concerned organization to ensure the provision of  
32 accurate and area-specific weather information to the  
33 farming communities in the study area as the weather  
34 is an important factor in farming and crop cultivation.  
35 Moreover, the ineffectiveness of agricultural advisor's  
36 opinion predicts certain incompatibilities between the  
37 delivered information and farmers needs and hence  
38 this study recommends the provision of farm-related  
39 content tailored according to the farmers' actual needs.

40 Similarly, the reported vagueness in the  
41 Robocalls (pre-recorded voice message) urges the  
42 need to consider such a mode of communication in  
43 which farmers can give their concern if they feel any  
44 doubts about the provided information. Moreover,  
45 farmers' limited aptitude of the mobile phone which  
46 was also reported as a major limitation in acquiring  
47 farm knowledge; therefore, this study recommended  
48 the information delivery using a simpler mean that  
49 requires very basic mobile operating skills.

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## DECLARATION OF CONFLICT OF INTEREST

The authors declare that they have no conflict of interest. The founding sponsors had no role in the design of the study, nor in the data collection, analyses, or interpretation of data, the writing of the manuscript, nor the decision to publish the results.

## AUTHORS' CONTRIBUTIONS

All authors contributed equally for the conception and writing of the manuscript. All authors critically revised the manuscript and approved of the final version.

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