

Review of Literature and Development of Models Relating to the Application of ICT in Paddy Procurement System in Bangladesh

Md. Ashraful Islam¹

Abstract

The economy of Bangladesh is vitally dependent on agriculture which supports the vast majority of her population. This sector employs 47 percent of the total labor force. The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development and food security. Paddy is the main crop in Bangladesh and the life-line of the farmers. The main objective of this study is to propose Information and Communication Technology (ICT) based model for paddy procurement system which is appropriate in Bangladesh. The author primarily reviews the literatures and through the review he constructs some models which have been presented in this paper.

1. Introduction

Agriculture is the backbone of Bangladesh economy. The contribution of agriculture in GDP was estimated to be 15.35 percent by 2015-16 (BBS, 2016). The economy of Bangladesh is vitally dependent on agriculture which supports the vast majority of her population. This sector employs 47 percent of the total labor force (BBS, 2016). The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development and food security. Paddy is the main crop in Bangladesh and the life-line of the farmers. Three types of paddy namely Aus (March to August), Aman (June to January) and Boro (November to May) are produced in this country. Today the paddy production largely depends on the use of fertilizers, irrigation, pesticides etc. Majority of the farmers of Bangladesh belong to medium and low income group. Often they have to borrow the cost of paddy in credit which requires selling their

¹ PhD Researcher, Centre for Higher Studies and Research, Bangladesh University of Professionals, Cell: +8801712516838, ashraful.islam@manarat.ac.bd

paddy immediately after production because of mainly two reasons: these farmers do not have adequate storage facilities and they require money at the earliest period as they have to repay the loans taken for purchasing seeds, fertilizers, pesticides and to cover the day to day expenses etc. Based on this weakness, several types of middlemen or intermediaries have emerged in the market, namely faria, bepari, paiker, aratdar-cum-wholesaler and miller who often try to exploit these farmers. So in the harvesting season farmers are to sell the paddy with comparatively lower price. The price of paddy is, in most of the cases, unstable and ironically, since independence, the seasonal fluctuation is very common in price of paddy. (Chowdhury, 1987). The suffering of farmers is also very common. Government has been launching many programs one after another in order to boost up the agricultural sectors. To solve this particular problem of farmers in the low price of the paddy in harvesting season, the Bangladesh Government has taken very effective initiative to procure the paddy from the farmer with supporting price and within the time of harvest when they are in dire necessity to sell it. This procurement serves the dual purposes of building rice stocks for the Public Food-grain Distribution System (PFDS) and of providing income support to farmers. (Alam *et al.*, 2014). Considering all the factors relevant to production of paddy, every year the government declares procurement price at the harvesting time of the crop so that producer gets proper price commonly known as minimum support price. If procurement price is higher than the production cost, producers get profit and encourage on the cultivation of paddy in following year (Raha *et al.*, 2013). In practice, due to illiteracy and poor communication knowledge, it is the middlemen, not the farmers, who are getting real price; the middlemen purchase paddy from the farm-gates and market places. Then they sell it to the other middlemen in the same market or other markets. The middlemen, like farias, beparis, paikers and aratdar-cum-wholesaler, sell the same to millers. Consequently the government has no other way except purchasing paddy from the millers (Dewan, 2011). So, the benefits of support price go to many, rather than farmers. Despite very good initiatives taken by the government, farmers are deprived of the benefit due to the lacking of paddy procurement system. Procurement is the act of finding, acquiring, buying goods, services via a tendering or competitive bidding process. The process is used to ensure that the buyer receives goods or services at the best possible price, with desired quality, quantity, time and location (Weele, *et al.*, 2010). The target of this research is to make all the activities of this procurement system transparent and ensure the support for the farmers. In this regards, Information and Communication Technology (ICT) can play a vital role in paddy procurement system to make it transparent. As ICT can be used in diverse applications to accelerate information collection, storage, processing and dissemination to improve efficiency of paddy procurement system, it will certainly increase the transparency and accountability of all the activities relevant to paddy procurement system. Though the role of ICT is very effective and its application is increasing in agriculture day by day, unfortunately paddy procurement system of Bangladesh is not ICT

based. Some developed and some developing countries have been using ICT in paddy procurement system in many different ways. Even some provinces of India like Chhattisgarh, Odisha, and Uttar Pradesh are using ICT based paddy procurement system but not in complete form. Bangladesh Agriculture Information Service (AIS), E.KRISHI, Access to Information (a2i), Bangladesh Agricultural Research Council (BARC) and many other national and international organizations are working for the development of this area (Shahnewaz et al., 2015). But it is very clear that a vast scope is there to work on a comprehensive level of application of ICT based paddy procurement system suitable for the country and supportive to farmers. In this research a model of paddy procurement system will be proposed which is Information and Communication Technology (ICT) based. The strategy is the use of ICT based paddy procurement system to make the activities transparent to farmers, planners, policy makers, administrators, researchers and other stake holders who are concerned with paddy procurement system in Bangladesh and that will support the farmers to get the actual price.

2. Problem Statement and Rationale of the Study

In Bangladesh the procurement of Aman, Boro and Aus paddy from the farmers is increasing day by day but the suffering of farmers is also increasing. Lack of information at the proper time causes a huge loss to farmers. Also, due to lack of proper paddy procurement system in Bangladesh, the farmers are suffering as well as the middle men and the corrupt personals involved are getting the benefits provided by the Governments. This gap in communication may be bridged by Information and Communication Technology (ICT). Information of the required quality always has the potential of improving efficiency in all spheres of procurement. There is very little study or research on the field of ICT use in paddy procurement system in Bangladesh to support the farmers. So, it is very much important to know the contribution and prospect of using ICT in paddy procurement system in Bangladesh to solve problems of the farmers and thereby to lead to actual development of Bangladesh. Information and Communication Technology (ICT) is one of the most important information systems applied in many levels of procurement all over the world. So, Bangladesh also can get maximum benefit of ICT in its paddy procurement system, if the ICT becomes popular and user friendly to the end user. In global environment, competitiveness is the most important factor that must be kept in mind to be successful. ICT can play a significant role in an organization for real time decision by analyzing the surrounding situations with the help of different information systems in global competitive environment. At present, the agriculture sector in Bangladesh faces fierce problems like lack of adequate storage facilities to store the produce and the farmers require money at the earliest as they have to repay the loans taken for purchasing seeds, fertilizers etc. So they have to sell the paddy/ product and with the lacking of proper procurement system they have to suffer and are deprived of the real price, though

the government is paying it. This research will be focused to find out the problems in this sector and propose ICT based paddy procurement system to support the farmers. The study will broaden the knowledge of the relevant fields and indicate to the possible initiatives that could be taken for improving the system. Finally, a conclusion will be drawn suggesting some recommendations for effective and efficient use of ICT practices in paddy procurement system as well as in agriculture sector in Bangladesh.

3. Research Objectives

Main objective

The main objective is to propose Information and Communication Technology (ICT) based model for paddy procurement system which is appropriate in Bangladesh.

The Specific objectives of this research are

- i) To assess the current state of paddy procurement system in Bangladesh and the perception of farmers regarding this system.
- ii) To identify major challenges and to suggest possible remedies to overcome the challenges identified.
- iii) To explore the prospect of application of ICT in paddy procurement.

4. Literature Review

“Domestic rice procurement serves the dual purposes of building rice stocks for the public food grain distribution system (PFDS) and of providing income support to farmers. To fulfill the objective of income support the government provides a support price higher than the cost of production in order to ensure that farmers do not produce at a loss. The National Food Policy Plan of Action (2008-15) also put emphasis on the importance of enhancing effectiveness of PFDS and has been providing effective support to producer prices. However, it is not yet identified what works better for the betterment of small and marginalized farmers who are the major suppliers of agricultural produce. Given the above backdrop, this study attempts to assess the effectiveness of the procurement system in terms of impact on the farmers, with particular emphasis on small and marginal farmers, and to suggest alternative instruments to achieve the objective of sustaining farmers' income and rice production.”(Alam *et al.*, 2014)

“Food grain procurement program has a fairly long history in the region now comprising Bangladesh. For a long time, the primary objective of the procurement program has been to secure enough food grains to feed the Public Food Distribution System (PFDS). Since 1975, however, price support became an important objective, although feeding PFDS remained an important concern. The price support program has itself involved in two phases. Initially, the

idea was to guarantee a floor price, which was announced just before the harvesting season. More recently, the whole system has been geared up towards guaranteeing an incentive price. The procurement price is now consciously related to production cost and is announced before the sowing season. It is said that the present procurement program is not effective to provide incentive to the farmers. Government procures paddy from the farmers and rice from the millers through its procurement centers located in different areas of Bangladesh. Due to some practical reason the farmers sell their paddy mainly to the middlemen in the post-harvest season. Middlemen involved in the trading of paddy are of different categories. They are commonly known as Kutial, Barkiwala, Faria, Bepari and miller. But the Kutial and Barkiwala were not involved in the procurement channel. The suppliers to the procurement center are either farmers or the millers.”(Sabur S. A. *et al.*, 2003). “Paddy, being the major food grain has to pass through too many middlemen such as commission agents, wholesalers, millers cum wholesalers, retailers in the chain of distribution. Such too many middlemen take lion share of profit and consequently the price goes up abnormally. Hence, as a measure to avoid profiteering by the middlemen, our Government is bound to evolve a sound food policy of keeping the price always under control and maintaining adequate stock position to meet the rice requirements of people under public distribution system. Also the Government is bound to effect a sound marketing system to enable the producers to get fair price for their produce by eliminating the inherent defects prevalent in agricultural marketing such as lack of organizations, forced sales, presence of superfluous middlemen, multiplicity of market charges, multiplicity of weights and measures and malpractices of markets. Thus, it becomes important to study about monopoly procurement system and its success in achieving its objectives. (Prakash C., 2012)

“Procurement is the act of finding, acquiring, buying goods, services or works from an external source, often via a tendering or competitive bidding process. The process is used to ensure the buyer receives goods, services or works at the best possible price, when aspects such as quality, quantity, time, and location are compared. Corporations and public bodies often define processes intended to promote fair and open competition for their business while minimizing risk, such as exposure to fraud and collusion.”(Weele, *et al.*, 2010) ” Dewan conducted a study to identify the marketing system of rice sector in Bangladesh. For conducting the study a total number of 90 samples were purposively chosen from Dinajpur, Sherpur and Dhaka district for collecting primary data and also secondary data were collected from DAM and other secondary sources. Simple arithmetic procedures, Engle and Granger co-integration and Error correction Mechanism (ECM) were used for analyzing the price relationships between the spatially separated markets, to see the speed of price adjustment in the long-run equilibrium. It was observed that, rice millers were the dominant

traders and also influenced the price of paddy greatly and buy huge amount of paddy during harvest season at lower price and store it to run their business effectively in lean period.” (Dewan 2011)

“E-Procurement (electronic procurement) is the business-to-business or business-to-consumer purchase and sale of supplies and services through the Internet as well as other information and networking systems, such as Electronic Data Interchange and Enterprise Resource Planning. Kameshwaran conceptualized EP as “an internet-based business process for obtaining materials and services, and managing their inflow into the organization”. Typically, E-Procurement websites allow qualified and registered users to look for buyers or sellers of goods and services. Depending on the approach, buyers or sellers may specify costs or invite bids. Transactions can be initiated and completed. Ongoing purchases may qualify customers for volume discounts or special offers. E-procurement software may make it possible to automate some buying and selling. Companies participating expect to be able to control parts inventories more effectively, reduce purchasing agent overhead, and improve manufacturing cycles.” (Kameshwaran *et al.*, 2007).

“Some governments have moved to use ICT in an effort to streamline the procurement process within the public sector. The key processes could range from identification of requirements, through payments to contract management. Access of information in a timely and reliable manner is very critical to suppliers who depend on the function of procurement. ICT ensures that this critical role is achieved and access to information is also ensured at a cost effective manner and access is devoid of geographical location and people can thus access information in whichever corner of the world they are in.” Aker, J.C. (2008).

“ICT ensures that this critical role is achieved and access is also ensured at a cost effective manner and access is devoid of geographical location and people can thus access information in whichever corner of the world they are in. This provision further enhances competitive bidding thereby promoting the principles of procurement; accountability, transparency and integrity as advocated for by Transparency International. ICT provides for dynamism in operations and also allows customization to meet specific user needs and specifications. In procurement, ICT can play a critical role due to its ability to handle and analyze massive amount of data within a short period.” (Yang et al 2012).

“The middlemen or intermediaries in the marketing channels were *faria*, *bepari*, *paiker* and *aratdar*-cum-wholesaler. The middlemen purchased paddy from the farm gates and market places. Then they sold paddy to the other middlemen in the same market or other markets. *Farias* purchased paddy from the farmers either at farm gates or in the markets and sold the same to the *beparis*, *paikers* in the market. The *beparis* purchased paddy from farmers and

farias and sold the same to the *paiker* and millers. The *paikers* bought paddy from farmers, *farias* and *beparis* and then sold to the millers.” (Robel. *M.*, 2013).

“Raha conducted a study on structure, conduct and performance of the rice market and the impact of technological changes in milling. The study covered 12 districts of Bangladesh of which six are from rice surplus area and six are from rice deficit area. Price is set through bargaining both in buying and selling of paddy. The paddy traders had not undertaken any product policy and sales promotion policy. They concluded that paddy market is operating smoothly throughout the country; millers are getting paddy as much they need, though farmers are not getting reasonable price for their paddy. So, from farmers’ perspective, they argued that paddy market is not running in favor of them.” (Raha *et al.*, 2013)

“Under the decentralized procurement of paddy in Chhattisgarh, paddy is procured from farmers at minimum support price (MSP) so that farmer gets value for his produce. The purpose of the system is to ensure that the payment to the farmers is made instantly. The paddy bought by farmers is weighed and details are directly entered in the system so that 'receipt' and 'cheque for payment' are immediately generated through computers.” (Ananth *et al.*, 2011)

“Farmers are registered online and once paddy is procured from them, they are given computer generated receipts. Cheques for payment to farmers and delivery orders for movement of paddy from the procurement centers to the miller and storage centers of MARKFED and FCI are printed in real time. Workshops were held every 15 days during the initial stages of the project to train 1532 data entry operators in basic computing” (Shukla, 2011)

“The global significance of e-agriculture which stands for electronic or digital agriculture is being felt through its diverse influences on agricultural input procurement, production, processing, distribution, market exchanges, agribusiness development, food security, and rural poverty alleviation. E-agriculture development is driving major transformations in agriculture today. The benefits from e-agriculture are derived from high value agricultural chains, productivity gains, global market access, e-agriculture services, efficient decision making, and enhanced communication with key industry stake holders.” (Okello, 2010)

“Information and Communication Technology (ICT) is an extended term for information technology (IT) which stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information. The term ICT is also used to refer to the

convergence of audio-visual and telephone networks with computer networks through a single cabling or link system. However, ICT has no universal definition, as "the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis." The broadness of ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form, e.g. personal computers, digital television, email, robots." Paas, L. (2008)

"However, there are few analytical studies or impact assessments that confirm that such benefits have been delivered in large-scale projects" (Bhatnagar et al., 2010) "A recent book on fighting corruption recognized the important role of ICT in reducing corruption, but points out that it has not been easy to harness this potential. In assessing the status of e-governance the United Nations Public Administration Network (UNPAN) survey of 2012 noted that, while it is important to continue with service delivery, governments must increasingly begin to rethink in terms of e-government and e-governance. The scope of e-government should be widened for a transformative role of the government toward cohesive, coordinated, and integrated processes and institutions. Since the e-governance activity in developing countries in Asia is at best at a moderate level, there is scope to expand the deployment of e-governance. It is important to understand the full potential of deploying ICT to improve the delivery of services. It is equally important to understand the challenges in harnessing this potential by identifying the critical success factors for wide-scale deployment." (Bhatnagar, 2013).

"People around the Globe from few years from now will be carrying a handheld computer connected to the Web to get the information about the World at their fingertips. E-Agriculture is an emerging field focused on the enhancement of agricultural and rural development through improved information and communication processes."(Chandra et al., 2011).

"The transformational role of ICT in the social and economic spheres of man engendered development of the communication technology in Nigeria. Based on the telecom deregulation policy of the Nigerian Government in 2001, the country witnessed an upsurge of private investment in ICT development and its consequential ICT revolution. The applications are primarily used for linking actors in the agricultural value chain, accessing real time information on prices, buyers and sellers, transport and haulage, and other relevant information services in the agricultural value chain. Limited evidence from Ghana and elsewhere show that cell phone applications have resulted in increased incomes but the impacts and sustainability of other ICT applications have proven elusive. The role of ICT in overcoming the key constraints in the agricultural value chain and for making evidence-based

decisions will be greatly enhanced if farmers, aggregators, and other stakeholders in the value chain pay attention to their business scope and schedule planning, executing, monitoring and control, procurement, risk planning, and stakeholder communications in a “project management” context. When this is done, ICT applications will facilitate supply chain management through sharing of timely and pertinent information on producers, buyers and other services, thereby helping to promote industry competitiveness. The increased concern of consumers to health, food safety and environmental issues has increased the stipulation of integrating ICT in food and agriculture quality control systems and related tracking and tracing systems of consumer goods in the supply chain.”(Fafchamps, 2005)

“Transaction costs tend to be particularly high among smallholder farmers due to poor communication and transportation facilities, lack of production and market information, as well as thin and segmented markets” (Tiwari, S.P. 2008). “Studies and projects around the world related to agricultural information dissemination have encountered different obstacles depending on several issues like poverty, illiteracy, insufficient support, lack of timely information, user-friendly interface, two-way communication, insufficient network infrastructure and a lack of awareness of ICT benefits and cultures.” (Margono et al., 2011)

By reviewing the above mentioned literature, it appears that a number of studies on Agriculture, Food security, Minimum support price for farmers and paddy procurement system have been conducted in Bangladesh and also in other countries. A few studies on application of ICT based paddy procurement system have also been done. Limited application of ICT in the system is implemented in sporadic areas. Agriculture Information Service (AIS), E.KRISHI, Access to Information (a²i), Bangladesh Agricultural Research Council (BARC) and many other organizations are working for the development of this area. But it is clearly apprehensive that a vast scope is there to work on a comprehensive level of application of ICT based paddy procurement system suitable for the country and supportive to farmers.

5. Research Methodology

Methodology is a necessary and integrated part of any research. Careful considerations are needed by a researcher before conducting a study. The researcher has great responsibility to describe clearly what sorts of research design, method and procedure s/he will follow in selecting the study area, sampling technique to analyze and interpret those to arrive at correct conclusions. Working with the objective of identifying best solutions researcher will conduct extensive research to identify initiatives that contribute towards the betterment of paddy procurement system. The application of ICT based paddy procurement system in all over Bangladesh will ensure transparency and accountability in paddy procurement system.

5.1 Study Area

The study will be conducted in three Upozila: Phulbaria, Patnitola and Monirampur—three paddy producing zones in Dinajpur, Noagaon and Jessore respectively in Bangladesh for collecting primary data from the farmers and field-level-personals involved in paddy procurement. Study will also be conducted in Dhaka to collect data from planners, policy makers, administrators, researchers and other stakeholders. We have to study the daily newspapers, journals articles, research report of different national and international organizations for secondary data. Problems with paddy procurement system are a social research in nature and, therefore, both of qualitative and quantitative research approach will be used for this study.

5.2 Design

Basically this research will be a questionnaire study. As the purpose of this study is to find out the problems of farmers and proper authority of paddy procurement system; hence information and opinion from farmers and proper authority will be gathered. Semi-structured interview will be taken of the farmers and the relevant personals. Interview session will also be arranged with the representatives from the civil society and renowned personals to make the study more powerful. Along with it, the observation of the researcher will also get importance.

5.3 Sampling Frame

Sampling frame provides a base for the selection of the sample. Sampling frame is the actual set of units from which a sample will be drawn. The study will be conducted in three Upozila: Phulbaria, Patnitola and Monirampur—three paddy producing zones in Dinajpur, Noagaon and Jessore respectively in Bangladesh for collecting primary data from the farmers and field-level-personals involved in paddy procurement. Study will also be conducted in Dhaka to collect data from planners, policy makers, administrators, researchers and other stakeholders.

5.4 Instruments and Data Collection Process

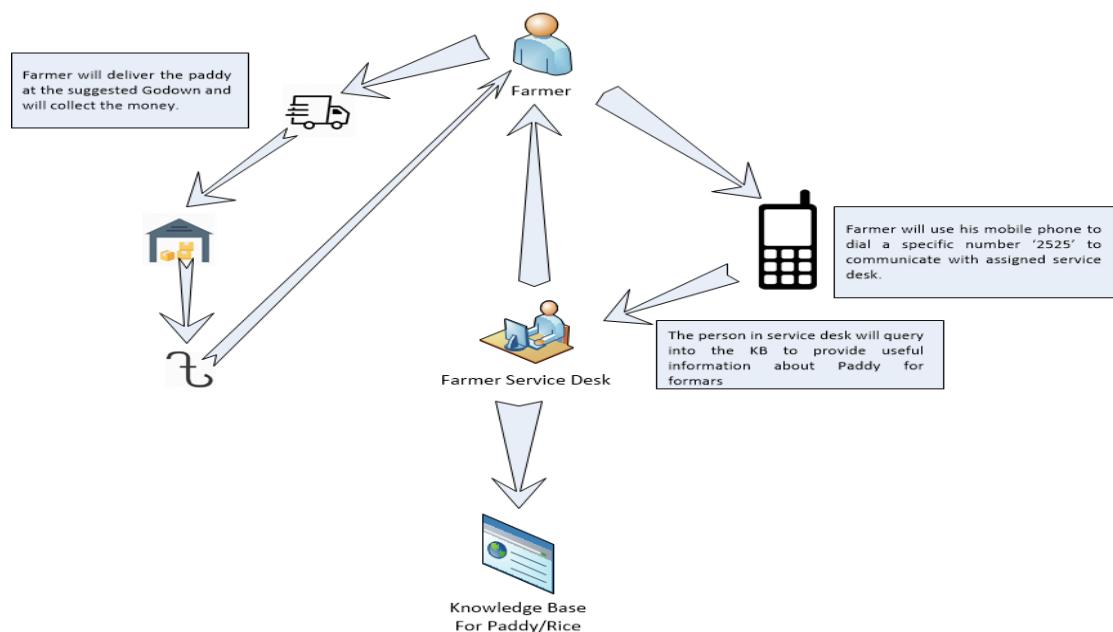
Questionnaire – open-ended and close-ended questions / Semi-structured interview / Observation. Both research methodologies—qualitative and quantitative—will be followed in this study, using semi-structured interviews as the primary research approach. It is proposed to begin with the interviewing process with the farmers and policy makers, administrators, researchers and other stakeholders. It will begin with unstructured questions like, “What do you think about paddy procurement system? / How does paddy procurement system guidance help farmers? Often, with only occasional questions from the researcher for clarification, it is anticipated that the interviewee will talk about a wide variety of topics throughout an extended interview. It is anticipated that up to 210 interviews and necessary follow-up

interviews will be conducted with farmers and personals involved with paddy procurement system selected from three Upozilas—Phulbaria, Patnitola and Monirampur paddy producing zones of Dinajpur, Noagaon and Jessore. Questionnaire survey will be done among 45 Farias, Aratdar, Miller, planners, policy makers, administrators, researchers and other stake holders of paddy procurement system. Then some data analysis will be completed to obtain an understanding of the findings. The interviews will be informal and open-ended, and will be carried out in a conversational style. Field notes will be written in conjunction with the interviews, follow-up interviews, observations, and casual encounters with subjects. Memoranda will also be written while listening to interviews, typing transcripts, and reflecting upon a particular interview. In addition to the interviews and follow-up interviews, we expect to obtain other data throughout the study, such as comments from administrators and papers or other materials and ongoing literature review.

6. Data Analysis and Presentation

It is expected that ongoing data analysis will take place throughout the study. The collected data will be run through SPSS software. The collected data will be interpreted using cross tabulation. For presenting information, tables and figures (bar diagram and pie chart) will also be used. Finally, the opinions of the respondents like farmers, planners, policy makers, administrators, researchers, other stakeholders of paddy procurement system will be presented as recommendations.

6.1 Sample of proposed model as follows



7. Expected Results and Significance of the Study

The research output will be useful to improve the paddy procurement system and related infrastructure in Bangladesh. This research will be helpful not only to the farmers in Bangladesh but also would be helpful to planners, policy makers, administrators, researchers and other stake holders who are concerned with paddy procurement system in Bangladesh. It also may be the model of ICT based procurement system in the whole world. The researchers will get benefit of Big data analysis and the Government may get information about the production and demand of paddy.

8. Concluding Remarks

Finding out the state of paddy procurement system in Bangladesh, the researcher will propose an ICT based paddy procurement system model. In the proposed model, the farmers should be registered into the ICT based system by providing information of paddy production. Through Agricultural Information System (AIS) the farmers will come under communication system using text and other digital tools. Usually, one coordinator/knowledge worker will be responsible for several farmers or some ICT literate farmers might act as coordinators/knowledge worker using authentic/verified personal ICT tools/devices like mobile/ internet farmer him/herself or knowledge worker store / retrieve data in/from knowledge base system which is actually the storage of all the data related to paddy procurement system. Thus paddy will be procured only from the right farmers and the payment will also go to the right farmers. For the detailed works, researcher will need the use of Software Engineering approaches, System Analysis and Design, Unified Modeling Language (UML), R-Programming, some application software like Project Management, Visio and overall Data Science Knowledge.

As paddy procurement serves the dual purposes of building paddy stocks for the public food safety and of providing income support to farmers, it is very important to ensure that the support of the government to farmers is working properly. This research will be useful to improve paddy procurement system and related infrastructure in Bangladesh. The proposed ICT based model of paddy procurement system will make transparent the procurement of paddy from farmers, Payment to farmers, Storage at warehouses, Calculation of required paddy to be needed each year, Transportation of the paddy and all the activities will be very effective, easy, friendly and transparent to all—the farmers, planners, policy makers, administrators, researchers and other stake holders who are concerned with paddy procurement system in Bangladesh.

References

- Aker, J.C. (2008). *Does digital divide or provide? The impact of cell phones on grain markets in Niger*. Job market paper. California: University of California
- Alam, M. J., Akter, S. & Begum, I. A. (2014). *Bangladesh's rice procurement system and possible alternatives in supporting farmer's income and sustaining production incentives*. A study report. Mymensingh, Bangladesh: Department of Agribusiness and Marketing, Bangladesh Agricultural University
- Ananth B. S., & Somasekhar A. K. (2007). Dhan Kharidi-Online - Easy paddy procurement from farmers with instant cheque delivery to farmers. Project paper, Department of Food, Civil Supplies and Consumer Affairs, Govt. of Chhattisgarh. Chhattisgarh, India
- Ashraf, M.A. (2008). Econometric analysis of the impact of domestic rice procurement policy on producer price: The case of rice in Bangladesh. *Journal Agro Ekonomi*, 26(1): 80-89
- BBS. Bangladesh. (2016). *Statistical yearbook of Bangladesh 2015*. Ministry of Planning, Government of Bangladesh. Dhaka: Bangladesh Bureau of Statistics
- BBS. Bangladesh. (2016). *Statistical pocketbook Bangladesh 2015*. Statistics and informatics division. Ministry of Planning, Government of Bangladesh. Dhaka: Bangladesh Bureau of Statistics
- Bhatnagar, S. & Singh, N. (2010). Assessing the impact of E-Government: A study of E-Government projects in India. *Journal of Information Technologies and International Development*. 6(2). pp 109–127
- Bhatnagar, S. (2014). *Public service delivery: Role of information and communication technology in improving governance and development impact*. Manila: Asian Development Bank
- Chandra, D.G. & Malaya, B.N. (2011). Role of agriculture in rural development in Indian context: Emerging trends in networks and computer communication. Conference paper. Udaipur, India
- Chowdhury, N. (1987). Seasonality of food grain price and procurement programme in Bangladesh since liberation: An exploratory study. *The Bangladesh Development Studie*. 15 (1):105-128
- Chowdhury, N. (1994). *Causalities and cost effectiveness of public rice procurement in Bangladesh*. Bangladesh Food Policy Project, IFPRI, Washington DC
- Dewan, M. F. A. (2011). "A study on rice marketing system in Bangladesh with time series and cross-sectional data", M.S. Thesis, Department of Agribusiness and Marketing, Bangladesh Agricultural University, Mymensingh
- Fafchamps, M. & Hill, R.V. (2005). Selling at the farm gate or travelling to the market. *American Journal of Agricultural Economics* 87(3): 717-734
- Hassan, M.S., Hassan, M.A., Samah, B.A., Ismail, N., & Shaffril, H.A.M. (2008). Use of information and communication technology (ICT) among agri-based entrepreneurs in Malaysia. *Proceedings of the World Conference on Agricultural Information and IT*. pp. 753 - 762. Japan: Atsugi

- Kameshwaran, S., Narahari, Y., Rosa, C.H., Kulkarni, D.M. & Tew, J.D.(2007). Multi attribute electronic procurement using goal programming, *European Journal of Operational Research*, Vol. 179, No. 2, pp.518-536
- Karnka, S. (2006). ICTs' appropriate model for e-farmers group development in Thailand. *Proceedings of the 4th World Congress Conference: Computer in Agriculture and National Resources* (pp. 140 - 145). Florida: Orlando
- Kumar, B.N., Suma, V., & Poornima, U.S.(2014). "A Localized bottom-up approach for Indian agricultural scenario using information technology", *Electronics and Communication Systems (ICECS), 2014 International Conference on*, on pp:1 – 5
- Margono, T., & Sugimoto, S. (2011). The barriers of the Indonesian extension workers in disseminate agricultural information to farmers. *International Journal of Basic & Applied Sciences*, 11(2), 98 – 105
- Okello, J. J., Edith, O.A., Oliver L.E. M. & Ruth, M. O. (2010). Using ICT to integrate smallholder farmers into agricultural value chain; The case of Drum Net project in Kenya. *International Journal of ICT and Research Development*, 1:23-37
- Paas, L. (2008). How information and communications technologies can support education for sustainable development: Current uses and trends. International Institute for Sustainable Development. Manitoba. Canada
- Prakash, C. (2012). Problems and expectations of the farmers in marketing paddy in Tiruvarur district, Tamilnadu. *Asian Journal of Management Research* (O). Open Access publishing platform for Management Research. ISSN 2229 – 3795
- Raha, S.K., Moniruzzaman, M., Alam, M.M. & Awal, M.A. (2013). *Structure, conduct and performance of the rice market and the impact of technological changes in milling. Research Report*. Mymensingh, Bangladesh: Institute of Agribusiness and Development Studies, Bangladesh Agricultural University
- Robel, M. (2013). Marketing of boro paddy in selected area of Netrakona District. M.S. Thesis. Mymensingh, Bangladesh: Institute of Agribusiness and Development Studies, Bangladesh Agricultural University
- Sabur S. A, Jahan H. & Reza M. S (2003). An evaluation of government rice procurement Program in selected areas of Bangladesh. *Bangladesh J. Agric. Econ XXVI, 1 & 2(2003)* pp.111-126
- Shahnewaz, N., Haque, M. E., Afrad, M. S. I. & Hoque, M. Z. (2015). Role of Union Information and Service Centre in Community Development. *American Journal of Computation, Communication and Control*. Vol. 2, No. 5, 2015, pp. 40-47
- Shukla, A. (2011). Process Computerization of Paddy Procurement and PDS in Chhattisgarh Presented in Agriculture Skill Council of India: ASCI on 11.06.2011. India

Soni, A. K, Singh, H. P. & Kapre, A. (2013). Golden Research Thoughts: A case study on online paddy procurement system in chhattisgarh.vol:2(7)

Tiwari, S.P. (2008). Information and communication technology initiatives for knowledge sharing in agriculture. *Indian Journal of Agricultural Sciences*, 78(9), 737 – 747.

Weele, Arjan J. van (2010). *Purchasing and Supply Chain Management: Analysis, Strategy, Planning and Practice* (5th ed.). Andover: Cengage Learning. ISBN 978-1-4080-1896-5

Yang, C., Shao,Y., Chen, N. & D. (2012). *The cloud computing for a dynamic agro geoinformation processing*. First *International Conference on Agrogeo informatics (Agro-geoinformatics)* 2012. Shanghai: China. 2nd -4th August, 2012. pp. 1-4