Evaluation of the Factors Influencing the Application of Mobile Payment

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A R T I C L E I N F O

A B S T R A C T

Background: The necessity of approaching electronic payment systems has become increasingly important due to the significant advantages of electronic banking. Among various electronic payment systems, mobile payment systems are of great benefits for implementation in the banking network. This is due to their several plusses such as high diffusion ratio, quick growth of the mobile phone users at different age categories, accessibility to any geographic region at any time, instant access to the features of Customer Relationship Management, decline in bank expenses, decrease in inter-city travel costs, reduction in air pollution and traffic. Hence, it appears essential to provide a suitable architectural design for mobile payment systems in the country. **Objective**: In this paper, the importance of mobile payments has been evaluated and commercial mobile applications in different fields including mobile banking, mobile shopping, mobile sales, training through cell phones, etc. are reviewed. Afterwards, the latest status of mobile payments in the Iran banking network is appraised. Moreover, the related issues to the existing methods of mobile payments are explained to provide an all-inclusive picture. These issues include payment-based methods, timing of payments, and the payments intermediate. **Results**: After that, six main players are introduced who play major roles in mobile payment systems. The six main players involved in a mobile payment system are: financial service providers (FSP), payment service provider (PSP), merchants, end users, network service providers (NSP), and equipment manufacturers. Success factors and different requirements are related to the involvement of different players. Having studied different resources, five success factors are determined including: ease of use, security, comprehensiveness, expenses, and technical acceptability. **Conclusion**: we can conclude that 1) mobile payment systems at the national level should be provided free of charge for the end user, 2) it is acceptable to take indirect costs such as SMS fees from customers, 3) A mobile payment system should be designed that could transfer information among all the interfaces in a secure way, 4) The mobile payment system should be completely independent of the type of cell phone, 5) Security has been always an important issue in the development of mobile payment systems.

INTRODUCTION

In today's world, an increasing growth in application of cell phones has significantly influenced on various methods of commercial activities and it has created a new branch in trading called mobile commerce (m-Commerce). Having benefited from numerous special advantages of mobile commerce, including no spatial constraint, minimum required facilities, and relatively high penetration rate of cell phones, various mobile payment applications have been attracted the attention of many users such as mobile commerce, mobile banking, mobile shopping, mobile auctions, mobile inventory management, etc. Some of the most important applications of mobile commerce are listed in Table 1 (Ahmadi, Sh and F. Ebrahimi, 2008; Ahmadi, Sh and F. Ebrahimi, 2008; The office of electric business developments, 2005).

According to the diverse applications of mobile commerce, architectural design is necessary to be developed for mobile payment systems particularly at the national level. This article discusses this important issue. Mobile commerce like e-commerce can be done through B2B, P2P, and B2C. Our focus in this article is on the B2C model. Mobile commerce includes mobile payment processes that can be run through mobile phone devices. These processes should be implemented at the highest level of security in order to provide high

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reliability for customers in the system. The future of mobile payments is very promising due to the high diffusion rate of mobile devices, especially mobile phones, PDAs, etc.

Table 1: Some of the most important applications of mobile commerce.

Category	Details	Description	Example
Mobile banking	Financial operations through wireless networks.	Banking operations, brokerage, and payments by cell phone devices.	Buying shares from Stock Exchange.
Mobile shopping	Purchasing a product, a service, or an information via a cell phone device.	A payment for purchasing of a product can be also done through mobile payment systems.	Purchasing a drink from a smart selling machine.
Searching for a selling place	Searching in the electronic shopping networks in order to find a selling location of specific goods or services with certain characteristics.	It is especially useful for purchasing goods, which are impossible to be bought online, or for the goods that customers prefer to compare the price or check at the store.	Searching for the selling location of a car of a specific model, color, and accessories.
Mobile entertainment	Purchasing and receiving games and entertainments that can be used by a variety of mobile devices.	Purchasing may be made either directly or through subscription method.	Games, ringtones, and cell phone screen background pictures.
Mobile auctions	Purchasing and selling goods in an auction through cell phone.	In this way, there is a possibility of participating in an online auction using a mobile network.	Participation in a competition for a painting during a flight in an aircraft.
Mobile inventory management	Reducing warehousing costs through a wireless distribution and warehouse management system.	Transportable warehouses on cargo trucks can be guided using such systems.	A distribution center that shows the nearest stores to the transportable truck.
Active service management	Trying to improve the quality of services by using mobile devices and wireless networks.	Many of administrative tasks can be carried out through mobile networks instead of presenting at the related bureau.	The Insurance Expert can observe the accident scene through mobile camera and confirm the compensation costs instead of being at the location.
Mobile office	Office management through a cell phone device.	The office can be even only a virtual environment in mobile networks.	A manager can supervise his office and staff from outside the workplace.
Training trough cell phone	Providing educational supports for mobile users.	There is a possibility to develop the distance education with a mobile satellite network especially in the areas where constant communication is impossible.	A student attends a class using audio and video features of mobile devices.
Wireless information bases	Creating databases to store information, or to offer data as a service.	In this way, users can access to databases using a mobile network.	One can receive meteorological information and weather forecasts through cell phone in the next few days.

Today mobile phones have become a major component of the e-commerce. Financial transactions can be now executed rapidly for any person in any place at any time. Commercial markets are extensively influenced by utilization of these new technologies in mobile phones, which have converted mobile phone devices from simple communication tools into viable payment systems.

2. The current status of mobile payment in Iran:

Mobile banking services need to take the advantages of the latest telecommunications infrastructure and technologies in the world. However, they have not been sufficiently developed in our country considering the existing telecommunications infrastructure. Thus, the current status of mobile banking in the country is discussed in this section. For this purpose, banks, financial institutions, and credit websites have been studied in order to assess the latest situation of mobile banking services in the banking network. The results of these studies are shown in Table 2.

The results of the investigations about mobile banking in the banks and financial institutions show that services has had a remarkable growth in past 2 years considering the existing barriers of mobile banking in Iran and currently, banks and financial institutions are struggling to initiate or expand SMS and mobile banking services for their customers.

3. A review on the existing methods of mobile payment:

Existing systems can be compared according to a variety of classification methods that are mentioned in (Guo, W., 2008).

3-1. Payment-based:

Mobile payment methods that are currently in use or being tested in the pilot stages, can be categorized according to the payment types as follow (Antovski, L.J. and M. Gusev, 2001):

Based on bank account:

In this method, a specific account is assigned to each customer, which is supported by the internet payment provider. Debit and credit accounts can be easily exchanged during financial transactions. Thus, bills of a customer are recorded periodically and he can pay his statements in order to balance his account.

Traditional payment methods based on bank accounts were generally inappropriate for those financial transactions with very low values (such as micro-payments) due to their high administrative charges of such payments. For the transactions with low values, the third party payment processor is required. The third party payment processors in order to be able to cover their costs should accumulate low financial transactions and pay them in a single large transaction.

Table 2: The latest status of present mobile banking services in the country.

Mobile banking status		SMS banking services	Mobile banking services	Downloadable mobile payment softwares from the website	Software support for different cell phone devices	Source
Banks	Export Development Bank of Iran	No	Yes	Yes	Yes	[4]
	Refah Kargaran	No	No	No	Unknown	[5]
	Mellat	Yes	Yes	Yes	Unknown	[6]
	Melli	Yes	Yes	Yes	Yes	[7]
	Tejarat	Unknown	Yes	Yes	Yes	[8]
	Keshavarzi	Yes	Yes	Yes	Yes	[9]
	Maskan	Yes	Yes	Yes	Yes	[10]
	Sepah	Yes	Yes	Yes	Yes	[11], [12]
	Saderat	Unknown	Yes	Yes	Yes	[13]
	Bank of Industry and Mine	Unknown	Yes	Yes	Yes	[14]
	Post Bank	No	Yes	No	No	[15]
	Qarzol- Hasaneh Mehr Iran Bank	No	No	No	No	[16]
Yes	Eghtesad Novin	Yes	Yes	Yes	Yes	[17]
	Saman	Yes	Yes	Yes	Unknown	[18]
	Parsian	Yes	Yes	Yes	Yes	[19]
	Pasargad	Yes	Yes	Unknown	Unknown	[20], [21]
	Karafarin	No	No	No	No	[22]
	Sarmayeh	Yes	No	No	No	[23]
	Tat	No	No	No	No	[24]
	Day	No	No	No	No	[25]
	Sina	Yes	No	No	No	[26]
Financial and credit institutes	Mehr	Yes	No	No	No	[27]
	Ghavamin	No	No	No	No	[28]
	Ansar	No	No	No	No	[29]
	Shahr	No	No	No	No	[30]
	Tosse-eh	No	No	No	No	[31]

Agent-based:

An alternative method for mobile payment methods based on bank account, is to use electronic agents. Here it means an intermediary to exchange money, which indicates the financial amounts that can be supported by a bank. This agent will be exchanged during a transaction. In agent-based payment methods, consumers need to convert the real money into its electronic equivalent like financial agents listed above. A special advantage of agent-based payment methods is that these methods are very suitable for micro-payments. Because their operating costs are lower compared to methods based on bank account.

3-2. Timing of payment:

The timing of mobile payments is possible in different ways, which are reviewed in (Bulbrook, D., 2001).

Real-time:

The payment methods in which the money, either the real or electronic agent, is exchanged instantly are called real-time. Electronic cash can be among these methods of payment.

Prepaid:

In this method, the consumer has already paid the amount to get the credit, which can be also rechargeable. An example of this payment method is payment by Visa card or other shopping cards.

Credit-based:

In this method, the internet payment provider makes the transaction by evaluation of a consumer credit and charges the customer later on, according to a certain pre-planned timing in accordance with banking regulations. Electronic cheques and credit cards are examples of credit-based payment methods.

3-3. Payment intermediaries:

Mobile payment methods are classified as follow according to payment intermediaries (Gusev, M., 2000): Mobile payment by bank account or credit card

This kind of payment can be divided into two categories. First, no direct access to the card is required during the payment. This category of payment systems is based on payment methods such as direct payment or credit card payment, without physical access to their relevant cards. These types of mobile payment systems are like Paybox and other systems. The advantage is that these systems are based on pre-verified and pre-tested payment systems.

The second category works as a payment card is inserted into the cell phone device. Data is read directly by the cell phone. For this purpose, it is needed to use cell phones with two SIM cards.
Mobile payment by using cell phone billing

The customer is billed on the monthly basis on his/her cell phone bill. The benefit of mobile payment by cell phone bills is that the process is simple and has significant potential for cost reduction. The prerequisite for extension of this method is that cell phone operators should become more reliable than what they currently are.

4. Appropriate framework for mobile payment systems at national level:

In this section, an appropriate framework for mobile payments for the future of the country is proposed.

4-1.The four-layer framework for mobile payment systems at national level:

This four-layer framework for mobile payment systems are offered at the national level, which is shown in Figure 1 and described accordingly.

4-1-1. The base layer of mobile payments:

This layer is the base of mobile commerce and basically includes the entire types of network technologies and the infrastructures used in mobile commerce, such as GSM, GPRS, 3G, etc.
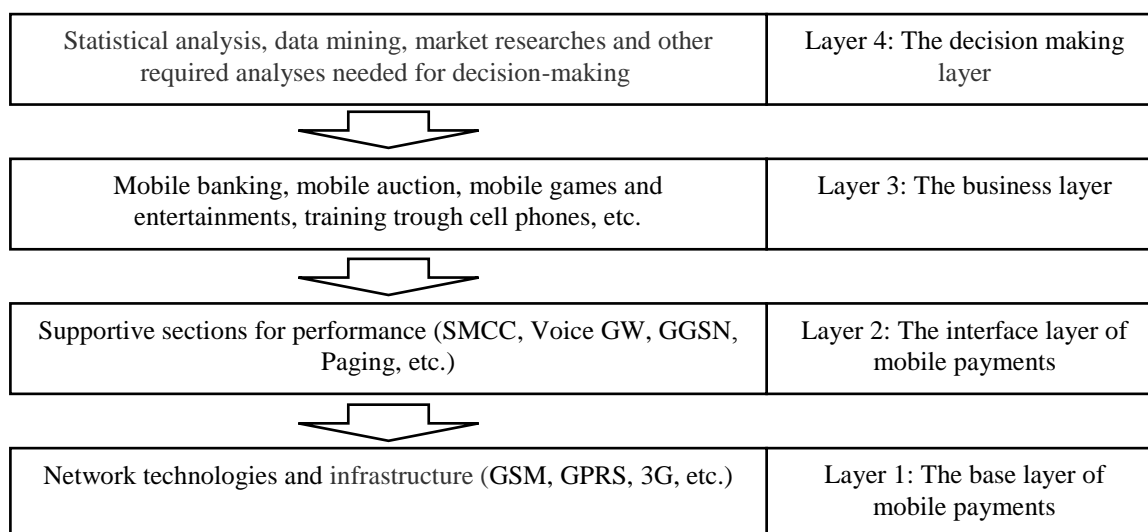
4-1-2. The interface layer of mobile payments:

This layer specifies the data elements and transfers them among the consumer, content provider, and the bank.

4-1-3. The business layer:

This layer includes all kinds of businesses based on mobile payment systems, such as mobile banking, mobile auctions, and etc.

4-1-4. The decision making layer:

This layer is the highest layer in the framework of mobile payment. This layer uses technologies such as statistical analysis and data mining in order to analyze the mobile payment market and assist in decision making.

Statistical analysis, data mining, market researches and other required analyses needed for decision-making	Layer 4: The decision making layer
Mobile banking, mobile auction, mobile games and entertainments, training trough cell phones, etc.	Layer 3: The business layer
Supportive sections for performance (SMCC, Voice GW, GGSN, Paging, etc.)	Layer 2: The interface layer of mobile payments
Network technologies and infrastructure (GSM, GPRS, 3G, etc.)	Layer 1: The base layer of mobile payments

Fig. 1: The four-layer framework for mobile payments.

The layer frameworks for mobile payments have been also considered in other countries. China can be mentioned as an example case (Guo, W., 2008).

4-2. Mobile payment process:
For mobile payments, a 10-step process can be considered as described below.

Step 1 – Registration:
Consumers are required to open an account with the mobile payment service provider in order to use mobile payment.

Step 2 - Sending the original request for purchase and payment:
Consumer can announce his intention to purchase and pay in different ways, such as sending SMS, sending two-dimensional codes, etc.

Step 3 - Sending the payment request:
The mobile interface base categorizes consumers' requests and transfers them to the mobile payment system.

Step 4 - Sending the request and receiving the approval from the content provider:
After receiving the request, the system asks the content provider about the details and content provider will respond in return.

Step 5 - Financial request:
If content provider agrees with the consumer's request, the system will process the initial consumer request and send financial requests to the bank.

Step 6 - Financial validation:
Banks review financial requests and send the approval or disapproval response to the system.

Step 7 - Referring the payment response to the content provider:
After receiving the bank response, the mobile payment system sends the successful delivery of financial payment and then, requests the delivery confirmation to the content provider.

Step 8 – Delivery:
The content provider sends requested product to the consumer.

Step 9 - Referring the results:
After receiving the response from the bank, the mobile payment system transfers the response to the mobile interface base.

Step 10 - Referring the payment result to the consumer:
The mobile interface base transfers the response to the consumer, i.e. to his cell phone number.
The process described above represents a successful payment. If at any stage, the above process fails, the mobile payment system will send a failure message directly to the consumer and stop the payment process (Guo, W., 2008).

5. Future suitable protocols and technologies for mobile payment:
No new standard or special network is required for mobile payment transactions. Thus, mobile payments can be carried out through existing networks, which can be cellular networks (GSM, 2.5G, and 3G), wireless LAN (protocol IEEE 802.11), Bluetooth, and infrared. The most important technologies for mobile payments include SAT, WAP, WTLS, WIM, Voice, and special factory applications, which are described in the following.
SAT is a technology that provides the configuration and programming of SIM cards. SIM card has a logic that is capable of exchanging the information with the SMSC in order to execute the transactions of mobile payment. Cell phone devices are equipped with WAP browsers and able to exchange information with a web server. Information can be transferred through wireless protocols and GSM, 2.5G and 3G networks. WTLS is a layer in WAP stack and is the small-sized SSL 3.0 wireless version. WTLS can provide secure communications for the transmission of confidential information. WIM is a module for data storage in cell phone devices and is usually used in the connection with WAP transactions. WIM with WTLS transaction is used for permanent protection of private encryption keys. WIM stores these keys and operates various functions using these keys.

A voice response system in the payment service provider section can contact the consumer and guide him/her during the payment process. The voice recognition can be also used as a means of authentication for the payment system. Manufacturers of mobile phone devices can also interact with software companies active in the field of mobile payments and supply necessary softwares for mobile payments on their handsets (Guo, W., 2008).

6. Success factors in mobile payments:

The six main players involved in a mobile payment system are: financial service providers (FSP), payment service provider (PSP), merchants, end users, network service providers (NSP), and equipment manufacturers. Success factors and different requirements are related to the involvement of different players. Having studied different resources, 5 success factors are determined including: ease of use, security, comprehensiveness, expenses, and technical acceptability. Table 3 overviews the main characteristics of success factors (Guo, W., 2008; Eero, V., 2002).

Table 3: The most significant success factors and their characteristics.

Factors	Characteristics
Ease of use	Few clicks required, flexibility, performance, installation / download
Security	Privacy, reliability, integrity, validation, verification
Comprehensiveness	Transmissibility, divisible, standardization
Expenses	Installation costs, transaction costs, subscription fees
Technical acceptability	Interoperability, scalability, remote access, efficiency

7. Conclusion:

According to the above-mentioned findings, we can conclude that mobile payment systems at the national level should be provided free of charge for the end user. However, it is acceptable to take indirect costs such as SMS fees from customers. Indirect costs may be acceptable, such as low SMS fee, if the minimum value is taken. A small fee for specific equipment for merchants might be acceptable. However, it should be considered that the transaction costs higher than the standard level may not be accepted. For example, any cost for Internet transactions may be unacceptable. Merchants, PSPs, and FSPs must secure servers, databases, and their communication networks. A mobile payment system should be designed that could transfer information among all the interfaces in a secure way. This system should be compatible with different equipment of factories in the country in order to make use of mobile payment systems at the national level. The mobile payment system should be completely independent of the type of cell phone. This could enable the system to be used widely and developed in the country. The system must be independent of the network to have the required comprehensiveness.

Security has been always an important issue in the development of mobile payment systems. The existing infrastructure for mobile payments in the world presents a comfortable environment for secure transactions. Thus, it is possible to provide an appropriate infrastructure for secure mobile payments at the national level by developing telecommunication networks in the country and eliminating the existing impediments and taking the necessary measures.

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