INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Dissemination of Personalized Agricultural Knowledge for Farmers in Bangladesh

Mehdi Hasan
Student, Department of Information Systems
Graduate School of Information Technology, Kobe Institute of Computing, Japan
Mamoru Ito
Professor, Department of Information Systems
Graduate School of Information Technology, Kobe Institute of Computing, Japan
Ashir Ahmed
Associate Professor, Department of Advanced Information Technology
Faculty of Information Science and Electrical Engineering, Kyushu University, Japan

Abstract:
Bangladesh is predominately an agricultural country. To feed her 160 million people from 8.2 million hectares of cultivable land is a tough task. 15, 089,000 families out of total 17,600,804 families are directly or indirectly involve with the agriculture. Every year, almost 0.20 million people are being added to the total population whereas the estimated annual shrinkage of agricultural land is about 0.08 million hectares due to various non-agricultural activities like constructions of houses, roads, etc. In 1971, agriculture was the first contributor to the GDP 71% which is currently 20.60%. In terms of employment, agriculture still remains to the largest source. To continue the sustainable agricultural development, farmers need updated knowledge. Currently they have various sources to get knowledge as like TV, mobile phone, radio, private group and so on. However, 60% farmers are still expecting knowledge from the government agriculture extension officers. But it is quite difficult to disseminate personalize agricultural knowledge for 12,000 extension officers to 16 million farmers around the country. This research will identify the existing gap for getting agricultural knowledge from the most preferable sources and propose the improved service design which can support to disseminate personalize agricultural knowledge for farmers in Bangladesh.

Keyword: *Dissemination, personalized knowledge, service design, knowledge bank.*

1. Introduction

The role of agriculture in economic development has long been recognized and can play a unique opportunity in reducing poverty (Aker, J., 2010). The economy of Bangladesh is based on agriculture, industry and services (Hussain, S. G., 1992). We have 94,000 sq. Km arable land which is more than 65% of the total land of Bangladesh (1, 47,570 sq. Km). In the crop production cycle, there are 3 different stages, Pre-Planting, Growth and Post Planting. In every stage, farmers expect a different type of knowledge from the authenticated and updated sources. 64% people in our country live in rural areas where 84% people are directly or indirectly involved in the agriculture sector. And their priority source to gather knowledge is a government agricultural extension officer. In Bangladesh there are 12,000 agriculture extension officers who are tightly involved with farmers day to day farming activities. To ensure secured crop production and capacity building is one of their major job responsibilities. However, the total number of farmers in Bangladesh is about 16 million. So if we calculate the ratio between farmer and extension officer then we can get 1333:1. As a result for them it is quite difficult to serve each and every farmer. Apart from the extension officers' service we have 22,000 farmers club who is also playing a vital role to build awareness regarding good practice of farming activity. We can break down the government agriculture extension officer's workflow in terms of knowledge dissemination, which is as like,

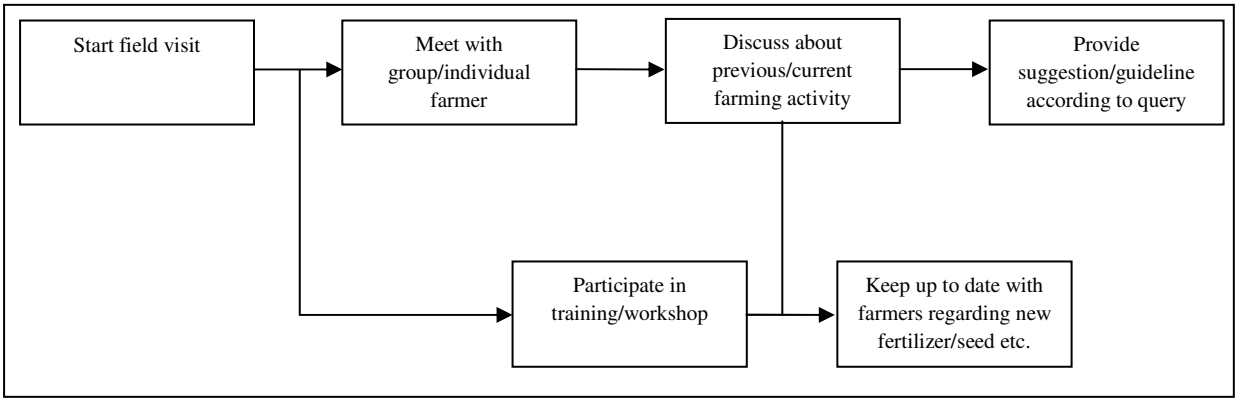

Figure 1: Simplified Work Flow of Government Agriculture Extension Officer's Role.

This research will focus on the service design as a supplementary platform which can able to disseminate personalized agricultural knowledge (*d*-pak) to the farmer community in Bangladesh and that solution can also play as like extension officer's role.

2. Research Methodology

ICT4D research is a multi-disciplinary. Researchers come from various branches of social sciences (Raiti, 2007), although the domain is largely centered on Information Science (hex 2007). This research methodology of this study is following,

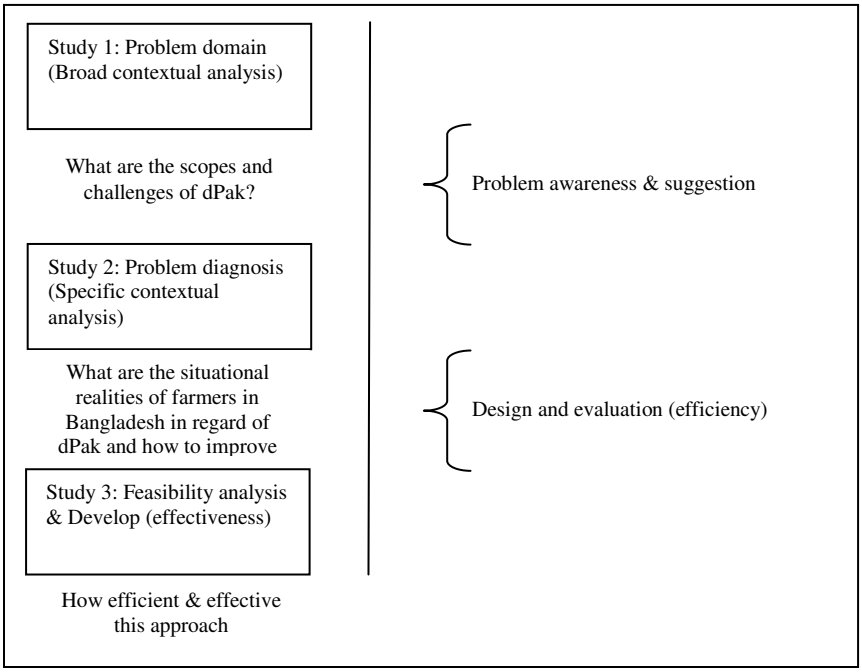

Figure 2: Overall Design of the Research

Firstly, this study analyzes the existing sources to get agricultural knowledge for farmer in Bangladesh. And prioritize the most preferable option to receive the information for different agricultural activity and to identify the existing problems with it which is actually the main challenge that not to full fill farmer's expectation. Secondly, we choose an existing agricultural mobile value added services provided by one telecom operator (Robi Axiata Limited), also to identify that why farmers are not interested to get this service.

3. Analysis of Existing Services

For farming activities, farmers prefer different sources for different queries. 60% farmers expect information from the government ("The Katalyst Cases, 2012"). And agriculture extension officers are playing a vital role around the country. To know the weather forecast update farmer depends on television. Nationally Bangladesh Television (BTV) is the most watched TV channel (83%). For cultivation technique, television programs are preferable because in rural areas 92% and in urban areas 69% are viewship (Human Development Report UNDP, 2010). But this media is one directional knowledge dissemination method. To know the farming guideline, farmers prefer a bidirectional approach. An agriculture extension officer is doing this from the long run and also sometimes

extension worker works closely with farmers to know their previous farming history. That is why it is easier for extension officers to providing personalized suggestion.

Types of Information Sought	Principal Information Source					
	Extension Officer	Private Sector	Peer Group	Lead Farmer	TV	Others
High yields crop	*34.8%*	22.4%	12.6%	6.6%	19.4%	4.2%
Cultivation technique	*20.6%*	10.6%	18.8%	10.6%	24.6%	14.8%
Soil condition	*35.4%*	3.8%	9.6%	7.0%	13.8%	30.4%
Seed usage	20.0%	*39.0%*	20.8%	8.2%	4.4%	7.6%
Pesticide	14.2%	*65.2%*	5.4%	6.6%	2.8%	5.8%
Fertilizer usage	15.6%	*55.6%*	8.8%	7.8%	2.4%	9.8%
Irrigation method	12.4%	12.4%	23.6%	13.6%	5.2%	*32.8%*
Market access	6.6%	20.0%	*41.0%*	15.2%	5.2%	12.0%
Weather forecast	2.6%	1.4%	4.2%	1.4%	*62.2%*	28.2%
Source: The Katalyst Cases, Case Number 6, 2012.						

Table 1: Principal sources of agricultural information among farming population

However, due to the limited number of extension officer it is difficult to get personalize agricultural knowledge. To cover this existing gap different telecom company provides their agricultural mobile value added services. To get those services by SMS farmers need to subscribe. The farmer can also call to the call center to get information. They are providing fertilizer, livestock, fisheries and other related information. But providers do not have any option to analyze their previous farming history to provide the sufficient guideline. Which means the disseminated information is too general.

4. Proposed Solution

In order to collect farming history from the farmer on the knowledge bank, this study adopted experimental environment architecture from Ahmed, A. 2009. They designed a tool, BIGBUS (Base of Pyramid, Information Generation Broadcast and Uploaded System) as an adaptor to be installed in the BOP (Base of Pyramid-who are the poorest, but the largest economic group in the world) adaptation layer (Ahmed, 2009). In this section, we describe the experimental environment and demonstrate an example showing how a farmer can upload his previous farming history of the knowledge bank by using a mobile phone and finally the approach to disseminate personalize agricultural knowledge (*d*-pak).

4.1. Data Migration Process

Fig. 3 shows the data migration process from farmers to the Knowledge Bank. Farmers can upload their farming information to BIGBUS through voice navigation functionality. Data migratory transfers those data from BIGBUS to Knowledge Bank.

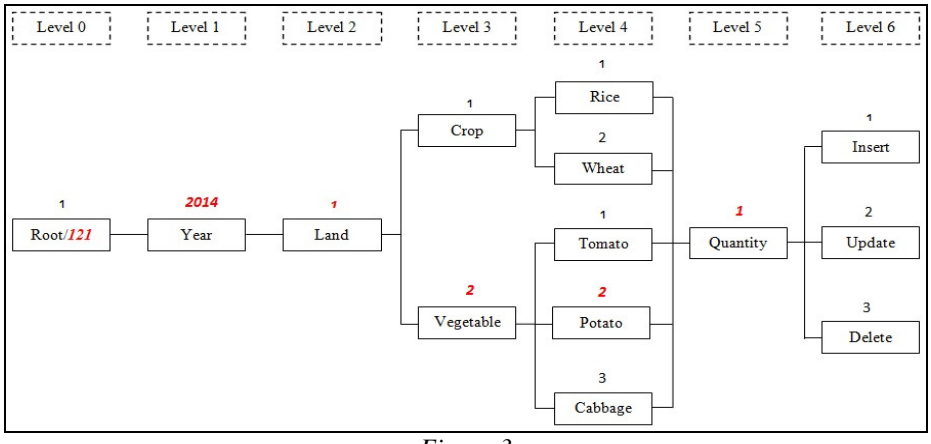

Figure 3

Navigation tree is a process to collect farmer's previous farming records. In order to provide suggestion and guideline, it is necessary to analyze those collected data. Level 0 is the root of the tree where the hotline number is configured (farmer call in this number and the system will detect the mobile number as an identification number). From which year's information farmer want to provide that will be enlisted in Level 1. To know the measurement of land is important for providing fertilizer as well as irrigation process, which will be Level 2. Level 3 and 4 will be used to input actual data related to previous production. Quantity is also an important factor for selecting the prospective crops which will be Level 5 and at the end of Level 6 farmers can edit and add or delete provided information.

4.2. Functionality Process

From the *Data Migration Process,* we identified three factors to play their roles, 1) Farmer, who wants to upload their own farming history 2) Knowledge Bank/System Administrator to manage the BIGBUS in order to develop Knowledge Bank 3) Knowledge Contributors (local expert farmer) who can also able to provide specific suggestions to the farmer. A list of functionalities of each factor is described in Table 2.

Actor	Functional Activities
Farmer	Connects to BIGBUS
	Choose Category & sections
	Add/Delete/Update information
	Confirm, Input Data
KB Admin	View data & Analyze.
	Type necessary recommendation.
	Convert text to voice (IVR)
	Send IVR to farmers ID.
KB Contributor	Knowledge Bank connects to the local expert farmer.
	Send farmers details by IVR.
	Open channel with farmer. (Note: 1. Knowledge Bank will connect farmer to local expert farmer if the initial discussion does not satisfy to the farmer. 2. The IVR can send farmers farming history to local expert farmers.

Table 2: BIGBUS Actors and Functionality

The process flow is described in Fig 3.

1. The farmer calls to the hotline number (121) AT BIGBUG. The hotline number is pre-configured in the IP-PBX at BIGBUS. BIGBUS can keep the mobile number as future identification.
2. IVR (Interactive Voice Response) of the IP-PBX consults with the navigation tree and asks the farmer with a series of queries. Voice announcement is pre-recorded and linked to the navigation tree.
3. The farmer from a mobile phone inserts digits (0-9) to select the product and input detail farming record. In this example (as in Fig.3), the farmer's land size is 2 acres and produced potato in 2014 is less than 200 kg.
4. IVR collects the farming history in digits (in this example 121-2014-2-3-200) which means the farmer's land size is 2 acres and produced potato in 2014is less than 200 kg. After that farmer sends this information to the database server in BIGBUG.
5. A tool data migratory then collects this information from the temporary DB and send it to the Knowledge Bank.

4.3. Dissemination Approach

According to BIGBUS navigation tree if a farmer can successfully upload his farming history, then based on existing information, Knowledge Bank will analyze and provide expected suggestion. The Knowledge Bank dashboard will be like,

Prospective Crops	Recommended Fertilizer	Using Technique	Irrigation Method	Another Suggestion

Table 3: Knowledge Bank Dashboard

Knowledge Bank will generate IVR notification based on analysis and send it to farmers in every week. As because of there are character limitation and literacy issue in the SMS that is why voice can be another approach for dissemination. To get the IVR farmer have to register in the Knowledge Bank. However, if Knowledge Bank does not able to provide satisfactory suggestion or need further discussion then the agent will transfer the call to the local expert farmer.

4.4. Service Design

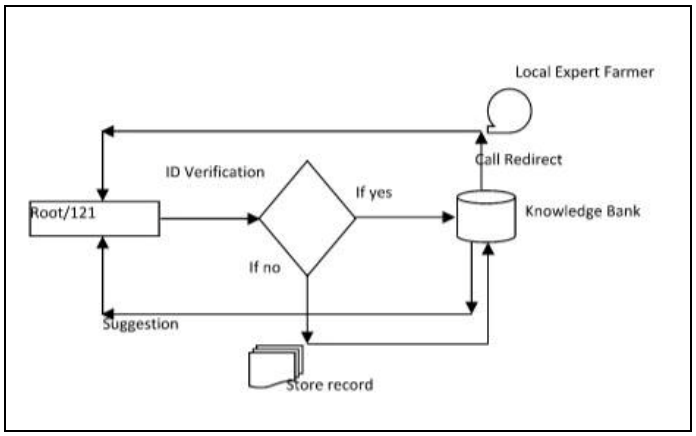

Figure 4

At the last stage, to get personalize agricultural knowledge, the farmer needs to call hot line number (for example, 121). The system will verify that the identified number is already registered or not. If the number is registered, then it goes to Knowledge Bank and an agent will provide suggestion in analyzing with existing general knowledge with his previous farming history. However, if the farmer is not satisfied after getting suggestions than agent will redirect the call to the local expert farmer for further discussion. On the other hand, if the identified number is not registered then the system will ask to store the previous farming history (Fig 4).

5. Discussion and Future Research Activity

In this proposed system one of the major challenges will be to set an important parameter for the Knowledge Bank dashboard, for example, farmers have some common queries like, what kind of crops I have to produce now and how to use proper fertilizer and is there any new irrigation process of this farming activity. Another challenge will be how to inspire farmer to store their previous farming history. In Bangladesh there are 4516 Union Information and Service Centre (UISC). 3.19 million citizens visiting every month. To reduce the information gap among rural citizens is their major responsibility. We can deploy our Knowledge Bank (registration portion) to store farmers farming history. In that case farmer needs to contact to UISC. And finally, how to motivate local expert farmer to provide suggestion and guideline.

6. Conclusion

The growth of ICT in Bangladesh offers a new opportunity for accessing information both in urban and rural areas. Though there are different private initiatives to disseminate agricultural knowledge for farmers in Bangladesh however major farmers' group are expected personalize knowledge which government agricultural extension officer is currently providing. However, this study identifies some major gaps and proposes an effective method to disseminate local and customized knowledge to farmer's end via a feasible service design. But to scale up this framework, relevant stakeholders need to ensure the local farmers participatory approach.

7. References

i. Ahmed, A. (2009, June). An information production and ownership platform for BoPers. In G. Bradley (Ed.), Proc. IADIS International Conference ICT, Society and Human Beings (MCCSIS 2009), IADIS Press (pp. 147-154).
ii. Hossain, MS. 2009. Food Security Situation in Bangladesh with Focus on the Impact of
iii. High Food Prices. The Guardian. A national Monthly, published by editor from
iv. 794/KA, South Shajahanpur, Dhaka-1217, Bangladesh.
v. BBS. 2007. Bangladesh Bureau of Statistics. Statistical Division, Ministry of Planning,
vi. People's Republic of Bangladesh. Dhaka, Bangladesh.
vii. BRRI. 2009. Bangladesh Rice Research Institute. Extension of Agricultural Machinery at
viii. Union Level. A Paper presented from Farm Machinery and Processing
ix. Engineering Division of BRRI.
x. Kashem, M. A., Faroque, M. A. A., Ahmed, G. M. F., & Bilkas, S. E. (2013). The Complementary Roles of Information and Communication Technology in Bangladesh Agriculture. Journal of Science Foundation, 8(1-2), 161-169.
xi. Aker, J. (2010). Dial "A" for agriculture: using information and communication technologies for agricultural extension in developing countries. Tuft University, Economics Department and Fletcher School, Medford MA02155, 37.
xii. Hussain, S. G., & Asaduzzaman, M. (1992, January). Country Paper: Bangladesh. In workshop on Sustainable and Effective Management Systems for Community Forestry.
xiii. The Katalyst Cases. Case Number 6, (November 2012), Making ICT for Bangladesh's farmers, p.10.
xiv. Human Development Report UNDP. (2010). Web site. Retrieved September 13, 2015. http://a2i.pmo.gov.bd/sites/default/files/resource_docs/Concept%20Note%20for%20HDTV.pdf.
xv. Union Information and Service Centre (UISC). Web site. Retrieved January 30, 2016. http://a2i.pmo.gov.bd/sites/default/files/Union%20Information%20and%20Service%20Centre%20%28UISC%29_09_Janu_14.pdf