

The Role of Trust and Risk in Mobile Commerce Adoption within South Africa

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Abstract

South Africa holds the promise of a fast take-off in mobile commerce (M-commerce), potentially leapfrogging the country past its low Internet penetration. However, consumers demonstrate a lack of enthusiasm, possibly due to a lack of trust. This research investigates a model that incorporates trust and risk factors to explore adoption of M-commerce. A survey was used to test the trust model using partial least squares (PLS). The study determined that personal characteristics and influence the perceived trustworthiness of the vendor, technology and the institutional framework. Although systems-based trust influences the intention to use M-commerce services, none of the other trust types did. Risk only impacted trust (negatively) but had no direct impact on intention to adopt. Amongst early adopters, M-commerce benefits such as compatibility and image were at least as, if not more, important than trust.

Keywords: Mobile Commerce; Trust; Risk; South Africa; Technology Adoption; Diffusion of Innovation

1. Introduction

Rapid developments in mobile communication technologies have raised high hopes for a fast take-off in mobile commerce (M-commerce). These expectations are especially high in those developing countries where fixed telephone line penetration and, consequently, computer-based internet access is very low. This is also the case in South Africa where US/Europe-style cable infrastructure is unknown and less than 10% of the population has a fixed telephone line, and thus home internet access by means of personal computers is even lower. However, more than 90% of the South African population owns and uses mobile phones: “an extraordinary penetration rate in this burgeoning market, one of the highest in the developing world” (Wireless Federation, 2008). Because a similarly multiple ratio of mobile to fixed telecommunications line take-up holds for most other developing African economies, many hope that much Africa could leapfrog straight into a wide-scale adoption of M-commerce, and thereby skip the perhaps unnecessary step of first developing a significant E-commerce penetration. Because South Africa has one of the most sophisticated telecommunication infrastructures of all emerging markets, mobile subscribers have seen the launch of exciting many new services, such as mobile banking, video telephony, television services and location-based services. So far, however, the adoption of these services has been lethargic.

Lack of trust has been found to be a significant factor influencing the uptake of mobile commerce services (De Ruyter et al, 2002; Schmidt-Belz, 2003). Trust is important during situations that are perceived to be risky, and M-commerce exposes consumers to new vulnerabilities and risks. For instance, South African consumers are often not aware who the vendor is that is accountable for delivering the service and a party to trust is therefore absent. Additionally, some M-commerce service providers have been exposed in the media for their unethical conduct. Also, M-commerce technologies introduce additional complexity and expose consumers to Internet-type risks, such as cyber-crime, SPAM, viruses and illegal content. Although South Africa offers consumers legal protection against these risks, confidence in law enforcement remains at a low level.

From this, research issues emerge about the consumer perceptions of the trustworthiness of the **vendor** as well as the trust placed in the **technology** that delivers the M-commerce service and the **legislative** environment. The research objective was to investigate the degree to which various trust and risk factors influence the **adoption** and usage of mobile commerce by consumers in South Africa. This research hopes to make a research contribution to the empirical study of trust and risk by studying these in the context of other adoption factors, since previous trust research has been criticised for either failing to effectively conceptualise trust or describing trust in too narrow a scope (Grabner-Kräuter et al, 2003a; Ho et al, 1999; Chervany et al, 2001a; Grandison et al, 2000).

Additionally, a qualitative approach was used to generate research findings which could have an important contribution to make to the industry due to the significant investment made by corporate stakeholders in M-commerce technologies and market development. This study, therefore, aims to enhance understanding of consumer behaviour regarding M-commerce.

2. Definitions and Related Prior Research

This section explores how the key concepts used in this research, namely M-commerce, Trust and Risk, have been defined and operationalised in prior research studies. This is followed by a brief overview of the most popular models used by researchers in M-commerce. This serves to introduce the particular trust and risk research model used in this study.

2.1 M-commerce and the South African Context

M-commerce has been described as, “e-commerce business processes and models carried out on a mobile terminal” (Gordon et al, 2001). This view has however been challenged because many M-commerce services are unique to the mobile environment – such as location-based services, airtime purchases, ringtone downloads, mobile payments (including Point-of-Sale payments). We strongly support this view and hence our belief in the leapfrogging potential M-commerce holds for the sparsely wired sub-Saharan African continent. Therefore, the definition of M-commerce adopted for this study is “any information interaction where a mobile device and networks are used where the transaction leads to the transfer of real or perceived value” (Schwiderski-Groshe et al, 2002). Apart from the examples above, typical M-commerce transactions also include the purchase of digital premium-rated content, purchases of physical products or services to be delivered, and mobile banking. However, voice calls which lead to value transactions are excluded from the definition of M-commerce.

2.2 Towards a Trust Typology

Trust is a “complex, multi-dimensional, context-dependent construct” (Gefen et al, 2003). Various researchers emphasise different aspects of trust, a fact which often leads to inconsistencies between various research studies. The variables of trust used in our research model are: (1) disposition to trust; (2) institution-based trust; (3) systems trust and (4) vendor trust.

Disposition to trust is a ‘belief’ that relates to the ‘propensity’ of the consumer to depend on the vendor (Gurviez et al, 2003). Each consumer, based on their personal characteristics, has a unique willingness to depend on others (Chervany et al, 2001a). An individual can be born with this personal characteristic or develop it later in life. ‘Disposition to trust’ is also described as, “a rational assessment of reliability” (Araujo et al, 2003) and a “generalised morality” (Granovetter, 1985). It therefore involves a decision-making process, influenced by ‘societal rules and norms’. ‘Disposition to trust’ is a “generalised tendency across situations” and influences the consumer’s perception of all other trust variables (Chervany et al, 2001b). Even though Lewis et al (1985) argued that trust could not be reduced to a personal characteristic, various trust researchers have identified indicators of disposition as a significant indicator of overall trust, even when other important determinants of trust are present (Lee et al, 2003).

Institution-based trust is the belief of the truster in the security of a specific situation, due to the fact that certain performance structures are in place. Many researchers feel that trust will not develop without “institutional infrastructures that establish and enforce rules and regulations” (Cheung *et al*, 2001). The power of institution-based trust is best explained by Mahadevan and Ventakesh (2000) who suggest that when vendors “do not support fair information practices and enforcement mechanisms when addressing user’s privacy and other concerns, the legal framework could play a vital role in regulating the industry and restoring confidence in the minds of customers.”

Institution-based trust thus relates to laws, regulations and institutions. In South Africa, the Independent Communications Authority of South Africa (ICASA) is the primary regulator for the telecommunication industry. ICASA additionally fulfils the role of monitoring and dealing with customer complaints that were unsatisfactory resolved by MNOs. Another avenue of recourse available to consumers is the Wireless Applications Service Provider Association (WASPA), established in 2004 (Weideman, 2004). In terms of legislation, the Electronic Communications and Transactions (ECT) Act is the most relevant and important customer protection law. However, despite South Africa having some of the most advanced electronic commerce legislation, few South African websites appear to comply fully with the regulations of the ECT Act (Van der Merwe, 2004). The question is, therefore, how effectively legislation protects South African consumers.

Trust in technology is often referred to as **systems trust** (Grabner-Kräuter et al, 2003a; Lee et al, 2003; Kim et al, 2002). Schmidt-Belz (2003) propose that the assessment of trustworthiness of a system requires “special and profound expertise,” which means that the ‘expert’s’ assessment of trustworthiness of a system might differ from that of an ‘ordinary’ consumer. A case in point is that mobile operators believe that mobile phones offer more secure payments than traditional credit card payments (Danesi et al, 2001). Consumers, however, do not share this view and regard security as one of their primary concerns (Methlie and Petersen, 2000; Hague, 2004). Therefore, our study focuses on the customer viewpoint of systems trust.

Systems trust can be improved through increased “network reliability, redundancy, improved security and the support of atomic transactions (transactions with no steps)” (Varshney, 2002). The latter is important in the case of a disconnection during the transaction. The technology platform should also address trust issues relating to security, performance, scalability, compatibility, reliability and authentication (Araujo et al, 2003). Another trust-building mechanism is improved security, including encryption, digital certificates and private and public keys (Siau et al, 2003). Security is seen as a technology issue, while privacy can be seen as a business process (Van der Merwe, 2001). Security relating to technology will therefore conceptually form part of systems trust, while privacy will form part of trust in the vendor.

Vendor trust is the degree to which the consumer perceives that the vendor will fulfil the transactional obligations in risky or uncertain situations (Bailey et al, 2002b). Vendors can use ‘interventions’ to influence consumers to show trusting behaviours. Example of an intervention embedded in the environment is third party certification or ‘trust promoting seals’, such as TRUSTe and VeriSign (Hu et al, 2002). Mayer et al (1995) see vendor ability, integrity and benevolence as key vendor trust characteristics although Bhattercherjee re-labels ability as vendor competence.

2.3 Risk

Trust is pertinent in risky situations and only relevant in contexts where decisions have to be made in situations that involve a degree of (perceived) risk. Xu et al (2003) suggest that trust “is always combined with risk, since to trust essentially means to take risks and leave oneself vulnerable to the actions of trusted others.” Unfortunately, but probably due to the complex nature of trust and risk, many researchers have ignored the role of risk perceptions (Gefen et al, 2003b). E-commerce trust researchers show that increased trust reduces the trustee’s perception of risk and influences their attitudes towards the trustee, which, in turn, influences the willingness to purchase (Jarvenpaa et al, 2000). The risk management discipline views risk as related to the cost of outcomes, where trust and risk are ‘mirror images’ with an “approximate inverse relationship” (Grandison et al, 2000; Johnson et al, 2002).

This view begs the question of whether the study of trust is relevant in instances where risk is perceived to be low. Some trust researchers feel that, without risk, there is neither need nor opportunity to trust (Johnson et al, 2003). This is disputed by Magura (2003) who coined the terms ‘low-involvement transactions’, to distinguish low risk items (such as ring tone downloads) from ‘high-involvement transactions’ (such as mobile banking). He found that trust becomes even more important during high-involvement transactions.

Gefen et al (2003b) argue that, within the context of low risk items such as ring tone downloads, it is trust, and not risk as perceived by the consumer, that influences the decision to take part in M-commerce. However, within the context of ‘high-involvement’ transactions, risk becomes more important and trust assumes a secondary role of reducing risk instead of directly influencing the purchasing decision. For new types of services perceived risk will be the dominant factor whereas in long-term relationships characterised by multiple interactions between the truster and trustee, vendor trust will prove to be the dominant factor.

2.4 The Relationship between Risk and Trust

No scholarly consensus has been reached on how to depict the relationship between trust and risk in models (Johnson et al, 2002). Gefen et al (2003b) identified three types of risk and trust models.

In the **mediating relationship**, trust is hypothesized to influence perceived risk that, in turn, influences behaviour. If trust exists, the perception of risk is reduced, which, in turn, increases the willingness to take part in M-commerce. For example, if the consumer has high trust in a specific MNO who is in the process of launching a mobile banking service, the high vendor trust would probably negate the perceived risk and increase the probability that the consumer will participate in mobile banking.

The mediating relationship therefore implies an ‘explicit causal relationship’ between trust and risk which Pavlou, Tan & Gefen (2003) depict as trust having a “negative effect on perceived risk”. Olson and Olson (2000) take the converse view and see trust as the consequence of risk, implying that trust mediates the relationship between risk and behaviour. Olson and Olson (2000, p43) state that “we trust more when the stakes are relatively low... or when the potential loss is miniscule”. Trust is therefore seen as a positive influence on the decision to take part in a relatively low risk M-commerce activity, an example of which is downloading ring tones.

Two other trust and risks models exist; namely the moderating relationship and the threshold model. In the **moderating relationship**, the influence of trust on behaviour is seen as varying depending on whether it is a low risk or a high risk condition. When trust is high, risk will have less of an impact on the formation of attitudes (Mayer et al 1995). In cases where high-risk conditions exist, for example mobile banking, trust between the truster and trustee will be higher than low-risk conditions. This is true for the downloading of ring tones. However, the hypothesis of the moderating relationship was not supported by the empirical research of Grazioli and Wang (2001).

The **threshold model** views trust and risk as two independent perceptions. If the perception of risk is higher than the trust relationship, the truster will not engage in M-commerce. The threshold model assumes that no relationship exists between trust and risk and that the consumer evaluates the relationship independently (Kim and Prabhakar, 2000). This model assumes a decision-making process whereby the truster will evaluate each situation and compare the levels of trust versus the levels of risk. If trust is higher, the consumer will engage in M-commerce.

This study will use the mediating model as this is the model to which that the majority of e-commerce researchers subscribe (Cheung et al, 2001; Lee et al, 2003; Jarvenpaa et al, 2000; Yousafzai, 2005).

It is further necessary to distinguish between vendor and systems (technology) risk. Technology risks may have a greater influence on behaviour than vendor-related risks because technology introduces extraneous elements, such as hackers, thereby increasing the probability of unexpected losses (Gefen et al, 2003b).

In order to develop questionnaire test items for the construct of risk in a specific context such as M-commerce, Johnston *et al* (2002) suggest that one should consult ‘practitioner sources’ to find specific risks. Systems or technology related risks include viruses, blue-snarfing (theft of private details using BlueTooth), systems errors, security laps, fraud, health (brain tumour) and errors originating from the handset or network. Vendor-related risks included privacy issues, bill shock (excessive unexpected telephone expenditure), SPAM and access to harmful content such as porn or gambling. Institutional-based risks include the lack of transparency (due to multi-tier industry), lack of knowledge about consumer rights and interception of communications by government security institutions.

2.5 Theoretical Framework

A number of theoretical models on technology adoption, including the Technology Acceptance Model (Davis, 1989) and Innovation Diffusion Theory (Rogers, 1995) were used to build an expanded model of trust for M-commerce as shown in

Figure 1.

Expanded Model of Trust in M-Commerce

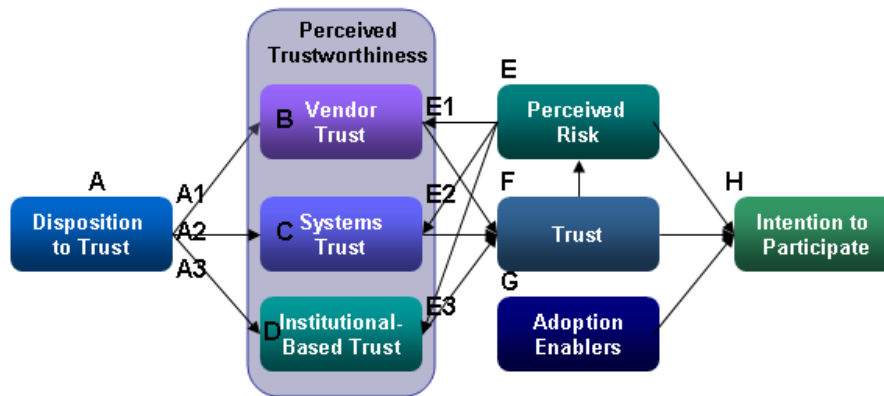


Figure 1: Expanded Model of Trust in M-commerce

The key constructs of the research model are summarized in Table 1 below:

Variable	Definition	Questions relevant to the research
A: Disposition to Trust	Personal characteristics of the consumer that influence his or her general ability to trust (Gurviez <i>et al</i> , 2003; Chervany <i>et al</i> , 2001a; Granovetter, 1985).	Do the personal characteristics of the South African consumer have a significant influence on the decision to use mobile commerce, via their influence on trust in the vendor (A1), systems (A2) or institutional (A3)-based trust?
B: Vendor Trust	Trust factors that demonstrate that the vendor that provides the M-commerce service can be trusted. The vendor can be a WASP, MNO or SP. The vendor has full control over trust factors which demonstrate competence, predictability and goodwill towards the consumer. Sub-variables, e.g. benevolence, integrity and competence are not examined individually (Davis <i>et al</i> , 2000).	Does the perceived trustworthiness of the vendor influence trust and the intention of the South African consumer to participate in M-commerce?
C: Systems Trust	The expectation the user has in the ability of the technology and underlying services to work as expected and to deliver appropriately (Davis <i>et al</i> , 2000).	Does the trustworthiness of the mobile technology, such as network coverage, influence trust and the intention to participate in M-commerce?
D: Institutional based Trust	Formal mechanisms such as legislation and consumer protection institutions that increase consumer trust, usually because they increase the cost of opportunistic behaviour (Ho <i>et al</i> , 1999; Cheung <i>et al</i> , 2001; Zucker, 1986).	Are South African consumers aware of consumer protection bodies and legislation? Does trust in the environment influence trust and the intention to participate?
E: Perceived Risk	Weaknesses exposed by M-commerce that can leave the consumer vulnerable (Chervany <i>et al</i> , 2001a).	Will perceived risks negatively influence adoption of M-commerce by reducing the amount of vendor (E1), systems (E2) or institution-based trust (E3)? Or will high trust in the vendor alleviate these concerns?
F: Trust in Mobile Commerce	Overall perception of the consumer that he/she can trust the M-commerce service (Grandison <i>et al</i> , 2000). Positive expectation which the truster has in M-commerce (Schneiderman, 2000).	Will overall trust, culminating from trust in the vendor, system or institutional environment, influence the intention of consumers to adopt M-commerce? (In the analysis, direct influences from individual trust factors will also be tested.)
G: Adoption	Rogers (1995): Theory of Innovation Diffusion	Do innovation diffusion characteristics have a

Variable	Definition	Questions relevant to the research
Enablers (Innovation Diffusion)	(IDT) determined innovation characteristics which influence the adoption of new innovations. Includes characteristics of relative advantage, complexity, compatibility, trialability, observability, expanded with two additional variables, namely cost and image (Gilham & Van Belle, 2006).	significant influence on the intentions to participate and are the influences more significant than trust and risk factors?
H: Intention to Participate	Consequences of the sum of the trust variables that culminate into an intention that demonstrates that the consumer is willing to perform M-commerce transactions (Grandison <i>et al</i> , 2000).	Do trust and risk factors have a significant influence on the intention to participate?

Table 1: Definition of Research Components

3. Research Design and Methodology

The research model conceptualises relationships between variables and this model was tested using a quantitative survey approach. This section explains the methodological issues relating to the survey.

3.1 Hypothesis and Research Model

Based on the research model, five main hypotheses were formulated to summarize the model and to allow for statistical analysis (Table 2).

Hypotheses	Description
H₀₁	Perceived trust influences the intention to use mobile commerce services.
H₀₂	Disposition to trust influences perceived trustworthiness.
H₀₃	Perceived risk negatively influences perceived trustworthiness.
H₀₄	Perceived trustworthiness of the vendor, system and institution influences overall trust.
H₀₅	Adoption enablers influence the intention to participate in M-commerce.

Table 2: Research Hypotheses for the Importance of Trust and Risk on Intention to Adopt

3.2 Sampling Frame

The target population for the statistical analysis portion of the study were ‘early adopters’ of mobile services. The desired characteristics typical of early adopters of innovative technologies, are a relatively young age, high use of mobile phones, innovativeness, relative affluence and better educated than the general population. These factors are well presented in a telecommunications call centre and thus two of the Cape Town-based call centres of one of the two largest mobile telecommunications company in Africa were used, yielding a sampling frame of approximately 500 call centre agents. These are representative of South Africa in terms of race, language and gender. However, most have an above-average university exemption qualification and are relatively young with an average age is 22.

3.3 Questionnaire Design

The questionnaire drew its test items from a number of previous trust studies conducted in both electronic and mobile commerce. ‘Intention to use’ was tested using Moore *et al*’s (1991) test items. Trust in the vendor and ‘disposition to trust’ was based on the questions developed by Jarvenpaa *et al* (2000) and Koufaris *et al* (2002). The Innovation characteristic questions have been adapted from Moore and Benbasat’s (1991) model, to test for M-commerce services, as it was suggested by Gilham (2004) that the standard questions might not be best suited for the M-commerce environment.

A number of new questions relating to **risk** were included in the study because trust researchers, such as Yousafzai (2005), remark that, “the examination of more detailed facets of risk would be a promising area for future research.” Also, no prior South African study has been conducted to assess the risk perception of South African consumers in terms of M-commerce. Risk perceptions raised in the popular literature are however seldom included in trust studies and only limited examples could be found in research such as Bauer *et al* (2005). Since many of these questions were new, extra test items were incorporated to check validity but this increased the length of the questionnaire.

Although thought to be relevant by the researchers, no socio-demographic characteristics could be collected because the University's Ethics Committee, in its wisdom, deemed these not relevant to the study. The full instrument is available on simple request from the authors. After an initial pilot, only two questions were re-phrased. Note that questions were randomized and some phrased negatively to reduce bias.

4. Importance of Trust and Perceived Risk to Adoption of M-Commerce

Overall, 110 responses to the 'early adopter survey' were received, of which 8 cases were rejected due to incomplete information. Additionally, three influential outliers were identified and removed. It appeared as if these 3 questionnaires were completed mindlessly by the respondents by mechanically choosing all the extreme response options (i.e. all 1s or 7s). Although the sample may be seen as relatively small, it must be realized that the nascent character of M-commerce in South Africa made obtaining a sufficiently homogenous larger sample size almost impossible. However, the statistical significance of the findings did not seem to suffer unduly from the sample size: PLS handles small sample sizes well and no results were only marginally below the required level for significance.

4.1 The Importance of Trust and Some of its Antecedents

The data shows a very strong correlation between the Intention to Participate in M-commerce and a number of its supposed antecedents. In fact, on its own, Overall Trust accounts for 42 percent of the variance in Intention to Participate ($p \ll 0.001$), which appears to be strongly supportive of H_01 .

Using *multiple linear regression*, only Vendor Trust ($p = 0.014$) and Institutional Risk ($p = 0.026$) are found to be significantly antecedents of Intention to Participate, along with three of the seven IDT factors, namely Compatibility ($p \ll 0.001$), Cost ($p = 0.013$) and Image ($p = 0.019$). However, prior exploratory factor analysis found that, although item reliability is high (Cronbach alpha > 0.77 for all non-IDT items), a number of test items of different constructs loaded onto the same factors, indicative of highly correlated data. In addition, many of test item scores were not nicely distributed and to assume normality was unwarranted. Thus a more robust technique second order statistical technique was advisable. Because of the relatively small sample (99), the not very normal data and the fact that we are more interested in specific path hypotheses than attempting to validate the overall model, PLS was chosen over covariance based SEM (Gefen, Straub & Boudreau, 2000).

Figure 2 below gives an overview of the final model that was tested using smartPLS (Ringle, Wende & Will, 2005), along with the path coefficients and explained variances for the dependent constructs. Case-wise replacement was applied to missing values and path weighted factors were used. For the final model, those test items which loaded less than 0.50 were omitted. This affected especially the risk constructs (although it did not affect their impact significantly) and made their number of test items more manageable. In order to calculate the significance of the relationships, the bootstrapping technique was followed with half i.e. 50 cases selected at random to build 1000 samples in order to estimate the T-statistic. The 5% significance level was chosen (single-tail) and the statistically significant relationships are indicated.

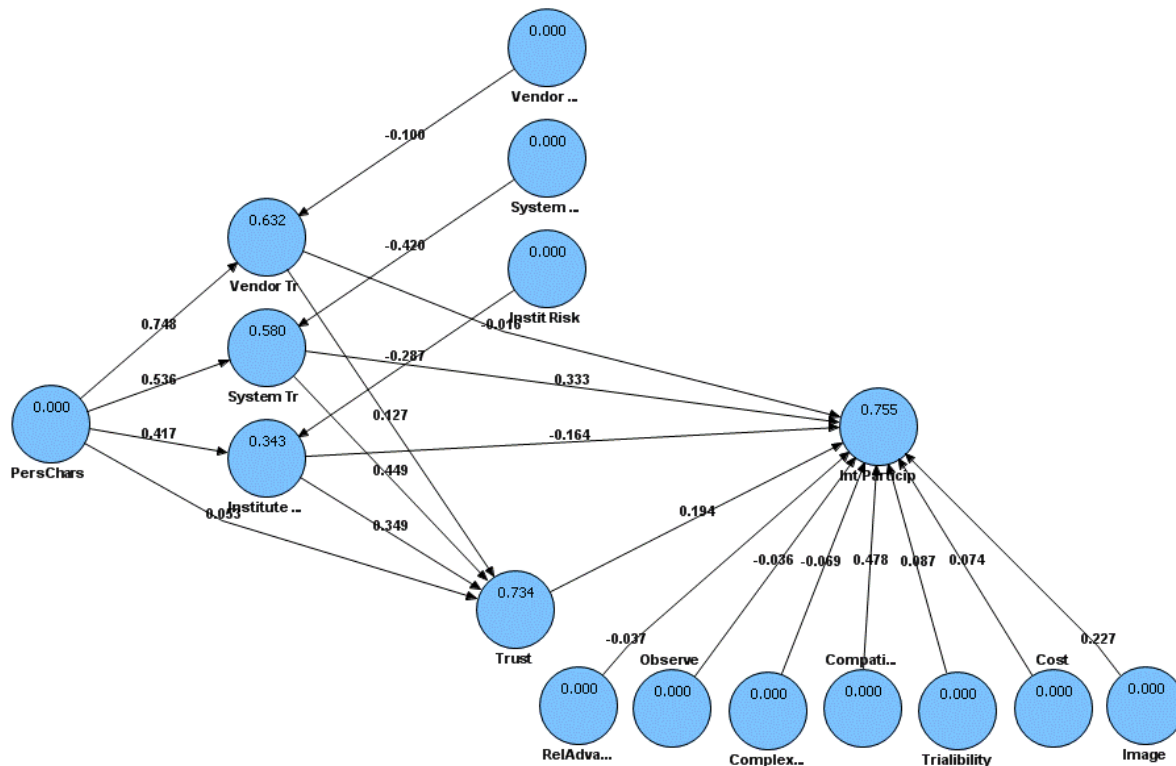


Figure 2: Trust and Risk Model as Tested (Path Coefficients and AVE shown)

Contrary to expectations (from the theory as well as the initial “naive” regression analysis), only ONE trust type shows a significant (positive) impact on the intention to participate in M-commerce, namely **systems trust**. The impact of the **overall trust** construct does *not* show a significant impact, the role of vendor trust is non-existent and institutional trust even shows a negative though far from significant influence. Thus H₀₁ can only be supported in respect of systems trust. However, the findings do support H₀₂ to H₀₄ quite strongly. Disposition to trust (Personal Characteristics) effects a **very significant influence** on Vendor, Systems and Institutional Trust (thus H₀₂ is fully supported). Both Systems Trust and Institutional Trust are significantly (and, as expected, negatively) influenced by the respective Risk Perceptions (supporting H₀₃, except for effect of Perceived Vendor Risk on Vendor Trust). Finally, both Systems and Institutional Trust are in turn strong antecedents to Overall Trust in M-commerce (this supports H₀₄ except for Vendor Trust). It must be remembered that the sample was drawn from a call centre for one single SPs so their assumed company loyalty may have depressed the relative importance of Vendor Risk and Vendor Trust.

Overall, the **trust model** is validated quite strongly in terms of trust sub-constructs and trust antecedents (risk and personal characteristics) except for Vendor Trust and the fact that only one single trust concept – namely Systems Trust – was found to impact participation in M-commerce when taking into account the impact of other M-commerce (IDT) variables.

4.2 The Role of Perceived Risk

As shown above, perceived Institutional and Systems Risk exert a strong influence on Institutional and Systems Trust respectively. This is consistent with the mediating relationship model of Olson *et al* (2000). However, because of the lack of influence of Institutional Trust, only Perceived Systems Risk demonstrates a statistically significant *overall but indirect effect* on Intention to Participate in M-commerce (Total Effect Path Coefficient = -0.1763; p = 0.038).

This can perhaps be explained due to the fact that the sample consisted of early adopters, which typically display a much more risk-tolerant behaviour. Incidentally, the general lack of influence of Perceived Risk on Intention to Participate was corroborated in a separate survey among the focus group where most participants agreed that they could see nothing that was a big enough inhibitor to prevent them from using M-commerce (mean ranking 3.9), though the possibility of receiving spam (mean ranking of 2.2), the services not fulfilling their needs (2.2) and bad vendor reputation (2.0) were ranked as the next three highest potential inhibitors.

As an interesting aside, the three other risk models mentioned in the literature were tested.

Table 3 below summarizes the results. Since the path coefficients cannot be compared, especially not with the moderating model, T-statistics are given instead. These were estimated using the bootstrapping method as described above, and with the full remainder of the model i.e. including all IDT and trust constructs. (Note that the values are already quite stable after less than 300 samples.)

Path coefficients for the following model	Vendor Risk	Systems Risk	Institutional Risk
Mediating model (Olson <i>et al.</i> , 2000): Risk → Trust	0.982	3.948 ^{***}	1.832 [*]
Mediating model (Pavlou, <i>et al.</i> , 2003): Trust → Risk	4.588 ^{***}	6.692 ^{***}	3.783 ^{***}
Moderating Model (Mayer <i>et al.</i> , 1995): Risk moderates (Trust → Intention)	0.278	0.722	0.807
Threshold Model (Kim & Prabhakar, 2000): Risk → Intention	0.636	0.292	0.353

Table 3: Comparison of Different Risk Models (T-values; significance: * = 5%, * = 0.1%)**

This supports the finding of Grazioli & Wang (2001) that the model stipulating a moderating effect of risk on the trust-intention relationship does not hold (at least, for our data). It also confirms that fact that risk is in a mediating role, rather than a threshold model. Finally, it appears to confirm the view of Pavlou, Tan & Gefen (2003) who see trust as having a negative impact on perceived risk rather than vice versa. However, this view does not help in using risk as a factor in explaining M-commerce adoption, thus it appears as the initial model view – and indeed the one adopted by most researchers – is appropriate.

4.3 Innovation Diffusion Factors Influencing M-commerce Adoption

Apart from Trust and Risk, some traditional adoption variables were also investigated. Of the seven IDT constructs, only **two** emerged as significant (i.e. predictive) factors: Compatibility ($p = 0.003$) and Image ($p = 0.038$). None of the other IDT factors assist significantly in the prediction of Intention to Participate. This supports H₀₅ partially in that some adoption enablers were found to be significant.

4.4 Summary of the Expanded Trust Model

In all, a major portion of Intention to Participate in M-commerce can be explained using just Compatibility, Image (H₀₅) and Systems Trust (H₀₁). Trust is shown to be a complex construct that can be decomposed into Institutional and Systems Trust (H₀₃), each in turn strongly influenced by Personal Disposition to Trust (H₀₂) as well as being strongly associated with the corresponding Perceived Risks (H₀₃).

Figure 3 below shows the significant variables and relationships uncovered in our survey. The causal directions were imputed from underlying theoretical models as explained in the literature review above.

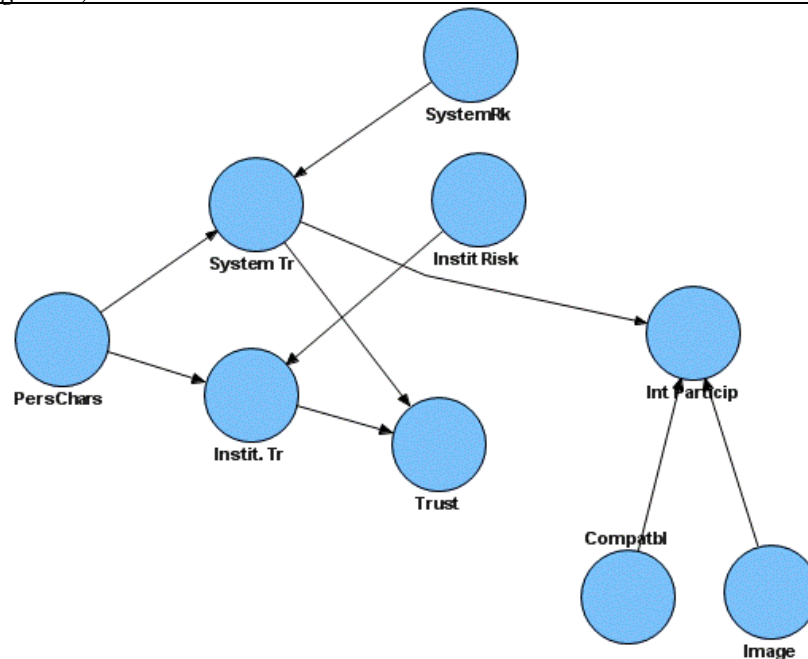


Figure 3: Significant Relationships in Trust Model

5. Conclusion and Implications

5.1 Overall Findings

South Africans in general have a positive attitude to mobile devices and services as evidenced by the extremely high mobile phone penetration. The popularity of SMS and mobile content points to a great potential demand for M-commerce services. The institutional framework and consumer protection authorities are in place to encourage future adoption of M-commerce. Finally, South Africa has low fixed-line Internet penetration rates, which leaves a huge untapped market potential for mobile Internet. However, many barriers to adoption exist. One of these barriers is believed to be a **lack of trust**. This research is probably the first South African study to develop a model and investigate whether trust and risk factors are important factors that will influence the adoption of M-commerce. The research explored the relative importance of trust and risk factors for the South African consumer and whether other significant enablers exist that are considered more important indicators of future M-commerce adoption.

The development of the trust model was based on previous trust research, but included additional variables that relate to the benefits of mobile technologies; namely the Innovation Diffusion Characteristics. Quantitative analysis explored the relative importance of the various factors for early adopters and the role that they play in inhibiting M-commerce.

The study confirmed that consumer perceptions about trust and risk influenced the adoption of M-commerce. Significantly, **Systems Trust** was found to be a strong influence on intention to adopt. Both systems trust and institutional trust were found to be influenced strongly by a person's personal disposition to trust as well as his/her perception of risk. A number of alternative risk models were also tested but neither the risk threshold (where trust and risk are relatively independent from each other) nor the moderating model (where risk moderates the trust – adoption relationship) were found to have any statistical support. Part of the research process involved the development of test items for the various risk constructs in the context of M-commerce and these can be used and further refined by other researchers. Another important finding of this study is that, among 'early adopters', compatibility and image were also important indicator of intentions to adopt M-commerce. Together with trust they explain most of the variance in adoption intention.

5.2 Limitations and Further Research

The quantitative analysis focused on early adopters, who are known to have a higher tolerance for risk. Our findings may therefore not necessarily be generalisable to the whole population, as the research was not based on a random sample. Future research might determine whether the findings of the study can also be considered applicable to late adopters. It is a conjecture of this research that the model potentially pertains more to the general population, who have a lower risk tolerance compared to early adopters.

It is further suggested that future studies should focus on specific M-commerce services that are regarded as more risky, for example mobile banking. Test items were developed to measure systems, institutional and vendor risk. Not all of the test items were found to have an equally high validity and a refinement of the instrument may well provide better results. While the study provided several interesting findings that could be used in practice by vendors of M-commerce services, the importance of specific interventions has not yet been tested by the model. It is expected that the model could potentially be expanded and used to test specific characteristics of vendors which would, in turn, increase their perceived trustworthiness. Future studies could additionally expand on the model to investigate trust and risk issues related to specific features of mobile technologies and services.

5.3 Conclusion

The study established that, amongst South African early adopters, the benefits of M-commerce – namely Compatibility and Image – were seen to be more important than Trust and Perceived Risk. Systems-based Trust however, was still identified as a significantly contributing factor to Intention to Participate in M-commerce. Risk and Personal Disposition to Trust are important antecedents to Trust but Perceived Risk did not appear to drive the adoption decision directly.

6. References

- Araujo, I., Araujo, I. (2003). *Developing trust in Internet commerce*. Proceedings of the (2003) Conference of the Centre for Advanced Studies on Collaborative research (CASCON '03): 1-15.
- Bailey, B.P., Gurak, L.J., Konstan, J.A. (2002). Trust in Cyberspace. In *Human Factors and WebDevelopment*, (ed) J. Ratner. New Jersey: Lawrence Erlbaum Associates, (2002), 311-321.
- Bauer, H.H., Barnes, S., Neumann, M.M., Reichardt, T. (2005). Driving consumer acceptance of mobile marketing: A theoretical framework and empirical study. *Journal of Electronic Commerce Research*. 6(3): 181-192.
- Bhattacharjee, A. (2002). Individual trust in online firms: Scale development and initial test. *Journal of Management Information Systems*. 19(3): 213– 243.
- Chervany, N.L., McKnight, D.H. (2001a). *Conceptualising trust: A typology and e-commerce customer relationships model*. Proceedings of the thirty-fourth Hawaii International Conference on System Sciences.
- Chervany, N.L., McKnight, D.H. (2001b). While trust is cool and collected, distrust is fiery and frenzied: A model of distrust concepts. *Proceedings of the America's Conference on Information Systems*. 883-888.
- Cheung, C., M. K., Lee, M.K.O. (2001). Trust in Internet shopping: Trust in Internet Shopping: Instrument Development and Validation through classical and modern approaches. *Journal of Global Information Management*. 9(3): 23-55.
- Danesi, F., House, B., Mahajan, R. (2001). B2C mobile commerce: Sizing the opportunity. *Flashpoint Adventis*. 11(01): 20.
- Davis, F. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly* 13(3): 319-340.
- De Ruyter, K., Kleijnen, M., Wetzels, M. (2002). Factors influencing the adoption of mobile gaming services. *Mobile Commerce: Technology, Theory and Applications*, Eds: Mennecke, Strader, Idea Group Publishing, Hershey, PA: 202-217.
- Gefen, D., Straub, D.W. (2003). Managing user trust in B2C e-services. *E-service Journal*. 2(2): 7-24.
- Gefen, D., Straub, D. & Boudreau, M.-C. 2000. Structural Equation Modeling and Regression: Guidelines for Research Practice. *Communications of the Association for Information Systems*. 4(7): 1-70.
- Gefen, D., Karahanna, E., Straub, D.W. (2003)a. Trust and TAM in Online Shopping: an Integrated Model. *Management Information Systems Quarterly*. 27(1): 51-90.
- Gefen, D., Rao, V.S., Tractinsky, N. (2003)b. The conceptualisation of trust, risk and their relationship in electronic commerce: The need for clarifications. *Proceedings of the Thirty-sixth Hawaii International Conference on System Sciences*.
- Gilham, C. Van Belle, J.P. (2005) Factors Affecting the Adoption of Mobile Content Services amongst Youth in the Western Cape, South Africa. Proceedings of the 4th International Business Information Management Conference (IBIMA), Lisbon (Portugal).
- Grabner-Kräuter, S., Kalushcha, E.A. (2003a). Empirical research in on-line trust: A review and critical assessment. *International Journal of Human-Computer Studies*. 58(1): 783-812.
- Grabner-Kräuter, S., Kalushcha, E.A. (2003b). Consumer trust in online purchasing decisions: Empirical findings and managerial implications. *Paper presented at the (2003) American Marketing Association: Summer Marketing Educators' Conference*. August 15th – 18th, (2003). Chicago: IL.
- Grandison, T., Sloman, M. (2000). A survey of trust in Internet applications. *IEEE Communications* 3(4).
- Granovetter, M. 1985. Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*. 91: 481-510.
- Grazioli, S., Wang, A. (2001). Looking without seeing: Understanding unsophisticated consumer's success and failure to detect internet deception. *Proceedings of the ICIS*.
- Gurviev, P., Korchia, M. (2003). Test of a consumer-brand relationship model, including trust and three consequences. *Thirtieth International Research Seminar in Marketing*.

- Ho, T., Weigelt, K. (1999). Trust building among strangers: An experimental investigation of mutual trust and trustbuilding. *A working paper of the Reginald H. Jones Centre*. The Wharton School, University of Pennsylvania.
- Hu, X., R., Lin, Z., Zhang, H. (2002). Myth or reality: effect of trust-promoting seals in electronic markets. *Proceedings of the 11th Annual Workshop on Information Technologies and Systems (WITS)*, New Orleans, Louisiana: 65-70.
- Jarvenpaa, S., Tractinsky, N., Vitale, M. (2000). Consumer trust in an Internet store. *Information Technology and Management*. 1(2): 45-71.
- Johnston, A.C., Warkentin, M. (2002). The online consumer trust construct: A web merchant practitioner perspective. *Proceedings of the Seventh Annual Conference*, Southern Association for Information Systems: 221-226.
- Kim K.K., Prabhakar, B. (2000). Initial trust, perceived risk, and the adoption of Internet banking. *Proceedings of ICIS 2000*. Brisbane.
- Kim K.K., Prabhakar, B. (2002). Initial trust and the adoption of B2C e-commerce: The case of Internet banking. *The DATA BASE for Advances in Information Systems*.
- Koufaris, M., Hampton-Sosa, W. (2002). *Customer trust online: Examining the role of the experience with the website*. [Online] Available: [http://cisnet.baruch.cuny.edu/papers/cis\(2002\)05.pdf](http://cisnet.baruch.cuny.edu/papers/cis(2002)05.pdf) [Accessed 11 March 2012].
- Lee, T. (2005). The impact of perception of interactivity on consumer trust and transaction intentions in mobile commerce. *Journal of Electronic Commerce Research*. 6(3): 165-180.
- Lewis, J.D., Weigert, A.J. 1985. Trust as a social reality. *Social Forces*. 63: 967-985.
- Magura, B. (2003). What hooks M-commerce customers? MIT Sloan Management Review: *EBSCO Publishing*.
- Mahadevan, B., Venkatesh., A., (2000). A framework for building on-line trust for business to business e-commerce: Issues and challenges. *IT Asia Millennium Conference*.
- Mayer, R.C., Davis, J.H., Schoorman, F.D. (1995). An integrative model of organisational trust. *Academy of Management Review*. 20(3): 709-734.
- McKnight, D.H., Choudhury, V., Kacmar, C. (2002). Developing and validating trust measures for e-commerce: An interactive typology. *Information Systems Research*. 13(3): 334-359.
- Methlie, L.B., Pedersen, P.E. (2002). Understanding mobile commerce end-user adoption: A triangulation perspective and suggestions for an exploratory service evaluation framework. *Proceedings of the Thirty Fifth Annual Hawaii International Conference on System Sciences*. HICSS-35.
- Moore, G.C., Benbasat, I. (1991). Development of an instrument to measure the perception of adopting an information technology innovation. *Information Systems Research*. 2(3): 173-191.
- O'Connor, (2005). Cautions regarding Item-Level factor analysis. [Online] Available: <http://flash.lakeheadu.ca/~boconno2/itemanalysis.html> [Accessed 15 February 2012].
- Olson, J.S., Olson, G.M. (2000) i2i trust in e-commerce. *Communications of the ACM*. 43(12): 41-44.
- Pavlou, A.P., Tan, Y., Gefen, D. (2003). The transitional role of institutional trust in online interorganisational relationships. *Proceedings of the Hawaii International Conference on System Sciences*.
- Ringle, C.M., Wende, S. & Will, S. (2005) *SmartPLS 2.0 (M3) Beta*, Hamburg (2005), Available: <http://www.smartpls.de> [Accessed 12 December 2012].
- Ritchie, J., Lewis, J., (2003). *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. Sage Publications Ltd., London.
- Rogers, E. (1995). *Diffusion of Innovations*. Free Press: New York.
- Schmidt-Belz, B. (2003). *Aspects of user trust in mobile guides*. *Workshop HCI in mobile guides*. [Online] Available: <http://www.comp.lancs.ac.uk/computing/users/kc/mguides03/Schmidt-Belz-final.pdf> [Accessed 12 March 2012].
- Schneiderman, B. (2000). Designing trust into online experiences. *Communications of the ACM*. 43(12): 57-59.
- Schwidorski-Groshe, S., Knopse, H. (2002). Secure M-commerce. [Online] Available: <http://www.isg.rhul.ac.uk/~scarlet/documents/secure%20-mcommerce%20ECEJ.pdf> [Accessed 20 July 2012]
- Siau, K., Shen, Z. (2003). Building customer trust in mobile commerce. *Communications of the ACM*. 46(4): 91-94.
- Van der Merwe, J. (2003). *To what extent do the websites of SA e-commerce companies comply with the provisions of the ECT Act in terms of protection of Consumer rights?* University of Cape Town: Dept of Information Systems, Honours (2003).
- Van der Merwe, J.P. (2001). *An investigation into the adoption of electronic commerce by South African consumers, from a social, technological and business perspective*. PhD Thesis, University of Pretoria: Dept of Computer Science.
- Varshney, U., Vetter, R. (2002). Mobile commerce: Framework, applications and networking support. *ACM/Kluwer Journal on Mobile Networks and Application (MONET)*. 7(3): 185-198
- Weidemann, R. (2004). WASPA finalising code of conduct. *IT Web*. 2 May 2004.
- Wireless Federation, (2008). South Africa Rated as World's Fourth Fastest Growing Mobile Market. *Wireless News*, 12 November 2008. [Online] Available: <http://wirelessfederation.com/news/south-africa-rated-as-worlds-fourth-fastest-growing-mobile-market> [Accessed 28 Dec 2012].
- Xu, R., Ba, S. (2003). *Analysis of online trust building technologies*. Seminar Paper Contemporary Issues on E-Commerce. University of Mannheim, Department of Information Systems
- Yousafzai, S. (2005). Multi-dimensional role of trust in Internet banking adoption. *Internet and Information Technology in Modern Organizations: Challenges and answers*. (3): 706 - 713
- Zucker, L.G. (1986). Production of trust: Institutional sources of economic structure. *Research in Organisation Behaviour*. Eds B.M. Staw et L.L. Cummings. 8: 53-111.