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A framework for evaluating mobile payments

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The opinions expressed in this paper are those of the author and do not necessarily reflect the views of the Bank of Finland.



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Abstract

A great number of mobile payment schemes exist in the market. This paper suggests a framework, based on payment type and technology, to classify mobile payment schemes. The framework supports a definition of mobile payments as a way to use existing payment instruments. Based on the framework, mobile payments' success factors from the payer and payee viewpoints are discussed. In the mobile payments value chain, both banks and mobile operators are critical players, but their business cases are not self-evident. This paper aims at contributing to central banks' need to better understand the functioning of mobile payment schemes and mobile payment markets.

1 Introduction

On many occasions mobile payments have been referred to as the most efficient future means of payment. Several initiatives and trials have been launched all over the world, the only thing in common being the use of mobile phone or handsets in payment initiation in one way or another¹. Fast development of both technology and innovations, together with technology convergence, are responsible for the great variety in this field. Use of mobile devices in payments has the potential to change the structure of retail payments, and it enables new entrants to the market. Use of new technology raises questions about its reliability and efficiency. For these reasons authorities, and especially the oversight function of central banks, should be interested in developments in this area. Motivation for this paper arose from a need to systematically analyse the diversity of applications called mobile payments and from a need to better understand how these initiatives can change the retail payment landscape.

The purpose of this paper is to create a viable framework to analyse various mobile payment initiatives. The framework is based on a review of existing mobile payment definitions, applications and classifications. Based on the suggested framework, success factors of various mobile payment initiatives are discussed. This paper also elaborates the core market participants' role in the mobile payment value chain and how the provision of

¹ See e.g. Appendix 2 in Mobey Forum (2008), Karnouskos (2004) and Vaughn, P. (2007).

payment services may change due to mobile payments. The focus of central banks is in the smooth functioning and efficiency of payment systems. This paper hopefully contributes to central bank analysis of the payment market development.

Related analytical literature can be found in payment economics and in research on technology acceptance and diffusion of innovations. Payment economics studies payment systems as part of financial intermediation. Also developments in payment systems and changes in the payment market via new technology have been studied. The microeconomic view covers the market imperfections in privately-run payment systems, economies of scale and related externalities. The industrial organisation of the payment industry is highlighted on in research of network economics, two-sided markets and card payment fees². In some recent studies, attributes concerning consumer's choice of payment instrument have been included in these analyses³.

Mobile payments have been studied in past years quite largely from technology acceptance point of view. The Technology Acceptance Model was originally aimed to shed light in organisations' acceptance of new technology, but it has been adapted to consumer research. Perceived usefulness and ease of use are the main attributes determining the acceptance of technology. Research on mobile payment services has also recognised the importance of perceived risk and trust as important factors⁴. Most existing research on mobile payments does not make distinguish between different technologies or applications by which the payment service is created. This is in spite of the fact that the payment application characteristics greatly impact the consumer's perceived usefulness, ease of use and trust.

This paper does not explain different mobile technologies or payment instruments or payment systems but relies on the readers' previous understanding of the basic concepts and functions of mobile handsets. Internet banking with a mobile device is also excluded. By using Internet banking with a mobile device the customer can access all available banking services, including payments, the same way as with his laptop or a terminal in an Internet café. The use of a mobile handset creates added value to the customer by liberating him from the constraints of heavier equipment, but from the functional perspective, this is normal Internet banking. Hence, payments made in this connection, irrespective of the technology used, hardly deserve to be called mobile payments. This is notwithstanding the fact that

² Kahn, C. – Roberds, W. (2009).

³ E.g. Ching, A. – Hayashi, F. (2008).

⁴ E.g. Viehland, D. – Leong, R. (2007) and Mallat, N. (2006).

combining Internet banking services with mobile alerts, confirmations and especially identification is one of the most promising areas of development in banking services.

This paper begins with a short, and certainly non-exhaustive, description of various mobile payment definitions and how existing applications in Finland, Europe and globally have been classified. Based on existing knowledge, a payment type based typology is developed and a framework is suggested for analysing mobile payment applications. The question asked is what are we talking about when we talk about mobile payments. How does the environment influence the development of applications and what are the relative advantages or disadvantages of different mobile payment applications compared to existing ways to pay? A short look, focused on developed countries, is taken at the potential success factors of these initiatives and which technologies and payment types are likely to succeed. By describing the value chain of mobile payments this paper then discusses the roles of banks and mobile operators in mobile payments. In conclusion, possible implications of the regulatory framework and developments in payment industry structure are discussed. Also, some suggestions for further analysis are made.

2 What are mobile payments?

In every-day language the concept of mobile payments refers to any method of paying where the mobile handset is involved. The corresponding wide definition is by **Dewan and Chen**, which classifies a payment as mobile when the payment is made by using mobile devices, including wireless handsets, PDA or RF devices or NFC-based devices⁵. This definition includes different available technologies, and does not limit a mobile payment to mobile phones, but e.g. the NFC application may be attached in anything a person carries with him, like the mp3-player, key ring or wrist watch. By this definition, a card payment with an NFC chip embedded in the plastic should be considered a mobile payment. It is obvious that this definition does not support a deeper analysis of payment markets.

The **ECB** has defined mobile payments as a sub-group of e-payments, where mobile phones or other wireless communication devices are used to access accounts and to use payment services⁶. This definition recognises the user interface as significant criteria for mobile

⁵ Dewan, S. G. and Chen, L. (2005).

⁶ ECB (2004).

payments, though no distinctions are made between different applications. The payment services are also not defined, and any general or proprietary system may be included.

Mallat defines mobile payments as use of mobile device, commonly a mobile phone, to make a payment transaction, where funds are transferred from payer to payee, either via a bank or directly, without an intermediary. This functional definition considers mobile payments as a payment instrument comparable to credit transfers, direct debits or card payments⁷.

The presented definitions are vague due to two missing aspects: mobility is defined very broadly, and the characteristics of a mobile handset, e.g. the display and keypad, are ignored in the use of payment application. The definitions also ignore the fact that it is possible to create many differing payment applications for use with a mobile handset. **This paper considers that mobile payments could be as a channel for payment services** instead of a payment instrument or scheme. A mobile handset could be considered to be a carrier of various payment instruments, and as a technological platform it adds some elements to the usage of the payment instrument in question. The next classifications seem to support that kind of an approach.

2.1 Mobile technology based classification

Technological development and convergence has made modern mobile phones a bundle of technical options: the same phone can be used in a GSM-network for calls, SMS-messages or WAP-connections, or it can be used to transmit data or as an Internet browser through GPRS, 3G or 4G connections. It can also use WLAN and in future WiMAX to connect to the internet in local networks⁸. Short distance communication technologies like infrared, Bluetooth, RF⁹ or NFC¹⁰ are embedded in the phone. A payment application may be used with any of these technologies. Chip technology allows different applications in the phone, whether a plain SIM card is used or a SWIM card where the SIM is equipped with PKI certificates or the multifunctional UICC chip¹¹, which allows the use of a secure element¹² in

⁷ Mallat, N. (2006).

⁸ This paper does not distinguish between 2G, 3G and 4G applications of packet oriented mobile data services such as EDGE or UMTS. The next generation, like WiMAX, is also not discussed separately.

⁹ RF radio frequency chip, a chip readable from short distance, Smart Card Alliance 2007.

¹⁰ Near Field Communication, a chip capable of both being read and reading other NFC-tags, MobeyForum 2008.

¹¹ Universal Integrated Circuit Card, smart card platform for wider mobile or other service offerings, MobeyForum 2008.

¹² Secure element is a combination of hardware, software interfaces and protocols that enable secure storage and use of credentials. It forms a platform where applications can be installed, personalised and managed, MobeyForum 2008.

payment applications. Communication between chip and phone is developing rapidly and creating new possibilities. In addition to these, separate devices may be attached to the phone to facilitate payments.

NFC applications may require contact with an RF reader or operate contactless. So far, the NFC applications used in mobile phones have been realised by adding an RF chip in the phone's cover. This means that the application does not make use of the phone's attributes, and could be attached to anything the user prefers: wristwatch, key ring or plastic card. In the future, it will be possible to integrate the NFC application with the same multifunctional chip that carries the SIM or in a separate UICC in the phone. There have been trials with dual-chip phones, where the other chip carries the payment application. These trials have, however, not been long lived.

Table 1. Existing mobile technologies and some examples of payments based on them

Mobile technology:		Examples of payment applications:
GSM	fixed radio connection	Sms-based payment applications like ringtones or Helsinki public transportation, or mobile-PayPal
GPRS + 3G/4G	packed data transmission	Payment application embedded in chip together with sim, using secure element or not. Sms-based solutions like Banxafe or UICC-based as described by MoneyForum. Browser based Internet-banking.
WLAN + WiMAX	short distance wireless internet connection	Browser based Internet-banking, web-payment.
RF-chip	radio frequency transponder for NFC, either as separate device in mobile handset or embedded in UICC.	I-mode, Visa Contactless, MasterCard PayPass, public transportation like Octopus, Oyster

The variety of very different technical options for mobility and existing applications makes a definition based on just the presence of a mobile phone rather fuzzy. From the technology perspective, the mobile phone is more of a channel or a carrier of a payment instrument than an independent payment instrument of its own right. This is evident especially when considering the use of a mobile handset in Internet banking. Browser based Internet banking services are the same from the functional and juridical points of view, irrespective of the instrument used to access it. This is why Internet banking has been excluded from the scope of this paper. The same applies, however, to stand-alone RF-based applications, where the RF chip may be embedded in any carrier such as key ring, jewellery – or mobile handset.

2.2 Usage based classification

Mallat classifies mobile payments according to the environment (remote vs. proximity) and value of the payment and the charging type used: prepaid, real time or post paid, according to table 2 below¹³. The same attributes have been used commonly in articles describing new payment applications.

Table 2. Mobile payment categories and examples

Environment	Value	Charging Application examples	Mobile payment system examples					
			pre paid			real time	post paid	
			pre paid account	mobile account	RFID chip	direct debit	credit	billing
Remote Internet, mobile, mail, order, TV, papers	micro	music, pictures, games, parking, public transport	Pre-paid call / sms	Mobile money		Peppercoin	HKL mobile ticket	
	macro	goods, services, subscriptions to contents, ticketing	PayPal mobile				Mo-neta (slo)	
Manned POS	micro	newspaper, milk			i-mo de Feli Ca	Pay-box Austria	Mobi-pay	
	macro	fast food, groceries						
Unmanned POS	micro	vending, ticketing, cigarettes	Pre-paid call / sms				Post-paid call / sms	
	macro	ticketing						
Proximity P2P	micro	lending money	PayPal mobile					
	macro	splitting a restaurant bill						
Remote P2P	micro	lending money						
	macro	weekly allowance to children						

The picture again shows the wide variety of possibilities to initiate a payment using a mobile device. Money remittance applications are not even listed by Mallat. The environment or size of payment seems to differentiate between the applications rather poorly; most existing mobile payment schemes could be used in all environments. Nor does this scheme clarify

¹³ Mallat, N. (2006).

possible differences in the use of applications. However, the way of settlement of the payment seems to be an attribute capable of differentiating between existing applications.

Even though this classification reveals the heterogeneity of mobile payment applications it does not support the view that the use of a mobile device as such could define a payment instrument.

2.3 Payment type based classification

Payment is about transferring funds irrevocably between payer and payee. When done in any other format than by exchanging cash from hand to hand, the activity is profoundly regulated. It also requires a trusted service provider to guarantee the flow of funds. In traditional terms, the financial industry, banks and payment card companies, have acted in this role as trusted service providers and settlement agents. When paying with a mobile handset, mobile operators have also assumed this role. In the following, existing mobile payment schemes are discussed from the payment transmission point of view.

Airtime based mobile payments are typically calls or SMS to toll numbers which decrease the prepaid balance of the SIM-card or add to the mobile bill. In other words they are **billing systems**. The final settlement of the purchase happens when the phone bill is paid and the operator transmits the fee to the provider of the service or product, be it ring tones or a can of soda. This type of payment intermediation or transmission puts the operator outside of its traditional role, and on a larger scale may require a licence (e.g. as a payment institution in Europe). Air time based payments also easily reach the upper limit of SIM-holder's credit, effectively preventing the wide use of this type of payments.

Account based payments may be provided either by a financial institution or a separate mobile payment company. Until now these companies have often been seen as electronic money institutions, at least in Europe¹⁴. In an account based model, the payer may have a separate account where he transfers funds for his mobile payments¹⁵. This creates a **proprietary system**, where the funds in the mobile account are usable only in the mobile payment scheme in question. The payment is initiated usually with an SMS, where the payment service provider recognises the payer by his telephone number, or by using a separate application with credentials in the SIM-card. A normal payment easily requires several SMS messages when the payee first transmits the purchase information to the payer,

¹⁴ The Payment Services Directive could also allow payment institutions to act as service providers at least in some applications.

¹⁵ Account based model could also be called the credit transfer -model, as payments between accounts are executed either in a proprietary system or as normal credit transfers between payer and payee.

the payer confirms the transfer of funds and confirmations are sent to both parties. This type of paying seems lucrative from the operator's perspective, but the payment process itself is both slow and vulnerable, if any of the required SMS-messages is not successful. Examples of account based mobile payments are the Finnish Digiraha, Belgian Banxafe, PayPal Mobile and the money transfer applications such as M-Pesa in Kenya. In Austria (PayBox), it is also possible to generate one-off direct debits with this type of payment.

The payment card industry has also been interested in developing new ways to make **card payments**, e.g. by using the mobile handset. Use of contactless chip technology, with EMV-standard or lighter solutions, makes it possible to use almost anything as a carrier. Over the years, several trials have been made with a payment card application embedded in the cover of the mobile phone, with dual-chip phones or multifunctional chips. The transaction itself, however, is done by using the four-corner model of card payments¹⁶. Basically, the mobile handset carries the payment card application and the communication with the payee occurs with NFC, e.g. by "tapping" the terminal with the phone, or by sending the card data to the terminal using the secure element in the multifunctional chip.

Payment type seems to differentiate between various mobile payment schemes and, combined with the technology choice, it is used to create a framework for mobile payments in the following.

2.4 Suggested definition and framework for mobile payments

Based on previous analysis it seems justified to suggest a new definition for mobile payments, where the use of mobile device is seen as a channel to payment services. A formulation could be: **Mobile payments mean the use of payment services, other than Internet banking, by using a mobile handset, its keyboard and display.**

As described in Section 2.2, mobile technologies provide a rough basis for classifying mobile payments: any type of payment may be done with all available technologies, and these technologies may even converge or be present at the same time. Most existing SMS or phone call based applications should be classified as billing systems, not payment systems. Internet banking with a mobile is also excluded from the scope of mobile payments.

The usage based classification discussed in Section 2.3, makes a distinction between proximity and remote payments as well as with prepaid, real-time and post-paid applications.

¹⁶ In four corner model the payment is processed separately by the acquirer for the merchant and by the issuer for the card holder, the card scheme defining how the transaction and its settlement is done between the issuer and the acquirer. Further information is found in the wide payment card literature, e.g. Chakravorti, S. (2003) and Hunt, R. (2003).

Most existing applications may be used either in place of purchase or remotely. The main difference is in the usage experience: many of the applications described in the classification are rather clumsy at the counter, but may be more useful in a remote payment situation. RF technology, however, can only be used in proximity payment situations.

Usage based classification also includes prepaid, real-time or post-paid alternatives. The time when the payer's bank account is debited does not give any particular guidance in evaluating the functioning or usability of mobile payments. Rather, it seems logical to use the payment type described in Section 2.3, as the second criteria for classification of various mobile payment applications. This approach is according to the suggested definition of mobile payments, and it captures the fact that many mobile payment applications are a variation of existing payment types (like direct debits, credit transfers or card payments). It also allows the comparison of various initiation channels or techniques by keeping the payment transmission process as constant. Based on the elaborations in this section this paper suggests the following classification (Table 3) for mobile payments:

Table 3. Suggested classification for mobile payments

	SIM-based applications	UICC based application	NFC-based applications
Operator billing	ringtones, charities, Helsinki public transportation (FI)	No applications yet	RMV-Handy-Ticket für NFC (DE)
Money remittance (cash sent)	M-Pesa (KE), Western Union Mobile Money Transfer Service	No applications yet	not applicable
Credit transfers	Banxafe Pay2Me (BE), PayBox (AT), Rabo Mobile (NL), China rural, Wizzit, First National Bank (ZA)-Mango, GXI (PH)	No applications yet	RMV-Handy-Ticket für NFC, direct debit (DE)
Card payments	Mobipay (ES)	No applications yet	Visa Contactless/payWave, MasterCard PayPass
Account-based proprietary systems	Mobile PayPal, Digiraha (FI), Obopay (US), Sendairtime (UG)	No applications yet	Osaifu-Keitai (JP), EZ-Link (SG), Public transportation

The large number of mobile payment applications fit quite well within the suggested framework. Information about the applications was collected from public sources (see footnote 1 and applications' Internet pages), and may not be completely accurate. However, the over-all fit should be reliable. In this framework it is also possible to shed light to various service providers in the mobile payment market: card schemes seem to focus in payments

made with NFC -technology whereas mobile network operators (MNOs) and money transmitters rely on SMS-messaging.

3 Evaluating mobile payment solutions

The examples and classifications above show the diversity of available options for mobile payments. The starting point for development has been the ubiquity of the mobile handset¹⁷, and as in the early stage of innovation, competing solutions have been tested. All analysis of existing applications is bound to be outdated before publishing. We still lack clarity as to which applications are to prevail, but some indications of the future developments may be offered.

In developed countries, the payment business is a highly saturated market. Both consumers and businesses have various ways to make and receive payments. Most of the established ways are provided by financial institutions, including payment card companies, and only a limited number of people are unbanked, i.e. lack banking possibilities. Cash provides a universal payment means in cases where non-cash payments are not viable. New ways to make payments must prove their advantages to consumers, merchants and payment service providers, meaning that they face competition in the market. This competition with established payment instruments is tough.

A different situation prevails in developing countries, where financial services are not commonly available, the majority of people are unbanked and no broadband connections for Internet or other services are available. The value of needed payments is usually very low, a few eurocents. In this environment, however, mobile networks do exist, and the handset manufacturers' investment in low-cost mobile phones may create a possibility to make payments in areas where no such opportunity has existed before.

¹⁷According to public sources mobile phone penetration in Western Europe is over 100% , in the USA around 80% and globally around 50%. (Reuters 2008a and Reuters 2008b, Digitoday 2008). In developing countries the penetration is lower, but growing rapidly. In Africa the penetration was, however, around 8–9% and in South of Sahara are just around 5% in 2005 (Finnfund.2005). In many Asian countries the penetration level is around 30%.

With the starting points so far away from each other, there will hardly be a single way forward to global mobile payments. Rather, the development will take separate courses in these two environments, at least in the short run.

In developed countries, comparison to existing payment instruments may provide a good framework for evaluating various mobile payment initiatives' potential to success. In the following, initiatives are discussed according to the framework presented in table 3. In order to succeed, mobile payment must provide all participants in the payment value chain an incentive to use it. The incentive may be financial – savings or profits – or gains in efficiency or ease. The financial incentives are divided into investment cost and usage cost. As gains in efficiency or ease, attributes such as usage experience, speed, availability and security are discussed. According to the chosen framework, the payment processing, settlement of payments, is kept constant, and each technology is discussed from the payer's and payee's point of view in Sections 3.1. and 3.2. The characteristics of different payment schemes are discussed from the payer's – or mobile phone user's – and from the payee's – most commonly a merchant – point of view in Section 3.3.

3.1 Mobile payment applications, payer's viewpoint

Table 4. Mobile payment applications from payer's viewpoint

	SIM	UICC application	NFC
Easy to get	<input checked="" type="checkbox"/>	?	?
Easy to use and understand	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Safe, reliable	Prone to errors, delays	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Widely accepted	<input checked="" type="checkbox"/>	Investment required	Card infra can be used
Cheap	<input checked="" type="checkbox"/>	?	?

For a consumer, a payment instrument must be easy to get, use and understand. It must also be widely accepted as a payment instrument, as nobody wants to experience disappointment at the counter when a lucrative purchase has been found but, in spite of means, cannot be paid for. It must also be safe from criminal use or technical disturbances.

Both industry's anecdotal information and some studies strongly suggest that price elasticity of consumer demand is high in payments. People don't want to pay for paying¹⁸.

SIM-based applications are mainly SMS-based. Whether billing, credit transfer or card payments in the settlement, they fulfil many of the prerequisites. SMS-based paying is indifferent to the mobile device version or age, and no investments are needed. SMS-messaging is also widely adopted. These are likely the reasons why e.g. the money transfer systems highly rely on SMS.

The handicaps of SMS-based paying relate to the eventual errors and delays in messages. Also the user interface commonly with a lot of manual typing is not optimal to everyone and certainly does not lend itself to the shopping environment.

The security of SMS-based applications for larger payments otherwise applicable for account based transactions may also be questioned. To reach the security level of credit transfers, the use of a secure element and a specific application in the mobile device is needed. The multifunctional UICCs provide a technical platform for this. However, getting a new chip or separate devices and applications for the phone creates an investment cost for the payer: if not as a direct fee, then as the burden of getting the application. E.g. according to Rhein-Main Verkehrsverbund experience the most problems in their billing based mobile payment system occurred during the installation of the required software¹⁹.

So far, there are hardly any known applications based on multifunctional chip (UICC), due to the novelty of the technology. However, this platform has the potential to bypass many of the weaknesses of SIM-based payments. In order to succeed, the ease of obtaining the chip and applications, ease of use and understanding how to pay, in addition to reasonable pricing, should be emphasised. E.g. the need for typing should be minimised, to create a fluent user experience. Perhaps the amount of manual typing in EMV card payments at POS can be used as a benchmark. Especially the use of the secure module makes it possible to create a method for payments of different sizes and environments. As proprietary payment schemes limit its usage, general schemes, such as credit transfers or card payments with wide interoperability, would provide the best basis for UICC-applications²⁰. When creating these applications, special attention should be given to the separation of payment

¹⁸ The relevance of these attributes has been confirmed in academic research on mobile payments using the technology acceptance model, e.g. Viehland, D. – Leong, R. (2007).

¹⁹ Preuss, P. (2007) NFC@RMV, a presentation given by Peter Preuss, RMV, in New Payment Channels Conference, London, 2007.

²⁰ According to discussions with industry experts, the European Payments Council, in co-operation with GSMA, is developing a mobile payment solution based on UICC.

applications from the voice- and data-transmission. Otherwise the use of company phones effectively prohibits the use of personal payment applications.

NFC-based payment applications have so far been card payments, either proprietary – and usually pre-paid – such as public transportation, or general such as international credit cards. The NFC chip may be a separate device in the phone or embedded in the UICC. The use of NFC is easy: ‘tap and go’. NFC-based payments could be used without payer confirmation (pin or signature) for smaller sums, but larger payments would be more secure with a separate confirmation, in accordance to current card payment schemes' rules. When used for card payments, the existing infrastructure and acceptance network are available, making the launch of the service relatively uncomplicated.

The main questions about NFC-based applications relate to the acquiring of the payment, delivery of the NFC-device, possible security of pin at payment terminal and its cost to the user.

As described in Table 3, most non-payment card applications are currently based on SMS. UICC-based applications seem to be effective due to the possibility of enhancing the safety of payments, easy user-interfaces and the ability to embed a NFC application in the same chip. SMS-applications, either text or voice for illiterate users, seem to provide the best technical environment to money transfers and other payment systems for developing countries, where these systems are mainly run by MNOs. However, in developed countries, payments making use of existing settlement infrastructure and with easy and reliable payer interface could best be created with UICC.

3.2 Mobile payment applications, payee's viewpoint

Table 5. Mobile payment applications, payee's viewpoint

	SIM	UICC application	NFC
Minimum investment	☑	?	Card infra can be used According to card payments
Optimise liquidity	?	?	
Safe, payment guarantee	?	Secure module allows Enhanced guarantee	☑
Widely accepted	☑	?	☑

From the payee's viewpoint, a payment must be secure, preferably guaranteed by the payment service provider. It must be fast for both better customer service and for optimising the liquidity. It must also be easy to install with minimum investment, and it should have a wide user group. Payees are as unwilling to pay for payments as are the payers. From this perspective, the NFC-based payments seem to be best positioned to fulfil the requirements.

Most general payment schemes using NFC are card payments. In these cases, the merchant only needs an NFC-reader, otherwise the existing payment card terminal and acquiring technology may be used. The operations at the counter may be faster with an NFC than with other cards or cash. Electronic accounts are always easier for the merchant than cash. There is an ongoing debate about merchants' fees for card payments, but compared to alternatives, at least the tariffs, schedules and rules are familiar and most often guaranteed. However, NFC payments can only be used in proximity.

It is possible to build various payment applications based on the UICC, for both proximity (NFC) and remote use. Payee's requirements for fast, secure and investment-free payments can be created based on credit transfer, direct debit or e-payment. The UICC seems to provide good possibilities, but unless developed by the payment industry jointly, no general, sufficiently widely accepted way to pay can be reached. Also, the need for no or low investment for payees must be kept in mind.

3.3 Mobile payment services

From the consumer's point of view, MNO billing systems offer a practical way to pay for certain items or services, such as ringtones or display logos for phones. As a matter of fact, it is difficult to imagine that this type of low value mobile content could be paid for with any other payment instrument: credit transfers or card payments are too expensive for small sums like the ones in question and not always available for the major clientele of these services. An advantage is that the billing/paying happens in real-time with the delivery. The possibility to bill the customer in real-time is important also when funds are collected for a charity or a public transportation ticket is bought – if there were more time to think about the expenditure, the consumer might have regrets and not buy the service or make the donation after all.

The flip-side of billing system' benefits is the willingness to combine various expenditures on the phone bill. MNOs have been forced to provide customers with various services by which the balances or usage are restricted: these have been required by parents with mobile-heavy-user children or companies wanting to restrict the use of toll-numbers or other

fee-based services with company phones. Also, in case of disputes, it may not be self-evident or easy to sort things out between the service provider and the MNO.

Account based services, when not linked directly to the payer's current account (i.e. proprietary), may be clumsy: to transfer funds to a separate mobile account is an extra step in making payments. These funds are typically not credited with interest, so there is no incentive to deposit larger sums "just in case". Usually both the payer and the payee must be participants in the same scheme – this means that these payment instruments are actually not general, that is, widely usable. The most promising payment instruments to be applied with the mobile seem to be the general card payments and credit transfers/direct debits.

Proprietary account based systems may be useful to payees when no better alternative is available. Critical factors are the investment costs and how fast the payee is able to convert his funds from the proprietary system to general payment systems for interest or other use. A transaction between current accounts would most likely be the fastest and cheapest (analogy with credit transfer, direct debit or debit card).²¹

From the payee's point of view, MNO based billing systems seem uncomplicated: the payment instrument is widely available and no investment is needed. The payment instrument can be used both remote and in proximity. The MNO disburses the billed amount according to a bilateral agreement to the payee. However, the service provider's negotiation power with the MNO may be unbalanced and there is no explicit knowledge about the fees the MNOs put on their billing service or the time of crediting the fees or the liabilities of credit risk. The billing systems seem to be suitable for a limited area of services, as described earlier (mobile content, charities, ad hoc ticketing), but it seems unlikely that this type of paying would expand, in spite of trials in some vending machines. The payer experience and the dependence of the billing on someone else are weaknesses which do not exist in e.g. e-payments or e-banking, services available with modern mobile handsets.

3.4 Conclusion for payer and payee viewpoints

Based on the above analysis, it seems justified to say that operator billing and SMS-based payments have had a role to play in the early stage of mobile payments development. They may also have a prevailing role when no better payment instruments are available: according to experience such services are low value, ad hoc and remote. Proprietary account based payment services have filled a gap in the payments markets, but by all measurement the

²¹ These conclusions are supported by e.g. Mallat, N. (2006).

financial industry (banks) would be far better positioned to perform payment services between current accounts in a reliable and safe way: the advantages of general payment infrastructure for larger network and better liquidity management are obvious. This, however, will require far more determination by banks to develop these services and development of applications using the secure module and a multifunctional chip in the phone.

For proximity payments, the NFC provides unique benefits, and NFC based card payments seem to be commonly acknowledged as the next generation of payment services. Again, the existing payment infrastructure has a huge advantage over any other form of payment.

All this analysis applies to the developed countries payment landscape. The situation changes dramatically in the absence of financial services and with completely different payment needs. In developing countries SMS-based money transfer services which are usable with any handset and easily redeemed for cash by a wide co-operative network are in a position to make a huge difference in the everyday lives of individuals, both payers and payees. As a matter of fact, they enable the emergence of economies in areas where that has not been possible before, irrespective of the service provider. The impact of this type of payment service may be compared to the impact of micro financing in many developing societies.

4 Mobile payment value chain

Introduction of a new way to initiate payments has the potential to change the usage of payment instruments systems. From the authorities' point of view, it is interesting which payment types, credit transfers, direct debits, card payments or proprietary payments, are growing and which may be declining. New ways to pay also have the potential to change the structure of the payments industry, the roles and participants of the service provision. These potential changes are discussed here based on value chain concept²².

In a basic payment value chain, the participants are the payment service provider, payer and payee and eventual service providers for these participants (Picture 1). In the traditional payments environment, the value chain is dominated by the financial industry, banks and payment card companies. When the mobile handset is introduced, new participants emerge at both ends of the value chain (Picture 2): mobile device manufacturer, application and

²² Porter, M. (1988).

terminal provider and mobile operator. This is true also for proprietary account systems, where there is transmission between the general payment system and proprietary system. These new participants are not dominated by the financial industry, which is a challenge to banks. The concept of mobile payment ecosystem sheds light on the new structure of the payment industry in a mobile world²³.

The changed value chain also demonstrates the fact that the use of a mobile device influences mainly both ends of the value chain: the payer and payee environments, while the payment transmission remains constant. This conclusion supports the chosen framework where mobile payments are considered just a new way to initiate payments. But it also reveals the fact that the use of mobile handset in payments does not automatically streamline the payment process but introduces new participants who need their share of the revenues generated. With end-customers unwilling to pay for paying, the business case for mobile payments may be challenging. This approach may contribute to future research on e.g. the efficiency of mobile payments.

²³ MobeyForum (2008).

Chart 1. Traditional payment value chain

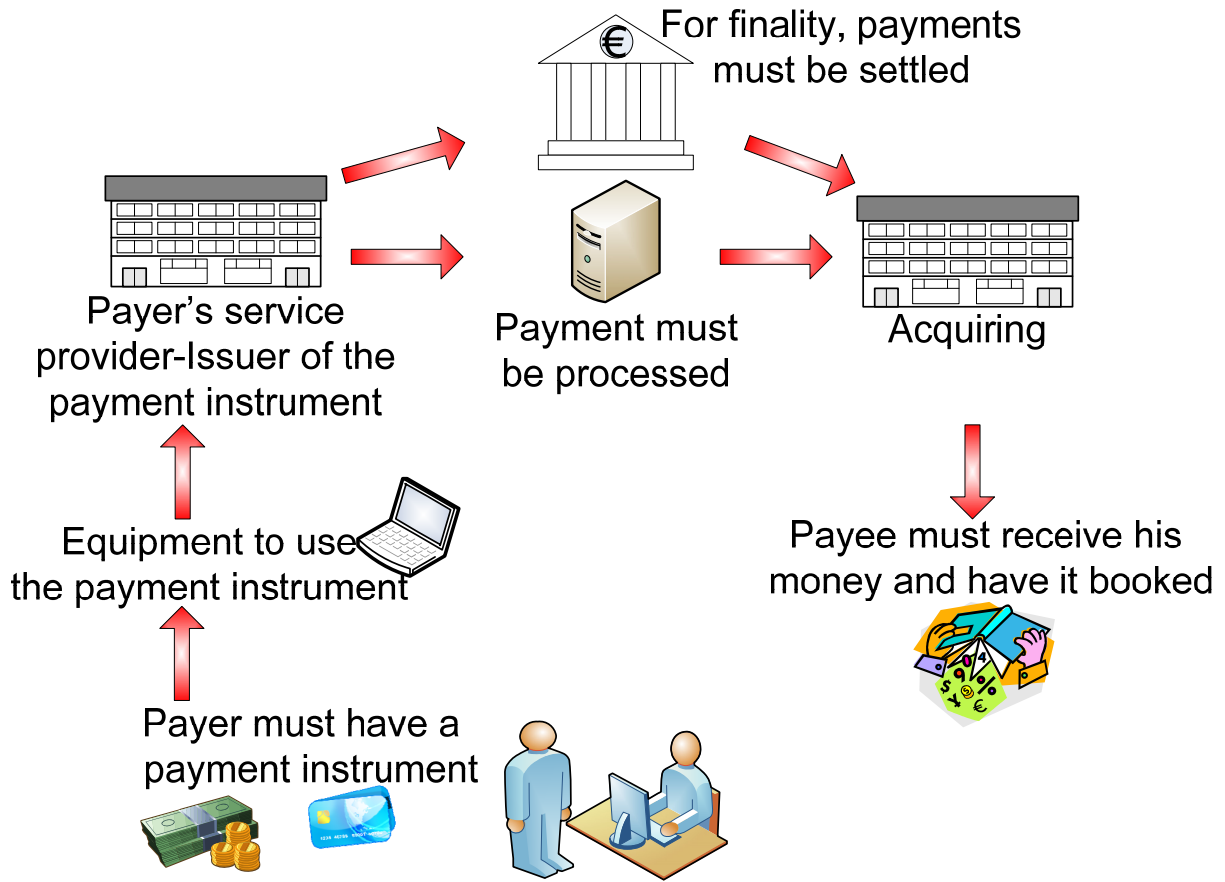
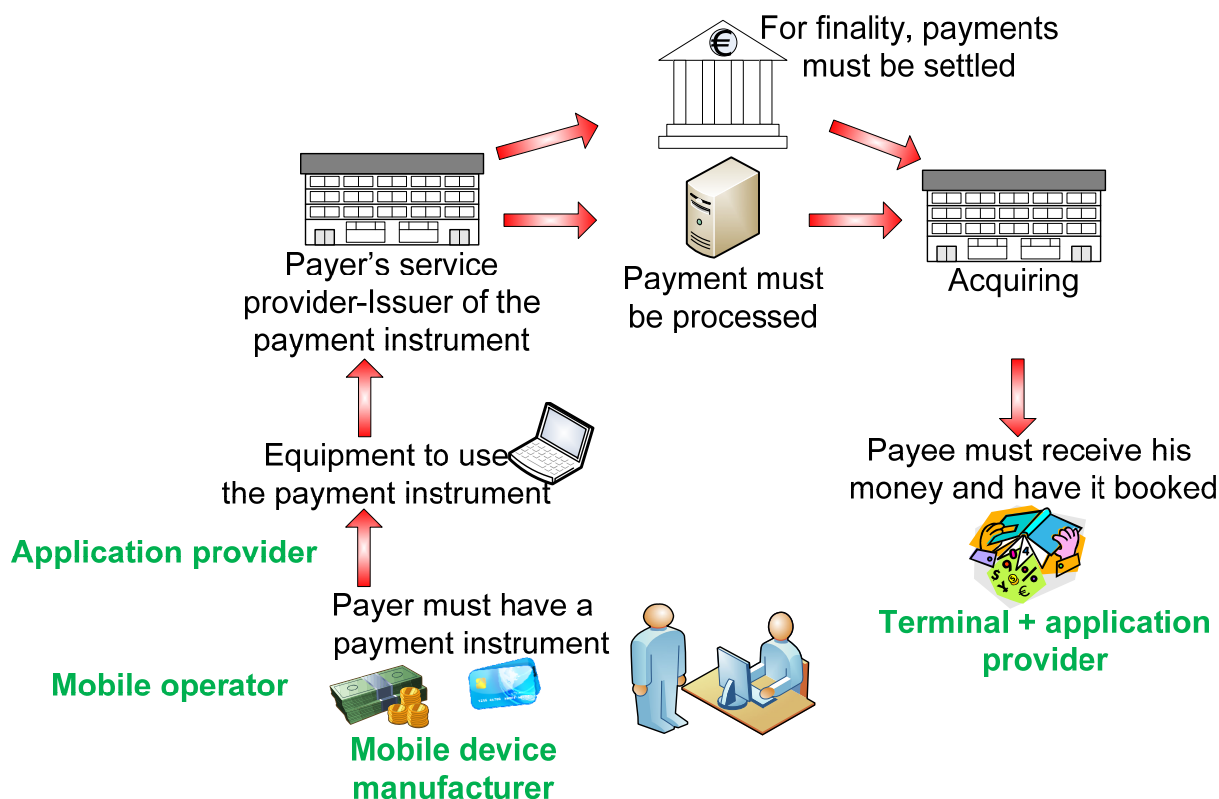


Chart 2. Mobile payment value chain



The main players in the mobile payment value chain are financial institutions and mobile operators. The final success of mobile payment services depends on the co-operation and power-plays between these two entities. Terminal and application service providers will follow the leader, whichever it is. A fruitful outcome might be balanced co-operation between the two. Based on previous experience from banking and insurance and retailing, co-operation for synergies across business sectors is not always encouraging.

4.1 Financial institutions' role

Financial institutions manage the payment systems. However, they do not offer payment services in a vacuum but as part of financial services: accounts and credit. In many cases, the payment services are considered as a side product for overall customer profitability. These services are developed either to increase the internal efficiency of producing these services or to attract customers to the institutions' other services. Considering the slow development of mobile payment applications by banks, this may be one reason why banks seem to lag behind mobile operators or even card companies in this respect. Financial

institutions have been facing a stream of sizable mandatory changes during the last decade: starting with Y2K, euro in Europe and new accounting and prudential requirements. There has not been much space for product development for payments. This is notwithstanding the fact that without payment services banks would lose the tight daily connection with their customers. It is very much in banks interest to keep the payment industry in its core business and dominance.

Payment card companies' main product is the credit next to payment. Though most of the mandatory requirements described above also apply to them, in times of economic boom they have been in a better position to look at new technologies. Card companies compete fiercely with each other, which creates an incentive to develop new products for customers. This probably explains why the payment card companies have been so active, and why most payment applications launched for mobile handsets have been by card companies.

4.2 Mobile operators' role

Mobile operators are the ones in charge of the SIM-card, and in many countries they also dominate the handset markets with their combined product offerings. Their main income has been from the fees for calls and data transmission. For these obvious reasons, MNOs have much effort into finding ways to generate new business. Having the customer base and billing systems in place, payments have been a natural area to explore. Concerning SMS-based payment applications, the revenues are generated in two ways: from payment service fees and from increased SMS traffic.

Comparing the roles of financial institutions and MNOs, there are similarities but also fundamental differences: the financial institutions own the payment transmission channel and the MNOs own the payment initiation tool [SIM, (UICC delivery) handset]. Both have a customer base, but the their customer contact differs greatly: while a normal bank customer uses his web bank 4–5 times a month²⁴, checks his balances and uses his payment cards on regular basis, a MNO customer hardly has a contact with his service provider unless there is something wrong with his invoice or pre-paid loading. Customers, both consumers and businesses, are used to financial institutions' services for payments, they have established ways to do so, and there is a certain amount of trust in the industry. MNOs lack these advantages, and they must create the acceptance network from scratch. MNOs also enter new terrains when expanding their credit line per customer: typically MNOs have lots of

²⁴ Average usage of a Finnish web bank customer, according to informal industry information.

customers, but the credit risk per customer is relatively low. When entering the payment industry, the per-customer credit may increase, creating pressure for financing and capital.

The regulatory framework also frames MNOs possibilities to expand its business: at least in Europe, when acting as a general payment service provider, an MNO must become either a credit institution or a payment institution. This requires not just adoption of capital requirements but also of other supervisory and information requirements.

4.3 Co-operation of financial institutions and mobile operators

A successful mobile payment application requires the key competences of the two industries, the financial sector and MNOs. According to EPC, there are over 6,000 banks active in the payment industry in Europe²⁵. GSMA represents about 850 MNOs²⁶. For a general way to pay with a mobile, all, or at least the vast majority of these market participants should be linked with technical interoperability and common rules. This can be reached in several ways: financial industry may expand to mobile industry (Rabobank + Rabo Mobile), mobile industry may expand to financial industry (NTT DoCoMo) or they may bind alliances, either led by one or through a third party. The Mobey Forum Mobile Business Ecosystem²⁷ identifies the function of a Trusted Service Manager (TSM) as balancing and bringing together various payment service providers and mobile operators. A TSM structure could ensure interoperability between different mobile networks and payment schemes. It also brings one more participant to the value chain. Currently, there are some companies providing this type of service²⁸. However, they can gain a position in the value chain only with the consent of both banks and MNOs.

Non-SMS-based payment applications require a delivery process for bringing the payment application to the payer's handset. This is one of the key questions in the success of a mobile payment application. There, analogy to existing payment instruments does not provide very good guidance but new models and processes are needed.

When getting a mobile handset, the MNO provides the phone holder with SIM, subscriber identity module, which enables the use of the phone. To make the payment application a natural part of the mobile handset, the platform should be delivered at the same time with the phone and the SIM. Unless banks wish to start delivering mobile handsets or UICC chips to

²⁵ EPC (2008).

²⁶ GSMA (2008).

²⁷ MobeyForum 2008.

²⁸ We are aware of Venyon, Gemalto and Motorola services.

their customers, the MNOs have the critical role in the value chain for facilitating the payments platform. Another option could be a dual-slot phone, where the SIM and other applications are located in different chips. This requires the phone manufacturers' clear stance in preferring this option. So far the phone manufacturers have not seen enough demand for such differentiated products, but if the co-operation of MNOs and payment industry does not prove fruitful, there might be willingness to reconsider.

The payment application can be readily available in the UICC. It may also be loaded to the chip at a later stage, either by visiting a service provider or over the air (OTA). Management of OTA services belongs to the core competences of TSMs. However, when upgrading the chip with sensitive data, e.g. e-identifiers or payment application data, the customer must be indisputably identified. Hence, a stepwise approach is most likely required: the customer verification tools are delivered to the platform in a face-to-face contact, whereas payment applications may thereafter be uploaded OTA.

Compared to existing payment schemes, the mobile schemes require participation of at least one, possibly two other players, who both need to have their share of the revenues. If end-customers are not willing to pay more for the mobile alternative, its success is dependent on the service providers' ability to agree on how the available revenues are divided, i.e. the cake does not grow bigger by introducing the mobile, but it must be divided between more participants than before. Without solving this dilemma no bank – MNO – TSM co-operative model can work.

Industry convergence has proven successful in Japan, where NTT DoCoMo has introduced banking services to support its mobile payments. In Europe, such development has not happened yet, but the current financial markets turmoil may enable MNOs to expand their operations to payments. In the Netherlands, Rabobank has its own MNO, RaboMobiel, which enables SMS-based payments and makes it possible to link mobile payments to the general payment system. It might be too daring to speculate about the future, but since the previous industry convergence happened between insurance and banking for investment services, the next wave may be between mobile operators and banking for payment services. The development would only be logical, considering the high dependency of banking on ICT in general and of payments especially. The main question is, in which terms this co-operation or convergence is happening.

5 Conclusions

By analysing the current supply of mobile payments from the payments, technology and value chain points of view, there seems to be justification for redefining the concept of mobile payments: this paper suggest that mobile payments mean the use of payment services other than Internet banking using a mobile handset, its keyboard and display. This definition is very close to the definition of the ECB, but it recognises the mobile phone's characteristics as an element in the definition. By this definition, the mobile handset is understood simply as a tool for accessing various payment services.

Based on the elaborated definition, payments initiated with mobile handset are just payments: card payments, credit transfers or proprietary system's payments. Hence, no separate regulation should be needed to ensure their reliability: existing regulation on retail payment services should be applied. Similar requirements for reliability, contingency, security and anti-money laundering must apply to all payments, irrespective of the way of initialising them or the operator providing these services. Also the institutional requirements should be the same.

When analysing existing mobile payment schemes from the end-user's perspective (payer and payee), it seems like schemes utilising existing payment infrastructure – card payments or credit transfers – have the best possibilities to evolve into widely accepted payment methods. As security plays an important role in customers' acceptance of new technology, the use of a multifunctional chip (UICC) for enhanced security may provide the best platform for payment applications. NFC for card payments could be the easiest application to spread through the economy. In developed countries, mobile payments compete with existing payment methods and ease of access and use are prerequisites for a successful mobile payment scheme. End-users' price sensitivity creates a challenge to viable business models.

There are good arguments favouring the banking industry as the service provider also for mobile payments. For quick adoption of a new payment method, banks have the trust, the customer relationships and the acceptance network of existing payment instruments as their advantage; banks have a close relationship with end customers, both payers and payees. Their comparative advantage is also in the reliability and familiarity of their payment services – introduction of a new way of initiating payments could be quite easy.

For reasons like numerous mandatory changes or the role of payments in banks' service portfolio, the banking industry has not been very active in developing mobile payments, and

payment card companies and mobile network operators have created more services and trials. The leading role in retail payments is critical for banks' other businesses, accounts and lending; hence it is important for the banking industry to carefully follow developments in mobile payments and to make use of its comparative advantage in the area.

MNOs are best positioned to deliver the payment application platform to the customer, be it embedded in the phone or in UICC. A separate NFC chip could theoretically be delivered separately, but without a fully standardised phone-NFC-interface, it could not make use of the phone's or UICC/SIM-cards' intelligence. That kind of application would undoubtedly be only of rather limited use.

For MNO-centred mobile payments to spread out across consumers, MNOs should be able to co-operate. For a general payment instruments, MNOs need banks' settlement and payee network. It is difficult to see how any of the two main players could create mobile payments alone. However, e.g. under European jurisdiction, MNOs have an option to become payment institutions and claim access to sufficient retail payment systems in order to bypass the banking sector. This could lead to banks losing part of the payment industry to these new institutions. It remains to be seen if any of the Trusted Service Managers can create enough coverage – banks and MNOs – to become an integrating player in the mobile payment market.

In all cases, introduction of the mobile handset in payment initiation introduces new participants into the payment value chain. All these new participants must see payments as a lucrative business area in order to play along. This, however, creates pressure on the fees imposed on end-customers, payers and payees. Traditionally, end-customers are very sensitive to payment instrument pricing, and in developed countries they also have alternative ways to pay. All mobile payment systems face the challenge of a viable business model in a highly fee-sensitive environment.

The different environment in developing countries requires a different approach by market players. Currently in many cases the MNO has created a payment system where its own shops or other co-operators act as service points, i.e. redeeming airtime for cash and vice versa. This has been enabled by the different regulatory environments in these countries – in developed countries such services would require a banking licence. For the benefit of developing countries' mobile payment users, it is important to create sufficient regulation for these payments. The developed countries, however, do not necessarily provide a good example, as the different environment must be taken into consideration. The benefits generated by current mobile payment systems certainly exceed their risks, even if they would

be unorthodox by developed-country standards. In time, when balance between banks and mobile operators is achieved, there will be no obstacle to this type of scheme to becoming viable also in developed countries.

From the central bank point of view, the operations of mobile payments and their linkage to payment systems and business models are an interesting area for further research. Mobile payments have the potential to change the payments landscape and also the structure of the payment industry. Oversight of payment systems is focused on the smooth functioning and efficiency of payment systems. Many central banks also have a role as a catalyst for further development of payment infrastructure. In these capacities, the central banks need further information and understanding of both the functioning of various mobile payment schemes and the conditions and functioning of mobile payment markets. In its description of the mobile payments value chain, the efficiency of mobile payments has been questioned by this paper. Elements of efficiency, costs and revenues from both the end-users' and service providers' side, would deserve deeper analysis. Hopefully, the framework presented in this paper will prove useful for that purpose.

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