Mobile Payment

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Declaration

This is to certify that this term paper has been written by me. The articles and literatures read for the preparation of this paper has been acknowledged and are cited both on each page footnotes and also at the end of document.

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1. **Introduction**

Payment has evolved from the physical exchange of notes and coins, to writing checks, to transferring payment card details over the phone or the Internet. This evolution has involved a shift from the physical transference of tangible tokens of value to an exchange of information between parties.

The emergence of e-commerce has further digitized the payment process, whereby payment details are sent over open networks with no physical contact between the buyer and the seller. The recent development of high-speed mobile data networks has created a new channel for commerce, while more sophisticated mobile devices are enabling the virtual exchange of payment information known as proximity payments.

The shift from physical to virtual payments has brought enormous benefits to consumers and merchants. However, it has put extra pressure on payment service providers, including banks and card companies, and mobile operators, to provide robust security and interoperability.

Despite the differences, the success of mobile payments is contingent on the same factors that have fuelled the growth of physical world non-cash payments, namely: security, interoperability, privacy, global acceptance, and ease –of use. Mobile payment is a very promising service which is still in an early stage of development.

Although new horizons in future is expecting mobile payment, a number of factors are threatening to arrest the development of this new medium, including the proliferation of competing network standards, as well as incompatible operating systems and devices. Another major factor is the lack of secure and interoperable standards for mobile payments.

Beside above mentioned influencing technical factors other numerous issues, such as market uncertainties, viable business models need to be solved before the complete realization of mobile payment concept. Therefore it appears that the success of mobile payment can hardly be predicted by considering only one single dimension, but rather requires to unite the considerations which can be obtained from different angles. The main goal of this paper is to suggest the use of a multi-perspective research framework for analyzing the mobile payment industry so as to generate useful ideas for stimulating and directing further research efforts in the mobile payments field.

2. **Mobile Payment Definition**

Mobile payment is defined as “paying for goods or services with a mobile device such as a phone, personal digital assistant (PDA), or other such device”\(^1\)

Therefore the mobile payment can be defined as the process of two parties exchanging financial value using a mobile device in return for goods or services.

Mobile payment is regarded as the next big innovation that will enhance existing e-commerce and m-commerce efforts to unleash the potentials of mobile business.\(^2\)

There are several mobile payment systems and approaches currently powered by different concepts and technologies. In the rest of this section we will try to group them based on some of their attributes.

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\(^1\) Y. Liu*, X. Cao*, and L. Dang*Mobile Payment, ISN National Key Lab, Xidian University, P.R. China

3. Mobile Payment Procedures

The long term goal of mobile payment is to integrate all legacy payments (those possible with cash, bank transfers, credit cards, etc.) and provide an alternative that uses the different channels in a homogeneous way. Therefore it targets a wide range of payments including location, value, charging method and ... In this section different groupings based on different attributes in mobile payment is introduced:

3.1. Types of payments based on location can be categorized as:

- **Remote Transactions:**
  Here transactions are conducted independent of the user’s location. Examples include prepaid Top-UP services, delivery of digital services, mTickets, digital cash, peer-to-peer payments, etc.

- **Proximity/Local Transactions:**
  In this category fall transactions where the mobile device locally communicates. Proximity payments involve the use of short range messaging protocols such as Bluetooth, infrared, RFID, and contact less chip to pay for goods and services over short distances.

3.2. Types of payments based on value include:

- **Micro-Payments:**
  These are the lowest values. Micro-payments are expected to boost mobile commerce as well as pay-per-view/click charging schemas.

- **Macro-Payments:**
  Macro-payments refer to larger value payments such as online shopping or proximity-based payments.

3.3. Types of payments based on charging method include:

- **Post-paid:**
  This is the most common method used in e-/m-commerce transactions today. Examples are:
  - Phone-bill based: This is the charge method most commonly used by mobile network operators.
  - Account-based (bank/credit card): This method is used by banks, which have an account of the user, or the credit card industry.

- **Pre-paid:**
  This is the most common charging method for mobile network operators as well as third-party service providers in order to be able to evaluate only that the user is capable of paying. The prepaid user is a significant part of the current mobile network operator customer base.

- **Pay-now:**
  In this method the user pays in real-time or close to real-time (based on technical limits).
  - Real-time: This method includes solutions that charge the user of the service in real-time, with

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Jan Ondrus, Yves Pigneur, A Disruption Analysis in the Mobile Payment Market, 38th Hawaii International Conference on System Sciences - 2005
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the funds immediately available to the merchant (same as cash). Electronic wallets are an example.

- Near “real-time”: This method includes solutions that charge the user of the service in a reasonable amount of time. A typical example of this category is the debit card, as well as systems that do real-time fund reservation, but the clearing and fund transfer happens later and typically at the end of the day. The time frame between the reservation and the clearing can be handled by the bank according to its risk management policy.

3.4. Based on the validation of the tokens exchanged in a MP scenario we can have:

- **Online Mobile Payment:**
  This assumes that in a MP procedure the tokens exchanged (e.g. electronic money) can be verified by contacting an external entity (typically an authorization server) that both transacting parties trust. This is the trivial case for almost all MP procedures.

- **Offline Mobile Payment:**
  This implies that no third party is involved during the mobile payment procedure and that the tokens that are exchanged between the two transacting parties can be verified without external help, e.g. an authorization server. Typical examples are the e-coins transferred in mobile wallets.

4. Multi-perspective environment of Mobile Payment

Mobile payment has been dramatically developing in recent years, and although it is still considered to be fairly new, it brings great promise and hope to the mobile industry.

In order to analyze the various relevant aspects of the mobile payment environment and achieve a general picture of this technology, it is necessary to consider this topic from different perspectives. Perspectives such as market, and stakeholders point of view and technological aspect of this industry.

5. Technological Perspective

5.1. Mobile Payment as an Electronic Payment System

With the rapid growth of wireless technologies, Cellular Networks and Wireless Wide Area Networks mobile payment as one type of electronic payment systems has become of great importance for financial institutions and the financial industry is increasingly aiming towards providing mobile financial services to the end user. The ultimate goal is that mobile communications channels will be used in financial transactions not only to benefit communications over wired channels but also to be a start in newer services that only mobility can enable. For example, stock alerts can be sent to wireless personal digital assistants so that the active trader can conduct transactions while on the move independent of space and time constraints. Or for example, the user can use a cellular phone for buying snacks from a vending machine while passing by it. The rationale for such a vision is that mobile devices like cellular phones, wireless enabled personal digital assistants and so on will increasingly become the platform of choice for users for managing their finances (for example, accessing their bank accounts or investing in the stock market), making purchases in local environments (for example within a store) and remote environments (for example, over the Internet) and securing authenticated access to various services.

Mobility can be accorded to electronic payment systems in one of following ways:

1) using wireless communication technology as a substitute for standard wired communication channels

2) Using a new paradigm of Contact-less Payment.
The first method is used mostly for financial transactions like purchasing over internet. Broadband wireless access is typically used to support wireless access to data networks when this method is used from mobile laptops.

When network access is desired using slower carrier-based mobile communication technology like GSM or CDMA as in PDAs or cellular phones, a still evolving standard called WAP (Wireless Application Protocol) is used to support these applications. There are no major changes to the underlying payment protocols and hence this method will not be discussed further. The second method, on the other hand, is a relatively newer model of non-cash electronic payment that has been enabled by emerging technologies such as bluetooth, and Wireless Infrared Communication. The major characteristic of these technologies is the relative short communication range offered (typically in the range of a few centimeters for Radio Frequency devices to tens of meters for Bluetooth enables devices.)

Thus the second method find widest adoption at retail point of sale terminals. Sometimes this method of payment is complemented by carrier-based mobile technologies like CDMA and GSM.

Contact-less payment is based on establishing a wireless communication between a user’s payment device that stores one of the forms of electronic money and a point of sale payment terminal or infrastructure device. The technology can be broadly classified into five major categories depending on the wireless communication methodology that is used – radio waves, and infrared light.

These are:
I) ISO 14443 proximity card standard based methods
II) ISO 15693 vicinity card standard based protocols
III) Proprietary radio frequency technology based protocols
IV) Bluetooth based systems
V) Payment systems by cellular service providers
VI) Infrared communication based protocols

The first three uses radio waves at different frequency levels for communication. The forth and the fifth technologies use microwave while the last one uses line-of-sight infrared beams for communication.4

Electronic payment systems have more or less the same set of requirements as traditional paper based systems. In between mobile payment also as an electronic payment system is not an exception. The difference is that based on the unique nature of electronic payment transactions, these requirements impose different types of challenges on the payment system design and the infrastructure support. Security is of crucial importance in electronic payment systems, more so probably than in traditional paper based system. There are several reasons for this. First, a major portion of these transactions is carried out over open networks, which are rather easy to eavesdrop on even with a limited amount of resources. Thus, confidential financial information may no longer

4 Encyclopedia Of Information Systems, Hossein Bidgoli (Editor In Chief), 2003, Elsevier Science (USA),Volume III, Don-Wan Tcha, Mobile and Wireless Networks, 165-179
remain confidential if they are not protected adequately. Second, since the transacting parties can remain faceless, it is quite easy to forge identities of end users and systems in the Internet. Anybody can masquerade as somebody else and continue on a transaction with impunity. However the situation in mobile payment is somehow different, as mobile devices are transformed to personal trust devices, which generally considered to belong to and be managed by a single user, i.e. the owner. Gathering evidence of a crime is also more difficult. Third, electronic and mobile payments are often carried out over inherently unreliable medium. This implies that messages that are exchanged for execution of the transaction can be corrupted or altered during transit resulting in unforeseen results. Last, but not least, electronic and mobile payment transactions can span both geographical and judicial boundaries. While this is also possible for traditional payment transaction, the implications for electronic payments are different. It is more difficult to identify a felon in an electronic payment crime and bring her/him to justice.

By summarizing the requirements for electronic and electronic payment systems, challenges can be categorized as network management requirements, database requirements, and security requirements. These challenges are true for mobile payment as well, although in addition there are some technical issues which are specific about mobile payment which will be discussed in the following.

5.2. Network Requirements:

To increase productivity and competitiveness, financial institutions are increasingly relying on computer networks to connect offices, partners, suppliers and most importantly customer. As the volume of financial transaction increases, the payment infrastructure must increase with it appropriately. Servers must be powerful enough to support the rapidly expanding customer base. The new payment methods should decrease transaction time, automate transaction. Communication channels with higher bandwidth need to be established to support the high volume of traffic. To support the real time requirements of most financial transactions, networks supporting high transmission speeds are also needed. In addition, any disruption of telecommunications services will critically affect financial services processes. Therefore network resiliency is another important consideration for the financial sector.

The first step towards achieving resiliency is to have redundancy in the network. Redundancy ensures that a single point of failure does not disrupt services. Redundancy is achieved by having multiple routes for network traffic from the source to the destination, multiple telecommunications circuits and / or alternative communications technologies. Although redundancy ensures a significant degree of fault tolerance, by itself it cannot ensure availability in the face of deliberate attacks. To protect against attacks, diversity needs to be incorporated into the network infrastructure. Proper diversity management can ensure that redundant assets do not share common vulnerabilities.

Beside mentioned network requirements, regarding electronic and mobile payment, specially in mobile payment, wireless networks begins to implement personal mobility and service provider portability in addition to terminal mobility. Personal mobility is the ability of the user to access their personal services independent of their attachment point or terminal. Service provider portability

allows the user and/or the terminal to move beyond regional mobile network. The user will be able to receive his personalized end-to-end services regardless of the current network, within the limits of the visited network's service offerings. This freedom then requires the coordination of a wide range of service providers, compatibility of backbone networks, and network operator's agreements.\(^7\)

Regarding some other requirements, in financial services, interoperability has always been a highly contentious topic, and its progress has been uneven and in many cases rather slow. Standardization around the payment service should make interconnection of networks and systems technically easy and cost-effective. Mobile payment component development should be based on standards and open technologies that will allow any system to interact with another system on a global scale at all levels (e.g. any mobile with any POS, any payment software should run on a wide range of mobiles etc.). The number of acceptance points is critical; therefore, standardized solutions that can be composed of plug-and-play components are a must.\(^5\)

5.3. Database Requirements

Electronic Payment Systems (mobile payment is included as well) process massive amounts of data every day. To manage this data, techniques must be developed that can store and retrieve the data quickly and efficiently, and can ensure its long-term health. As the volume increases, the technological infrastructure must be able to scale up appropriately. Powerful database engines are used to support these functionalities. As in the case of network support, any disruption to database support will be catastrophic. Thus, resiliency and fault-tolerance must also be built into such engines.\(^9\)

Storage and retrieval performance of data depends not only how the data is logically organized but also on the underlying hardware that is used to store the data. The first step towards designing the database is to understand the logical structure of the data and design the database schema properly. Relational database design is a technique that combines and balances mathematical rigor with user friendliness for this purpose. Moreover, the results of relational database design are relations or tables, which can be efficiently stored and retrieved using current technology. Most commercial database engines support relational databases. Thus, using relational databases is a good choice for providing storage and retrieval support for electronic payment systems.

Designing the database as a set of relations does not address all issues. First, it is quite likely that many users will be accessing the database simultaneously. If such accesses are not controlled properly, the database values can be easily corrupted. Therefore it would be a definite concern to ensure that such important financial information is protected even from major catastrophes.\(^10\)

5.4. Security Requirements

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\(^7\) Encyclopedia Of Information Systems, Hossein Bidgoli (Editor In Chief), 2003, Elsevier Science (USA), Volume III, Don-Wan Tcha, Mobile and Wireless Networks, 165-179


Upon subscribing to an mobile payment system, users are expected to place inherent trust in the system. Giving access to a checking or savings account to a software company is not the same thing, in most users’ minds, as giving that same access to an already trusted entity, such as a bank. Unless the basis for electronic payment systems is based on tried and true secure banking practices, it is unlikely that users will adopt it. Needless to say, all steps should be secured/trusted from a technological as well as social perspective. Furthermore, mobile payment should minimize fraud losses and provide user-controlled transaction-specific privacy support. The last implies that anonymous payments should be possible (as with cash today). Furthermore, technologies such as mPKI, biometrics, and mobile digital signatures will have to be further advanced in order to be easily integrated into mobile payment architectures.

5.4.1. Need to Ensure Integrity for Payer, Payee and Payment System

This is the first major rule of thumb in designing any payment systems. There is need to ensure that (i) nothing happens without authorization, and (ii) nothing happens without generating sufficient pieces of evidence. Moreover, technical and legal procedures for dispute handling should be made part of the system.

Ensuring proper authorization by itself is not a very big challenge. All that is needed is a provision for signatures, may be given legal status, at the right place for the authorization to be recorded. This needs to be accompanied by proper identification of the signatory and correct linkage of the signature to the signatory. However, usually in electronic payment systems the process of authorization is considered simpler than its real realization. To begin with, although sometimes even the security of digital signature is stronger than of traditional signatures (some with even stronger non-forged properties than traditional signatures) the technology and infrastructure for these are not yet widely available. Many communities are yet to establish laws that recognize the validity of such digital signatures. (Currently, only in some countries digital signatures are recognized as legal) The fact which has increased the problem is the technical difficulty associated with identifying and authenticating the signatory. Users of computer systems remain faceless throughout a transaction. Thus, although it is easy to authenticate the process that is employed in the transaction, it is extremely difficult to associate the process with a real life entity. This implies that it is quite easy for the digital signatory of a document to refute a signature later. But this feature is of less problematic view in mobile payment vis-a-vis other electronic payment systems as is already mentioned formerly the mobile devices are transformed to personal trust devices, which generally considered to belong to and be managed by a single user, i.e. the owner.

Generating sufficient pieces of evidence for such payments is also considerably difficult. In other words providing detailed record of information on paper or on a computer that can be examined to prove what happened, e.g., what pieces of business were done and what decisions are made, is not easy. The fact which requires proper audit trail of a transaction to be maintained at all times during the entire transaction life cycle and until such time as it is no longer needed. In addition, other important point is that it should be ensured that such audit trails are not tampered and changed after generation. This is quite difficult to ensure specially with the fundamental feature of all electronic payment systems including mobile payment that such audit trails and other associated information may often need to be transmitted over open, unsecured networks.

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unreliable networks. With currently available technology, it is not possible to prevent the tampering of audit trails completely. We must accept that there will be times when such tampering occurs. Obviously, this creates a number of technical challenges when disputes need to be handled based on audit trail data. Thus, in the event of audit trail tampering, we should be able to detect and prove the tampering. Further, it is necessary that some contingency plans be generated for such eventuality. While the technology to perform these individually have been available for many years, an integrated mechanism that incorporates the individual technologies into a cohesive framework that is also supported by proper legal and procedural methodologies, is still not widely available.\textsuperscript{13}

5.4.2. Privacy for Payer and Payee

Providing privacy for payer and payee in all electronic payment including mobile payment systems arises in much the same way as of traditional payment systems.

Users of mobile payment systems need the assurance that their financial information remains confidential throughout the transaction, that only such information that the user considers needed to be disclosed, is actually disclosed. Further, the user needs the confidence that the revealed information, which is considered as confidential but has been disclosed due to the need, is not used by any legal or real receipt entity. Each of these requirements is extremely difficult to ensure in the electronic and mobile world.

The first feature which makes the privacy for payer and payee vulnerable, is that, many electronic and mobile payment transactions are carried over open and wireless networks. Such networks are very likely to be influenced by eavesdropping. Thus, if appropriate preventive actions are not adopted, any financial information that is transmitted is available to whoever is eavesdropping. Proper encryption of information may before transmitting seems to be the solution for this problem. Many people believe that proper encryption is the panacea of all confidentiality problems. This, however, is not really the case. To begin with, we need to remember that a brute force approach can always, in principle, break the strongest of currently available encryption technology.\textsuperscript{14}

In other hand, assuming that we can protect confidential information from prying eyes while in transit, we note that it is extremely difficult to ensure that confidential information is treated in a confidential manner by the recipient. For example, many of us use credit cards (which can be a contact-less one) for purchasing services. The merchant stores such credit card numbers electronically in its computer system. However, there is no guarantee that the merchant’s computer systems are adequately protected. While this is also the case for traditional financial transaction, we at least know to whom we are revealing confidential information. In the electronic world, the end parties are faceless. We may easily be led to believe that we are revealing information to trusted parties when we are not. In addition, we do not know if the recipient handles the information in the appropriate manner or not.

A related problem is how to ensure the anonymity of the user of the mobile payment system.

\textsuperscript{13} Hand Book of Computer Networks, Hossein Bidgoli(Editor In Chief), 2007, Wiley (USA), Volume III, Part 3, Indrajit Ray, Electronic Payment, Chapter 191.

\textsuperscript{14} Hand Book of Computer Networks, Hossein Bidgoli(Editor In Chief), 2007, Wiley (USA), Volume III, Part 2, A.Juels, Cryptography, Chapter 167.

Mobile payment should be able to provide anonymous payments as it is possible today with cash. A user may want that not only its financial information remain confidential but also that it remain anonymous in the transaction. In today's traditional transactions, it is not possible to associate a transaction that has been paid for, to a particular customer. It is also not possible to derive any personal information about the customer from this transaction while in the electronic and mobile world, this is more difficult to achieve. Part of the reason is that every message that is used in the transaction can be traced to a source address. Complex cryptographic protocols are needed to achieve such anonymity or unlinkability. At the same time, allowing anonymity creates additional problems, namely in the way of ensuring authenticity, proper authorization and fair-exchange.\(^{15}\)

However, in eBusiness transactions occur between people who are often represented by multi-user machines, a task that eases anonymity and makes it difficult to provide services such as identification, security, and trust within the ePayments domain. In the mobile world, this is different, as mobile devices are considered to belong to a special user but still the danger of extracting personal and confidential information from the source address, which the transaction itself may provide the access, is still remained as a problem even in mobile payment systems.

### 5.4.3. Fair Exchange

In the classical business environment, a transaction essentially involves fulfillment of some obligation by two parties; a contract describes the penalties if either party fails to meet its obligation. Since each transacting party has an identifiable place of doing business, if any party behaves unfairly, that party can be physically approached and held accountable for its unfair behavior. In the electronic and mobile world, on the other hand, a party does not always have a physically identifiable place of doing business. After behaving unfairly in the electronic transaction, a party can simply vanish without a trace. In such cases, it may be next to impossible to enforce the penalties of the contract leading to losses for the other party. For example, let a customer buy a product from a merchant. The customer pays for the product in some manner. However, once the merchant receives the payment, the merchant never delivers the product. This causes financial loss for the customer. Thus, any electronic payment scheme must ensure that at the end of the protocol execution, each transacting party receives the other’s product or none does. This is often referred to the problem of fair exchange and is quite difficult to achieve particularly if this needs to be accompanied by anonymity for the payer or the payee.\(^{16}\)

### 5.5. Simplicity and Usability

Simplicity and usability deal with how much a service used by its target addresses. This feature does not include just user friendliness of the payment system but also all other services and goods in this range that a user can purchase by using mobile payment system. These range can be the geographically availability of the user, the cost of using mobile payment systems in comparison with legacy approaches, better handling existing process in order to justify the existence of new systems and the level of the risk the user taking while using it. The learning curve should be close to zero and ease of use/convenience to the consumer should be

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enhanced. The customer should also have the ability to highly personalize the service in order to easily integrate it to his everyday payment activities.\textsuperscript{17}

5.6. Universality
Mobile payment systems should be available regardless of the location of the user (i.e. whether he is roaming abroad or not).
The European Union, e.g., requires a cross-border electronic payment system to be available in all of its members, and to be as efficient as any domestic system. Any global mobile payment system should be able to handle cross-border payments in any currency and at any place. For a mobile payment service to be widely acceptable, it should be possible to make cross-border payments almost as easily as local payments.

Further more e/m-commerce prefer expects on-line universal payment services, integrating, in a user-transparent fashion, person-to-person (P2P), business-to-consumer (B2C), and business-to-business (B2B), domestic, regional, and global coverage, low-value and high-value payments.\textsuperscript{18}

5.7. Integration of Legacy Approaches:
It should be possible to reuse existing infrastructure and legacy billing systems, especially those that are difficult to change (e.g. bank systems). Existing channels, such as pre-/post-accounts, credit card infrastructures, etc., should be supported, and the user should be free to choose the processing partner (e.g. bank, Mobile Network Operators, credit card) on a per transaction basis (corresponding to the requirements of each processing partner).\textsuperscript{19}

6. Market And Stakeholders Perspective
Introduction of a mobile payment system as a complex economic game with multiple stakeholder depends on multiple success factors which researches show that still immaturity of the market and the consequent unresolved technical, strategic and demand issues make the adoption of mobile payments highly uncertain. In particular, although many mobile payment solutions are already available, most are unsuccessful because they fail to provide the right value proposition to customers. This requires to investigate the needs and wants that may drive customers to adopt a mobile payment solution as well as their grouping in market segments. Discovering the most important adoption factors for consumers should also help to evaluate the different solutions with these selected criteria. The idea is to match the needs of a particular market segment with existing value propositions. A market segment could have specific needs, such as ease of use and low transaction cost, for example. This could typically be consumers who need to pay quickly and easily small purchases. Another segment could ask for good security for more important payments. Typical consumers within this segment are mostly people using mobile payment transactions as a replacement for credit cards. The next point is to analyze whether the value propositions offered to these customers match some of their needs. A value proposition could address needs totally or partially. In fact, there are currently several available mobile payment solutions to satisfy the customers’ needs for mobile payments. In reality, however, few of them have been successful so far. It seems that this is due to the fact that providers have difficulties to offer value


propositions answering the specific needs of the customers within their selected market segment. 

On the one side, there are the regulators which set a legal framework and controlling compliance. Moreover, technology suppliers are in charge of providing the technology to the players. Both have a great influence on the market since they design the future of mobile payments.

On the other side, there are the players that make up demand and the supply. Merchants and consumers represent the demand. They are very important since success of a mobile payment scheme necessarily depends on the adoption of both groups. Therefore, they need to be convinced that mobile payments are good for them. Most customers are used to existing payment methods and need an incentive to use anything new. The ability to use the mobile device as a payment tool in itself might not be enough. Users and merchants need to see additional benefits. Approaches that wish to be sustainable must either improve their functionality and usability, or be creative in making users and merchants perceive it as beneficial. Mobile payment service providers correspond to the supply.

Payment service providers are typically financial institutions, such as banks and card issuers. Moreover, Mobile Network Operators (MNOs) are also considered natural candidates to offer payment services. Therefore, there are obviously two dominant types of actors present on the mobile payment market: financial institutions and MNOs. They can choose to collaborate and cooperate, or compete. Each provider has its own advantages. Financial institutions are very powerful on the payment market. They have their financial networks and licenses. Moreover, they have expertise in risk management. On their side, mobile network operators have a large customer base due to the high penetration of the mobile phone. Furthermore, they control the mobile network infrastructure and the end-user device.

Just as each actor has advantages, each has the power to influence the others. For example, financial institutions are so present on the payment market that it would be hard to totally avoid their involvement in a mobile payment scheme. Therefore, they could put pressure on the mobile payment services providers with excessive transaction fees, for example. Some mobile payment solutions are also using a traditional payment instrument offered by the financial institutions (e.g. credit card). This gives them a new channel for their existing financial network. On their side, mobile network operators could greatly affect the development of new mobile payment solutions by raising the connection fees on their network. There are various models including one or more providers. However, given their respective advantages and weaknesses, there should be a trend towards collaboration. Whereby, each actor can benefit from the advantages of the others. This is probably the only possibility to obtain a win-win situation on the mobile payment market. This market is also open to competition with newcomers. Some specific industries with an important customer base could offer a profitable mobile payment scheme. In the public transportation industry, there are some successful schemes because the consumers found the payment solution efficient for purchasing fares. The immaturity of the market still leaves some space for speculations.

20 Hans van der Heijden, Factors Affecting the Successful Introduction of Mobile Payment Systems, 15th Bled Electronic Commerce Conference eReality: Constructing the eEconomy, Bled, Slovenia, June 17 - 19, 2002
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Jan Ondrus, Yves Pigneur, A Disruption Analysis in the Mobile Payment Market,38th Hawaii International Conference on System Sciences - 2005

6.1. Mobile Payment Players

In order to explain more in an organized way what was discussed formerly, the main parties in the mobile payment scheme are depicted in Fig. 1. The cooperation of all mobile payment players is the key to developing a global open solution instead of a closed system with limited scope. It is important to keep in mind that the mBusiness players reposition themselves constantly in the market, as they adjust to new opportunities and threats brought about by rapid technological developments.

1. the customer (payer) These transact with each other via the mobile payment process

2. the merchant (payee) These transact with each other via the mobile payment process

3. mobile network operators (MNO), MNOs have a huge customer base, and because they control the subscriber identity module (SIM) and/or the wireless identity module (WIM) card of the mobile device, their influence and strategic impact in the mobile payment model is great. However, they cannot fully handle an mobile payment system, as they have limited experience in payment services and the risks associated with them.

4. the financial sector institutions (e.g. banks, credit card companies, payment processors), On the contrary, the financial sector has been doing this for decades and can realize cross border payments. Successful cooperation of both sides is the key to empowering the mobile payment era.

5. device, software, and service providers. The device manufacturers also play a significant role and although they have no payment experience, they control the technology and capabilities of the end-device, which without doubt affects the implementation and deployment of a mobile payment service. Therefore it is important that the manufacturers cooperate with each other and with other mobile payment players to develop a common approach to mobile device capabilities. Finally, software providers develop the means of implementing a mobile payment infrastructure by producing standard compliant software that will connect the different parts of the mobile payment process. The service providers will bring this service to the market and adapt it to user’s needs. MNOs or banks can also play the role of the service provider and can offer limited mobile payment services on their own.

6. the government (legislation and regulation constraints) Finally, all mobile payment solutions are developed under constrains imposed by government legislation and regulation at the national or international level (e.g. the European Union).

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Various models and scenarios could be imagined but in order to achieve an insight in the mobile payment arena a typical digital payment scenario is depicted in Fig.2.

The customer is the party making the payment; the merchant is the party accepting the payment; the acquirer is the third party that has a relationship and interacts with the merchant; and the issuer is a third party that has a relationship and interacts with the customer. First a customer and a merchant agree on a transaction and either one of them notifies the service provider. In a typical retail transaction, it is the terminal at the point of sale who calls the provider. In any transaction the goal is the value transfer from the customer to the merchant.

For example a typical procedure followed by credit card companies is as follows. The customer “pays” a merchant for goods/services. Subsequently, the merchant sends the transaction details to the acquirer for clearing. The acquirer sends the transaction details to the financial network to which it belongs (e.g. VISA) which then forwards the details to the issuer. The issuer is informed to make the necessary fund reservation at the customer side. The scheme settles/pays the acquirer, the acquirer settles/pays the merchant, the issuer settles/pays the scheme, and the customer pays the issuer. However, other schemes may directly exchange tokens (e.g. cash, e-tokens) between the customer and the merchant. In the mobile payment arena we have similar procedures, with the only difference being that the customer and possibly the merchant use mobile devices in order to realize a transaction.25

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Factors Affecting the Successful Introduction of Mobile Payment Systems, Hans van der Heijden, 15th Bled Electronic Commerce Conference, Bled, Slovenia, June 17 - 19, 2002
6.2. Mobile Payment Models

6.2.1. Acquirer-Centric vs. Issuer-Centric

In this model the merchant and its respective agent are responsible for managing the interactions with the mobile device. In issuer-centric models the customer and his agent are in charge of handling the interaction with the mobile device while the merchant may be totally unaware of the mobile nature of the payment. In this model it is usual that the customer-issuer interaction is mobile, but the rest may be based on existing wired infrastructures and standardized e-payment protocols.

6.2.2. Bank-Centric vs. MNO-Centric

Financial transactions have been executed and control by banks for a long time. Banks and financial institutions acting as issuing banks (owning customers’ accounts), acquiring banks (owning merchants’ accounts), and clearing houses (clearing and settling transactions between the issuing and acquiring banks).

On the other hand mobile operators offer mobile services within their network until now. Therefore they are quite new to this business. Their billing systems have been used until today for charging their customers for the services they are used to offer. This billing system has been changing lately with pre-paid accounts and emerging data services, where content is produced and provided by third parties. In a bank-dominated mobile payment model, the bank handles the mobile payments while the MNO provides only the air connection between the user and the bank. In the MNO-dominated model the MNO is doing the billing either on the prepaid user account or later on the phone bill for their postpaid users. In some cases revenue-sharing agreements with multiple MNOs exist in order to broaden the customer base.

6.2.3. Cooperative model (Win-Win model)

Although the above mentioned models are the most common models in mobile payment systems, new concepts in mobile payment models are developing which deal with the cooperation between business partners in mobile payment arena. These composite models are usually on a revenue-sharing basis. Such a cooperative model is usually referred to as a win-win model, and is broader as it usually implies at least country-wide acceptance and cooperation among several partners from different domains. A large variety of mobile payment services exist in the market already, some of which are operated by banks and mobile network operators while others are operated by third parties. A key advantage of the independent players is that they enable every mobile user to use the service upon registration, regardless of their mobile service provider or bank. Therefore for example it is

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much more convenient and efficient for a specific merchant who is intended to use mobile payment services to contract with such an independent player than teaming up with three or more separate mobile operators.

On the other side for such independent players it is not easy to build a user base from scratch while network operators already have developed a wide network of customers. Who can be a potential mobile payment user. Therefore in win-win situation each business partner pursue its core business and co-operate with others harmoniously in a non-exclusive scenario. For MNOs the best argument supporting the concept of banks and MNOs joining in a co-operative business model is that for MNOs m-commerce will offset the reliance on prepaid mobile airtime/service (which tends to reduce average revenue per user). For banks the best argument is that it is expensive to develop a common platform for m-payments from the scratch. A promising model integrates new technologies at the infrastructure level, which makes possible interoperable cooperation between multiple banks, MNOs, and merchants. The last factor eases the task of establishing cross-border mobile payment functionality, the non dependability of the mobile payment service on specific banks or MNOs, and guarantees a high number of acceptance points which can help the mobile payment service to reach critical mass. 29

7. Conclusion

In this paper it was suggested that in order to achieve a comprehensive analysis regarding mobile payment environment, a multi perspective approach should be considered.

In the realm of technology different requirements, which is necessary for a successful realization of mobile payment system, have been discussed.

The market and stakeholders' perspective shows that in designing and developing mobile payment systems, adaptability with market segment needs is of great importance while the cross border operability of mobile payment system should be kept. Beside this, role and relations of many players and their respective strengths and weaknesses are very influential in this industry and requires an efficient collaboration among them.

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