

# Deployment of Contextual Mobile Payment System: A prospective e-service based on ICTization framework from Bangladesh perspective

Arif Mahmud and Abdus Sattar

**Abstract**— A new contextual mobile payment system has been proposed as one of the e-services based on our previously suggested ‘ICTization framework model’. This framework is supported by capability, connectivity and context provided in three separate layers namely core, management and distribution that maintain centralization, decentralization and parallelization features. Five entities are involved in the payment system namely user, merchants, network operator, bank and cell phone device manufacturer and incorporation of them is displayed in the architecture and operational steps. In this paper the mobile payment system impacting factors have been analyzed and prioritized through a survey. The proposed system supports ‘win-win’ proposition where the benefits of subscriber and bank are equally maintained and successful coordination among payer, payee and payment system are ensured as well.

**Keywords**— Contextual Mobile Payment System, ICT, ICTization framework, Impacting factors

## I. Introduction

Money transaction is one of the most important applications that we perform in our day to day life but more security, reliability and user satisfaction should be ensured in case of virtual transaction comparable to physical one. Cash, card, check etc. are the media of old fashioned physical transactions and started losing their popularity. Transaction process has been switched into mobile system where the combination of mobile operator and payment system technology has made the virtual transaction possible to fulfil the user’s demand and satisfaction.

Mobile payment system can be defined as a virtual transaction supported by mobile devices and wireless network [1]. This system has a large potential in e-transaction and can help E-commerce to grow up [2] [3]. This system embeds all possible transactions such as buy, sell, delivery services & products and so on [4] [5] for both provider and consumer; we

are involving ourselves with this technology through receiving the advantages as one of the most important e-services of ICT worldwide [6].

ICT, ‘Information and Communication Technology’, is used to specify a generic term for all kinds of technologies such as internet, intranets, extranets, enterprise resource planning (ERP) and their utilizations. An organization uses ICT to improve the services and operations to cover up the spectrum from basic infrastructure implementation to the technologies. Over the past several years, this powerful mechanism extends the effectiveness of most organizations and business sectors [7] [8] [9]. It basically changes the way where we live, what we learn, and how it’s working. It also increases the standard of living, improves the application regarding distribution and exchange of information. It is now widely accepted that ICT plays an important role for every sectors such as industry, governments, rural and urban development [10] [11] [12].

Few years ago information technology was not so well advanced to provide desired services to the users. But the scenario is getting altered day by day from device portability and ubiquitous services viewpoint. High speed internet and smart featured cell phones are playing the key roles in recent advancements. Advanced interaction functionalities, multi-touch, location search are the most popular offered services where users have freedom to choose and buy any application based on our previously proposed ‘ICTization framework model’ [13].

As a continuation of our previous paper [13], we have pointed out several research questions specified below and can be clarified through our proposed perceptions described in the rest sections of this paper-

- How can we establish an operational and standardized guideline for mobile payment system over the preset ICT framework?
- What are the factors related to the design and adaptation of this system from consumers, merchant and technology viewpoint?
- How can the consumer and company play equal role to turn the system functional and receive benefits equally?
- How the roles of different players or participants can be defined and divided in the proposed system?
- What are the limitations behind mobile payment system development and how can these be reduced through our proposed guideline?

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Figure 1. Color coding of mobile payment system impacting factors

This paper is systematized in the following approach: Section II depicts the literature review; Section III finds out the impacting factors in Bangladesh through a survey; Section IV defines the motivation and hypothesis; Section V presents the ICTization framework model; Section VI explains the implementation of our proposed payment model; Section VII describes the prospect in Bangladesh and conclusions are provided in section VIII.

## II. Literature Review

Some of the private banks in Bangladesh have already deployed mobile banking system based on the initiatives taken by Bangladesh Bank to ensure a secured and efficient payment system. Mobile banking is known for “no branch banking”, which means banking transaction is supported by unbanked communities in both urban and rural areas [14]. The mobile banking was first introduced in Bangladesh by Dutch Bangla Bank Limited (DBBL) where customer can only see their balance information. Brac Bank introduced another transaction system “bKash” which uses SMS system for transaction. Banglalink, Dhaka Bank and Western Union jointly launched a mobile banking system where Banglalink mobile users can access their money. Marcantile Bank and Trust Bank are going to launch a new mobile banking with the help of government union information centers, where they can access the identification of the users [15]. So we can say, currently a small number of mobile banking services are provided by several Banks and mobile companies to confirm the solutions like money transfer between same and different banks, payments in shops and restaurants, ticket purchasing, parking fees etc.

Some useful mobile payment systems are found in [16] [17] [18] and [19]. [16] highlighted several m-commerce applications along with their design and implementations. They brought up the idea of small scale investment maintaining subscriber’s confidentiality and authentication though relied on preset GSM security where [17] considered to enrich the wireless mobile payment into a customized business tool. On the other hand [18] and [19] prioritized the secured transaction among the players through proposed cryptographic techniques such as key generation, key

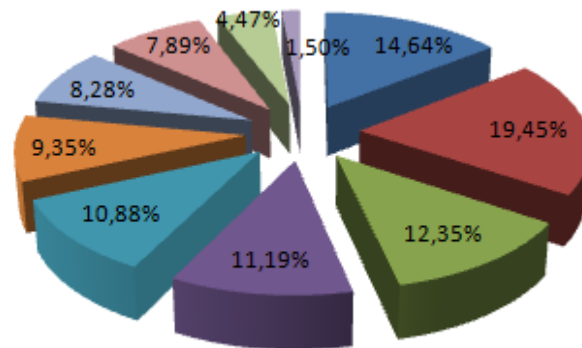


Figure 2. Results received from Group-A

management, message transfer etc. A completely different type of approach is followed in [20] and [3] where layered module frameworks have been suggested with flow of transactions for different applications. NFC supported payment systems are also found in [21] and [22] where they considered several issues like reliability, security, market acceptances, scalability, flexibility etc. in their quantitative research studies. However in all the cases preset ICT systems are assumed to be functional, useful and supportive. These concepts are module based layered framework describing the payment system in a simplified way and not enough concrete to be applicable in practice but in theory. Besides same methods cannot be exactly applied since lots of modifications are required from both ICT infrastructure and payment system viewpoint in developing countries especially in Bangladesh.

## III. Impacting Factors in Bangladesh

A questionnaire based on survey was conducted at different organizations related to mobile banking, and universities of Bangladesh. The respondents were divided into three groups; employees who are directly involved with mobile banking belong to group-A, university students who have knowledge in mobile payment system in group-B and users who receives benefits from the system places in group-C. All three groups of participants are aware of mobile banking and its benefits locally and globally.

We have gathered data regarding mobile payment system impacting factors from our three respondents and obtained ten issues and challenges which are shown in fig. 1. To be noted, the next three figures (fig. 2, 3 and 4) follow the same color coding of different payment system impacting factors.

We can see from fig. 2, bandwidth/ internet factor, knowledge in mobile banking, time efficiency and trust on companies receives 14.64 %, 19.45 %, 12.35 % and 11.19 % responds from group-A; Group-B priorities by 18.34 %, 15.78 %, 11.25 % and 13.26 % as shown in fig. 3 whereas 19.58 %, 16.59 %, 11.64 % and 17.86 % from group-C respectively (fig. 4).

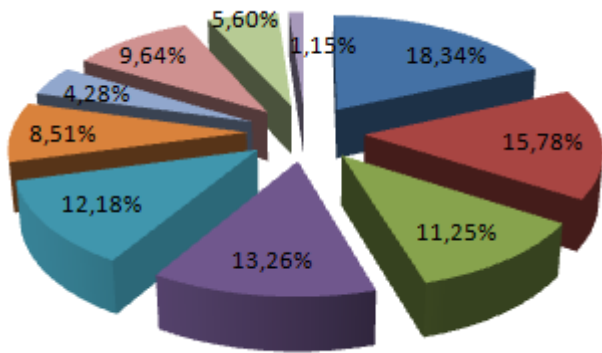


Figure 3. Results received from Group-B

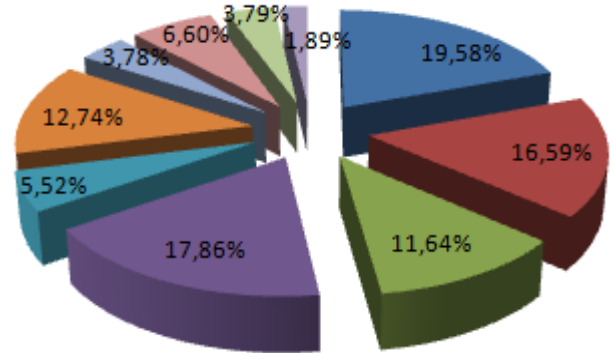


Figure 4. Results received from Group-C

#### IV. Motivation and Hypothesis

Several banks and mobile phone operators as stated previously are now jointly operational in mobile paying system but their implementing criteria, assumption, players, guideline and even future work plans are unknown. These companies are the only one to decide, monitor and control the whole system where subscriber's suggestions and participations are almost neglected and ignored. Billing amount, payment method, user satisfaction etc. are performed under direct observation of these companies. These assumptions and variables were attempted to justify by so-called surveys which always reside inside the question mark. The payment system businesses existed here have turned into monopoly and no longer trustworthy.

A complete framework is required to be functional where ICT strategies & impacting factors can be articulated nationally in order to synchronize with global payment system; ICT literacy program can run nationwide to integrate grass root people with its curriculum and benefits; Legal and supervisory rules can afford security to intellectual and patent law; A number of people can be trained and training centers can run countrywide; Participation and involvement of local people can be ensured so that their acquired knowledge and experiences can be fully utilized.

The quality of services, incorporation, and explanations are all aligned with the our research hypotheses specified below-

*Hypothesis 1: The influence of risk factor has negative impact on the system deployment.*

*Hypothesis 2: The influence of payment system impacting factors has impact on the system execution.*

*Hypothesis 3: The influence of people's participation has positive impact on receiving benefits out of ICT framework*

*Hypothesis 4: Facilitating usefulness and ease to use has positive impact on system functionalities and utilization*

*Hypothesis 5: Compatibility and relative advantages impact positively towards adopting the system.*

#### V. ICTization Framework Model

The deployment of an ICT framework is a complicated system and requires maintaining a certain quality of services. It's also true that just to deploy a novel framework over the present ICT infrastructure is comparatively convenient than to maintain and/or ensure the whole system perform accurately. Due to lack of a combined-synchronized work plan, still Bangladesh is staying behind in comparison to other ICT developed countries. That's why we have proposed a framework (fig. 6) that is capable to manage and maintain the ICT impacting factors and also can get quickly adapted with the ICT infrastructure where the preset architecture doesn't require to be altered. This framework is based on 3'Cs; capability, connectivity and context provided in three separate layers namely core, management and distribution. Our idea is to split the total framework into three separate layers as shown in fig. 5 based on the tasks assigned. These three layers establish a standard design for interfacing between assigned and received services explained below.

##### A. Distribution Layer

This is the top most layers that supports context which is a term applied to differentiate and designate the site and state of any entity originated in our environments. The information is momentous for the interaction between users and services where identity, locality, position etc. are taken into account. This layer bears a large prospect in distribution of novel services, resource sharing and service quality development in internet of things networks. It also includes placement virtualization for effective communication, network research and operations and a complete IT solution can be provided for organizations. A dynamic service can be automatically adapted to generate context through changing the service behavior and entity state. To be noted our proposed contextual mobile payment system is one of the e-services and functional in this layer; Data is sent in form of context where user location and identity are evaluated.

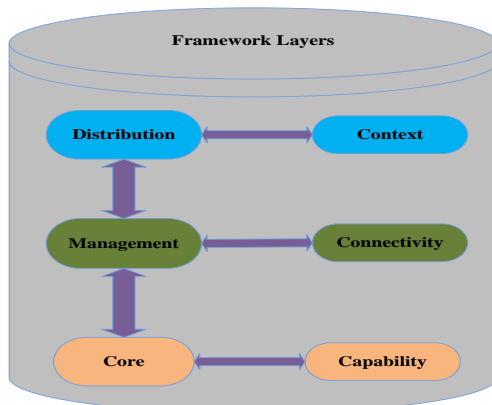


Figure 5. Framework layers

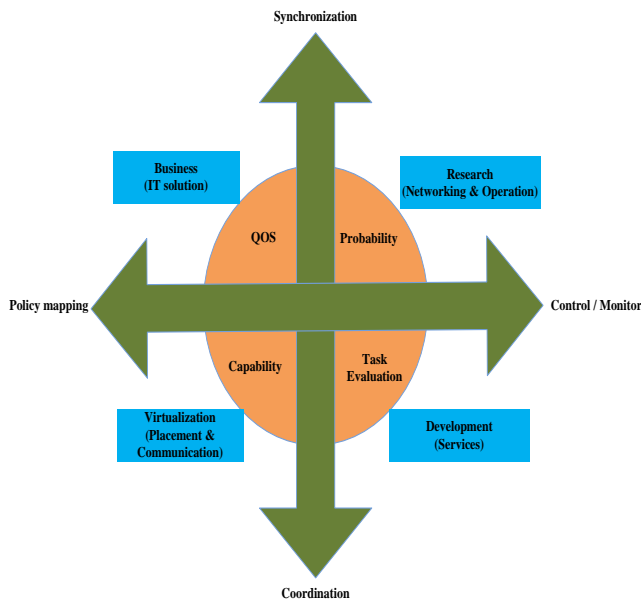


Figure 6. ICTization framework model

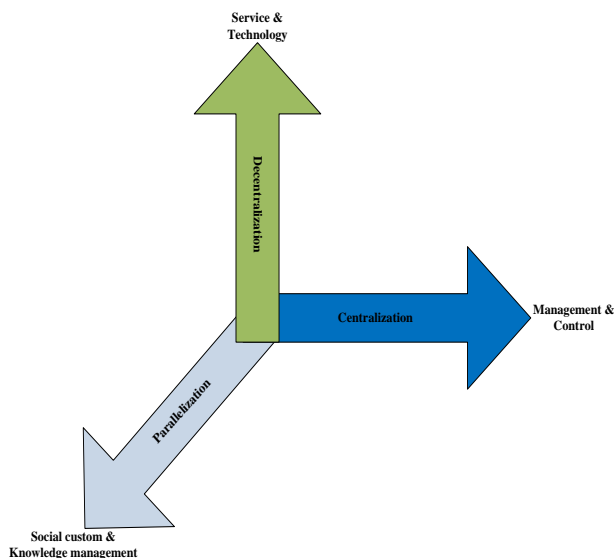


Figure 7. Framework features

## B. Management Layer

Connectivity holds the idea of reach ability or availability of desired services in management layer. It also includes harmonization among several services in order to save time, energy, cost etc. both from infrastructure and user viewpoint. Several forms of business models can find assistances from the connectivity or synchronization; cost and flexibility of small business point of view whereas over-all IT problems can be resolved of big companies. It will add benefits for corporations, their employees, customers, distributors etc.; the overall corporate solution can be provided.

This layer comprises storage control & system observation, policy mapping, coordination and synchronization of services. It combines the essential services with logistic solutions and new generation user service becomes convenient as a result. These upcoming services are compelled to be unified and combined to experience the demand of socio- economic aspects such as environmental analysis, security measurement, climate management, agricultural modernization etc.

## C. Core Layer

This is the bottom layer that holds the responsibilities of deciding and evaluating. This layer is capable to measures the possibilities of the assigned task along with the probabilities of errors. This layer bears the idea to sort out of unacquainted and/or imperative technologies and information which can turn the structure scalable and effectual. It is not only responsible for collecting data but also to afford security along with it. It also sanctions retrieving data effectively; incorporating data to develop service astuteness, analysis based on the services required and most importantly upsurges the storage proficiency.

Till today they found framework can be either centralized or decentralized. But our proposed framework (fig. 7) supports all the features centralized, decentralized and parallelized.

- Centralized: Management and controlling view point
- Decentralized: Technology and services view point
- Parallelized: Tradition, culture, social custom and knowledge management view point.

It is difficult to choose any since both of them carries advantages and disadvantages. Centralization is an effort to advance efficacy through receiving benefit of prospective economies of balance: refining the average; it may also increase reliability through lessening the opportunities of error. Decentralization is a challenge to develop swiftness and flexibility through rearranging to upsurge execution of services: adjusting the best circumstances. Neither is continuously better and/or conceivable in the precise sense. Extraordinary execution is progressively desired to operate the continuing escalation in the volumes of user requests being processed. Besides, the mounting significance of public infrastructure needs to be highly trustworthy. It is not possible to achieve maximum performances and reliability just with centralized and/or decentralized method, but with parallel services differentiating ever more swiftly.



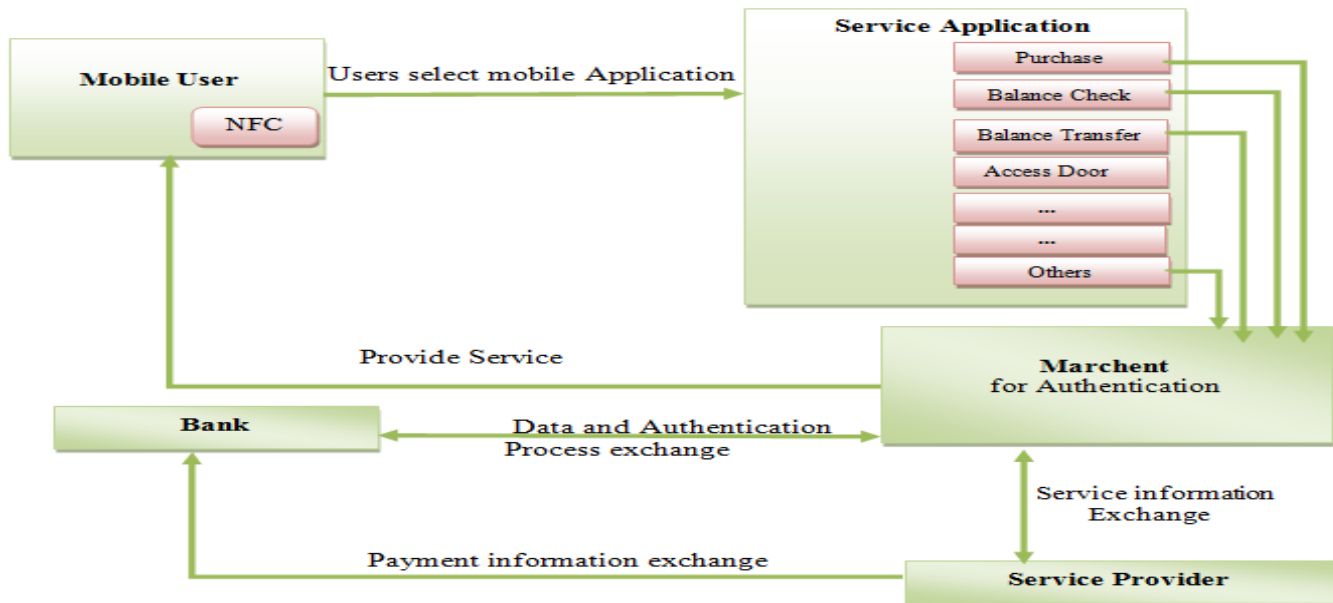


Figure 8. Architecture of contextual mobile payment system

## VI. Contextual Mobile Payment System Implementation

Five entities or players are involved in our proposed system drawn in fig. 8 namely user, merchants, network operator, bank and cell phone device manufacturer which are sited in management layer of ICTization framework model. Incorporation of all mobile payment system players is the key to developing global open solution players instead of a closed system within a limited scope. The brief functionalities of these players as follows:-

- Mobile user or customers can buy the products from the merchants and transact with others using their mobile phone.
- The Merchants acts as a middle man in providing the desired services asked by the users.
- The mobile network operators provide the network connection to mobile devices and control the subscriber's identity.
- Bank acts as a financial sector institute which is involved in mobile payment process and controls the flow of payment transaction.
- Mobile device manufacturers are involved in developing a common platform for payment applications based on the demand of subscribers.

The proposed system allows users to purchase products, balance query; transfer money to bank accounts using mobile SMS. It will also help users to check the transaction history like what the amount of money is left for them, how much they have spent during the last week or month, acknowledgement of transaction, notification of balance running out etc.

For example, if a user wants to purchase a transportation card then user will use his/her mobile phone to pay from his own account. Based on the steps followed in fig. 9, user intends to get any service or goods using mobile device with proposed application out of various types of services embedded into the application. An apps/icon added into the mobile screen to provide the facilities to the user. Users get into the application (payment) and proceed for further activities. The process of sending/receiving services occurred between consumer and provider where merchant plays the role of the third party who gets connected with both parties and confirms authentication.

When a user wants to pay against product or services, merchant will notify the bank that the particular user likes to execute the transaction. Then the bank will complete the transaction with user and provider and notify the merchant to provide the particular product or service to the end user. Finally merchant will provide the service or product to the user and the user can use the product or service without any interruptions.

## VII. Prospect in Bangladesh

The proposed mobile payment system supports the 'win-win' proposition where the benefits of subscribers and banks are equally maintained and ensured as well. Some of the important solutions from Bangladesh perspective are provided below but not limited to:

- The proposed mobile payment system is capable to achieve the satisfaction level through providing user friendly environment and required support and services related to electronic payment system.
- The system is based on accessibility; user has freedom to access and to use the services.

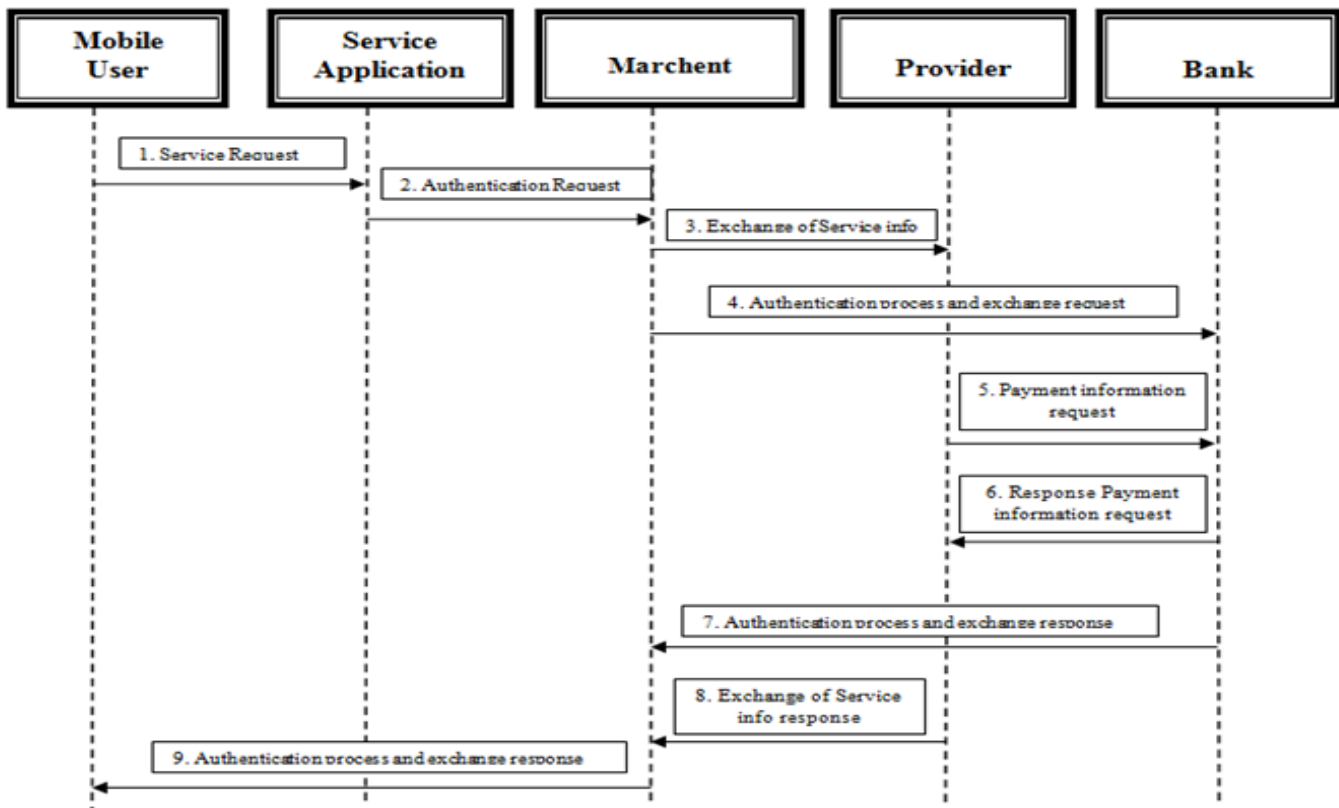


Figure 9. Operational steps of contextual mobile payment system

- This system is not surrounded by any boundary. It supports a cross border electronic payment system to make the transaction possible in any currency anywhere in the world.
- The system supports reusability which is an important part to integrate the mobile payment system with existing system. User can freely choose the processing partner such as bank, mobile network operators etc. based on their requirements.
- End users can access m-commerce applications using their mobile devices in real time from anywhere without using any external device. It also allows users to check their accounts and service validity.
- NFC based payment system does not only allow to save time, reduce error and cost reduction but also improve the efficiency and better product visibility.
- Third party checks the user identification before providing any service and it makes the system reliable. So, even if the device is lost, no one is able to receive any service due to uniquely identification procedure.
- The subscriber can carry the device and receive the service from anywhere within a network coverage area which proves the idea of mobility.
- One of the important features in proposed payment system is security and successful coordination among payer, payee and payment system is maintained.
- The customer, who has already an account in a bank, doesn't need any additional account for mobile payment system.

## VIII. Discussion

This paper is built on ICTization framework model that can prolong the work on cultivating enactment of ICT infrastructure. From the business standpoint, this research work will help in delivering a system to classify precise array of ICT infrastructural elements to attain an exact strategic placement. On the other hand from a social perception, this work will provide a combined framework with an aim to receive better citizen-oriented services.

Bandwidth, Knowledge in mobile banking, time efficiency and trust on companies were found to be the most affecting mobile payment system impacting factors through our survey and reflected in our framework thereby.

Several issues have been pointed out through our survey and can be outlined as: mobile payment system are required to be straightforwardly accessible by users from expediency, availability, recognizing and suitability point of view; Specialist should not be employed to complete the transaction; enough security should be provided in terms of loss, corruption and damage of data and system; fault tolerant system are required to be employed to update and/ or recover of lost material and information; the role of players in mobile payment system should be well defined over the preset ICT infrastructure. Our proposed Contextual Mobile Payment

System ensures fulfilling the requirements, objectives and issues being supported by the ICTization framework model.

In short we have proposed a new contextual mobile payment system as one of the e-services based on our previously suggested ICTization framework model. Thereby a survey was conducted to find out the factors related to the pros and cons of current payment system. The results and recommendations are reflected in the designed model where the rights and benefits of consumers, merchant and banks are equally and successfully ensured and maintained. Besides the implementation of the model can play significant role in m-commerce which turns out to be a huge achievement in terms of modernization of payment system in Bangladesh.

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