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Building trust in m-commerce: contributions from quality and satisfaction

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Abstract

Purpose – Mobile commerce (m-commerce) represents a new area of business opportunity. Past research has often focused on customer acceptance and its antecedents, rather than factors that build trust in m-commerce. The purpose of this paper is to provide an explanation of factors influencing customer trust towards vendors on the mobile internet.

Design/methodology/approach – M-commerce relies on mobile technology and well-maintained service quality. This paper has applied the service quality model (SERVQUAL) and technology acceptance model (TAM), coupled with proposed quality factors in relation to m-commerce that, according to the literature, influence customer trust, to empirically test the formation of trust. The proposed model was empirically evaluated using online survey data from 212 experienced m-commerce customers.

Findings – The results showed that despite customisation, brand image and satisfaction all directly affecting customer trust towards the vendor in m-commerce, customisation and brand image equally had a stronger direct effect on trust formation. In addition, interactivity and responsiveness had no direct impact, but had an indirect impact via satisfaction on trust towards the vendor.

Practical implications – This paper contributes a theoretical understanding of factors that activate the development of trust towards the vendor. For vendors in general the results enable them to better develop customer trust in m-commerce.

Originality/value – The paper verifies the effects of satisfaction and proposed quality factors on customer confidence in m-commerce. Moreover, this article validates the determinants of satisfaction.

Keywords Customer service quality, Customer satisfaction, Telecommunications, Trust

Paper type Research paper

Introduction

While the internet has created an unprecedented business opportunity for electronic commerce (e-commerce), trust is considered a major obstacle in initiating customer relationships. Building trust in e-commerce is difficult due to security concerns. Customers feel insecure conducting business activities without the observation of others, personal interaction and the ability to feel, touch and inspect products. Moreover as a subset of e-commerce, mobile commerce (m-commerce) – conducted over a web-based e-commerce system on a radio-based wireless device – has the same problem plus a few of its own. Building customer trust on a mobile platform, limited by interface design, communication speed and physical capability, is crucial for vendors due to its effect on long-term profitability. Recent research has identified trust as a research issue in both e- and m-commerce (Siau and Shen, 2003; Lai, 2004; Hsu and Lu, 2005; Hsu *et al.*, 2007). However, little is known about the mechanisms involved in



generating customer trust on a mobile platform. To fill this gap in the literature, in this study we focused on factors that influence trust-building in m-commerce.

Gaining the trust of mobile customers relies on customer satisfaction. Recent studies examined a variety of topics including the impact of satisfaction on loyalty in m-commerce (Lin and Wang, 2006), factors affecting satisfaction in m-commerce (Choi *et al.*, 2008) and the effect of culture on satisfaction (Cyr *et al.*, 2008). Of these relevant studies, Li and Yeh (2009) found that the level of satisfaction is a key determinant of gaining customer trust in m-commerce.

The quality of services was also shown to be important for gaining the trust of mobile customers. Studies related to service quality in relevant fields have examined web site or interface design (Liu *et al.*, 2005; Lee and Benbasat, 2003), information quality (Chae *et al.*, 2002), responsiveness (Corritore *et al.*, 2003) and mobile technology and mobile vendors (Siau and Shen, 2003). Similarly, it was found that the quality of services affected satisfaction as well as trust (Ribbink *et al.*, 2004; Chae *et al.*, 2002; Cyr *et al.*, 2008). However, the exact quality dimensions were not well defined, demonstrating a need to explore the nature and dimensions of service quality in m-commerce. Therefore we modified these factors to better reflect the m-commerce environment, making our model significantly different from the trust-building framework proposed by Siau and Shen (2003). We believe that a thorough examination of the factors mentioned above that promote trust and improve satisfaction in the mobile context is crucial and may have implications for trust development for m-vendors.

SERVQUAL, satisfaction and trust

The SERVQUAL model

Customers' perceptions of service quality have received extensive attention from academic researchers as well as market practitioners. In the marketing field Parasuraman *et al.* (1985) argued that service quality is based on a comparison between what the customer feels should be offered and what is provided. Due to this discrepancy Parasuraman *et al.* (1985) developed SERVQUAL, a 22-item scale for measuring service quality. This scale was five-dimensional – tangibles, reliability, responsiveness, assurance and empathy – and was empirically validated (Parasuraman *et al.*, 1988). Although the physical storefront may become virtual, SERVQUAL's applicability can still be extended to online business (Lai, 2006; Lee and Lin, 2005; Wang and Liao, 2007). Lai (2006) extended SERVQUAL with perceived value and examined customer satisfaction in a mobile communication context. Lee and Lin (2005) suggested that e-service quality also comprises five dimensions: web site design, reliability, responsiveness, trust and personalisation. They found e-service quality had significant impact on customer satisfaction. Finally, Wang and Liao (2007) included the construct of service quality as one of the dimensions affecting customer satisfaction in m-commerce.

Overall, prior research has suggested that SERVQUAL be service type-dependent and that a different type of service requires a modified SERVQUAL to measure the level of service quality. Ribbink *et al.* (2004) noted that responsiveness, one of the dimensions of SERVQUAL, is relevant to improving satisfaction in e-commerce environment. Further, Lee (2005) stressed the importance of responsiveness in leading

to trust in m-commerce. Thus we included this quality factor to improve the understanding of responsiveness in m-commerce.

Satisfaction

Satisfaction is the result of a process of post-purchase evaluation and comparison. Oliver (1981) considered this transaction-specific satisfaction as the emotional reaction following a disconfirmation experience. Based on Oliver (1981), the disconfirmation of expectations theory can be used to describe this cognitive process. Disconfirmation is a customer's process of evaluating a product's or service's performance, meaning that the actual performance relative to a pre-purchase comparison or expectation will be judged by the customer. When performance is better than expected, a high level of satisfaction occurs as a result of positive disconfirmation. When performance is worse than expected, a low level of satisfaction occurs because of negative disconfirmation (Yi, 1990).

Expectations are described as the beliefs developed by the consumer relative to the characteristics of a product or service before the purchase (Evrard, 1993). According to disconfirmation of expectations theory, expectations can be created by the previous experiences of the consumer and other customers who may become a reference group for the customer (Yi, 1990). When customers make transactions with the vendor, they may have different reactions towards the transaction, thus affecting overall satisfaction (Spreng *et al.*, 1996).

Previous studies have shown that satisfaction can be used to explain key post-purchase behaviours such as complaining, word-of-mouth and product usage (Oliver, 1981; Westbrook and Oliver, 1991). Later, Lin and Wang (2006) extended satisfaction with trust and perceived value, and examined customer loyalty in m-commerce. Consistent with Chae *et al.* (2002), Li and Yeh (2009) found factors affecting quality of service in m-commerce have an impact on behavioural intention to use 3G services through the improved level of satisfaction. There are other studies related to satisfaction in m-commerce. For example, Siau *et al.* (2004) showed that satisfaction was the fundamental performance variable affecting customer perceptions with regard to m-commerce. Wang and Liao (2007) developed a four-dimensional measurement of satisfaction for users of m-commerce.

Past research has demonstrated the importance of satisfaction and its link with trust in m-commerce but the empirical evidence is relatively scarce. To close this gap in the literature, we included satisfaction and investigated its effect on the formation of trust in mobile commerce.

Trust in m-commerce

Trust is a complex phenomenon (Butler, 1991; Barber, 1983) and it has been studied extensively in various disciplines such as marketing (Kumar, 1996; Doney and Canon, 1997), psychology (Rotter, 1967; Erikson, 1963), management (Dirks and Ferrin, 2002; Sako, 1980; Wang and Emurian, 2005), sociology (Strub and Priest, 1976; Lewis and Weigert, 1985) and economics (Dasgupta, 1988; Williamson, 1993). These studies argued that trust is central to the success of personal relationship building. Moreover the importance of trust is elevated in e-commerce (Gefen, 2000; Ba and Pavlov, 2002). Many researchers have suggested that trust is the most significant factor for success in an online environment (Kim and Prabhakar, 2000; Koufaris and Hampton-Sosa, 2004;

Salo and Karjaluoto, 2007). Lack of trust may result in reluctance to participate in e-commerce (Pavlou, 2003).

Now m-commerce, an emerging subset of e-commerce, faces the same issue. While building trust still remains imperative, a different method is required to reflect the mobile context. According to Siau and Shen (2003) trust in m-commerce (m-trust) can be divided into two categories: trust in mobile technology and trust in mobile vendors. By integrating these two factors a continuous trust may be developed for m-vendors. Moreover, Katerattanakul and Siau (2003) stressed the importance of web site design and provided guidelines for creating a favourable store image. With the aid of information technology, a virtual shopping environment may be effective in encouraging transactions and thus has implications for building trust. However, both Lee and Benbasat (2003) and Chae and Kim (2003) agreed that limited system resources (e.g. smaller screens and lower multimedia processing capabilities) can hinder the development of trust in m-commerce.

Overall, the literature is not conclusive on how trust can be developed and maintained in an integrated approach. Therefore we offer a service quality approach as a way to activate the trust building process in m-commerce.

Domains of quality in m-commerce and research hypotheses

The research model is depicted in Figure 1. Since there is no consensus on the exact number or nature of quality dimensions considered important by customers in m-commerce, for the present study it was necessary to identify the affective quality dimensions. Three quality (m-quality) dimensions were proposed: web site quality, mobile technology quality and vendor quality. The importance of these factors shows that a high-quality service not only improves the level of customer satisfaction (Parasuraman *et al.*, 1988) but it is also one of the main factors in gaining customer trust (Garbarino and Johnson, 1999). However a poor quality service can result in loss of customers to competitors and reduction in profits. Although these m-quality

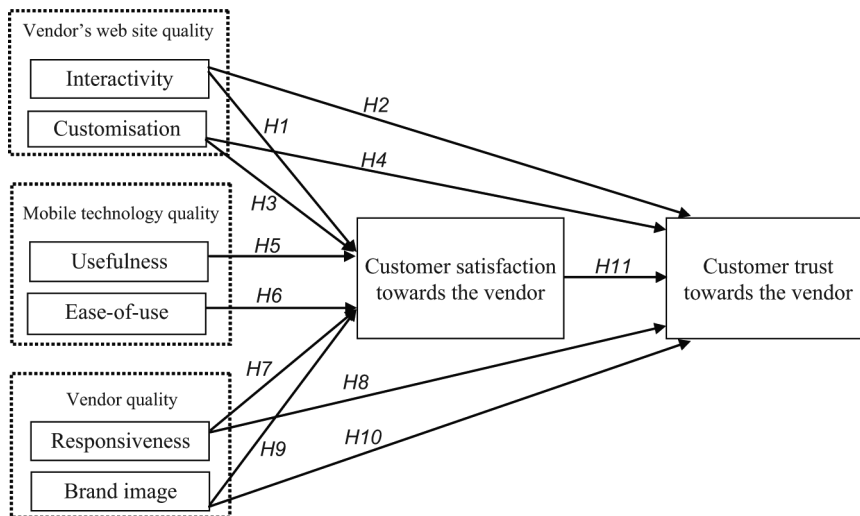


Figure 1.
Research model

dimensions were supported by the relevant m-commerce literature, the linkage from quality to trust is not clearly understood.

Web site quality

Mobile business applications that involve interactivity and customisation provide new opportunities for expansion and enhancement of markets. These two factors interact to influence customers' perceptions of satisfaction during the use of mobile technology (Liang and Wei, 2004). Lee (2005) argued that the interactivity is an influential source of trust. He suggested that the major characteristics of interactivity are ubiquitous connectivity and contextual offers and defined it as the continuation of mobile commerce activities irrespective of users' time and location. Lee and Benbasat (2003) defined customisation as a tailoring ability enhanced by users' mobile setting. Venkatesh *et al.* (2003) further suggested that customisation's impact can be extended to enhance the mobile interface design and to improve mobile usability, thus raising the level of satisfaction. Accordingly, web site quality refers to the satisfaction fulfilment process. Therefore we hypothesised that:

- H1. Interactivity as m-quality directly and positively affects satisfaction.
- H2. Interactivity as m-quality directly and positively affects trust.
- H3. Customisation as m-quality directly and positively affects satisfaction.
- H4. Customisation as m-quality directly and positively affects trust.

Mobile technology quality

Usefulness and ease-of-use are the two vital elements in the Technology Acceptance Model (TAM) (Davis, 1989). In TAM the behavioural intention to use is jointly influenced by attitude and usefulness, where the latter directly affects the former. Moreover, ease-of-use directly influences usefulness and attitude. In general TAM explains and predicts individual acceptance of IT.

Previous research in information science (IS) and information technology (IT) has shown that these two factors influence individuals' attitudes towards using the system. They were shown to be closely related to the acceptance of computer technologies (Davis, 1989; Venkatesh and Davis, 2000) and are of great importance for new users (Gefen and Straub, 2000). In recent research in the m-commerce context, usefulness and ease-of-use are modified to effectiveness and immediateness of purpose fulfilment, skill in using mobile services and degree of ease of utilising mobile services. Based on a review of empirical evidence, usefulness and ease-of-use may positively affect satisfaction (Ribbink *et al.*, 2004). Thus, we hypothesised that:

- H5. Usefulness as m-quality directly and positively affects satisfaction.
- H6. Ease-of-use as m-quality directly and positively affects satisfaction.

Vendor quality

Responsiveness and brand image are possible sources of perceived vendor quality. Responsiveness can specifically represent an e-retailer's commitment to providing rapid feedback (Dholakia *et al.*, 2000; Ku, 1992) or generally refer to being responsive to the service subscribers (Heeter, 1989). Its recent applications can be found in different

areas of e-commerce such as web-based services (Kuo, 2003), internet retailing (Barnes and Vidgen, 2001) and electronic banking (Zhu *et al.*, 2002). Previous studies suggest responsiveness is critical not only as a measure of service quality but also as a diagnostic tool for uncovering areas of service quality strengths and shortfalls (Kettinger and Lee, 1997, 1999; Pitt *et al.*, 1995; Van Dyke *et al.*, 1997). Enhanced management of any customer contact can significantly improve customer satisfaction. Thus responsiveness may influence customer satisfaction based on a business transaction. Moreover, a high level of responsiveness, representing a trust cue, can convey the trustworthiness of the vendor in m-commerce to customers (Corritore *et al.*, 2003). People are likely to place more trust in a vendor if assistance is readily available, therefore responsiveness may affect trust. Based on the reasoning above, we hypothesised that:

- H7.* Responsiveness as m-quality directly and positively affects satisfaction.
- H8.* Responsiveness as m-quality directly and positively affects trust.

As another possible source of vendor quality, brand image is more than a name given to a product. It can be broken down into a whole set of physical and socio-psychological attributes and beliefs (Simoes and Dibb, 2001), all of which affect customers' perceptions of the brand and the meaning they attribute to it. Moreover, similar classifications of brand image distinguish product-related and non-product-related attributes, as proposed by Keller (1998) and Aaker (1997). While the former refers to the components of the core product or function sought by customers, the latter are external to the function or process of the product or the service provided (Keller, 1998). These two attributes can be formed from customers' own experience with the brand or through the image portrayed via marketing channels (O'Cass and Grace, 2004).

Geyskens *et al.* (1996) suggested ease of relationships with service operators can improve the level of satisfaction. According to Lannon and Cooper (1983) ease of relationships can be built through the development of brand image and thus make customers become part of the brand. Accordingly, it seems that a strong image will lead to better customer satisfaction. In addition, Berry (2000) found that a strong brand image increases customer trust and becomes a surrogate especially when the service is intangible.

Based on empirical evidence, it seems that customers are more willing to trust a brand they are familiar with. Customers are also more likely to be satisfied when brand image is strong. Hence we hypothesised that:

- H9.* Brand image as m-quality directly and positively affects satisfaction.
- H10.* Brand image as m-quality directly and positively affects trust.

Satisfaction

Based on Casaló *et al.* (2008) satisfaction refers to an affective consumer condition that results from a global evaluation of all the aspects that make up the consumer relationship (Severt, 2002). According to Geyskens *et al.* (1999) satisfaction can be raised by economic conditions (e.g. monetary benefits) or psychological factors (e.g. promise fulfilment or ease of relationships with retailers). Consequently, the

consumer's post-trust level is affected directly by the level of satisfaction (Singh and Sirdeshmukh, 2000)

Past research has suggested that customer satisfaction is the antecedent of trust (Garbarino and Johnson, 1999). Recent studies have validated the positive effect of satisfaction on trust in the e-commerce environment (Pavlou, 2003). If customers have already had a satisfactory experience with the vendors, they form a higher level of trust on the basis of prior experience. As a result they are inclined to shop again. Moreover, these satisfied customers will also be willing to establish a long-term trust relationship with the vendors (Ganesan, 1994). A positive effect on trust in m-commerce can also be expected. Hence we relate satisfaction to trust in the model and hypothesised that:

H11. Satisfaction directly and positively affects trust.

Figure 1 summarises the stated hypotheses. The research model attempted to understand two issues. One was to validate the influential quality factors generated from the literature in relation to customer satisfaction and the other was to investigate the impact of customers' perceptions of satisfaction on the trust formation. It was expected that the components of quality would affect customer satisfaction, and in turn develop trust in m-commerce.

Research methodology

Samples

Taiwan had a mobile penetration rate of 102.97 per cent in 2007, of which 24 per cent were 3G users (FIND, 2007). In addition 57.5 per cent of users had adopted mobile value-added services and 54.2 per cent were aged 21 to 30 years old (FIND, 2006). Therefore we focused on this group of users. The research questions were examined by these experienced m-commerce customers. According to Kuo and Yen (2009) the customers in this age range are mainly university students and are distributed across the whole island. Therefore in order for the samples to be representative we selected two universities in northern Taiwan. After obtaining permission from class instructors, information such as the background and purpose of the research as well as a questionnaire hyperlink were emailed to 450 students enrolled in undergraduate and postgraduate level IS classes between February and April 2008. During the same period we also posted the same information on mobile communication-related campus bulletin board systems. To increase the response rate, subjects were offered 20 randomly selected movie tickets that would be mailed to their e-mail address.

The online questionnaire method was used. This sampling method has numerous advantages as suggested by Tan and Teo (2000). For instance, it can elicit faster responses either geographically or demographically. According to Hsu and Lu (2004) this method has been widely used in recent years. To differentiate the experienced customers from inexperienced ones, five popular experience types in m-commerce were identified: SMS, ring tone/MP3 download, wallpaper/photo download, MMS and email/news (FIND, 2006). Being used in our questionnaire as a proxy, participants were asked if they had conducted any of these five m-commerce activities in the past six months. The results were saved in the web server. A total of 212 responses were collected. Judging by previous studies this sample size was suitable for further statistical analysis (Luarn and Lin, 2005; Casaló *et al.*, 2007).

Of the 212 participants 46 per cent were male and 54 per cent were female. With regard to experience type, in the six months prior to the survey 30.2 per cent had used SMS, 27.4 per cent had downloaded ring tones/MP3s, 25 per cent had downloaded wallpaper/photos, 5.6 per cent had used MMS and 11.8 per cent had used email/news. Similar to the approach of Casaló *et al.* (2007) the sample's representativeness was verified by comparing socio-demographic characteristics (e.g. age, education level and number of m-commerce experiences) with other m-commerce studies sampling the Taiwanese-speaking population (Kuo and Yen, 2009; Lin and Wang, 2006). Their similar results demonstrated that over half of participants were aged 21-30 years old, over 60 per cent had university degrees and over 70 per cent had had at least one m-commerce experience. Thus we may conclude that our sample represented Taiwanese-speaking m-commerce customers. Table I summarises these descriptive statistics of participants.

Measure of constructs

Items selected for the constructs were primarily adapted from previous studies to ensure content validity. All the questionnaire items used a five-point Likert-type scale, ranging from (1) strongly disagree to (5) strongly agree. The scale items for web site quality (i.e. interactivity and customisation) were adapted from Lee (2005) and Ribbink *et al.* (2004). The scale items for mobile technology quality (i.e. usefulness and ease-of-use) were taken from Davis (1989). Items for vendor quality (i.e. responsiveness and brand image) were adapted from Parasuraman *et al.* (1988, 1991) and Hsieh and Li (2008). The constructs for satisfaction and trust were adapted from Lin and Wang (2006), Hsu *et al.* (2007) and Heijden *et al.* (2003). The survey items are listed in the Appendix.

Measure	Items	Frequency	Percentage
Gender	Male	97	45.8
	Female	115	54.2
Age	< 18	1	0.5
	19 ~ 23	75	35.4
	24 ~ 28	96	45.3
	29 ~ 35	29	13.7
	> 35	11	5.2
Education	High school	1	0.5
	Undergraduate	102	48.1
	Postgraduate	109	51.4
Number of experiences	1	84	39.6
	2	58	27.4
	> 2	70	33.0
Wireless handheld equipment type	Cell phone	95	44.8
	PDA phone	72	34.0
	Smart phone	45	21.2
Types of m-commerce experience	SMS	64	30.2
	Ring tone/MP3 download	58	27.4
	Wallpaper/ photo download	53	25.0
	MMS	12	5.6
	E-mail/news	25	11.8

Table I.
Descriptive statistics

Both a pre-test and a pilot test were conducted to ensure that the content was clear and appropriate. The pre-test involved three respondents who were experts in the field of m-commerce. Respondents were asked to comment on the length of the instrument and the wording. Then a pilot test involving 50 respondents from a management graduate school was conducted.

An exploratory factor analysis with a varimax rotation (using SPSS 13.0) was performed on eight factors that correspond to the eleven hypotheses. Factor extraction was based on the existence of eigenvalues higher than 1. In addition it was required that factorial loadings were higher than 0.5 and that a significant total explained variance (Hair *et al.*, 1998). Table II shows the rotated factors with variables loaded onto their respective constructs.

Statistical analysis

To test the proposed hypotheses, data were collected and analysed using structural equation modelling (SEM) supported by AMOS 5.0 with maximum likelihood estimation. SEM is a second-generation multivariate technique that combines multiple regressions with confirmatory factor analysis to estimate simultaneously a series of interrelated dependence relationships. SEM is a widespread technique in several fields including marketing, psychology, social sciences and information systems (Hull *et al.*, 1991; Methlie and Nysveen, 1999; Seibert *et al.*, 2001).

Items	Rotated component							
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8
C1	0.738	0.267	0.267	0.084	0.084	-0.037	0.075	0.091
C2	0.867	0.079	0.201	0.087	0.087	0.121	0.133	0.043
C3	0.881	0.111	0.076	0.133	0.133	0.245	0.068	0.033
I1	0.046	0.856	0.052	-0.050	0.133	-0.042	0.042	-0.107
I2	0.194	0.801	0.097	0.022	0.166	0.077	-0.094	0.019
I3	0.146	0.884	0.096	0.048	-0.043	0.075	-0.009	0.021
T1	0.159	0.075	0.864	-0.018	-0.018	0.071	0.076	0.043
T2	0.162	0.160	0.851	0.080	0.080	0.240	-0.011	0.025
T3	0.176	0.043	0.746	0.103	0.103	0.067	0.126	0.056
EOU1	0.027	0.020	0.082	0.773	0.176	-0.081	0.224	0.059
EOU2	0.159	-0.048	0.061	0.819	-0.018	0.117	0.179	0.004
EOU3	0.087	0.047	-0.010	0.839	0.133	0.099	-0.040	0.103
S1	0.113	0.112	0.156	0.140	0.822	0.136	0.036	0.147
S2	0.190	0.165	0.223	0.167	0.853	0.178	0.151	0.086
BI1	0.030	0.057	0.183	0.095	0.142	0.892	0.052	-0.012
BI2	-0.026	0.035	0.116	0.032	0.110	0.916	-0.014	0.010
U1	0.121	-0.026	0.039	0.187	-0.033	-0.004	0.867	0.014
U2	0.099	-0.024	0.102	0.116	0.202	0.042	0.853	0.049
R1	0.140	-0.025	0.045	0.077	0.003	0.037	0.016	0.885
R ²	-0.015	-0.038	0.046	0.065	0.187	-0.039	0.043	0.861
Eigenvalue	5.257	2.443	1.955	1.605	1.501	1.190	1.048	1.009
Explained variance (%)	26.285	12.215	9.777	8.027	7.507	5.951	5.240	5.047
Cumulative variance (%)	26.285	38.500	48.277	56.304	63.811	69.762	75.002	80.049

Table II.
Construct validity

The results of SEM include two components: the measurement model and the structural model. The measurement model, giving relationships between latent variables and observed variables, aims to provide reliability and validity based on these variables. The structural model studies path strength and the direction of the relationships among the latent variables.

Results

The measurement model

A confirmatory factor analysis (CFA) using AMOS 5.0 was conducted to test the measurement model. Seven model fit measures were employed to assess the model's overall goodness-of-fit: the ratio of X^2 to degrees-of-freedom (d.f.), the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), the norm fit index (NFI), the root mean square error of approximation (RMSEA) and the root mean square residual (RMR). As shown in Table III goodness-of-fit for the model was met ($X^2/df = 1.28$, GFI = 0.92, AGFI = 0.88, CFI = 0.97, NFI = 0.90, RMSEA = 0.036 and RMR = 0.044), following the suggested cut-off value. After the overall model was accepted we evaluated the psychometric properties of the measurement model in terms of reliability, convergent validity and discriminant validity.

Table IV summarises the results of internal reliability and convergent validity for the constructs. Internal consistency reliability was also included to test unidimensionality and it was assessed by Cronbach's alpha. The resulting alpha values ranged from 0.73 to 0.86, which were above the acceptable threshold of 0.70 (Nunnally and Bernstein, 1994). Internal reliability and convergent validity were estimated by the composite reliability and average variance extracted respectively. Because there is some concern that Cronbach's alpha may underestimate reliability (Smith, 1974) we further made use of composite reliability to assess reliability. Composite reliability – which describes the degree to which the construct indicators indicate the latent construct – for all factors in our measurement model was well above 0.8. The average extracted variances were all above 0.5, which meant that over half of the variances observed in the items were accounted for by their hypothesised factors. Both results satisfied the recommended values (Hair *et al.*, 1998). Moreover, convergent validity can also be evaluated by examining the factor loadings. Following Hair *et al.* (1998) the factor loadings in our model were all above 0.7, indicating a convergent validity. All factors in the measurement model revealed adequate reliability and convergent validity. To examine discriminant validity we compared the squared

	Recommended criteria	Measurement model	Structural model	Suggested by authors
X^2/df	<3.0	1.28	1.26	Hair <i>et al.</i> , 1998
GFI	>0.9	0.91	0.91	Gefen <i>et al.</i> , 2000
AGFI	>0.8	0.88	0.87	Gefen <i>et al.</i> , 2000
CFI	>0.9	0.97	0.97	Bagozzi and Yi, 1988
NFI	>0.9	0.90	0.91	Bentler and Bonett, 1980
RMSEA	<0.08	0.044	0.040	Bagozzi and Yi, 1988
RMR	<0.05	0.036	0.036	Gefen <i>et al.</i> , 2000

Table III.
Fit indices for the
measurement

Construct	Item	Internal reliability Cronbach's alpha	Factor loading	Convergent validity Composite reliability ^a	Average variance extracted ^b
Interactivity (Int)	I1	0.84	0.76	0.89	0.73
	I2		0.79		
	I3		0.84		
Customisation (Cus)	C1	0.86	0.76	0.86	0.68
	C2		0.77		
	C3		0.79		
Responsiveness (Res)	R1	0.73	0.72	0.82	0.69
	R2		0.80		
Usefulness (Use)	U1	0.75	0.74	0.83	0.70
	U2		0.80		
Ease-of-use (EOU)	E1	0.78	0.75	0.84	0.65
	E2		0.74		
	E3		0.72		
Satisfaction (Sat)	S1	0.86	0.86	0.84	0.75
	S2		0.85		
Trust (Tru)	T1	0.85	0.76	0.84	0.64
	T2		0.82		
	T3		0.85		
Brand image (BI)	BI1	0.85	0.98	0.86	0.75
	BI2		0.75		

Notes: ^a Composite reliability = (square of the summation of the factor loading)/{(square of the summation of the factor loadings) + (summation of error variances)}; ^b Average variance extracted = (summation of the square of the factor loadings)/{(summation of the square of the factor loadings) + (summation of error variances)}

Table IV.
Results of CFA for measurement model

correlations between constructs and variance extracted for a construct (Fornell and Larcker, 1981). The results showed that the square correlations for each construct were less than the average variance extracted (AVE) by the indicators measuring that construct, as shown in Table V.

	Mean	SD	1	2	3	4	5	6	7	8
1. Interactivity	3.44	0.71	0.73							
2. Customisation	3.35	0.73	0.33**	0.68						
3. Responsiveness	3.57	0.70	-0.03	0.16*	0.69					
4. Usefulness	3.25	0.71	0.01	0.25**	0.08*	0.70				
5. Ease-of-use	3.38	0.68	0.05	0.26**	0.17*	0.33**	0.65			
6. Satisfaction	3.42	0.88	0.23**	0.37**	0.25**	0.25**	0.35**	0.75		
7. Trust	3.42	0.77	0.04	0.04	0.10	0.19**	0.17*	0.29**	0.64	
8. Brand image	3.59	0.74	0.11	0.07	0.24**	0.16*	0.12	0.31**	0.22**	0.75

Notes: * Significant at $p < 0.05$ (two-tailed); ** Significant at $p < 0.01$ (two-tailed)

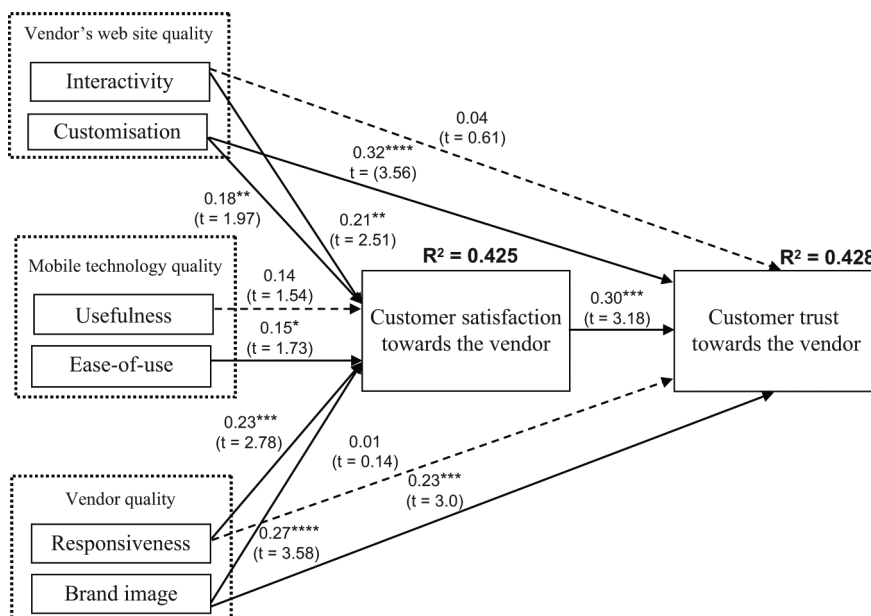
Table V.
Mean, standard deviation, average variance extracted and correlations of each construct

The structural model

Table III showed the structural model's overall goodness-of-fit. The values overall provided evidence of a good model fit ($X^2/df = 1.26$, GFI = 0.91, AGFI = 0.88, CFI = 0.98, NFI = 0.91, RMSEA = 0.035 and RMR = 0.039). Thus we could proceed to examine the path coefficients.

Figure 2 presents the results with a non-significant path as a dotted line and the standardised path coefficients between the proposed constructs. Customer satisfaction was significantly influenced by the proposed quality dimensions except usefulness. The path coefficients from the quality factors all together explained approximately 43 per cent of variance in the observed variance in satisfaction. Thus Hypotheses 1, 3, 6, 7 and 9 were supported. Moreover customer trust towards the vendor was significantly influenced by satisfaction and some proposed quality factors except interactivity and responsiveness. The path coefficients of satisfaction and other quality factors accounted for approximately 43 per cent of observed variance in customer trust towards the vendor. Thus Hypotheses 4, 10 and 11 were supported.

The direct and total effect of customer satisfaction on customer trust was 0.30. However, the total effect of customisation on customer trust towards the vendor was 0.37 because customisation had a stronger direct effect than customer satisfaction had on trust. Similarly the total effect of brand image on customer trust towards the vendor was greater than that of satisfaction on trust. Despite showing a weaker direct effect than user satisfaction on customer trust, brand image still exhibited a slightly stronger total effect on customer trust than that of customer satisfaction. The direct, indirect and total effect of all latent variables are summarised in Table VI.



Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

Figure 2.
Structural model

Discussion and implications

Motivated by the need to understand the formation of customer trust in m-commerce, we conducted an online survey to empirically investigate proposed factors affecting customer trust. The results showed that satisfaction significantly and directly affected customer trust towards the vendors on the mobile internet. Unlike previous findings (Lee, 2005; Corritore *et al.*, 2003) the results indicated that interactivity and responsiveness did not directly lead to trust development. This may be because m-commerce customers were more concerned with vendor benevolence (brand image) and familiarity (customisation) than service honesty (responsiveness) and factual signals (interactivity) in our sample (Ratnasingham and Kumar, 2000). According to the path model in Figure 2, the bivariate relations between quality factors and trust may be obtained from two paths. One is that web site quality \rightarrow satisfaction \rightarrow trust, and the other is that reputation quality \rightarrow satisfaction \rightarrow trust. Therefore we infer that customer trust towards the vendors on the mobile internet was influenced indirectly by vendor web site quality and reputation quality.

Satisfaction was previously validated as an important antecedent to activate customer trust in past research (Garbarino and Johnson, 1999). In this research web site quality (i.e. interactivity and customisation) and vendor quality (i.e. responsiveness and brand image) were found to be important factors affecting satisfaction. Moreover, the ease-of-use but not the usefulness of technology quality contributed to the formation of satisfaction. Together these factors explained approximately 43 per cent of the variance in customer satisfaction. As in the studies by Liang and Wei (2004), Berry (2000) and Parasuraman *et al.* (1988), web site and vendor quality influenced customer satisfaction.

Several implications for market practitioners are raised. First, understanding how satisfaction is built and how to improve it are important for the vendors on the mobile internet. While integrating their services it is equally important to return to the basic tenet that customers are the core of the business. Increasing their satisfaction can result in a larger customer base. Second, as quality factors such as interactivity and customisation have been validated as a means to improve satisfaction with business transactions, vendors on the mobile internet should provide an interactive and customised mobile online environment for customers, especially for their first time use. The mobile environment must gain customers' interest in continued use before they become bored. Meanwhile brand managers should think strategically about their brand because it may take many years of strategic planning before a successful brand can function to raise customer satisfaction and create customer trust (Hankinson and

	Direct effect		Indirect effect		Total effect	
	Sat	Tru	Sat	Tru	Sat	Tru
Int	0.21	0.04		0.06	0.21	0.10
Cus	0.18	0.32		0.05	0.18	0.37
Res	0.23	0.01		0.07	0.23	0.08
BI	0.27	0.23		0.08	0.27	0.31
U	0.14				0.14	
EOU	0.15				0.15	
Sat		0.30				0.30

Table VI.
The direct, indirect and total effects on user trust

Hankinson, 1999). Third, service feedback is crucial on the mobile internet. Customers need a rapid response from vendors when they encounter problems. Lastly, mobile technology quality factors such as ease-of-use are an important predictor of satisfaction. This finding implies that mobile software must be based on customers' needs. Interface design and the constraints of mobile technology are of particular importance.

One implication for academic researchers is that an examination of proposed service quality measurements may provide insights into the antecedents of satisfaction. In addition the model's empirical results confirmed that better web site quality and vendor quality levels produce a higher customer satisfaction level. The results also revealed that these two quality factors are more important predictors of customer satisfaction than mobile technology quality. That explains why the combined quality factors have a statistically significant effect on satisfaction. Another academic implication is that the proposed quality measurement in mobile commerce may be a means to examine customer trust formation in the wider mobile environment. The empirical results indicated that the indirect effects of both web site and vendor quality on trust were more significant than the direct effect of the same factors on trust.

One of the limitations of this study lies with the source of the data. The statistically significant result of satisfaction's impact on trust may not be applicable to vendors in other countries. Another limitation is that we have omitted other factors that may affect service satisfaction, such as security (Siau and Shen, 2003) and word-of-mouth referrals (Jarvenpaa *et al.*, 1999). Thus the proposed satisfaction measurement may not comprehensively reflect satisfaction.

Given the significant impact of satisfaction on customers' beliefs and, by extension, in the context of mobile banking where perceived risk is high, it seems necessary for researchers to seriously investigate the roles between trust and satisfaction in service adoption and continued use. Although the associations between m-quality and satisfaction and between satisfaction and trust were established in our study, future research in different contexts is encouraged to determine the generalisability of the results. While the model showed that the proposed variables were significant, there may be other predictors of customer trust such as empathy. For instance Parasuraman *et al.* (1988) suggested that empathy reflects a customer's self-fulfilment and has a significant impact on improving customer satisfaction, thus influencing customers' trust of services.

Conclusion

The purpose of this study was to develop and empirically test factors that influence customer trust in m-commerce. The proposed model enhanced the understanding of formation of customer trust. We verified the effects of satisfaction and proposed quality factors on customers' trust in m-commerce. In line with past studies, the research found that satisfaction is an important determinant of customer trust. In addition, while previous studies indicated that interactivity and responsiveness directly affect customer trust, we found that these two factors influence customer trust indirectly. Moreover, we validated the determinants of satisfaction, leading the way for a detailed exploration of how to improve customer satisfaction.

Compared to web sites on the mobile internet and vendors' own image quality, building trust based on customer satisfaction is important. From the customers' point

of view a satisfactory experience may determine their willingness to repeat it. Thus it is vital that their first experience of a transaction is positive.

In Taiwan m-commerce is open to business opportunities for vendors in general. As more customers conduct their business activities on the mobile internet, the demand for mobile services will continue to grow. How to retain existing customers and attract new ones become important issues. The results of this study suggest that by focusing on and improving the m-quality factors, vendors on the mobile internet can provide a more satisfying experience for customers. In turn customer trust may be developed to help vendors retain their existing customers.

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Appendix. Questionnaire items

Scales of interactivity, responsiveness, customisation, usefulness, ease-of-use, trust, satisfaction and brand image.

Interactivity

- I1: I can use this mobile internet site anywhere and anytime I need to.
- I2: This mobile internet site enables me to order products or services anywhere and anytime.
- I3: This mobile internet site offers timely and location-specific packets of information (e.g. restaurant coupons for lunch) to me.

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Customisation

- C1: I feel that my personal needs have been met when using 3G services or making 3G transactions.
- C2: 3G service provides me with information and products according to my preferences.
- C3: I feel that 3G service providers have the same norms and values as I have.

Responsiveness

- R1: It is easy to get in contact with 3G service providers.
- R2: 3G service providers are interested in feedback.
- R3: 3G service providers quickly reply to requests^a.

Brand image

- BI1: I feel that A company branded product fulfils its practical function.
- BI2: I feel that A company branded product possesses a positive symbolic meaning.
- BI3: I feel that A company branded product is associated with pleasant experiences.

Satisfaction

- S1: The web site provided in 3G service is successful.
- S2: The web site provided in 3G service has met my expectations.

Trust

- T1: Based on my experience with 3G service, I know it cares about customers.
- T2: Based on my experience with 3G service, I know it is predictable.
- T3: Based on my experience with 3G service, I know it knows its market.

Ease-of-use

- P1: Learning to use 3G service is easy for me.
- P2: It is easy for me to become skilful at using 3G service.
- P3: Overall, I believe that 3G service is easy to operate.

Usefulness

- U1: 3G service enables me to have the access to useful service.
- U2: 3G service enables me to use 3G service effectively.

Note: ^a Item was omitted during the factor analysis and initial reliability testing.

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