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Factors Affecting the Successful Introduction of Mobile Payment Systems

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Abstract

A prerequisite to carry out transactions using a mobile phone is an effective mobile payment system. However, no standardised, widely adopted mobile payment system has yet emerged, and this is believed to be one of the factors that inhibits widespread use of mobile commerce. This paper reports on a research project in which the factors are examined that affect the introduction success of mobile payment systems.

We start from the venture point that a lot can be learned from research on internet paying systems, payment systems that have been introduced to facilitate payments made over the internet. First we transferred factors affecting the introduction of internet payment systems to a mobile setting. We then contrasted this list with the views of 13 executives we interviewed in Sweden and the Netherlands.

We found that while many factors are at play at the same time, a subset of these stood out at the early stages of the lifecycle of mobile payment systems. In the area of consumer acceptance, these are their cost and their ease of use relative to other payment methods, and the perceived risk. In the area of merchant acceptance, transaction fees compared to debit and credit card systems are important, as is, to a significant extent, the ease of use for the merchant. Finally, both customer and merchant acceptance are highly interdependent as each influences the other, especially during the early stages.

1. Introduction

Given the sheer number of mobile phones around today, it is no surprise that the notion has been gaining ground that the phone can also be effectively used as a *transactional* device. In particular the telecommunications industry, looking for ways to increase revenue in unsettling times, firmly pursues the options available to allow consumers to pay for products and services using their mobile phones (Dornan 2001).

A prerequisite to carry out transactions using a mobile phone is an effective mobile payment system. However, no standardised, widely adopted mobile payment system has yet emerged, and this is believed to be one of the factors that inhibits widespread use of mobile commerce (Carlsson 2001; Kruger 2001). In one panel at last year's Bled conference, it was argued that "without standardised mobile payment solutions, the traditional problems of failure to complete transactions which are so prevalent in web-based EC would apply to mobile commerce as well" (Hampe & Swatman, 2001, p. 63).

This paper reports on a research project that examined the factors that affect the early implementation success of mobile payment systems. Mobile payments (or m-payments) are defined as payments that are carried out via the mobile phone (Kruger 2001). We define a mobile payment system, in line with Shon & Swatman's definition of an internet payment system (Shon and Swatman 1997), as "any conventional or new payment system which enables financial transactions to be made securely from one organisation or individual to another over a mobile network".

Relatively little has been published on the factors that affect the introduction of mobile payment systems (see Kruger, 2001 for an exception). No doubt this can be attributed to the sheer novelty of these systems, and the turbulent markets that these systems have been facing since their market introduction. All of this makes it difficult to observe and study them at this point in time. To overcome this issue we have started from the venture point that a lot can be learned from research on *internet paying systems*, payment systems that have been introduced to facilitate payments made over the internet. Specifically, our approach has been the following. First we transferred factors affecting the introduction of internet payment systems to a mobile setting. We then contrasted this framework with the views of 13 executives we interviewed in Sweden and the Netherlands.

This paper is organised as follows. The next section will introduce mobile payment systems in more detail and discuss their structure, the market players, and several examples. We then focus on previous work related to factors affecting the successful introduction of mobile payment systems. In particular, we examine the literature that discusses electronic payment systems in general. Section 4 describes the design of our empirical research in more detail. In section 5, we contrast the results of the empirical study with the literature. The last section presents some conclusions and directions for further research.

2. Mobile Payment Systems

Although the implementation details of different mobile payment systems vary, their structure is quite similar (Kruger, 2001, Figure 1). First, a customer and a merchant agree on a transaction and either one of them notifies the mobile payment service provider. The mobile payment service provider confirms the transaction to customer via his/her mobile phone and then asks the customer for approval. Once approved, the provider administers the transaction and stores the appropriate fund transfer instructions. Periodically, these payment instructions are cleared, resulting in net payment instructions. Settlement can take place in a variety of ways. On the merchant's side, it is usually the bank account which is updated. On the customer's side, one of a prepaid account, a bank account or a credit card account is updated. Also, in many payment systems a monthly bill is sent, similar to the monthly phone bill.

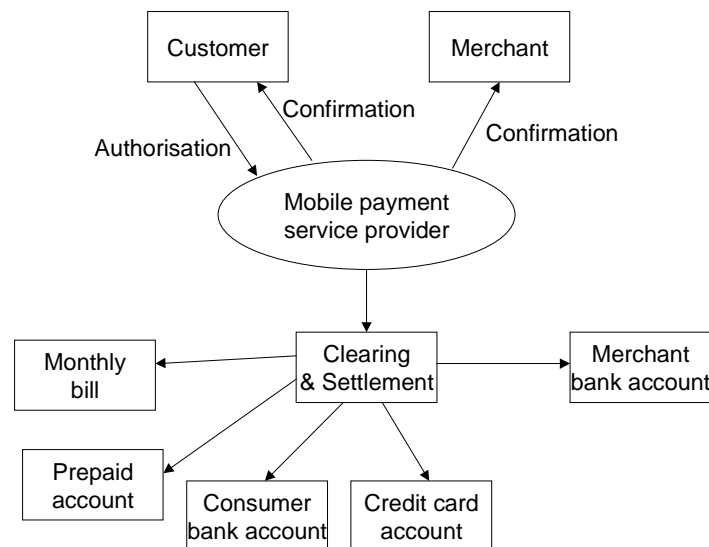


Figure 1: The Structure of Mobile Payments (adapted from (Kruger 2001), p. 15)

In a typical retail environment, it is the terminal at the point of sale who calls the provider. The provider then notifies the customer by calling his or her mobile phone. Approval takes place by entering a PIN-code. Some mobile payment systems do not require PIN-code approval for small payments. In that case, just pressing one button on the mobile phone is sufficient.

A notable difference between a mobile payment system and other electronic payment systems is the identification of the customer (and the merchant). In a mobile payment system, this identification is the GSM phone number. In other systems it is either the bank account number, or an interim account. The implication

is that one can send funds to and retrieve funds from a phone number, rather than the bank account. This is similar to payment systems that rely on the customer's e-mail address as the prime identifier (e.g. Paypal).

Because mobile payment systems encompass both the retail sector, the financial services sector and the telecommunications sector, their introduction is usually prepared by a consortium of market players. These players can include telcos, resellers, banks, credit card companies, 3rd party clearing houses, hard & software suppliers, solution integrators, retailers. Indeed, examples of consortia in almost any conceivable combination do exist today.

In Europe, a number of mobile payment systems are competing for market share. Table 1 lists a non-exclusive number of representative systems that are currently operational. An up to date, detailed overview of electronic payment systems in Europe, including mobile systems, can be found in the ePOS database, available online at <http://www.epso.jrc.es>, which is maintained by the Institute for Prospective Technological Studies in Seville, Spain.

Table 1: Representative Mobile Payment Systems in Europe

Mobile payment system	Home base
Paybox	Germany
Mint	Sweden
Paielement CB sur mobile	France
Mobipay	Spain

3. Previous Work on Internet Payment Systems

A number of authors have studied the factors that influence the success of an internet payment system (Clemons, Croson et al. 1997; Shon and Swatman 1997; Jayawardhena and Foley 1998; Bohle, Krueger et al. 2000; Turban and Brahm 2000; Turban, King et al. 2002). We will briefly discuss their work in this section.

A Delphi study carried out by (Shon and Swatman 1997) on effectiveness criteria for internet payment systems (IPS) revealed 15 factors distributed over six types of stakeholders: financial institutions, IPS providers, merchants, consumers, regulators and network providers. *Security* and *reliability* was important for almost all groups. *Lower transaction costs* were favoured by merchants, consumers and financial institutions. *Scalability* and *universality* were important factors for network providers. *Flexibility* was also important for merchants.

In a study of the Mondex system, an early alternative for cash in the beginning of the 1990's introduced by Mastercard, (Clemons, Croson et al. 1997) consider the factors affecting success of this new payment system. They argue that the issues are

not “simply whether benefits from the product will exceed the costs of its creation assuming that it is adopted, but rather issues of channel coordination, consumer acceptance, and merchant acceptance. The feasibility of the initial business case rests on gaining a critical mass of consumer and merchant acceptance” (p. 256). Critical mass is closely related to the universality requirement, as an important indication of critical mass is how universally available the payment system is. Poon & Chau (2001) studied the e-payment system Octopus, an alternative for Mondex, and also concluded that critical mass (which they term network goods leverage) and standardisation are important requirements for the success of any new payment system.

Jayawardhena & Foley conclude that there are three types of requirements for every internet payment system (Jayawardhena and Foley 1998). The degree to which an internet payment system can meet these requirements determines its success. There are requirements related to the transaction itself (1), to the security of the transaction (2), and other requirements (3). Transaction requirements include *cost*, *flexibility*, *ease of use*, *fungibility* (exchangeability), and *universality* of the payment system. Security requirements include *privacy*, *anonymity*, *trustworthiness*, and the extent to which the payment system is backed up by a *regulatory framework*. Other requirements include *transferability* of value, integration with *back end systems*, *unobtrusiveness*, *scalability*, *remote access*, *functionality*, and *user support*.

In a study of the strategic issues surrounding electronic payment systems, Bohle et al (2000) identify four issues that are related to „the demands of different actors who shape and constrain the corridor of future retail payment systems“ (p. 2). These are *regulation* (1), *standardisation* and *interoperability* (2), consumer *protection*, *anonymity*, *privacy* and *security* (3), and *integration* of payments into online transactions (4).

Finally, Turban et al. list a number of crucial factors that determine whether an internet payment system will achieve widespread acceptance (Turban, King et al. 2002). These are independence, interoperability and portability, security, anonymity, divisibility, ease of use, and transaction fees. *Independence* refers to the degree to which the system requires specialised hardware and software. *Interoperability* refers to the degree to which the system can integrate with back-end systems. E-Payment systems should minimise the risk run by buyer and seller (*security*) and not disclose information that trails a buyer to the transaction (*anonymity*). *Divisibility* refers to the spectrum of transaction amounts that a system supports, and *ease of use* to the degree of effort associated with making the transaction. A final factor that influences the acceptance of electronic payment systems is the amount of *transaction fee* charged to the merchant and/or to the consumer.

In Table 2 we have tried to synthesize these studies and arrive at a common set of factors that could influence the success of electronic payment systems. These factors provide the preliminary set of factors that influence the success of *mobile* payment systems.

Table 2: Preliminary set of factors influencing the success of mobile payment systems

Factors	Related factors	Mentioned by authors
Cost	Transaction fees	(Shon and Swatman 1997; Jayawardhena and Foley 1998; Turban, King et al. 2002)
Ease of use	Flexibility, unobtrusiveness	(Shon and Swatman 1997; Jayawardhena and Foley 1998; Turban, King et al. 2002)
Security	Reliability, Privacy, anonymity, trustworthiness, regulatory framework, regulation, consumer protection	(Shon and Swatman 1997; Jayawardhena and Foley 1998; Bohle, Krueger et al. 2000; Turban, King et al. 2002)
Technical feasibility	Integration effort, interoperability, scalability, remote access	(Shon and Swatman 1997; Jayawardhena and Foley 1998; Bohle, Krueger et al. 2000; Turban, King et al. 2002)
Independence		(Turban, King et al. 2002)
Universality	Critical mass, Transferability, divisibility, standardisation	(Clemons, Croson et al. 1997; Shon and Swatman 1997; Turban, King et al. 2002) (Jayawardhena and Foley 1998; Bohle, Krueger et al. 2000)
User support		(Jayawardhena and Foley 1998)

4. Study Design

In order to get a better grip on the set of factors that affect the success of mobile payment systems, we decided to carry out an empirical study. The subjects of our study were executives who were directly responsible for the introduction of mobile payment systems. The interview research method was selected because we felt that a rich, qualitative response would provide more insight than relatively standardised survey responses.

Eventually, we decided to conduct interviews with executives in one of the leading Scandinavian regions on mobile commerce: Stockholm, Sweden (in particular the Kista area). The market penetration of mobile phones in Scandinavia is very high if not the highest in Europe. Because of this, many international companies have set up mobile and wireless competence centers in Stockholm and Helsinki to experiment with new mobile services (Kviselius 2001). Also, there are at least two mobile payment systems fully operational in the Stockholm area, so we could benefit from the experience that was gained during the introduction of these systems.

Table 3 lists details about the interviews that were carried out in Stockholm. All the interviews took place in Winter 2001.

Table 3: Interviews held in Stockholm

Nature of company	Role of persons interviewed
Wireless competence center of U.S. soft and hardware supplier, located in Stockholm	Manager market development
Wireless competence center of U.S. hardware supplier, located in Stockholm	Director EMEA wireless center
Swedish startup hosting mobile payment solutions at the Point of Sale	Chief Operations Officer
Swedish startup selling B2B payment infrastructures	Chief Executive Officer
German startup hosting mobile payment solutions for P2P (person to person) funds transfer	Head of Consumer Sales
Swedish startup selling SMS services (also payment-related)	Director Business Development Product Marketeer
Wireless competence center of pan-European consulting firm, located in Stockholm	Head of Mobile Business consulting practice

Each of the interviews had the following structure. First, we introduced ourselves and explained the nature of our study. We then continued by explaining in brief the factors as identified in the previous section. The interviewees then explained their role in the mobile payment market and we continued by discussing each factor in greater detail. Also, we asked the interviewee whether he or she had encountered any specific bottle-necks or drivers of success that we had failed to identify so far.

To corroborate our findings, we decided to discuss the results with a number of executives in a different region in Europe: Amsterdam, the Netherlands. Similar to the Stockholm area, the region of Amsterdam has also an active mobile industry, and many new companies have been set up to exploit mobile opportunities. Confirmation or disconfirmation of the results in a different European region would strengthen our results and give us some right to claim pan-European generalisability (although admittedly, Stockholm and Amsterdam are not that culturally different when compared to other European cities).

Our approach in Amsterdam was similar to the approach in Stockholm. We also had the opportunity to invite the Dutch executives for a round table discussion, which took place after all interviews were conducted. Table 4 lists the executives who participated in the interviews and the round-table discussion in Amsterdam, which also took place in the Winter of 2001.

Table 4: Interviews Held in Amsterdam

Nature of company	Role of persons interviewed
U.S. soft and hardware supplier, Amsterdam office	Sales development manager
Large Dutch retail bank	Mobile business manager IT division
Dutch mobile telecommunications company	Senior manager Business development and partnerships VP Strategy and business development
Dutch solution integrator	Chief Commercial Officer
Large Dutch retail company	Head of E-business department Manager Customer Relationships Management
Dutch startup selling mobile business solutions	Chief Executive Officer

In the following section we will convey the results of our empirical study and link these results to the previous work from section 3.

5. Discussion

Rather than exposing the responses for each interview session individually, we have summarised and synthesised the various results in a number of key findings. Our overall finding was that the market players were skeptical, sometimes even cynical about the succesful introduction of mobile payment solutions. Certainly, there were no signs of massive take-up in both countries. This may well be a sign of the times, because in Winter 2001 the situation for the mobile industry looked particularly gloomy. For example, one interviewee explained that his company had participated in mobile payment experiments in multiple countries and with multiple participants. Neither of these had been very succesful and because of this he advised us to go back home and conduct another, more promising research project. While not every interviewee took this pessimistic stance, the general feeling was similar.

Of course, what was and still is interesting to us is *why* mobile payment systems had not been that succesful so far and *why* it was that not every participant agreed that it would be succesful in the future. Do the factors that were identified in the context of internet payment systems play a role, or were there other factors? The remainder of this section deals with these questions.

We observed that a mere list of critical success factors does not fully do justice to the fact that the introduction of a mobile payment system is a complex economic

game with multiple stakeholders. As in most markets with network externalities, the acceptance and use of the system by one stakeholder is highly dependent on the acceptance and use of the system by another (cf. discussion of this subject by Shapiro & Varian, 1999). The executives argued almost unanimously that merchant acceptance, consumer acceptance, telco acceptance, and bank acceptance were highly interdependent requirements, and that critical mass in one area would certainly impact critical mass in another area, and vice versa. Some of them felt like playing on four different chess boards simultaneously, and when they moved one chess piece on one board, various other chess pieces on the other boards would move at the same time, in unexpected ways. It is no surprise that such a complex management challenge, in the presence of bounded rationality, leads to 1) less than optimal results, 2) a more than average dependence on luck, and 3) radical attempts by the players to simplify the problem and to make it managerially tractable. Some mobile payment systems effectively ruled out, or „by passed“, banks *and* telcos in the beginning of their life cycle, because the complexities of dealing with these market players were simply beyond what the players could bear at that stage. Focusing on consumer and merchant acceptance and getting both of them to work at the same time was already hard enough.

While the interviewees agreed that bottle-necks could occur on all four „chessboards“, the merchant chessboard was particularly challenging. This had to do, in large part, with the fact that merchants were eventually the ones who would *pay* the payment system provider for their services, in a vein similar to credit card issuers. While every effort was made to reduce or eliminate transaction fees for consumers (such as a toll-free number to call the payment system), the merchants were frequently ear-marked as the prime source of revenue. Many merchants of course, are small and medium enterprises, and do not like the idea of paying for something when there are acceptable, free substitutes such as cash around.

The executives in our interview sessions who represented large retail organisations had a different view on this subject however. They saw mobile payment systems as a viable alternative to the debit card and credit card systems, in particular because mobile payment systems would charge lower transaction fees. Since the banks and the large credit card companies have a great deal of power because of their large customer base, merchants found it difficult to negotiate transaction fees with these parties. By introducing mobile payment in their stores, an alternative to the debit cards and the credit cards could be offered to consumers. As one executive said, „we are extremely interested in anything that transfers payments cheaper than debit and credit cards. But it has to be as fast and preferably faster.“

Another merchant acceptance issue was the ease-of-use at their side of the payment system. The shop attendants did not always know what to do when a consumer indicated he or she wanted to pay via the mobile phone. While initial training was of course provided by the payment system provider, the merchants tended to forget how to operate the system as time went by. Furthermore, there is always some turnover in retail shops, so new employees arrived who were not aware of the mobile payment system. Clearly, when shop merchants show anxiety in using the

system and „press the wrong buttons“, consumer confidence in the mobile payment system is unlikely to increase. And if these consumers, early adopters so valuable in the early stages of a new product, have a bad initial experience with the payment service, this is simply critical. Interestingly, one payment system provider attempted to beat this challenge by instructing his employees to systematically visit every shop that had accepted the payment system and to pay something using the system. This ensured that the mobile payment system was kept operational by the merchant and that the shop attendants did not forget how to operate it.

As noted earlier, the traditional alternatives available to consumers to pay for a product are difficult to beat. The advantages of physical cash exchange are clear: it is simple, fast, and there is no additional cost involved. Because of this, most mobile payment systems provide the service *free* to consumers, and continue to do so because switching back to cash is very easy for all consumers. Taking a more competitive viewpoint, one could argue that mobile payment systems compete with cash for the consumer's favour, and the consumer places value on one payment system by taking into account the value offered by the „competition“. For this reason, both cost and ease of use are typically evaluated in their relationship to other alternatives, such as traditional cash.

The interviewees agreed that in particular the calling of a phone number (10 digits most of the time) by either consumer or merchant to initiate the transaction was too time-consuming and too error-prone. Alternatives to overcome the usability problems were coming available on the market however. In particular, the technology to „identify“ a certain mobile phone using a desk panel was deemed promising. When the panel at the merchant desk had identified the phone, it could call the mobile payment provider automatically with the payment information. This would eliminate the manual calling of the phone number. A promising development also includes the integration of mobile payment systems with loyalty cards, who can be used at the P.O.S. to identify the customers and to call their mobile phones. At the time this study took place (winter 2001), these technologies were still relatively immature and were not incorporated in the mobile payment systems that were operational.

Looking back to the preliminary set of factors identified in section 3, we can observe that many of the factors that were identified in previous work also play their role in mobile payment systems. The interviewees emphasized merchant acceptance and consumer acceptance (*universality*), and stressed the importance of *cost* (transaction fees) and *ease of use* for both parties. Bank acceptance or telco acceptance were important too, but many executives (including those working for banks and telcos) agreed that this would not be too great a problem if merchant acceptance and consumer acceptance did materialise.

Security was emphasized, both for merchants and for consumers, but it was usually framed in a factor that can best be described as *perceived risk*. Most of the payments done through the mobile payment system are micropayments, and if for one reason or another the transaction fails, the damage done would not be particularly great. Many believed that the development of confidence in the mobile

payment system by taking appropriate security measures would positively affect perceived risk.

Technological feasibility and user support, two other mentioned factors, were de-emphasized by the interviewees. We suggest this is because 1) these factors were being treated like *hygiene* factors, and 2) these are issues that were largely *under their own control*. User support and technological feasibility were almost taken for granted: these are features of a mobile payment system that just have to be there. However, when they are present, they will not by themselves contribute to consumer and merchant acceptance – a typical characteristic of a hygiene factor. Second, the market players were confident that they could solve any technical irregularities by themselves. Because it is human nature to worry more about the tasks of those beyond your control than those within your control, this may be the reason why they did not regard these factors as critical for the acceptance of a mobile payment system.

Independence, e.g. the degree to which specialised hardware and software needed to be installed, was mentioned too by the interviewers (e.g. the desk panel in the shop). One can argue however, that eventually, independence boils down to issues of cost and ease of use. For example, the original set of factors assumed that additional installment of hardware and software will be costly and less easy to use. Thus, the more independent the system, the higher the acceptance. Yet, the desk panel technology was embraced by the interviewers, and so this would appear to conflict with our preliminary set, but in this case, the additional hardware would actually *increase* ease of use.

We have synthesized the critical factors for the succesful introduction of mobile payment systems in Figure 1. In this graphical framework, we have tried to adapt the original set of factors to what we have learned during the interview and round-table sessions. In summary, these enrichments are: 1) the explicit separation between consumer and merchant acceptance, 2) the dynamics between these stakeholders (rather than simply listing the *universality* factor), 3) the emphasis on factors the interviewees deemed important, and 4) the de-emphasis of factors that are less critical.

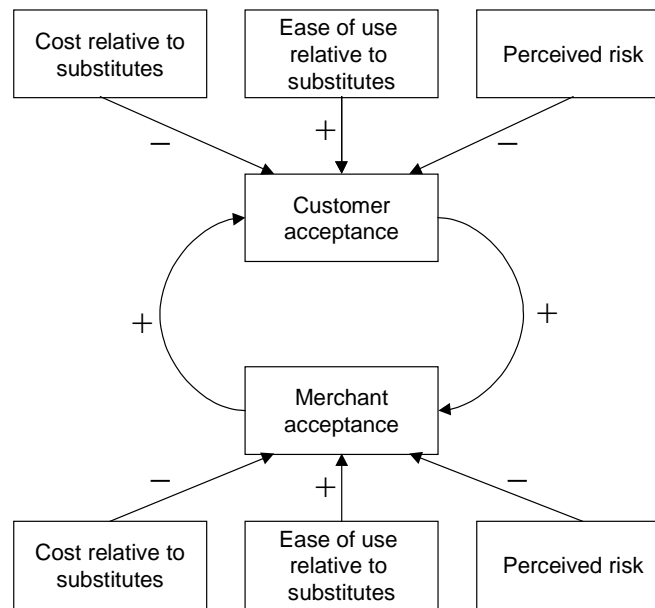


Figure 2: Factors Affecting the Successful Introduction of Mobile Payment Systems

6. Conclusions and Further Research

In this paper, we have conceptually and empirically investigated the factors that affect the success of mobile payment systems. While many factors are at play at the same time, a number of them stood out at this early stage of their lifecycle. In the area of consumer acceptance, these are their cost relative to other payment methods, their ease of use, and their perceived risk. In the area of merchant acceptance, transaction fees compared to debit and credit card systems are important, as is, to a significant extent, the ease of use for the merchant. Finally, both customer and merchant acceptance are highly interdependent as each influences the other, especially during the early stages of the lifecycle.

For practitioners who develop and introduce mobile payment systems, these findings have a number of implications. First of all, we believe merchant acceptance and consumer acceptance should be addressed and targeted separately, as each of these groups faces different requirements. Also, since the benefits of a mobile payment need to be addressed relative to substitutes, areas where the relative advantage is highest are especially attractive. These include, for instance, home deliveries, and car parking. A third implication is that building the customer base and the merchant base interdependently is one of the most important management challenges to get the mobile payment system successfully introduced.

In terms of further research, we recommend carrying out a more quantitative oriented study, for example a survey with consumers and merchants. This would give insight in the relative importance of each factor for the acceptance of particular mobile payment systems. Of interest would also be the opinions of those already exposed to a mobile payment system and those who are not, since this would give some insight into the degree to which such a system is actually an *experience* good (a good whose value can only be properly assessed after having consumed the good). Finally, an international study would also give insight in the degree to which consumers in different countries differ in their perception of the need for a mobile payment system.

We agree with Hampe and Swatman (2001) that standardised mobile payment systems are an important prerequisite for the widescale adoption of mobile commerce services. For this reason, we offer this study to practitioners and our academic colleagues. We do so in the hope that it will contribute to a sharpened focus on the critical factors affecting mobile payment solutions.

Acknowledgements

The author would like to thank Louis Kinsbergen for his support during this research, and Menno Schilder and Coen Wartenhorst for their assistance. Thanks also to the interviewees in Stockholm and Amsterdam for their willingness to participate in this project, and to Pablo Valiente for his valuable comments on an earlier draft of this paper.

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