Farmers Inclination to Adoption of Mobile Phone Agriculture Information and Trade Systems in Pakistan

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Abstract: *This research studies three aspects relating to farmers readiness for the proposed mobile phone information and trade system (MAITS) namely (a) farmer readiness to adopt newly proposed mobile information and trade system (b) key factors that affect farmers mobile decision support systems (c) farmers readiness to connect with mobile enterprise networks. These were investigated using a qualitative research method. After a careful selection of a set of questions, interviews were conducted with selected farmers from four cities of Pakistan including Lahore, Faisalabad, Vehari and Khanewal. The analysis revealed that farmers readiness to embrace new mobile phone information systems requires maximum level of optimism and innovativeness along with deal of the inhibiting factors which affect the readiness state; inhibiting factors in MAITS adoption comprised of uncertainty factors and current faulty existing system services; and there has been a complete consensus among the farmers to practice MAITS along with mobile decision support system because it can help them in crop planning, farm inputs (seeds, fertilizer, sprays etc), harvesting, transporting and trading. The findings of this study will provide guidance to the relevant organizations when considering readiness and barriers towards implementing of MAITS. The results of the study will give insight to many extension service and policy makers to understand what farmers actually need.*

Introduction

Pakistan is an agriculture country with seventy percent of its population living in rural areas. The agriculture sector is an important sector contributing 50 to 60% revenue to the national economy of the country and provides 50% of the jobs (Khan, 2011). Almost half of labor earnings come from this sector and it is one of the biggest sources of foreign exchange (Akhtar, 2007). The significance of agriculture, despite the fact that country has faced adverse climate change, drought and flash flood, has witnessed remarkable growth in the past (Thomas, 2011). A tremendous increase in out-put of crops (per acre) was registered in 2009 till 2013 (Pakistan Today, 2013). Despite of good contribution of agriculture sector in the economic development of Pakistan, the farmers are facing various challenges. There are farmers who work hard throughout the year to get their crops ready, but when the crops ready for selling, they face the problem of access to the retail markets and buyers to get competitive market rates. Thus, the quality of goods and commodities are affected and farmers are often paid lower market rates for their commodities. This process puts farmers into a situation where they barely mange to pay off loans which may have been taken for crop cultivation, and they end up with making little or no profit.

Another key challenge is the location of the agricultural trade markets, which are often located far away from the villages. Due to lack of availability of transportation, it is very hard for farmers to take their goods to the market. When farmers are offered a lower rate, they have no other choice but to sell their goods sometimes without making any profit. Moreover, complicated procedures affecting agriculture farming comprise, crop planning and selling in the market which requires greater attention for farmers to choose the best route for them (Amjad, 2010). Similarly, scarcity of funds for rural infrastructure which affects farm productivity and growth is also one of the challenges. Moreover, the low literacy rate in the villages where most of the farmers cannot read and write is itself a big challenge. The farmers do not know how to access information using latest technology that could improve yields to get better market rates for their harvested crops. The farmers mainly rely on conventional information systems and are not familiar with the new technologies such as use of IT, whereas farmers in developed countries have realized the importance of information driven economies.

To address various challenges, the government of Pakistan has focused more on research and development network which comprises of institutions such as the

Agriculture Research Institutes (ARI), Agricultural Universities (AUs) and Agriculture Development Banks (ADB). The function of these set-ups in research and extension services support activities is of immense importance. However, there has been no major technological innovation which could give fresh momentum to agricultural productivity levels. Inadequate extension services for trading, and limited access to information further broaden the gap in the adoption of specific agricultural technology which results in the poor yields of agriculture products or crops. In order to achieve the higher levels of agricultural productivity, farmers must be equipped with up-to-date information and decision support in the agricultural systems. This has often been considered as the next step in modernizing agricultural setups. The current levels of mobile phones and mobile-enabled information services in rural areas could reduce information asymmetry and allow further awareness of the core expertise within the extension services. In the Pakistani context, the impact of mobiles as a mode of providing information for farming purposes would depend on how effectively the proposed mobile phone information and trading system network is embraced by the farmers in order to attain the market information. The impact of technology can generate significant results on productivity of crops in terms of increased returns by adapting changes in best practice for cropping patterns that could improve yields and the better price information for agriculture inputs and outputs which will make the farmer's position better. Other non-price factors such as information regarding farming inputs, seed quality, and adoption of modern techniques are also crucial to enhance productivity.

In order to maintain the enhanced productivity levels and to resolve crop selling hurdles like infrastructure limitations, distribution inefficiencies and the key factors resisting the spread / gain, and considering the high usage of mobile phones in Pakistan, the Government of Pakistan has shown immense interest by applying telecom industry exemplary model of growth with agriculture sector. The agricultural model can be more modified in a way that it can use telecommunications and access its benefits. Today in Pakistan 72% out of total telephone penetration rate is 119.9 million mobile users and Pakistan Telecommunication Authorities (PTA) has begun encouraging the development of indigenous based content on mobile/information and communication technology provisions and set to offer any kind of support to benefit farmers by offering the reliable and timely information (Saadia, 2012; Aziz 2012).

The objective of this study is to explore and evaluate farmer's readiness and barriers towards implementation of newly proposed mobile information and trade system

(MAITS) in Pakistan. More specific objectives are to investigate a) farmer readiness to adopt newly proposed mobile information and trade system (MAITS) b) key factors that affect farmers' mobile decision support systems and c) farmers readiness to connect with mobile enterprise networks.

The rest of the paper is organized as: after introduction, literature review has been carried out followed by methodology. In next section, analysis and discussion has been presented followed by findings. The conclusion of the study is given at the end of the paper.

Literature Review

Despite a huge organizational setup by the government of Pakistan, the extension services do not reach to the most of farmers because of the geographical scatter and low motivation of the extension staff serving them (Siraj, 2011). Resultantly, this affects the growth of agriculture sector. There are various government, private and multinational organizations, as well as Non Government Organizations (NGOs) working to empower the farmers by providing the necessary agricultural information tools and inputs. However, the most striking cause which the farmer experiences is the shortage of relevant information needed for taking befitting timely action. Farmers are therefore disadvantaged and are unable to benefit with the existing agricultural knowledge. To provide timely and relevant information to the farmers, the government and some ICT organizations are planning to develop mobile phone information and trading system (MAITS). The purpose of mobile information and trading system is to create an information pool allowing access to farmers and to provide them appropriate training, support and motivation, and also rewards to serve the whole community in a productive way. The use of ICT in agriculture is not a new attempt in Pakistan as almost every mobile operator has launched agriculture associated services on partial basis (Siraj, 2011). For example, Telenor mobile operator has provided "e-Mandi" (Urdu name for e-market) information which consist only the rates of each agriculture commodity (Telenor, 2009).

The ICT technology still has not been diffused in agriculture in Pakistan. There is a need to evaluate the readiness of farmers towards implementation of MAITS in Pakistan. The term technology-readiness refers to people's inclination to embrace and apply novel technologies for accomplishing goals and objectives. It can be viewed as an evaluation process of overall state of mind that determines a person's predisposition to make use of novel ideas by using those technologies

(Parasuraman, 2000). Although new technologies are diffusing through different segments of daily life at a much faster pace than ever before but on the other hand other survey-based evidence have shown   signs of growing technology adopter's frustration and disillusionment (Alsop, 1999). Though overall benefits of technology is seen as prolonging the adoptive process - for instance, the automobile took 55 years to attain 25% share of the market, compare to the cellular telephones which took only 13 years to reach the same level of market share (Berry, 1999).

The concept of ICT readiness has received very infrequent attention in the literatures. Some studies have shown the evidence of higher level of technology readiness generally leads to lower level of innovation risk with a greater successful implementation outcome (Basole and Chao, 2004). A similar argument can be use in the context of mobile ICT: higher levels of mobile ICT readiness leads to lower technology risks and implementations that could also be successful. Individual readiness is important in explaining and predicting about the inclination to adopt new technology (Lin et al., 2007). Most of the models such as Technology Acceptance Model (Davis, 1989) and Technology Readiness Model (Parasuraman, 2000) were originally established for evaluating people's technology readiness or technology adoption behavior in particular organizational environments (Lin et al., 2007). People in work settings may unwillingly or reluctantly to adopt new technology due to management influence. However, individuals or consumers in free market settings are free to choose among conventional and mobile phones information and trading systems. When people make their minds to use new mobile information and trade system, they mutually create an e-service with the system but do not hold ownership of the system (Siraj, 2011). According to Lovelock et al. (2004), in e-service perspective, service provisions cannot be created separately from the customers' full contribution and participation explaining what they would like. Likewise a similar input is required from Pakistani farmers. Farmer readiness conceptualizes their general beliefs about technology, decision support factors and enterprise readiness linked with their engagement in technology-based products and services (Parasuraman, 2000; Basole and Chao, 2004; Basole, 2007). Indication of evidence from the work done in the field confirm that all the readiness and decision making factors are not enough to explain why farmers do not adopt new technologies, such as mobile phones with agriculture information systems or trade tracking systems.

Earlier research studies have developed different models/constructs/frameworks that had critically focused on several success factors related to technology adoption

decisions (Agarwal et al., 1997; Damanpour, 1991). Some focused on individual technology adoption of technologies which combined theories of consumer behavior and psychology. A variety of models have emphasized technology acceptance and use by individuals and these investigations have provided key indicators to technology adoption decisions. However, they do not describe organizational technology adoption decisions essential for integration process (Legris et al., 2003). Other researchers developed key dimensions of technology readiness (Basole, 2005) from the domain of engineering management, information systems, organization behavior and strategy, which has shown the different avenues of organizational adoption decision making criterion very well in adopting those technologies. (Lai and Guynes, 1997; Tornatzky and Klein, 1982).

In the literature, the recent and the most suitable and popular methodologies developed and adopted to evaluate the readiness of users for technology adoption are: Technology Adoption Model (TAM) (Parasuraman, 2000) which include optimism, innovativeness, discomfort and insecurity, Technology Readiness Index (TRI) (Basole and Chao, 2004) which include timeliness, trust, information richness, ease of use and Decisions Support Systems (DSS) (Basole, 2007) which include technology readiness, further including data and information readiness, process readiness, resource readiness, knowledge readiness, leadership readiness, employee readiness values and goals readiness…
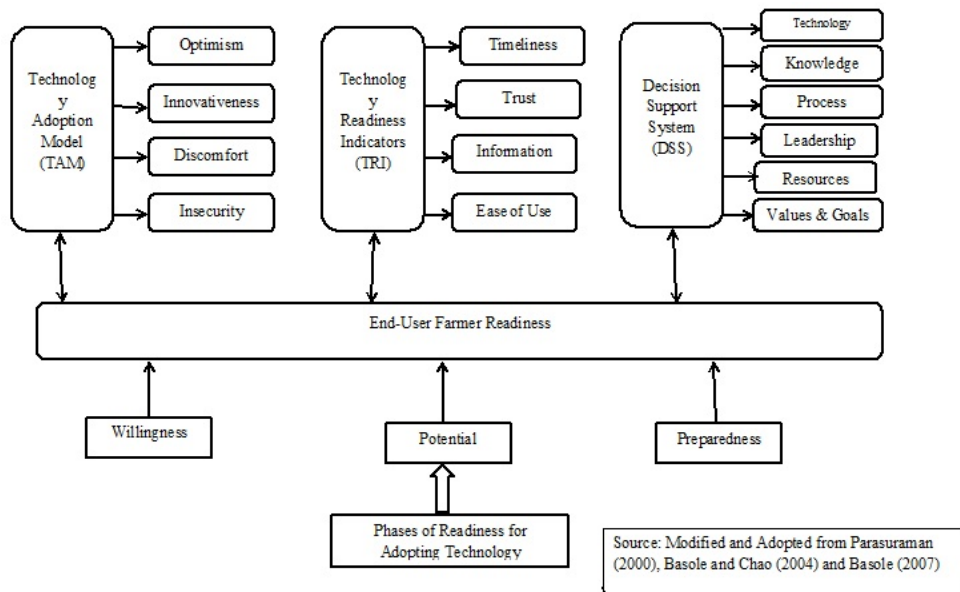
According to Basole (2007) any business entity itself passes through three phases which evaluate the readiness which include; preparedness, potential and willingness to adopt the mobile technology. A complete readiness assessment involves an evaluation process across the three layers along eight readiness dimensions. The first layer preparedness is assessed for all eight dimensions and refers to an organization's ability to adopt, distribute, and assimilate mobile information system. The second layer potential is evaluated along the process, employee, and value and goals dimensions which are aligned with organization's processes, employee, and strategy that could benefit from mobile information system. Third, willingness is assessed along the employee and leadership dimensions that reflect the leadership and employee attitudinal orientation towards adopting the mobile phone as a tool. Basole (2007) further find out the eight modes of readiness (key parameters) in evaluating specific aspects of readiness with actual information so that any company or entity can test these dimensions to check the readiness level before introducing the technology in their setup. These models include technology readiness, data and

information readiness, process readiness, resource readiness, knowledge readiness, leadership readiness, employee readiness and, value and goals readiness.

Methodology

In the literature, various methods have been adopted to evaluate the stakeholders' readiness for technology adoption. To evaluate the farmers' readiness to adopt mobile technology for agriculture development purpose, the following conceptual framework has been developed from Parasuraman (2000), Basole and Chao (2004) and Basole (2007) and adopted in this study.

Figure 1. Conceptual Framework for Evaluating Farmers Readiness for Technology Adoption

The following basic questions were designed on the basis of above framework.

- How ready are farmers to embrace the new mobile phone agriculture services in Pakistan?
- What are the key factors in mobile decision support systems which affect farmer readiness to adopt new mobile phone agriculture information and trade systems?
- How ready are farmers to work with mobile enterprise networks after getting agriculture services on their mobile phones?

The new proposed Mobile Phone Agriculture Information and Trade System (MAITS) is a mobile phone information system which will provide important market information to the farmers and traders about agriculture. The basic objective of MAITS is to increase farmers' returns by providing various information about agriculture activities including better price, better quality of seed, weather conditions, better time for cultivation, better pesticides and fertilizers etc for agriculture inputs and outputs which will make the farmer's position better.

Data was collected from four important city of Pakistan including Lahore, Faisalabad, Vehari and Khanewal using interview methods. The interview guide has been developed (see Appendix). In order to get valid and reliable data, interview was recorded from only those farmers who were listed by agriculture development banks and agriculture research institutes. Twenty people including farmers (Progressive Farmers, Economical Farmers and Small Farmers[i]) and agricultural experts were interviewed. Interviews were conducted in local language Urdu and then translated into English because English was not the first language of informants. The research theme and the interview guide were sent to the informant a day prior of interview, so interviewees have clear perception about the research and be able respond correctly. A credit officer better known as a mobile credit officer from the Agriculture Development Bank and a second officer from the Agriculture Research Institute cooperated in conducting interview. A digital recorder was used to record all the interviews in order to increase the accuracy of the data collected and to remain more attentive to the informant.

Analysis and Discussion

Technology Adoption Model (TAM)

In Pakistan farmers are aware of the new technology uses in their personal life. Information is needed to cut down their problems related to agriculture. Different interactions with the people give them an ability to appraise and appreciate use of new technology whilst working in their fields. They use technology to produce more crops and to get good offers from customers or market dealers.

According to the Expert of Horticulture and Parks Authority Development, "The customers and market dealers are well informed about the results of promising technologies and usually collaborate with those farmers who have adopted or a considering adopting the new technology."

The technologies effects are perceived to be promising – with greater understanding of the use of these technologies it provides the users a greater insight into new modes of thinking and processes in agricultural reform. In Pakistan, the farmers who use technology perceived it to be more valuable than the other farmers who lack in it, but were vaguely aware of it, According to the farmers, "latest technologies make the life easier, save time and make easy and quick approach to other person / organization & departments."

The accurate information, at precise times, at the exact place is important for the farmers. However in Pakistan mostly there exists no complete set of mobility information sources that travel with farmers. While they are in a field visit or in markets for agriculture buying and selling, they use mobile phone for communications. According to the Expert of Agriculture Research Institute "Phone calls are not made for agriculture purposes. They are just made for normal gossips." Majority of farmers informed that farmers "use information from TV, radio and newspapers." One of the farmers who was using internet in field responded as "internet made us aware of what is going around the world." However, Agriculture Research Officer (Expert) pointed out that farmers who are using this facility are very small in number. According to a farmer, well-informed farmers consider them more confident in discussing those issues which they learnt from media.

The media has created positive and negative impacts on farmers. The negative impact is, the farmers are most of the time unknowingly mislead about the

information and most of time they use partial information which put adverse effects on their productivity. The information is needed for agriculture - physical infrastructure, agriculture inputs and market information which make the farmer rethink to look for sources of information rather than personal use. Their ambition shows their future is connected through mobile phones that will provide them in hand information to proactively manage their crops and trading. According to a farmer "we can harvest our crops before the weather changes… rain or heavy storms." Some farmer doubt that this system may not be successful in Pakistan, because of farmer illiteracy and middlemen influences. Farmers were found not happy with existing extension services offered by government and private organizations. Farmer concerns about extension services that "these services are very limited and old fashioned and they are ready to adopt new technology which reduces their time of information searching." Most farmers are looking for more choices if available so they are interested to know about mobile phone affects and its progression in most of the fields of other sectors.

According to a farmer: "Simple! This is very helpful for us. From weather update (information) we can plan our sowing, irrigation, spray of pesticides and use of fertilizers… "We can compare our old varieties of crops with new one if mobile company provide authentic yield of new variety… From market updates I can manage the selling of my agriculture commodities."

It is common behavior to know about people more familiar with new technologies who have more information. They are the ones who are interested in latest technology information and can especially handle high-tech products and services without any further help. As they know a lot about working of technology and face fewer problems as compared to those people who are not innovators. For evaluation of farmer readiness it is necessary for farmers to have an innovative mind. The farmer who intends to take risks is the only one able to use new proposed mobile information systems. In Pakistan, Innovator type farmers prepare other fellow farmers for new technologies. The prior type of farmers observes their surroundings carefully in expectation to get latest ideas. They discover new ways of approaching the technology and try them fitting to their exact situation or to see if that is relevant to solve their specific problems - readiness state. All the way through this procedure, many farmers during the interviews for the technology benefits made up their minds to adopt latest ideas and latest methods of the systems. The similar response from the farmer to urge for new information and their readiness level to act on it can identify "man to man information… we go to different farmers and ask them that what

should we plant and how?… On their provided information we act on the information what they have told us to do."

Farmer readiness to use technology is activated by causes or problems like pesticide spray prices. Currently, the cost of fertilizer has increased to the level that some farmers may not be able to afford to buy this. Thus, the use of information is productive in different ways, a farmer responded as "the use of information has equipped us with many skills… I would say farmers do not broaden their exposure… otherwise there are lot of opportunities here… from which farmer can easily increase the yield… for example there are some insects… if you use those insects in your crops they kill the insects which are destroyer of the crops… now this technology is available and at free cost… many farmers do not know about this." In similar case of mobile phones, these trends are proving farmers readiness to use mobile phone in place of old and existing systems due to innovativeness.

Farmers think that when they are connected with agriculture world through mobile phones, it will increase their knowledge about agriculture business and will impact on other regions. The interviews data shows that the farmers want to learn new ways in agriculture. Indeed, most of information transferred to them is only one sided. Until the farmers do not put their wisdoms through innovativeness, the adoption of mobile phone services will not occur. A farmer who was active participant of different agriculture forums argued that "until we have a better communication with other farmers, trainers, experts and organizations… then only we will be able to understand about any new information… what presently is going on?... information is one sided delivered and nobody encourages the discussions… we perceive discussions facilities should be as far provided to us because we need sometimes to clarify and rectify some terms… which we are unable to understand easily in one go."

Farmers have shown their issues regarding traditional agriculture systems as a weak dispersal mechanism with a long search time, and incomplete levels of information retrieval. There is no certainty of information be delivered on time. During interviews farmers were found complaining about the current agriculture system lacking especially about the technologies in government sector which are not fully supporting them and how uncomfortable they were feeling in obtaining information. Even use of technology by others brings discomfort to them.

According to a farmer, "I go to them for soil test... they give me two weeks time… and after that the results were recommended for the color land… they have interchanged results with other farmer mistakenly."

One farmer felt uncomfortable because as he stated he does not know exactly whom to call in the case of emergency; who is the best person to get them the relevant information? When farmers tried to call the consultants or advisors, they usually end up with busy calls. Farmers suggest that there must be built in recording facility so that their calls are recorded automatically on the consultant cell phones. According to a farmer, "mostly when we are in field … we missed some information and not able to completely understand what we missed or even convey concerns to the relevant authorities."

Farmer does not know exactly to whom to call in case of emergency. Who is the best person to get them the relevant information? According to a farmer, "my crops were attacked by… insects… the climate condition was helping to grow those insects in no time but in this emergency state I was not able to get any help from anywhere. Eventually as a last step I burned my crops. This was a big loss for me"

Most of farmers consider human involvements are too crucial in some farm activities. They are reluctant to give information on mobile phones. Farmers are skeptical in providing information, indeed if it actually gets to the right person in the right location. One farmer said that "they do have to trust middlemen" and not see any secure option to do any type of financial transactions via mobile. Some farmers have put this as their deep concern that any deals, they do by machine should be authenticated afterward in writing, "before this it was done by the middlemen." Farmers feel insecure shifting from traditional agriculture system to mobile phones, while the limitations are the payment and lack of contact in the market. Farmers perceive that they cannot rely on only mobile information systems; they have doubts on the technology like the technology is too complex that how are we going to get out our payments.

According to a farmer, "we get immediate payments from middleman, we do not know how mobile phone will give us this facility, we cannot trust the services for buying and selling purpose but we can trust in case if it's backed by the government… banks.

The proper information and standards should meet in any case. A number of organizations from the government sectors provide the free information, but most of farmers do not have access to this information sources. There must be some centers which also check the communication flow and how these systems can respond effectively. According to a farmer "most time when we are in the field… we know when we have missed some information and are therefore not able to completely convey the complete information or query… to the concerned authorities."

Farmers hire people and do not use the technology by themselves in sensitive matters where chances for damage are greater than the chances for enhanced productivity. Few farmers responded as "to get rid of weeds there are special skills required, you have to treat without damaging the main crop… sometime technology is dangerous like you need unique skills to spray… same deficits are in mobile phone… how you can be save from radiation effects."

In traditional agriculture farmers face middlemen who charge the higher money from them. According to a farmer, "the role of middle man is very dominant in our market system. Sometime middle man earns more than farmers. It will be a great change if we are able to get rid of these intermediaries. Surely the more profit I will get from my produce…".When farmers were asked about whether they like to minimize or eliminate the role of middleman, few farmers responded as "this will be miracle. The middle man provide us low market rate, take its percentage also. The only creditability is the payment… He paid money within weak. If mobile company opens its own purchase centre, payment guarantee, provide fair market rates, which ultimately increase our profits more than the middleman… we appreciate the elimination of the middleman." Farmers only go or reach to the middleman when they do not have investment to grow their crops, under hard pack circumstances. Farmers are force to take loans from the middleman on their terms. Most of the farmers have shown their willingness that if the mobile phone technology or the MAITS system is associated with some banks or government department which give them loans on the light terms and conditions they like to have it. According to the expert opinion from the Agriculture Development Bank, "… for farmers who are excited to use this new facility the service should be personalized and superior. The mobile Agriculture should provide the access to farmer consistent, reliable, updated information that is tailored for his use."

Technology Readiness Indicators (TRI)

The farmer's decisions making factor has to be decided within time while it has been noted through the interviews that farmers were indeed had the greatest concerned about information timing. For, instance, deciding which mobile phone function is important; a farmer says "time is critical factor… we perceive that instead of SMS services… bear just little cost and just makes the phone call."

The decision support system in current situation is working around information from government, private companies and middlemen. Due to time factors and other information sources tendency towards media habits are changing. According to a farmer "…there are many agriculture programs aired on TV, radio… but due to our presence in field… we do not have time to see it… now these programs are available on CDs…which we purchase and watch according to our own available time slots… The recording systems are expensive and complicated … so we just bring CDs and watch it"

Few agriculture experts responded, "time factor varies from region to region, every region has its own set of conditions... The timing of crops is different in each region so mobile services must emphasize these implications on ground realities… depending on region to region requirements."

Most of the farmers which are connected to old modes of information technology have information and time advantages. From the total interview sample, five farmers responded that they through online sources identified the markets which were selling commodities in the offseason "We get it in cheap rates", a farmer stated.

The majority of farmers are showing the lack of trust in the new system suggesting that both systems should run on parallel basis. According to a farmer, "…among choosing old and new systems… I think MAITS should run parallel to traditional systems... We cannot leave the tradition system in very beginning of the technology diffusion… I think the system will be chosen on our goals basis... we can adopt any system we like to facilitate our goals."

Farmer's attitude towards technology acceptance shows that trust plays a vital role in the farmer's decision making process. As stated above farmers trust the media including TV, radio, newspapers but the amount of information provided is not good enough to meet their requirements. Some complaint that they are able to get

only basic information from old media – TV shows them the rate slides, radio inform about specific advertisements and newspapers publish advertisements and incomplete messages. Even personal source contacts fail to get complete information in the name of business secrets, one farmer said "we collect the information from different places but if it is available from a single source … we will be effectively proceeding to crop planning… sowing to trading… easily."

Most of the farmers do not agree that mobile phones would give complete information. According to a farmer "…we do not know how a tiny device can cover these all information needs." According to experts the mobile phone can just provide the immediate information and rest of information will be linked to other technology sources like internet. According to the Expert of Associate Agriculture Chemist, "even they get the information on mobile phone, they will not take the risks and will opt for the other information sources… like as laboratory tests, rates.. "

Detail explanation is required to change the understanding level of farmers. In current traditional system farmers are informed about new varieties of crops through seminars arranged by the mill owners. Thus, the information provided is according to their research and requirements to which they can get crops from the farmers. According to a farmer, "we are invited by various sugar making factory owners… They provide us with the information about new varieties and ways for sugarcane productions."

Farmers know about the mobile phone uses to the extent of making phone calls and some of them use SMS. Majority of them are using it for their personal uses only. There were number of farmers who were using the mobile functions (MMS, internet) more than calling and writing SMS. Farmers take the mobile phone as a convenient technology device that is easy to use, easy to carry and from using it can call any time with little effort as they already know its basic functionality. There are some difficulties while using mobile phone such as many farmers get confused during calls in which they are asked to press several buttons to talk to a customer service representative. Instead of convenience, it becomes a time taking device.

According to some farmers "mobile phone technology is more convenient to talk from any place and could get the information as well as pass on the information… the demerits of mobile phones we cannot see the faces on the other side… some time it is a time taking process to call companies and interact with automated message systems… she ask us to press too many buttons… it just waste our too much time."

Decision Support System (DSS)

Farmers are willing to interact with technology. According to them "we need interaction with the technology experts… they provide us information about agriculture-related technologies and detailed information of different market access… sometimes over internet… for example."

Sometimes the infrastructure is available from a different funding agency which aids the agricultural sector free of charge (Siraj, 2011), but farmers unfortunately cannot get any information about these agencies because of lack of awareness of these types of organizations. As one of the farmer responded that "recently, solar cell tube wells (water production unit) were introduced in Pakistan and most of farmers do not know about it or came to know late… it was already installed in other places with other farmers." Farmers also stated that access to the technological experts will make them more knowledgeable to use the technology in agriculture sector and the linkages with the industry will benefit all stakeholders in one go. Farmers perceive that due to technological support they will be able to produce crops according to the new innovations. A farmer from Khanewal responded as "I like to do the research… I am planning to install a unit (factory) for energy drinks… yes these energy drinks would be produced by natural ways… It contains lot of vitamins and calcium… I need its formula to add flavor… I need the technology to produce it in canned form…. I do not know where from I can take help about these, the mobile phone services you are telling about if help I will adopt it."

A farmer also pointed out that "the farmers have to go to different agents… the worse of them is middlemen role… they give the loans on this promise made by farmers... they will buy farm inputs form them… they will sell their crops to them on fix rate… middleman is taking more advantages than the farmers… they are getting profits out of farm inputs, standing crops… and where they sell forward… from end buyers they charge this." It is sometime difficult to get loans from Agriculture Development Bank as there is long queue of farmers standing in the waiting lists. Farmers have complaint that they have not able to get loans on time According to them "they are biased in giving the debt money… they give big loans to big land farmers… we have to always wait… mostly time mobile credit officers are out for recovery in field." The bank officials argued on this problem differently, according to them they are always at the disposal of the farmer. Expert from Agriculture Development Bank pointed out that "when the farmer come to us they try to give them maximum leverage… sometime problem is face by us that the next

sanction of loans are depended on the previous records of farmer… Farmers with higher recoveries paid get more quickly and the farmers who are still not clear from previous recorded loans have to give the justification to sanction new loans for them… we have the databases but here staff more work manually as they do not have access directly to databases… meanwhile after weeks of fieldwork they come and enter their records through IT experts… which is also time taking factor… if farmers are connected to the bank customer databases… they will be able to request before coming to bank… By then we will check their records."

Farmers encounter scarcity of labor and technical equipment at times crops are ready for harvesting and sowing. According to some farmers "time management is very important… the weather is not predictable… so the market… we need immediate number of labor and technical assistance at the time of planting and harvesting the crop…". However, experts from Agriculture Research Institute and Agriculture University informed that "the technical assets and labors are available from scattered places. Farmer has to run after the individual need. This is the big waste of time. Even they are not sure that they will be able to get them."

Expert from Mobile Operator Company, farmers and expert from Agriculture Development Bank informed that agriculture technical equipment being expensive is not affordable by farmers and they have to rent that from either government bodies or private sector. Farmers desired that there should be a database about renting equipments for them. For better connectivity farmer should remain well-connected through mobile phones with these networks to check the availability of related resources.

Farmers keep changing patterns of producing crops, seeds buying and harvesting as per the market conditions. For example, in case of high demand of sugar cane, maximum number of farmers will produce the sugar cane in next year without predicting the market demands. According to some farmers, "we change our product sales… naturally according to the rate variations. We delay products if prices are not suitable… but in some case we are force to sell it… some grains are perishable which are out of control… so we need other sources… which give us options to decide".

Thus, farmers need different type of knowledge about the new technology innovations needed in particular agricultural environment. Most of the farmers in interview have recommended that the knowledge can be provided through different sources like mobile social communities network and information mobile centers.

One of the farmers said that "the training of mobile uses should be imparted in schools adjacent to the villages. The children are quick with technology especially new emerging technologies. They will pick the information quickly and educate their elders about its significant uses."

Overall, farmers have shown willingness to have greater knowledge than before. As one of the farmer state "every day we are learning from our society… the knowledge we retrieve is in raw form… we are unable to process it… if we can get systemized knowledge… we will perform in more better way".

An educated farmer responded to a question on leadership role in following manner: "I have not faced any kind of problems, I am the member of different committees… we represent farmers and gave suggestions about the current agriculture needs and they consider our valuable suggestions… I have not experienced any kind of problems in respect of technology and other agricultural innovations accessibility." Other farmers who do not have access to such networks stated: "they are biased and they just provided the agriculture facilities to those with whom they have contacts".

The day to day processes are long and farmers feel uncomfortable using those. One of the farmers said: "they are such lengthy and time taking processes… irrigation system is one of them, we have to wait for the water and due to non availability of water sometime our crops growth gets affected… same effects come out from fake fertilizers and insect killing sprays available in markets".

Farmers also see agriculture processes of dealings, transactions, selling, seeding as very complicated as one of the farmer responded: "If information is of the worth which reduces cost and travelling then this will be appraised by the farmers". Expert from Horticulture informed that farmers can go into more new processes of farming like "tunnel farming is one of the skills related to agriculture technology which farmers need to adopt this process should handle with very careful analysis of land condition that best fit with the seeds this can only be done if the farmer has obtained useful information to how to launch these processes". Mobile phone should have some packages that support the farmer more in detail to understand the information more specifically. Thus, another farmer reflect like the process can be handle with "…communities involvement in information and knowledge sharing will put better impact" on our day to day engagements and procedures.

Support for farmers for enhanced execution of processes that could give better productivity or access to new emerging markets is very necessary to help them achieve their goals because far too many bureaucratic blocks prevent some farmers from operating in a free market enterprise like system. A farmer showing his disappointment in information and other processes connectivity says that "we can get information of international market but we are not able to get licenses and fulfill the other requirements which are mostly time consuming, expensive and complicated".

It is noted with concern that majority of the farmers in Pakistan do not have the potential to use mobile phones services. It is because of their disillusionment about the technology that they have already presumed that is only for personal purposes. In future they expect to change their attitude in adopting those technologies. As expert from agriculture bank reflected that "we are seeing lot of changing pattern of farmers… today farmer is having… of difference than they use to be in 5-6 years ago… today farmer is willing to adopt the technology for their crops production… most of farmers come to us and ask about new innovations of agriculture… we have declared the model villages in all areas and urge farmer to go there… they get the information and apply in their fields… They are now very successful in it".

The overall readinesses of farmers for technology adoption are surmised in the following table 1.

Table 1. Results of Farmers Readiness for Technology Adoption

Farmers Readiness	Technology Adoption Model (TAM)	Technology Readiness Indicators (TRI)	Decision Support System (DSS)
Farmers Willingness	**Discomfort** Farmer see lack in current information system: Farmer feel information is not delivered on time: Farmer could not call anyone in case of emergency: Farmer when try to call experience busy calls on	**Technological readiness** Farmer like to use MAITS if it connects with technical experts: Farmer like to use other networks through MAITS: Farmer want to know more feasible technologies available: Farmers want someone	**Timeliness** Farmer see in time information is crucial for decision making, use phone calls service instead of doing SMS, presume time factor is changing their media habits, time varies region to region basis, get cheaper

other side: Farmer touring in field missed a lot of information: Farmers cannot read messages: Farmers do not have record facility to store their messages: Farmer retrieval information is not economical: Farmer got general information which is not of any use: Farmer experience absence of social amenities.

Insecurity
Farmers doubt and distrust MAITS: Farmers like to interact with humans rather than MAITS: Farmer believe payment methods are not ensure on mobile phones: Farmers feel transactions on MAITS should be authenticate after in writing also: Farmers feels MAITS model is too complex: Farmer feel human presentation skills are more valuable than MAITS: Farmer feel MAITS will not be successful for longer period.

to tell them about new Agri-related technologies.

Resource Readiness
Farmers like to acquire loans from financial institutions: Farmer feel more feasible sending loan request before they visit the source: Farmer like to have easy access to labor: Farmer have to search labor and technical assets from different places: Farmer require to communicate government bodies or public sector companies for necessary assistance in resources

Knowledge Readiness
Farmer have the knowledge of current mobile phones working: Farmer do changes in their patterns according to known values: Farmer like to know about different available options in using technology innovations in their field work: Farmer desire to know about the market rates: Farmer can access the basic knowledge of MAITS uses in their nearly training centers

commodities in offseason.

Farmers Potential	**Innovativeness** Farmer want to be a first user of MAITS: Farmer desire more Agri-information than others: Farmer can handle MAITs functions: Farmer creative ability to apply information differently: Farmers are ready to take risk to adopt MAITS: Farmers expect latest ideas: Farmer interact in community: Farmer give advices to other farmers: Farmer are ready for change	**Leadership Readiness** Farmer have a key role in policy making of Agriculture: Farmer contact different higher management officials in order to register their suggestions and feedback: Farmers feel the officer decisions are biased: Farmer perceive strategy makers must do decisions on the basis of root cause situation **Process Readiness** Farmer think mobile phone services must be relevant to agricultural processes: Farmer opt for new processes in agriculture sector: Farmer understand processes can be improved through communities involvement: Farmer cannot access international markets due to strict process for licenses and other government approvals	**Information Richness** Farmers think incomplete information mislead them, believe MAITS system will not convey complete message, Farmer would not like to get immediate information form MAITS: Farmer need a detail explanation to understand information: Farmer like information in form of video, audio and graphic wise **Ease of Use** Farmer perceive technology will be free of effort, understand MAITS System is easy to carry, experience sometime mobile phone complexities, feel difficulty to talk sometime without face interactions
Farmers Preparedness	**Optimism** Farmer knows mobile phone benefits: Farmer feel MAITS convenience in use: Farmer can use it in flexible timings: Farmer	**End-user readiness** Farmer support MAITS system as thinking change is positive: Farmer feel MAITS model is source of relieve to them:	**Trust** Farmer is resistant to change due to MAITS newness: Farmer do not share relevant knowledge in name of business secret: Farmer

	desire to have a new agriculture technology: Farmer can improve their skills: Farmer's source of knowledge and information: Farmer can mold it easily according to their use: Farmer realize other uses of mobile phones than their personal use: Farmer understand demerits of partial information: Farmer well understand the MAITS proposed model: Farmers can manage their crops using this technology: Farmer can sell and purchase commodities, farm inputs: Farmers are not happy with existing agriculture system.	Farmer do not have potential to use technology due to illiteracy and other factors: Farmer are frequent user of mobile so be for MAITS **Values and Goals** Farmer believe MAITS will provide ways for profit maximization: Farmer through MAITS will able to sell and purchase their commodities to different markets	do trust in case they got decision choices

Findings

Mobile phone device perception to connect the other information enables farmer's efficient accessibility to new data and information sources not available easily. The real-time option along with highly tailored information reflected Pakistani farmer readiness to adopt the same system, as they are optimistic to real benefits of mobile phone and well aware of implications these mobile phone will put in agriculture sectors. As a result of the interviews, the views of the farmers tend to suggest use of mobile phones in new ways for advancement in agricultural productivity increases mobile-enabled information services. Pakistani farmers have mobile phones but without agricultural information systems to take full advantage of information sources required in their working life. The farmers want to access the technology which they need the most. The farmers seem to be ready for the technology through

innovation readiness for change. They do not have control over the technology. Extensions services do not give details knowledge to understand by farmers. Sometime Extension Service Provider believes that technology uses are not for use by common farmer due to illiteracy factor. Farmers like to have less complex devices and feel discomfort with extra functions. The farmers are unhappy from these extension services as information provided to them is general and it is country or provincial level information but not relevant to their specific local requirements.

Even though the farmers would like to get rid of middlemen and may be biased information providing by companies. They still believe that this is a double ended sword, adhering to a view from buyers' perspective that it is not possible to buy crops or products for the whole year whilst farmers can only provide products on a seasonal basis.

The timely available current and appropriate information helped farmers to make decisions at specific times and locations. Furthermore, source and media trustworthiness guide a farmer's trust in information sources. The information richness will convince farmers to trust the new sources of information.

Farmers perceive that information could be more understandable through mobile phones if supported with audio, video or graphical explanations. Ease of use is important to evaluate farmers' perception towards usefulness of the technology. In agriculture systems there is lack of technical support, physical infrastructure and agricultural technologies related information. Farmer connectivity through mobile phones would be feasible if existing and related networks were well established and interconnected. The agriculture technical equipment being expensive is not affordable by farmers and they have to rent that from either Government bodies or private sector. Farmers desire that a data base be maintained for renting that equipment on merit. For better connectivity farmer should remain well-connected through mobile phones with these networks to check the availability of related resources. Like other sectors, farmers dealing on mobile phone require to get help from financial, human and technical assets providing networks. Due to the lack of connectivity with financial institutions networks and other aiding agencies, farmers some time face severe shortage of money which effects their crop production. Currently farmers are taking loans either from Agriculture Development Bank in Pakistan or they approach to the middlemen. The lack in financial resources is too severe or is on such terms and conditions which is not convenient to farmers' pocket.

Thus, farmers need different type of knowledge about the new technology innovations needed in particular agricultural environment. Most of the farmers in interview have recommended that the knowledge can be provided through different sources like mobile social communities network and information mobile centers.

Farmers take the leadership role while they represent farmers in different networks. Most of farmers state their good relationship and identify their role as policy maker in Organizational level decision making for agricultural purpose. Expert says it is necessary to take farmers on board for framing stable policies in agriculture sector. The management support in decisions of technology adoption is important.

Farmers see the mobile phone information system success only if that fit to agricultural processes. Farmers face long waiting processes like as crop planning, seeding, purchasing of farm inputs, transporting, trading and loaning during connecting different fellow farmers, middlemen or market dealers and sometime mobile credit officers from Agriculture banks. The farmers perceive that in time information helps in sorting out problems faced by them .Farmers consider technology as a source of relieve, farmer will be in very clear position to plan for crops variety, seeding to harvesting and transporting produce for selling.

In the farmer interviews, farmers show their ambition to get access to different markets and mobile agriculture information system to (i) minimize the middle men role and(ii) take maximum part and gain profits. To achieve their specific but different values and goals they are expecting some breakthroughs. The crop insurance facility, technical assets, sustaining competitive advantage, profit maximization, time and cost savings in crop production are the key values for the farmers to develop.

Research Implication

Farmer's readiness to adopt mobile agriculture system revolves around mobile decision making support and accessibility to different networks. Any factor missing is prone to deviation from use of this technology. The analysis of the data retrieved from the interviews has suggested, the evaluation of readiness is not only the final place to decide whether farmers will adopt the new mobile information system or not. It is associated with the attitude which comes from innovativeness, optimism or inhibitor like discomfort which either helps farmers' preparedness or unpreparedness before replacing the existing system with the mobile information system. Thus,

further analysis shows that potential to decide is related to farmers' interaction because of some problem or cause. In particular situation Pakistani farmers have shown their unhappiness about the existing system.

So, to adopt the mobile phone is greatest reason for discontinuing use of the existing system. Although farmers have a primary ability to assess the basic information, but access in depth; the farmers need more prominent information sources which give them the potential to properly assess the value of the new system. Thus, preparedness, potential and generating value are the key factors which lead farmers acquainted with other factors in readiness. Pre training involving demonstration, seminars and other related activities are important to convince farmers for new innovations in the field.

Research limitations

The research is limited to the primary data which has been collected from rural areas adjacent to four cities of Pakistan. The research describes the opinion of different farmers and experts from these four cities only. More suggestions could have been gathered and added for Mobile phones Agriculture and Information systems (MAITS) acceptance by including more farmers and retailers from other cities of Pakistan as well. This research has evaluated the Pakistani farmer readiness for adopting mobile phone information and trade system on the basis of different dimensions quoted in literature. The method used is qualitative in nature. However, a quantitative approach can be carried out using various quantitative methodologies. It would be intriguing to establish a global model for the whole agriculture world with all databases in technologies interconnected.

Conclusion

Pakistani farmers very well perceive the merits/demerits of mobile phone usages. They have begun to realize other usages of mobile phones rather than restricting only to personal uses. Thus, majority of the farmers are ready to manage crops, purchase farm inputs and sell commodities through MAITS. The innovative farmers are recognized because of their outward role advising other farmers. The current amenities and informal communication structures have led the farmers to rethink and opt for alternatives systems which could give value addition.

The overall conclusion is that farmers are ready to embrace new mobile phone information systems. However, it requires maximum level of optimism and innovativeness along with removal of the inhibiting factors which affect the readiness state. The inhibiting factors in MAITS adoption comprised of uncertainty factors and current faulty existing system services. There has been a complete consensus among the farmers to practice MAITS along with mobile decision support system because it can help them in crop planning, farm inputs (seeds, fertilizers, spray etc), harvesting, transporting and trading.

The findings of this study will provide guidance to the relevant organizations when considering readiness and barriers towards implementing of MAITS. The results of the study will give insight to many extension service and policy makers to understand what farmers actually desire.

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Interview Guide

1. How the latest technologies of communication affect your life.
2. At present what type of communication technologies are you using?
3. Do you use mobile phone, what type of merit and demerit of cell phone do you experienced?
4. Do you use mobile phone for only making calls or you also use it for SMS or any other services.
5. From where you get the latest information about new technologies for crop production. Is it easily available or you experiences difficulties?
6. Do you want to adopt new technology by which you can get all latest information about crop production at your door step? How can u compare this new method of getting the information with the old traditional one?
7. Do you like that a mobile company provide you all information starting from sowing to selling, weather forecast, cost of fertilizers and pesticides, new varieties at your door step. How much you will be benefited from this new intervention.
8. Is the way of Government for the dispersal of agricultural related information hinders or favors the adoption of Mobile phone information systems? Do you agree with the government policy about agricultural like supporting price of different crops? Whether you like to take this information on your mobile phones?
9. If a mobile phone company eliminate/minimize the role of middle man and it will increase you profit do you ready to adopt this system.
10. If Mobile phone information system increases the number of buyers of your product and gives your information about, how to increase your profit by going to various markets, what will be your degree of willingness to use the above mentioned Mobile Phone information system?
11. If a mobile company provide you the information of the latest rate of crops of different markets of the country, will it increase your profit and can you able to sell your commodities there.
12. If a mobile company provide you all information at a nominal cost which save your traveling cost to enquire information from different sources do you adopt this, if no why.

(Follow up Questions)

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[i] Progressive farmers: The farmer who run his form mechanically i.e. mechanized forming by adopting latest agriculture technologies.