

TRUST ENHANCED TECHNOLOGY ACCEPTANCE MODEL - CONSUMER ACCEPTANCE OF MOBILE PAYMENT SOLUTIONS

Tentative evidence

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ABSTRACT

This study aims to explore and model the central consumer perceptions that affect the decision of whether to use mobile payment systems. In particular, we study whether the Technology Acceptance Model (TAM) describing user acceptance of technology offers comprehensive explanation for consumer decisions related to adoption of mobile payments.

This study is based on two rounds of focus group interviews, the total number of subjects interviewed being 61. Our analysis suggests that the Technology Acceptance Model (TAM) provides a good basis to explain use of mobile payment solutions, yet, our data proposes that a new construct, trust, should be included into the model to augment the present descriptors in explaining consumer adoption decisions in the mobile payment context.

1. INTRODUCTION

1.1 The Development of Mobile Payment Solutions

The commercial history of mobile payment solutions¹ is short but at the same time characterized by rapid development. One of the first commercial mobile payment solutions was a service launched by the Finnish telecom operator Sonera in 1997, in which goods were purchased from vending machines

¹ The terminology related to mobile payments is vague and inconsistent. We define payment as a transaction in which money or funds are transferred from one party (payer) to another party (payee) directly or via an intermediary such as a financial institution. Payments are compensations for purchased physical or digital goods/services or fund transfers between transactions parties. Payments are carried out with payment instruments, such as coins or debit cards. Payment instruments can be classified into financial payment methods, such as cash or direct debit payment instruments. Mobile payment is defined as the use of mobile devices, such as mobile phone, to commit payment transactions. Mobile devices can be used both for proximity and remote payments. Payment transactions have also several other attributes, such as the timeliness, size and credit aspects of payment transactions. The term payment solution is used as a condensed concept, which includes payment method, payment instrument, one or more application areas (use cases) of mobile payments, technologies applied, payment transaction parties and other attributes of payment transactions.

with mobile phones and paid for with mobile operators' service bills together with mobile telephony services. New technological innovations used in mobile payment solutions and new application areas for mobile payments have been launched at an increasingly fast pace ever since. Technologies applied include among other things gateway based payment services such as charging gateway initiated payment brokering solutions, messaging based payment services such as short message (SMS) and multimedia message (MMS) initiated payments, stored value based payment services such as mobile wallets and accounts, and mobile identification and authorization based payment services such as the use of (secure) wireless identification modules (SWIM/WIM) together with (wireless) public key infrastructure (WPKI/PKI) or other identification and authorisation schemes used to provide digital signatures and certificates for large value payment transactions. The application areas of mobile payment solutions have broadened to include among other things vending, ticketing, purchase of mobile telephony services, mobile commerce (ring-tones, logos, news, mobile games...), electronic banking, peer to peer fund transfers, purchase from the Internet, and purchase of services/goods from service providers and shops. Mobile payment solutions cover all main financial payment methods; cash, direct debit, credit card, and payment against service bill.

Several industry drivers have been pointed out as explanations for the interest in mobile payments. Problems with payments are claimed to hamper severely the development of electronic and mobile commerce. This argument is valid, especially if one assumes that traditional payment solutions are inapplicable for one or another reason. Obviously, electronic and mobile commerce transactions cannot materialize unless goods and services purchased can be paid for in a secure, easy and cost-efficient way, which is at the same time acknowledged and accepted by all transaction parties.

Mobile payment solution providers have proposed several benefits in favour of their solutions. Although there is a big variety in the claimed benefits, almost all vendors argue that their solution is more secure, easier and faster to use than competing (traditional) solutions. Security claims are often based both on technologies used, such as PKI and (S)WIM, and on some basic characteristics of mobile networks such as that mobile networks are closed, monitored by mobile operators all the time and regulated by authorities.

There are several related arguments. If traditional payment instruments and mechanisms are used in the case of electronic or mobile commerce, the payment transaction is separated from the purchase transaction. This may result in lesser transactions due to a more difficult purchase and payment process. Buyers or sellers may also fear losses related to authentication and non-repudiation, ability to pay/deliver, illegal use of credit/debit card information, etc. For example, there are several studies, which show that consumers are unwilling to give their credit/debit-card numbers via the Internet.² Consequently, mobile payment solution vendors are tempted to propose that their solutions are able to solve these issues.

The majority of new mobile payment solutions address retail payment transactions, including so-called micro-payments.³ These solutions offer the possibility to pay for the purchase of small value physical products (e.g. fast food from a restaurant), vending (e.g. soft drink from a vending machine), ticketing (e.g. bus tickets), mobile content services (e.g. mobile phone entertainment), games, intangible services (e.g. Internet content), etc. The interest in new mobile payment solutions derives partly from

² On the other hand, the separation of purchase and payment happens in mail order and in payment against service bill transactions. Accordingly, instruments and mechanisms tested in such applications could be used in the case of electronic and mobile commerce transactions at least for large value transactions. However, new authentication and authorization solutions might be needed.

³ The monetary value of micro-payment is typically defined to be less than 10 USD or Euros. Another, practically at least equally valid concept is small value payment. Small value payments are payments the value of which is so small that it is not necessary to strongly identify the parties of the transactions or their right to possess the payment instrument.

expectations according to which effective payment solutions will make - at last - the charging of digital content and other intangible services economically feasible even when small fees are involved.

Mobile operators are also claimed to need new revenue sources to solve their financial difficulties and to create payment solutions for their new services. Currently, most of small value payments, if purchased via mobile devices, are paid for with mobile operators' bills. Operator could benefit both from payment transaction fees and from the revenues of new services. Financial institutions, merchants, service providers, mobile solution software vendors and consumers are also claimed to benefit from mobile payment solutions due to new services and new or lower payment fees.

As a whole, the development of mobile payment solutions has been rapid and can be estimated to remain so. Most, if not all, developed economies have witnessed both mobile payment pilots and commercial launches. Some of the most important US and especially European offerings are reported e.g. in Strategy Analytics (2002), ECBS (2003) and Bank of Finland (2003). The rapid development of mobile payment solutions parallels with a significant increase in the use cashless payment instruments - other than checks - during the last 10 years as reported e.g. by Gerdes and Walton II (2002) and Bank of Finland (2003). The Bank of Finland report also clearly shows that there are major differences between countries even between current European Union countries.

Yet, it is a challenging task to estimate how far mobile payment solutions have penetrated. Part of this problem relates to the definition of mobile payments. If the purchase of logos, ring tones, mobile content services, vending and ticketing paid for with mobile operators' bills is included in mobile payments, one can reason that as much as one fourth, one third or even half of mobile phone users have at least tried mobile payments as the penetration figures of these services are in these ranges in various countries. At the same time, the use of other mobile payment solutions - mobile wallets, separate mobile accounts, mobile banking, mobile use of debit and credit cards, etc. - is still only emerging.⁴

There are several issues that may potentially slow down the development of mobile payments and related services. As an example, we take a glimpse at some of the factors, which limit or may limit the development of small value payment services. Most service providers and merchants - whether they sell tangible or intangible goods/services - do not have direct access to sophisticated billing solutions nor to the development of mobile payment solutions. On the other hand, according to many jurisdictions including European Union, operators are not allowed to provide significant credit or account-based services to third parties, such as merchant and service providers, unless they are granted a financial institution or banking licence. In Europe, this has resulted in a situation where operators have abstained from offering non-operator services, have acquired banking licences and met competitive position related fears from banks, or have started to provide some of these services under their own brand. In the last case the terms of revenue sharing may leave a large part of the revenue with operators, in Europe typically at least 10 to 20 percent.

As a whole, there are still issues related to technology, the roles and responsibilities of various market participants, jurisdiction and its implementation, which need to be solved before mobile payment solutions become largely used. Another major issue is consumers', merchants' and banks' willingness

⁴ Compared to some previous estimates from 2000 and 2001, recent market analysts' reports see clearly more limited growth in revenue streams generated from mobile payments. For example, Strategy Analytics (2002) estimates that mobile payments for other types of goods and services than network operators' services will create only marginal, slowly growing revenue streams within the next 5 years. Another recent development is also mentioned. Most mobile payment pilots and launches so far have been operator, bank or vendor specific or backed by a few of them. These include some much heralded initiatives such as Paybox launched in several European countries and backed by Deutsche Bank. Although standardization work has been carried out all the time - in many competing and overlapping groups - there are signs that mobile operators, financial institutions and credit card companies have started both inter-industry and cross-industry discussions concerning mobile payment solutions.

to adopt mobile payment solutions. With the exception of practitioners' subjective experience and speculative arguments and markets analysts' insight and forecasts, there is little empirical evidence on such topics as what value do mobile payment solutions provide to their users or why would they want switch from current payment instruments to mobile payment instruments, e.g. to mobile wallet. As the user interface of mobile payment solutions falls into information systems domain, it argue that is beneficial to study mobile payment solutions not only as new payment instruments and new technological payment methods but as new technologies waiting for user adoption.

1.2 Technology Acceptance of Mobile Payment Solutions and First Remarks on the Role of Trust

Several theories have been proposed to explain user adoption and acceptance of new technologies. Diffusion of innovations (Rogers, 1995), perceived characteristics of innovations, PCI (Moore and Benbasat, 1991; Plouffe et al., 2002) and Technology Adoption Model, TAM (Davis, 1989; Davis et al., 1989) are among the most established ones. To understand issues related to the adoption of mobile payment solutions we conducted two series of focus group interviews based on these theories but not limited to them as the nature of focus group studies is largely explorative. In this paper we focus on the TAM as it has been largely used in earlier information systems research to explain users' adoption intentions and as the current adoption situation of mobile payment solutions can best be described as tests and trials if payments with operator bills are excluded.

We acknowledge that it is not possible to test statistically the TAM with the qualitative data collected in the focus group sessions. That is not the purpose. Rather, we seek to evaluate its comprehensiveness as a model describing consumer adoption of mobile payment solutions as a reference for future empirical research.

This paper presents the main findings of our focus group studies. In particular, we charted the effect of trust on consumers' adoption decisions. As a result of the focus group studies we propose a new trust enhanced TAM to be tested later for validity with mail surveys.

2. TECHNOLOGY ACCEPTANCE MODEL

We chose the Technology Acceptance Model (TAM) as a theoretical basis for its parsimonious yet powerful capability to explain technology usage. TAM has been widely applied in various research of information systems use (for a recent review of TAM see e.g. Legris et al., 2003).

TAM (Davis, 1989; Davis et al., 1989) proposes that two particular beliefs, perceived usefulness and perceived ease of use, are the primary drivers for technology acceptance. *Perceived usefulness* stands for "the degree to which a person believes that using a particular system would enhance his or her job performance" and *perceived ease of use* for "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Perceived usefulness and perceived ease of use then affect jointly to a person's attitude toward using the system and thus further to behavioral intention to use the system, which then leads to actual systems use.

Several measures have been used for the TAM factors (see e.g. Davis, 1989; Legris et al., 2003; and Venkatesh et. al., 2002). The measures of perceived usefulness include performance increase, productivity increase, effectiveness, overall usefulness, time savings, and increased job performance. Correspondingly, measures for the perceived ease of use include ease of learning, ease of control, ease of understanding, ease of use, clarity, and flexibility of use.

Various additions and modifications to TAM have been proposed since the original model was introduced. Davis et. al. (1992) proposed a new model, motivational model (MM), where one factor was renamed and one additional factor was introduced. The two new factors were labelled extrinsic motivation and intrinsic motivation. Extrinsic motivation describes an individual's personal gain

associated with the use of a particular technology and it replaced perceived usefulness. Respectively, intrinsic value describes the perceived enjoyment associated to the use of a particular technology itself, different from possible performance outcome of the use. Venkatesh et al. (2002) introduced an integrated TAM, which integrates the intrinsic motivation factor from the motivational model with the original TAM. The measures of intrinsic motivation included enjoyment with the system, pleasance of systems use, and fun of systems use. (Venkatesh et al., 2002) The integrated model is depicted in Figure 1.

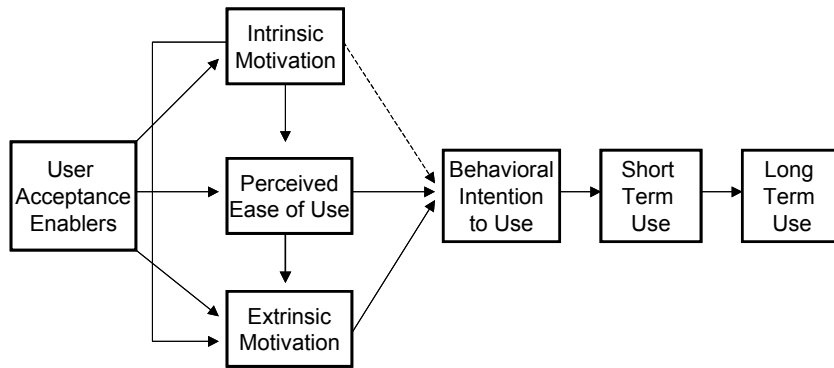


Figure 1. Integrated model (Venkatesh et. al. 2002)

The relation marked with dash line between intrinsic motivation and behavioral intention to use technology was not supported by the empirical test of the integrated model (Venkatesh et. al., 2002).

Legris et al. (2003) have detected heterogeneous results regarding TAM's constructs and propose that these may result from systematic factors left out and not present in constricted experimental settings with student subjects. Secondly, perceived usefulness and perceived ease of use are not easily operationalized or integrated into action. Therefore it is meaningful to include other explaining variables such as intrinsic motivation into TAM.

Intrinsically motivated individuals may perceive the use of new technology less difficult than others since they enjoy using it. Intrinsically motivated may also spend more time in using the technology and thus achieve better results than others. Intrinsic motivation thus further explains the perceived ease of use and usefulness of new technology. (Venkatesh et. al. 2002) Although fun is one of the concepts used to measure intrinsic motivation, we understand the term to be broader, describing any perceived enjoyment resulting from a system use that is not directly related with the performance outcomes.

3. METHODOLOGY

We chose focus group interviews for our method to explore the adoption of mobile payments since focus groups allowed us to probe consumer opinions and experiences of mobile payments in detail and chart issues not covered by TAM. While focus group data is often difficult to interpret, the method stands strong for validity of results. It is possible to interview consumers in a social context, and it is relatively easy to elaborate on issues that subjects deem important. According to Babbie (Babbie 1998), focus group interviews are particularly suitable for explorative studies.

Composition of the group is one of the central issues in studies where data is collected using focus group interviews. Contrary to many other research methods, focus group research relies more heavily on group interaction. Group dynamics, not interviewing, is the main source of data. Stewart and Shamdasani (Stewart and Shamdasani 1990, p. 33) have proposed that “the usefulness and validity of focus group data are affected by the extent to which participants feel comfortable about openly communicating their ideas, views or opinions”. We attempted to form a number of cohesive groups which loosely cover the phases of the original consumer life cycle (CLC) put forth by Wells and Gubar (Wells and Gubar 1966). Wilkes (Wilkes 1995) has demonstrated the validity of the CLC in

consumer inquiry: transitions in the family situation can be meaningfully related to systematic spending behavior.

The focus group discussions were arranged in two phases. The first round commenced in the fall 2001 and the second in October 2002. The phased arrangement allowed us to adjust our interview guide to cover in detail those topics consumers felt important in mobile payments. Our findings rest largely on the second round of interviews and we report the composition of those groups in more detail.

In the first round of interviews, two of the groups comprised of ISS students, one of ISS researchers and one of a mobile network operator's solution developers. Total number of subjects was 15. In these preliminary interviews participants were asked questions related to mobile and Internet payments. In this paper, only questions related to mobile payments are regarded. The motivation to include these preliminary results into this paper was to compare the results gained in two years and look for possible differences between perceptions and attitudes of the respondents.

In the second round of interviews we had six groups and the group size varied between 6 and 9 subjects. Total number of subjects was 46. We interviewed the following groups: teenagers (14-15 years of age), young adults (three groups), parents of small children, and middle-aged persons. We included teenagers and three groups of young adults in interviews since we predicted that most early adopters of mobile payments belong to these groups. Focus groups are time consuming, and therefore, incentives are often called for to encourage participation. We offered our candidates a gift certificate for 14 euros of value as an incentive.

Two researchers attended in each focus group conversation. One acted as the moderator, leading the conversation, while the other made notes, observed the research situation and took care of taping the conversation. The focus group interviews were recorded, and the researchers themselves transcribed the recordings to assure the quality of the data.

4. RESULTS

4.1 Focus group interviews

On average the interviewees had used mobile phones for five and a half years. In each group there were persons who had made purchase with a mobile phone. Typical purchases included mobile phone content such as ring tones and logos, purchases from vending machines such as soda, car parking tickets, and public transportation tickets. Most of the interviewees did not make these payments regularly however, but more on a trial basis. There were no differences in the purchases of groups interviewed in 2001 compared to groups interviewed in 2002.

The importance of security and trust was clearly established when interviewees discussed mobile payment solutions. All groups assessed security risks as one limitation for the use of mobile payment solutions. The security issues perceived by groups interviewed in 2001 were not different from those perceived by groups interviewed in 2002. Teenagers and parents of small children mentioned less security concerns than the rest of the groups. In each group, there were individual differences in perceived security between the interviewees. The differences were not group related but universal, depicting personal characteristics.

The following six different types of security risks were identified in the interviews:

1. **Unauthorized use:** the interviewees were concerned that someone would be able to pay with the mobile phone were the device lost or stolen.
2. **Transaction errors:** the interviewees perceived errors in payment transactions as a potential risk. The errors could be caused by the payment system or by their own mistakes in the system use. A common concern was whether a right amount would be credited and sent to a right account when

paying with a mobile device. Delays in the system might also cause repeated purchase trials so that the user ends up buying the same product twice.

3. **Lack of transaction record and documentation:** the interviewees perceived it difficult to follow up the amount of payments made with a mobile phone since they did not get any receipt or other efficient means to keep track of the payments. Also, without a receipt a payer has no proof of the payment transaction.
4. **Vagueness of the transaction:** the interviewees felt lack of control when paying with a mobile phone. They were unsure of whether the payment had taken place or not and whether the payment had been charged or not. Providing users enough feedback during the transaction and efficient documentation after the completion of transactions could reduce this uncertainty related to mobile payments.
5. **Privacy issues:** some of the respondents were unwilling to trust their personal information with the payment service providers. They were concerned that their purchases would be tracked or that they would begin to receive a lot of advertisements.
6. **Device and mobile network reliability:** the mobile device and network were considered unreliable for payments. The device's battery could discharge or the network connection could fail in the middle of a payment transaction.

We also asked the interviewees which parties they considered trustworthy enough to act as mobile payment service providers. The most trusted providers for mobile payment services were banks. Also large mobile network operators were trusted. Some interviewees also mentioned credit card institutions and national retail chains as large and reliable payment service providers. Small mobile network operators and other small companies were not considered trustworthy. Compared with the groups interviewed in 2001, groups interviewed in 2002 named a wider variety of potentially trustworthy payment service providers. In 2001 only banks were accepted as trustworthy parties.

The need for trustworthiness was not limited to mobile payment service providers but included merchants as well. The interviewees were willing to pay with a mobile phone only when doing business with well-known and established companies.

4.2 Trust enhanced technology acceptance model (TOMI)

Although it is not possible to test statistically the TAM model with the qualitative data collected in the focus group sessions, the TAM model seems to explain well a large part of our findings. Yet, one group of factors, constantly coming up in all focus group sessions and discussed above, is missing from the TAM model. That group of factors is trust, which includes security, trust, trust attitudes and concerns related to security and trust.

To include security and trust factors into the TAM model we added two factors to the original and the integrated TAM model. We named these factors as disposition to trust and perceived trust, and the proposed model as the trust enhanced TAM model. The two new factors are adapted from the trust construct proposed by McKnight et al. (2002). Disposition to trust describes whether a person is attitudinally willing to trust others or not. Perceived trust indicates whether a person perceives that a particular technological solution is secure and trustworthy or not.

The six types of security risks discussed above describe the perceived security of mobile payment solutions and correspond with the perceived trust factor. It was evident in the focus group discussions that these perceived security risks affected negatively to the attitude towards using mobile payments.

Interviewees' requirements for payment service providers' and merchants' trustworthiness refer to the factor of disposition to trust in the trust enhanced TAM model. Based on the focus group interviews,

the perceived trustworthiness of different parties in mobile payments further affects the attitude toward using mobile payments.

Our proposed trust enhanced TAM model, shown in Figure 2, is based on both the original TAM model (Davis, 1989; Davis et al., 1989) and the integrated TAM model (Venkatesh et al., 2002).

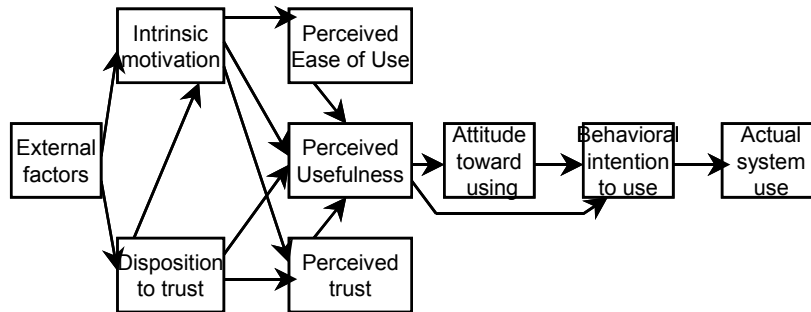


Figure 1. Trust enhanced technology acceptance model

5. DISCUSSION

The qualitative data collected during the focus group sessions indicates that trust factors offer an important additional explanation to the consumer adoption of mobile payment solutions. Perceived security and perceived trustworthiness of different parties affected significantly consumers' perceptions of mobile payment solutions. Based on the results we included two factors, perceived trust and dispositions to trust, to the TAM model and proposed a trust enhanced TAM to better describe consumer acceptance of mobile payment solutions. Parallel extension of the TAM can be found in the context of electronic retailing.

Gefen et al. (2003) study consumer intentions to repeatedly patronize electronic retail outlets and propose that the TAM should be augmented with a trust construct in B2C context. They maintain that four trust-related factors affect consumer intentions either directly or through perceived ease of use and perceived usefulness (see Figure 3). The trust factors added to the model are as follows: calculative-based trust, institutional-based structural assurance, institution-based situational normality and knowledge-based familiarity. Calculative-based trust factor relates to consumer's assessment of the costs and benefits of opportunistic seller behavior, i.e. does it pay off for the seller to behave opportunistically. Institution-based structural assurance factor refers to assessment of the strength of consumer protection in a given context and includes e.g. legal recourse, guarantees, and regulations. Situational normality is consumer's assessment of the seller's trustworthiness judged by the commonality of seller's actions and Web presence. Knowledge-based familiarity captures consumer's prior experience with a given seller.

While based on a similar vein of thought, a number of situational differences exist between our model and the Gefen et al. model. First, our model includes trust-related personal characteristics: a disposition to trust. We feel that inclusion of this construct is warranted to balance the model in which personal characteristics antecedes both of the original TAM constructs: perceived usefulness and perceived ease of use. Secondly, the model includes the attitude construct, which is in our opinion useful for measuring consumers' perceptions related to new and untried phenomena. In our model, we have abstained from dividing the trust construct into components to preserve the same level of detail throughout the model.

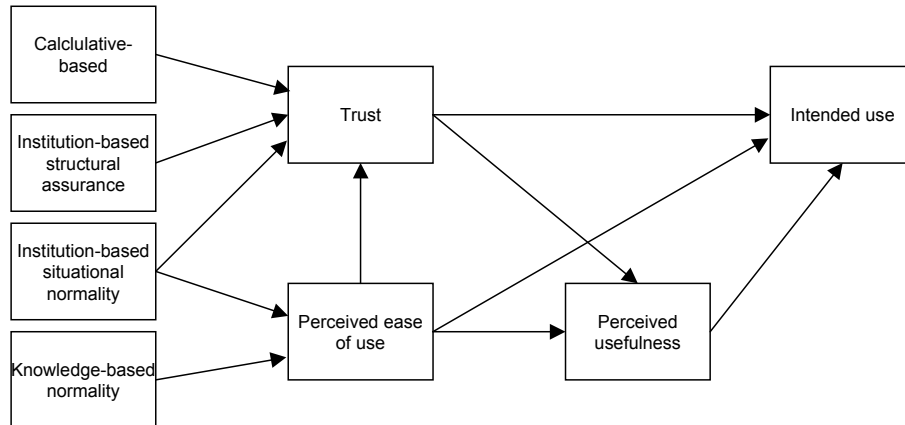


Figure 3. Trust and TAM (following Gefen et al. 2003)

While the Gefen et al. model shows promise in forecasting consumer patronization of electronic retail outlets, it is constructed to describe another consumption context, and therefore it is unlikely to explain consumer behavior in mobile payments arena, which is characterized by contracts that precede the actual consumption situation. Presently, consumers have to open a pre-paid mobile account in either their bank or mobile operator. Another deviation from the electronic retail context is the number of the actors in the characteristics of the systems in the market. Consumers are more likely to have some prior knowledge on the seller side. Mobile payment systems, on the other hand, appear to be more difficult for consumers to grasp and relatively sparse user interfaces provide fewer cues regarding the reliability of the payment system. Thus, more emphasis is likely placed on the reputation of the actors.

The validity and reliability of the proposed model could not be established due to the nature of the empirical data. Further research on this topic is needed to verify the presented trust enhanced TAM model. In addition to focus group studies we have, so far, collected empirical data by interviewing experts working for merchants, service providers, banks, and public authorities and asked about their intentions to use, provide or regulate mobile payment solutions in general and mobile wallet and mobile certificates in particular. These interviews will continue during March and April 2003. Empirical data will also be collected with consumer and merchant surveys during March and April 2003. Most important key findings of data analysis are available in May 2003 and will be presented in the future paper.

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