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Mobile Phone-Driven Innovative Farm Diffusion: The Nigerian Road Map

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ABSTRACT In this paper, the authors developed a detailed plan capable of delivering innovative farm information to and among farmers using mobile phones as the main channel. To develop the plan—which clearly shows the operational flow processes of an efficient mobile phone based farm information diffusion structure—the authors reviewed previous research on the need to diffuse innovative farm information to and among farmers, the potentials of using mobile phones for the process and the challenges to be overcome towards facilitating the process. The detailed plan developed will enable policy makers and other stake holders to identify hurdles to innovative farm information diffusion, their possible solutions, the necessary structure to be put in place in Nigeria and the implications of implementing the plan on the Nigerian farm policy. The authors inferred from their findings that mobile phones have the capacity to facilitate information diffusion process by providing a path of low resistance to information flow thereby complimenting the efforts of "local influentials" and extension workers.

Keywords: Innovative Farm Information, Diffusion, Mobile phones, Nigeria, Farmers

Introduction

The subject of farm information diffusion has received a lot of attention in many professional disciplines (Feder and Savastano, 2006). According to Adereti *et al*., (2006), information can be defined as data that have been put into meaningful and useful contexts which are communicated to recipients who uses them to make decisions. Various Researchers have observed clear patterns of information diffusion and the adoption of innovations by farmers (Feder and Savastano, 2006). Many farmers might know of innovative farm information but might not be willing to adopt them many years after. The term "adoption" refers to the process that an individual passes through since he or she first hears of an innovation until it starts to be used on a continuous basis (Rogers, 1962). Adoption must include learning about the innovative process or technology and putting it to work on a consistent basis (Feder et al. 1985). An innovative farm information such as that which has the potential of improving farm yield, breeding better resistance to pests and diseases, short term maturity period, etc. is useless if it does not reach the farmer who is the end user or if the farmer after hearing about it does not put the innovative practices and technologies to consistent use. Long term studies have shown that there are several ways by which farmers obtain, evaluate and use farm information for making decisions related to farm production and

management (Boone *et al.*, 2000; Labonne and Chase, 2009; Katengeza *et al.*, 2010; Fafchamps and Minten, 2011; Fu and Akter, 2011).

Today, mass advancement in telecommunications technologies due to public and private sector efforts have improved farmers' access to multiple information channels and a reduction in the time it takes for the innovative information or technology to diffuse among the farmers (Petr *et al.*, 2015; Bibhunandini, 2014, Pratap, 2005, Alawode, 2012). Farm information can be accessed through farm magazines, technical publications, general interest magazines and newspapers, radio and television, the internet and other computer based electronic data base, mobile phones, etc. (Oghogho, 2013). In Nigeria, majority of the farmers do not have access to several of these communication channels (Oghogho, 2013). Massive investment in expanding the telecommunications industry in Nigeria has provided wider coverage even in several rural communities (Onwuemele, 2011). This has opened up the possibility of using mobile phones to deliver relevant, innovative and useful farm information to farmers at much reduced costs (Oghogho, 2013). Mobile phones provide the potential of a path of low resistance for the innovative information or technology to diffuse to and among farmers. This paper provides information on the need to diffuse relevant innovative farm information to and among Nigerian farmers in a timely and cost effective manner, clearly showing the potential of using mobile phones to facilitate the process. A detailed plan that shows the operational flow processes of an efficient mobile phone based farm information diffusion structure that can be established and used in Nigeria was developed.

Why Diffuse Innovative Farm Information

Many studies have shown the need to diffuse innovative farm information to and among farmers (Brandie, 2011; Bibhunandini, 2014). Innovative farm information is useless until it gets to the end users (the farmers) who must also begin to put it to use on a consistent basis. Until a new innovative technology is adopted, its potential benefit cannot be unleashed. However, innovative farm information adoption is usually the after effect of innovative farm information diffusion. According to Calatrava and Franco, (2011) the major factors that influence farmers adoption of new technologies and practices have been identified to be largely dependent on (i) the farmers access to the information about the innovation through exposure to sources of information (which will accelerate its adoption by making individuals aware of the objective potential benefits of the technology), (ii) the process of both disseminating information and providing financial incentives (which will encourage adoption and the farmer's perception of the technology claims when compared with traditional methods) and (iii) the level of education and professionalism of the farmer (since more professional, well-informed and innovative farmers are more likely to adopt new practices and technologies).

The findings of Heong *et al.,* (1998) after the mass media campaign they carried out showed that the massive changes in the farmers' attitude and practices of the use of pesticides was due to the farmers' initial erroneous perceptions of the damage to the crops rather than the economic rational. The motivation of the farmers to adopt the innovation depended on the savings in chemicals and labour cost as well as the fact that the innovation could be tested which were emphasized by the campaign. A campaign concerning information diffusion process has changed the farmers' perceptions which led to a correspondence change in their behaviour leading to economic and social benefits.

Innovative information diffusion to and among farmers is therefore key to their adoption of a new innovation or technology because farmers cannot adopt a new innovation or technology except they hear of it, receive adequate information on how to use it and be sufficiently empowered to apply it on a consistent basis.

Vincent (1997) reported that several efforts have been made by International donors and the

Nigerian Government towards stimulating agricultural development in Nigeria. However these efforts have not yielded the desired results. He attributed this failure to the attitude of Nigerian Governments towards the treatment of information delivery and dissemination. He further affirmed that Agricultural information has not been properly integrated with other development programs to address the numerous related problems that face farmers. "Information is an essential ingredient in agricultural development programs but Nigerian farmers seldom feel the impact of agricultural innovations either because they have no access to such vital information or because it is poorly disseminated". The information provided to farmers is mainly focused on policy makers, researchers, and those who manage policy decisions without paying adequate attention to the information needs of the farmers who are the targeted beneficiaries of the policy decisions. The non-provision of agricultural information is a key factor that has greatly limited agricultural development in developing countries like Nigeria (Vincent 1997).

In the same vein, according to a World Bank research reported by Mink (2014), Nigeria is still far from reaching the expected indexes. On extension service delivery for example, Nigeria scored a baseline of 25000 as against 84,300 expected. In the same report under farmer adoption of new technology, Nigeria scored 8.7% and 19.1% for female and male farmers respectively as against the expected value of 28% and 72%. These statistics show the need to intensify efforts towards improving on farm information diffusion so as to meet the expected index in the future.

Innovative Information Diffusion Process

Clearly adoption of an innovative information or technology by farmers depends on the appropriate diffusion of the innovation to the farmers and among the farmers. However emphasis must be placed not only on innovative information diffusion to the farmers but also on the diffusion of the information among the farmers. The results obtained by Calatrava and Franco, (2011) suggested that the farm information diffusion process was based more on the interactions among farmers in an area rather than on the external factors such as EU subsidies or extension services. Many of the farmers relied mostly on other farmers and technical advisors from agricultural cooperatives to solve problems in their farms.

According to Feder and Savastano (2006), opinion leaders can be used to facilitate the acceleration of the innovative information diffusion process to and among the farmers. Opinion leaders are individuals who have the status, expertise, links to external sources of knowledge, or experience that enable them to provide information and advice about innovations to others within their community (Roger 1995). However the selected opinion leaders must not be excessively superior to other farmers so that their effectiveness does not diminish and they become essentially irrelevant to the diffusion of innovative farm information and technology beyond a small circle of those higher status individuals who are closely associated with them (Feder and Savastano, 2006).

The findings of Wyckhuys and O'neil (2007) showed that information on certain technologies—i.e. manual control, sugar-water application to attract arthropod predators—was shared among farmers, while knowledge of others—i.e. botanical insecticides—was largely restricted to training recipients. However in communities that were socially well organized and frequented by outreach agencies, selected information appeared to diffuse beyond trained farmers. These results suggested that the farmers (opinion leaders) consulted by their peers for information or advice, could not only validate innovative farm information practices under local agro-ecological conditions but can also facilitate widespread adoption of suitable technologies. Intensifying face to face interaction and highly interwoven social networks can thus enhance the diffusion of agricultural innovations.

In a study carried out by Okpara (2008), majority (70%) of farmers in Imo state preferred

using information from extension workers than other information channels or sources such as radio, friends and relatives, television, etc. Although extension workers may not be able to reach the entire farmers, they can use the opinion leaders as their link to facilitate information transfer. The opinion leaders referred to as "local influentials" are seen as "low resistance avenues" or paths through which farm information can be channelled to other farm operators because of their receptivity to new ideas about farming and their positions in the informal social structure (Oghogho, 2013). The difficult task is how to identify these "local influentials" and make them involved in strategic programmes targeted towards enhancing diffusion of information among farmers aimed at promoting safer and more productive practices.

The diffusion component of the study of Tucker and Napier (2001) asserts that individual farmers actively seek information through a range of communication sources and channels to assess costs and benefits before making an adoption decision. They suggested that communication managers should incorporate a wide range of information channels into their outreach efforts, including interpersonal methods, traditional mass media and emerging online technologies. Channels should not only be selected and evaluated strictly on their capacity to reach large numbers of farmers, but also based on their perceived credibility and relevance among target audiences. Oghogho (2013) presented a summary of information sources, the challenges, prospects, suggested solutions and final outcome when innovative information is adopted by farmers as shown in Figure 1.

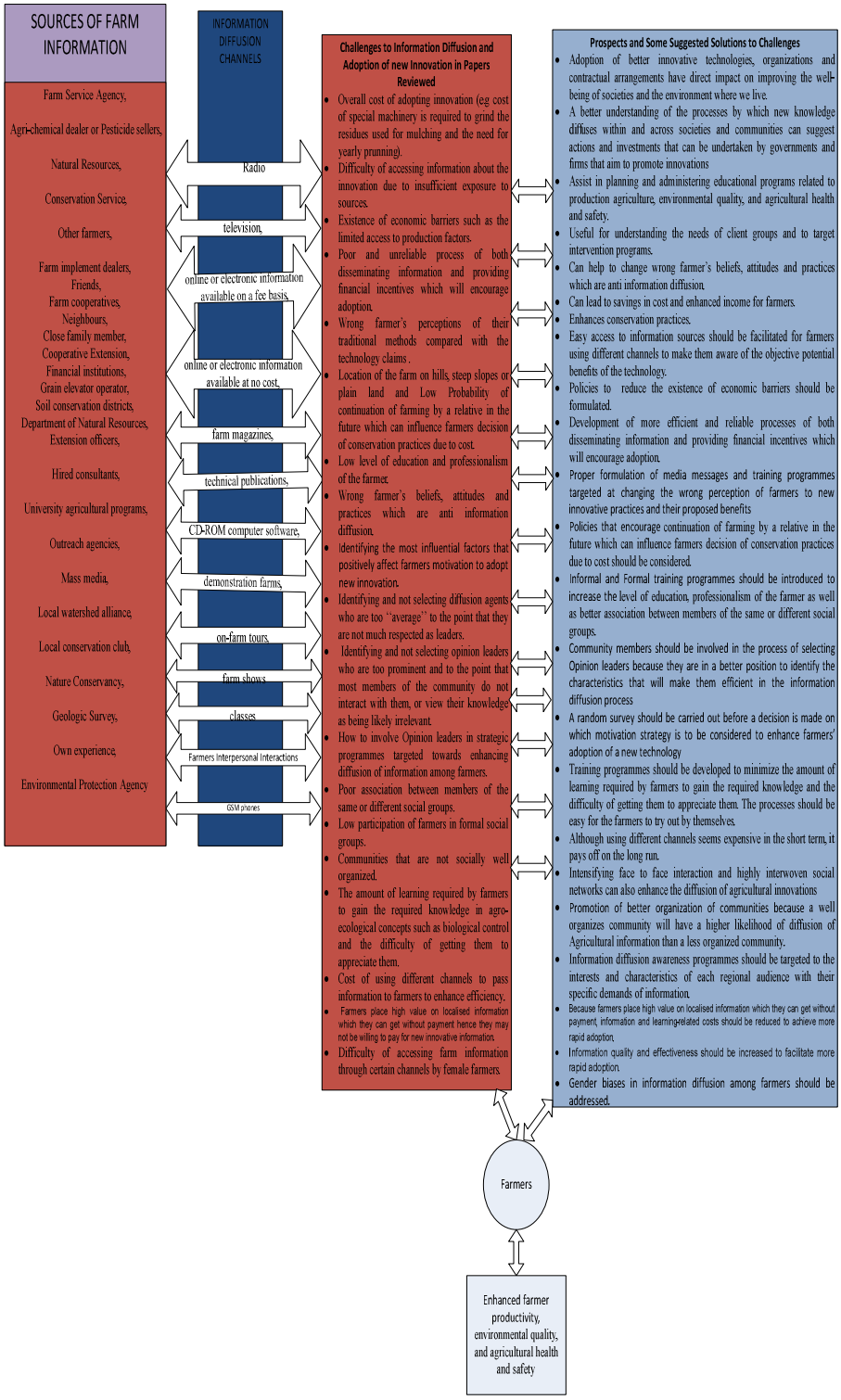

Figure 1: Information Sources, Channels, challenges, Prospects, Suggested Solutions and Finaloutcome when innovative information is adopted by farmers

Mobile Phone Driven Innovative Farm Information Diffusion

A study by Alene and Manyong (2006) on Farmer-to-Farmer technology diffusion and yield variation among adopters using the case of improved cowpea in northern Nigeria showed that yield efficiency was more dependent on crop management technology relating to the cereal-cowpea cropping pattern than the technology source. Although the "local influencials" in this case were efficient in diffusing the information on improved seeds, fertilizers and insecticides usage, they were not efficient in diffusing the crop management information hence the large yield variation observed in the study. This further supports the need to find a technology like the mobile phone structure that can largely bypass the opinion leaders and deliver relevant information to the farmers directly at much reduced costs in a timely manner.

The world is presently in information-driven age. The introduction of mobile phones—whether based on GSM or CDMA technology—has greatly enhanced information access for Nigerians (Onwuemele, 2011; Adewale and Falaki, 2003; Anyasi and Yesufu, 2007; Ajala, 2005). Information can now be easily transferred among family members, farmers, friends, religious and secular social groups, the government and their various agencies, etc. Diffusion of the mobile phones in the country has greatly enhanced access to information thereby facilitating quick conclusion of business deals, huge savings in time and other valuable resources, etc.

Telecommunications companies in Nigeria have continued to expand their coverage, hence many rural communities, especially those along main roads, have access to mobile phone services (Onwuemele, 2011). According to Iroko (2012), mobile phones have reached 80% of the populace. With the continuous competition among the telecommunications providers in Nigeria, the cost of owning and maintaining a mobile phone has continued to decrease; hence many Nigerians can now afford to own their personal mobile phone (Oghogho 2013). Those in the rural communities are not left out of this.

This widespread diffusion of mobile phones all over the country has been identified to have the potential to deliver innovative farm information to farmers both in the rural and urban communities (Oghogho, 2013). Paging, which supports large scale distribution of information using mobile phone in either voice or data forms in any preferred language, can easily be used to facilitate this process. Every farmer who has a mobile phone can easily be supplied with any innovative farm information that will be relevant to help them adopt the new innovation at any time in any preferred language.

Some of the questions asked by Oghogho (2013) towards tapping and unleashing the potentials of mobile phones in diffusion innovative farm information in Nigeria are: Where are we and where do we begin? How best can this huge potential be used efficiently to deliver innovative farm information to farmers? How do we acquire the data base of the farmers' phone numbers? How do we deliver this information in a manner that the farmers can understand them and will be willing to change their traditional practices? How do we create such innovative information in the appropriate electronic and easy to understand formats and in different Nigerian languages before transmitting them to the farmers? How do we establish a link between researchers who come up with these innovation and the farmers? How do we establish an efficient mobile phone based information diffusion structure that will reach the nook and crannies of the nation? What roles will Government institutions, Traditional rulers, researchers and other Agricultural extension service workers play in this diffusion process? What role will the telecommunications service providers play in the process? What role will the farmers and their organized associations play in this process? An improved version of the road map presented by Oghogho (2013) to be followed so as to facilitate answers to the aforementioned questions are presented in the following paragraphs.

The Road Map to Facilitate Diffusion of Innovative Farm Information in Nigeria Using Mobile Phones as the Main Channel

Nigeria as a nation already has a large telecommunication infrastructure base which is continuing to increase. A sizeable percentage of the populace is already connected to the national infrastructure. The mobile phone based technology has already supported applications that can distribute information—whether voice or data in any language—to a large number of subscribers. The most difficult challenge is how to acquire the farmers' phone number data base and how to deliver the information to them in a timely and easy to understand format. The following steps are recommended to efficiently deliver innovative farm information to farmers using mobile phones. The Federal, State and Local Government Ministries of Agriculture in collaboration with the Ministries of Information and Communications and the Nigerian Communications Commission (NCC) should set up a joint agency that will act as a backbone to pursue the establishment of an efficient mobile phone based farm information diffusion structure that will reach the nook and crannies of the nation. On the request of the agency, all mobile phone service providers should provide the information of their registered phone users especially those in rural communities. With the on-going SIM registration process (Juwah, 2012), this goal will be easy to achieve. The NCC in collaboration with Mobile phone service providers should also consistently send paging messages in English and several local Nigerian languages to all their subscribers requesting that all farmers should provide information on the Local government area where they live, where their farms are located and the type of farms they have through their personal phones to selected toll free phone numbers from each mobile service provider. The farmers will be encouraged to visit their local government headquarters for additional information if the need arises. The paging messages sent to the farmers should state the reason for the registration which is free distribution of innovative farm information to farmers who register. This will act as a motivation to the farmers.

Other information diffusion avenues such as the prints and electronic media, traditional rulers, farmers associations, farmers' cooperative societies, religious leaders, etc., will also be used to pass the information requesting farmers to send their information through their personal phones to the required numbers. Online registrations should also be provided as an alternative. This process of farmers' phone number registration will be continuous even after the initial deadline expires so that new farmers can also send their information to the agency. The data base to be acquired will also contain information of other stakeholders– such as traditional rulers, religious leaders, agricultural extension workers, farmers' association executives, executives of farmers' cooperative societies, agricultural research institutions and universities, etc.—involved in the diffusion process.

The NCC will collate relevant information on innovative farm practices already being used both locally and internationally and will collaborate with research institutes, universities and other relevant sources in gathering this information. The findings of Ofuoku *et al.,* (2008) showed that Universities and research institutes have not adequately carried out their functions of information generation and delivery to farmers because most farmers still obtain their farm information from farmer's group, other farmers and Non-Governmental Organizations (NGO). The proposed mobile phone driven innovative farm information structure will help to improve the farm information delivery efficiency of research institutes and Universities. New and proven innovative findings in research institutes and universities will be forwarded to the agencies for onward delivery to farmers through their registered phones. A reward, which may not be monetary, will be given to researchers who develop and bring innovative methods and technologies for farmers.

The media will be engaged to develop short audio and video dramas used to communicate

the new innovation to the farmers in an easy to understand format and in several languages. Data or text messaging will also be developed.

Information on the new innovation, weather forecast, farming seasons, available extension services, etc. will be forwarded to farmers on a regular basis. To avoid congestion of the telecommunications network backbone, this information will be forwarded during off peak periods. For voice information, farmers will be notified about the off peak timing so that they can be alert to receiving the necessary information. The mobile phone also has a facility which allows a voice message to be stored and accessed when the owner is available. The Federal, State and Local Governments are to provide visible support to the agency using the media so that all parties concerned will be willing to cooperate with the agency and practice their required roles. Farmers who show consistent use of new innovations and technologies can be given incentives of easy access to loans and other facilities for their farm practices. The agency will work hand in hand with agricultural extension workers so as to provide additional support information to the farmers. These agricultural extension workers will also be supplied with information on new innovation through their phones by the agency. Every Local government will have a unit under their ministry of agriculture which will collaborate with the agency to ensure their smooth operation in all Local government areas in Nigeria.

The NCC after developing the audio, video and text messages in collaboration with the media, will page them to the farmers in collaboration with the Mobile service providers. The farmers will receive direct farm information in their phones from the Agency through the telecommunications service providers. This will help to boycott the challenge associated with using opinion leaders only for diffusing innovative farm information.

Farmers will be provided with toll free phone numbers to which they can deliver feedback information to the agency that will be forwarded to appropriate destination for prompt action. Codes will be developed which farmers can send to request for particular farm information and responses which are software based, can be automatically generated to send the requested information to the farmer.

The developed structure to deliver innovative information to farmers using Mobile phones as the main channel is shown in figure 2.

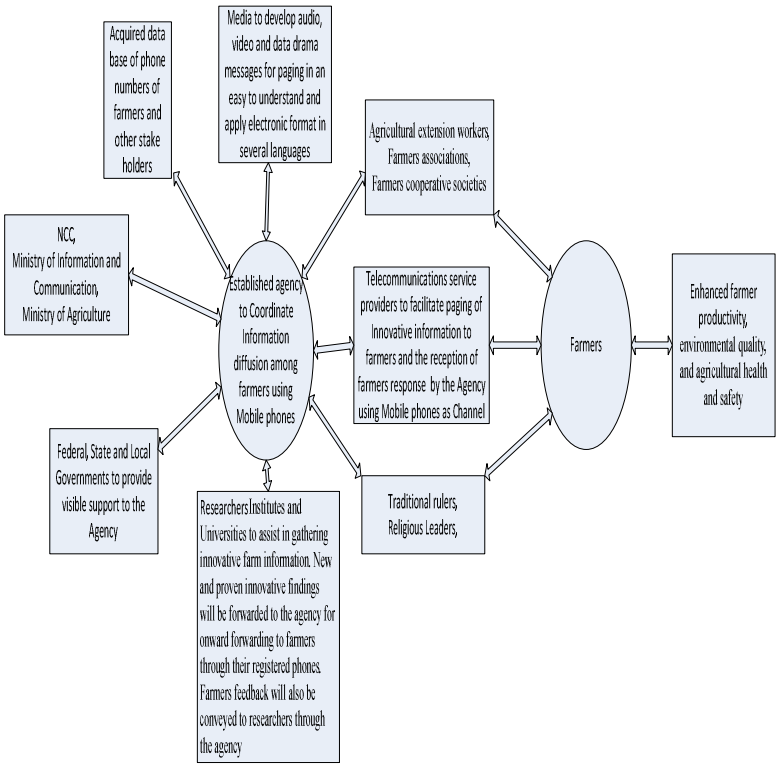

Figure 2:Developed Structure to Deliver Innovative Information to Farmers using Mobile phones as the main channel

When the above described structure is in place, all kinds of farm information can easily be delivered to the farmers directly at a much reduced cost. Feedback from farmers will also be facilitated using a toll free number. Heong *et al.,* (1998) and Roger, (1995) showed that the media is the most influential on farmers' perception of new innovation. The use of Mobile phones as an organ of the media through sending of paging messages will do just the same. It will be very economical once the data base of farmers' phone numbers has been acquired. The few farmers who may not have the privilege of getting the new innovation directly will be exposed to it through their interpersonal relationships with other farmers in their location. With slight adjustment, this structure developed can be used to diffuse any form of information to any target audience.

Possible Implications of the proposed road map for the Nigeria government farm policy and telecommunications service operators

One of the key features of the Nigerian Farm Policy is the evolution of strategies that will ensure self-sufficiency and improvement in the level of technical and economic efficiency in food production (Agriculture in Nigeria, 2015). This is to be achieved through (i) the introduction and adoption of improved seeds and seed stock, (ii) adoption of improved husbandry and appropri-

ate machinery and equipment, (iii) efficient utilization of resources, (iv) encouragement of ecological specialization, and (v) recognition of the roles and potentials of small -scale farmers as the major producers of food in the country. The successful implementation of the developed plan in this paper will help to facilitate attainment of points (i) and (ii) above stated in the Nigerian farm policy.

The implementation of the plan has both positive and negative impacts on the Telecommunications service providers. How will they tackle obvious pressures on facilities and the need to keep expanding their network coverage so as to connect all rural communities where most of the farmers live to the network? The network service providers will also need to expand their network capacity to avoid congestion as it is being used for mass deployment of information to the farmers. The associated costs in expanding the network coverage and the possible return on such investments within a short time will also become an issue of concern to the network service providers. However, implementing this plan will create more revenue for the operators as they provide services for information delivery. It will also provide the operators with the opportunity of providing community development impact initiatives by providing some of the services required to diffuse farm information at little or no cost.

Possible Limitations of the Developed Mobile Phone Driven Innovative Farm Information Diffusion Structure

Although the developed structure shows the potential to deliver innovative farm information to farmers in all parts of Nigeria, the structure is limited in the following ways:

1. It is only effective for farmers who have phones. However, this is not a serious challenge due to the widespread diffusion of the use of mobile phones all over the country. Also farmers who do not have phones can also be exposed to the new innovative information from their peers who have phones and are able to receive the farm information.
2. Congestion of the network, poor service delivery and out of service conditions can hinder the free flow and timely dissemination of farm information to the farmers.
3. Some farmers may be unwilling to register their phone numbers or may not see the need to use the information they frequently receive on their phones.
4. Language barriers may become an issue due to the different languages spoken in many Nigerian communities.

Most of these limitations can easily be overcome if corrupt practices are avoided and all stake holders play their roles and display a high degree of commitment towards implementing the project.

Conclusion

In this paper, the authors discussed the need to diffuse innovative farm information to and among farmers, presented the information diffusion process and proceeded to develop a road map that Nigeria can implement towards providing a mobile phone based farm information diffusion structure. The potential of Mobile phones in enhancing the diffusion of innovative farm information to Nigerian farmers was clearly articulated in this paper. The possible implications of the proposed road map for the Nigeria government farm policy and telecommunications service operators were also highlighted.

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