Pers Ubiquit Comput (2008) 12:57–65
DOI 10.1007/s00779-006-0126-z

ORIGINAL ARTICLE

An empirical investigation of mobile ticketing service adoption in public transportation

Niina Mallat · Matti Rossi · Virpi Kristiina Tuunainen · Anssi Öörni

Received: 4 August 2006 / Accepted: 3 September 2006 / Published online: 4 November 2006

Abstract In this paper, we present results from a study of mobile ticketing service adoption in public transportation. The theoretical background of the study is based on technology adoption and trust theories, which are augmented with concepts of mobile use context and mobility. Our empirical findings from analyses of a survey data suggest that compatibility of the mobile ticketing service with consumer behavior is a major determinant of adoption. Mobility and contextual factors, including budget constraints, availability of other alternatives, and time pressure in the service use situation were also found to have a strong effect on the adoption decision. Our findings suggest that contextual and mobile service-specific features are important determinants of mobile service adoption and should thus be integrated into the traditional adoption models.

Keywords Mobile commerce · Mobile ticketing adoption · Use context · Mobility · Mobile user behavior · Technology adoption

M. Rossi · V. K. Tuunainen · A. Öörni (✉)
Helsinki School of Economics, P.O. Box 1210,
00101 Helsinki, Finland
e-mail: anssi.oorni@hse.fi

N. Mallat
Accenture, SITE practice, P.O. Box 1109,
00101 Helsinki, Finland
e-mail: niina.mallat@accenture.com

1 Introduction

Early studies on mobile commerce suggest that there is a general consumer interest toward mobile commerce and service applications. Purchases on web sites, electronic receipts and tickets, mobile content, routine bank services, peer-to-peer payments, and vending are among the potential applications [1–3]. However, the adoption of mobile commerce and services has been slower than expected. It has been argued that this stems, e.g., from complexity of the transactions, perceived lack of security, and lack of user friendly mobile portals [4, 5]. While it is true that the miniaturization of the screen and keyboard, as well as the slow connections pose heavy design challenges, we believe that there are other issues that can explain why some mobile applications have been successful and why some others have not performed as expected.

In this study we aim to explain the use intention of mobile commerce by looking at an area, where it has been quite successful; that is, mobile ticketing in public transportation. The theoretical background of the study is based on the technology acceptance model (TAM) and diffusion of innovations theory, which have been suggested by prior studies as applicable frames of reference for mobile commerce context [6, 7]. Empirical data for the study was collected in the capital of Finland, Helsinki, where the Helsinki public transportation has offered a mobile payment service since 2001, first in trams and underground, and lately also in local trains, ferries, and certain buses. A survey was sent to 1,000 Helsinki citizens by post with a result of 362 accepted answers.

Our findings provide general support for the models of systematic deployment of innovations, but also

suggest that the theories need to be augmented with mobile and contextual factors which affect the use of the service. It can be argued that the use of mobile tickets in public transportation is context dependent: people use them occasionally in situations where they run out of cash, are in a hurry, need the ticket unexpectedly try to avoid queues. Our results suggest that people are willing and able to use even complex mobile services if they allow them to solve these types of immediate contextual problems.

The paper is organized as follows. In the next section we discuss the unique features of mobile services by looking at earlier research on mobility and mobile use contexts. We then review prior literature on technology adoption theories and postulate our theoretical framework, which integrates these two lines of research. In the third section we describe the empirical setting of our study and analyze the mobile ticketing survey data. The final chapter discusses our results and suggests paths for future research.

2 Literature review and research model

2.1 Mobility and mobile use context

The most significant feature of mobile technology is *mobility*: the ability to access services ubiquitously, on the move, and through wireless networks and various devices such as PDA and mobile phones [8, 9]. On a large scale, it refers to movement of technologies, people, settings, and information access [10], and to the means of mobile technologies to facilitate this movement. The term mobility is closely related to ubiquitous computing [11], and nomadic computing [9, 12]. Weiser [11] introduced the term ubiquitous computing and argued that in order to become ubiquitous, computers need to be more seamlessly integrated into the use environments and into people's everyday lives. Kleinrock [12] discussed the technical challenges of and solutions for nomadic computing. His expression of the ''anytime and anywhere'' computing became to manifest the essence of mobility—independence of time and place. By the same token, Lyytinen and Yoo [9] postulate mobility, digital convergence and mass scale as the three main drivers of nomadic information environment. In this environment, ''services will come to users whenever and wherever needed, through multiple devices at different sites, and on the move'' [9, p. 378]. Jarvenpaa and Lang [13] suggest, however, that although users value the improved convenience, flexibility, and connectedness provided by mobile technologies, the ''always on, always available'' technology creates increased pressure and demands that are coped with strategies of avoidance or confrontation [13].

A significant amount of research on mobility has been done to find out how mobile technologies should be developed to facilitate mobile work and workers [14–16]. These studies commonly highlight the increased geographic freedom of workers and see mobile technologies as a support and enabler for the workers' mobility [17]. Our study focuses on consumers, however, who have always been mobile when traveling to find a service, make a purchase or withdraw money. Mobile technologies do not necessarily increase their mobility but may in fact reduce the need for consumers to travel or move about as the services become more available through mobile technologies. Thus, for service use, mobility means more seamless service access. Consumers no longer need to visit a newsstand to catch the latest headlines, a record shop to get the latest tunes, or a ticketing machine before hopping on a tram: the services can be accessed through the mobile phone. We thus use the term *mobility* in the present study to express the benefits of time and place independent service access and use.

In addition to *mobility*, also the concept *use context* has significant importance when discussing mobile commerce adoption and use. As users increasingly carry the mobile devices with them and use them in a variety of environments, the use context becomes an issue in research and raises questions about the relation of the behavior and the environment within which it takes place [18].

Dey et al. [19] define context as ''any information that characterizes a situation related to the interaction between humans, applications, and the surrounding environment''. Similarly, Kakihara and Sørensen [20] postulate contexts as continuous frames for people's interaction with others. A more structured definition is provided by [21, 22] who categorize context to physical environment and human/personal factors and provide more detailed subgroups within these categories. Belk [23] defined five categories of different situational characteristics including (1) physical context, (2) social context, (3) temporal context, (4) task definition specifying the task at hand and the role in which the task is performed; and (5) antecedent states defined by momentary moods or momentary conditions such as loose change available.

Previous studies provide evidence on the effect of use context on consumer decision-making [23–26]. The studies suggest that use situations have a significant impact on consumer choice of products [27], stores [28], and other purchase channels [26]. Dabholkar and Bagozzi [24] found that two contextual factors,

perceived waiting time and crowding, had significant mediating effects to the attitude towards and use intention of consumer self-service technologies. Hirschman [29] investigated consumer use of different payment systems and found that consumer use of the systems and perceptions of the system attributes varied in different contexts. Wendel and Dellaert [30] found that consumers consider different media channels and require different benefits from them under different contexts.

Previous research has also discussed the effect of different contexts on mobile computing. Harrison and Dourish [31] and Perry et al. [15] discuss restrictions that social and physical contexts pose on mobile computing. They conclude that technologies designed for mobile computing should be more flexible and adaptable to support tasks in altering environments. Lee et al. [21] studied use contexts for mobile Internet services in Korea and found that contextual factors had significant correlations with specific types of mobile services. They further found that mobile Internet use was centered around a few key services and contexts. Tamminen et al. [32] investigated how changing contexts affect mobile people in urban environments. Their findings suggest that situational events commonly interrupt and affect planned actions and that temporal tensions from hurrying to waiting are continuously developed and dissolved in an urban environment.

The above discussed research provides important implications for studying the adoption of mobile ticketing. First, the findings suggest that contextual factors affect consumer choice and selection criteria of mobile services depending on when, where and which services are used [15, 29, 30]. Further, as there are limited amount of typical and identifiable use contexts for certain mobile services [21] it is sensible to try to identify them and examine their effect on mobile service adoption and use.

2.2 Technology acceptance model

Technology acceptance model, TAM, was developed to predict end-user acceptance of information systems within organizations [33]. TAM originates from theory of reasoned action, TRA [34], and proposes a behavioral model where two beliefs, perceived ease of use and perceived usefulness, are the primary predictors of use intentions. TAM postulates that these two beliefs determine the attitude toward using the system and that attitude, together with perceived usefulness, determines use intention. Use intention then predicts the actual system use. An extensive body of research has demonstrated the explanatory power of TAM in predicting use of various information technologies [33, 35–37].

A number of researchers have applied TAM to different domains of mobile commerce research including, for example, acceptance of handheld Internet devices [38] and physicians acceptance of mobile medical information [39]. Prior findings provide evidence on the relevance of ease of use, usefulness, attitude, and social influence for predicting the acceptance of mobile services [6, 7]. A study on consumer intentions to adopt WAP financial services found that consumer attitude toward the WAP financial services is formed by perceptions on the services' usefulness, ease of use, and system quality, which together with social influence then determine the intention to use the WAP banking services [40].

2.3 Diffusion of innovations

Diffusion of innovations theory by Rogers [39] is a multidisciplinary theory frequently applied in IS adoption research. The theory determines five innovation characteristics which affect the adoption of the innovation: relative advantage, complexity, compatibility, trialability, and observability [41]. Moore and Benbasat [41] developed a specific measurement instrument named Perceived Characteristics of Innovating, PCI, which was designed especially for studying IS adoption. A meta-analysis on IS innovation research suggests that especially three of the innovation characteristics, relative advantage, ease of use and compatibility, appear as constant determinants of adoption [42]. Other constructs, such as costs, have not played an important role in the individual level adoption within organizations [43] but they have been found relevant in predicting the adoption of mobile commerce [44, 45].

Previous research has successfully applied the diffusion theory to predict mobile commerce and services adoption [7, 44–46]. Early stage research on mobile banking adoption in UK confirms that relative advantage over existing services, compatibility of mobile banking with consumer needs and lifestyle, and the ability to test the new service and observe the successful outcomes for other users increased positive attitudes towards adopting whereas perceived complexity and risks had a negative effect on the attitudes toward adoption [47].

2.4 The effect of trust and risk on mobile services adoption

The concepts of perceived trust and risk have emerged as important determinants of electronic and mobile

commerce adoption [48–50]. The importance of trust is highlighted in electronic and mobile commerce because of the spatial and temporal separation between buyer and seller and because buyers are required to give delicate personal information such as telephone number or credit card number to the seller [51, 52]. Trust in other parties is conceptualized as a set of trusting beliefs, i.e., trustor's perceptions about trustee characteristics that indicate trustee's behavior [48, 51, 53]. Beliefs on the trustee characteristics include evaluations of the trustee's abilities, benevolence, and integrity [51, 54, 55]. In addition to transaction parties, another object of trust in information systems mediated commerce trust is the mediating technology, e.g., mobile devices and networks [5, 52, 55]. Siau and Shen [5] proposed a framework for customer trust in mobile commerce and postulated that both perceptions on mobile vendor and on mobile technology are influential in trust formation.

In addition to trust, perceived risk have been found to have a significant negative effect on mobile commerce and technology adoption [7, 44]. In mobile commerce environment, perceived risks often derive from the limitations in mobile networks, devices, and the actual payment solutions. Mobile networks have limitations in speed, connection [5] and coverage. Similarly, limitations in mobile device features include small displays and keypads, limited power, limited memory, and short battery life [5]. These features diminish the usability of the devices and make them risky because the solutions are prone to errors. Potential risks also occur from software failures, loss and theft of the mobile device, and loss of privacy due to security system failures [56, 57].

2.5 Proposed research model

The research model for our study is depicted in Fig. 1. In the model, we included the key determinants of technology adoption put forth by the aforementioned TAM and diffusion of innovations theories, and augmented them with factors based on empirical findings reported in mobile commerce and consumer behavior literature. These determinants were related to trust and risk [5, 7], mobility [16, 39] and use context [18, 23].

3 Empirical study

This study focuses on the adoption factors of the mobile payment services. Yet, no study is totally independent of the technological and social environment. To create a frame for interpreting the results of the study, we will first briefly discuss the application,

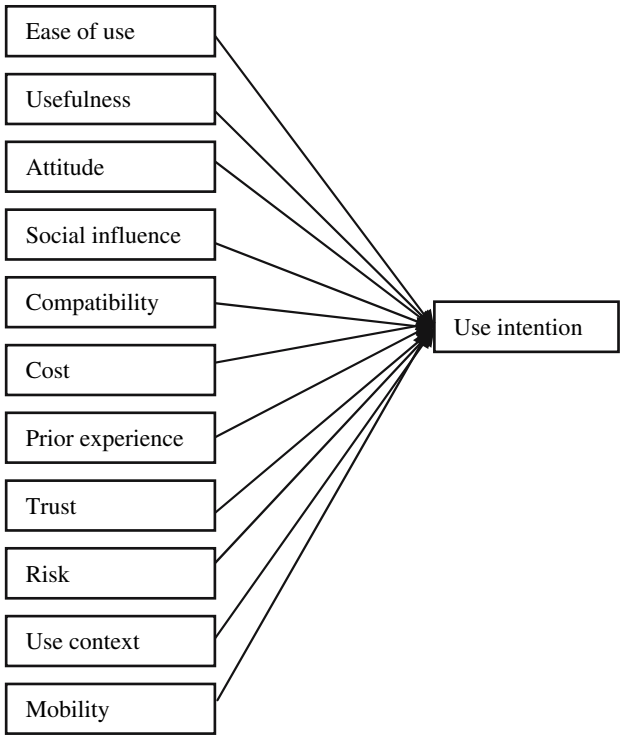

Fig. 1 Research model

the mobile ticketing services provided by the Helsinki Public Transport. After that the data collection procedure will be presented followed by a description of the analytical methods employed. Lastly, we will report the results of the analyses.

3.1 Case mobile ticketing service for Helsinki city public transportation

In 2001 Helsinki city Public Transport launched a short message service (SMS) based system for selling public transportation tickets. In 2004 close to 1,900,000 mobile tickets were sold and, at present, over 17% of all adult single tickets are purchased through the mobile channel.

The tickets can be bought by sending a four character SMS to a premium service number. As a return message, the customer receives a single SMS ticket, which is valid for one hour on trams, subway, local trains, and certain ferries and buses. The ticket costs €1.90 and is priced lower than a single ticket bought in the vehicle and paid in cash. The tickets are billed through mobile phone operators' billing systems.

3.2 Instrument development and data collection

For the purposes of our data collection, a self-administered questionnaire was designed. Measurement scales for the mobile payment characteristics, perceived

trust, and risk items were taken from TAM , PCI, and e-commerce trust instruments, with modified wordings to adapt the items to the current topic.

The measurement items for use context and mobility were developed based on our literature review, and the theoretical view was complemented with findings of Helsinki Public Transport's customer survey, which suggested that mobile ticket was perceived as especially valuable under certain situational conditions, such as, when they are in a hurry or do not have cash or a periodic travel card available.

All individual scale items were measured on seven-step Osgood scales ranging from totally agree to totally disagree. In a pretest phase, the questionnaire was first reviewed by a small group of academics from information systems science department and the scales were modified as a result of their suggestions. The questionnaire was next tested with a sample of 47 business school students and personnel. These tests resulted in some further modifications to the questions and scale item wordings. The questions in the questionnaire relevant to this study are reported in Table 5 (see Appendix).

The sample frame for the survey comprised the Helsinki citizenry. As, according to a prior customer survey of Helsinki Public Transport, the contribution of the central population to the users of mobile ticketing service is disproportionately high, we used stratified sampling to avoid bias in the sample. The two strata in our study were Helsinki inner and outer city regions, identified and separated by postal codes.

Respondents were randomly sampled in both strata among 15–50-year-old citizens. Younger and older age groups were excluded from the sample because they are entitled to a reduced public transportation fare. A self-administered mail survey was sent to 500 inner city and 500 outer city citizens in December 2004.

For an extra incentive to participate, a draw of a mobile phone was organized among the respondents. Questionnaires were mailed with addressed, stamped return envelopes, a reply coupon to the draw, and a cover letter. Of 1,000 mailed questionnaires 373 were returned and 362 accepted, which resulted in a response rate of 36.2%. We find the response rate at par with recent social sciences studies and, hence, deem the quality of the data acceptable.

4 Results

The aim of our data analysis was to uncover the latent variables in the data and, to test the reliability of the emerging scale items. The latent variables were uncovered with factor analysis and reliability was ascertained with multiple regression analysis. We used SPSS for Windows version 11.5 for all the analyses.

4.1 Factor analysis

The data was first studied with a factor analysis to validate the proposed mobile payment characteristics. As the measurement scales were modified to suit the current research topic we chose exploratory factor analytic technique to identify the observed underlying structure in the data matrix of variables affecting respondents' intention to use mobile payment services.

The data was first screened for inter-variable correlations to deem if the data justified application of factor analysis. We observed a relatively high number of strong inter-variable correlations. We also ran Bartlett's test for sphericity and Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy as presented in Table 1. These measures suggest that sufficient correlations among the variables existed to warrant factor analysis. The KMO measures above 0.90 can be interpreted as marvelous [58].

We chose to use principal component analysis as the method of extracting factors since it enables us to uncover latent variables in our survey. The number of extracted factors was decided based on the latent root and scree test criterions [58]. Nine factors had eigenvalues over 1 and that of the tenth factor was close to one. After examining the scree plot and the total variance explained, ten factors were chosen for the final analysis. The cumulative variance extracted by the ten factors was 76.7% (see Table 2). In the analysis mean was substituted for missing values.

To facilitate interpretation of the factors, VARIMAX rotation with Kaiser normalization was applied. The factor analysis suggests that there are ten dimensions in the evaluation space of consumers' intentions to use mobile payment services. These dimensions are: (1) ease of use, (2) risk, (3) context, (4) trust, (5) compatibility, (6) usefulness, (7) social influence, (8) mobility, (9) cost, and (10) attitude.

To verify the reliability of the measurement scales for the proposed factors, Cronbach alpha coefficients were calculated (see Appendix 1). Most scales dem-

Table 1 KMO and Bartlett's test

Kaiser–Meyer–Olkin measure of sampling adequacy	0.921
Bartlett's test of sphericity	
Approx. chi-square	12243.723
df	861
Sig.	0.000

onstrated values over 0.80 and all scales met the commonly suggested limits of acceptable values (0.70) (58, p. 88).

4.2 Regression analysis

The purpose of the factors obtained through factor analysis is to explain and predict the behavioral intention to adopt mobile payment services. To validate the factors, we tested the association between factor scores and the behavioral intention reported by the subjects. We constructed a multiple regression model to test this association. The least square estimates of the parameters of the linear model are given in Table 3.

One of the factors (cost) lacked statistically significant association with behavioral intention and was excluded from the final model. The resulting final multiple regression model explained 55.5% of the variance of behavioral intention (see Table 4).

5 Discussion and conclusions

Our findings support the effect of perceived technology characteristics on intention to adopt a mobile ticketing service. Ease of use and usefulness had a statistically significant effect on the adoption decision. The effect of both factors was, however, relatively weak compared with other studied factors. This result suggests that the traditional TAM constructs may not be as widely applicable determinants of adoption decision as they have been found to be in many studies conducted in organizational settings.

The strongest predictors for use intention were prior experience on mobile ticketing service and compatibility of the mobile ticketing service with a person's use of public transportation, use of mobile phones, and general habits. Consumers who perceive mobile payments as compatible with the way they use both public transportation and mobile phones, are most likely to adopt the mobile ticketing service.

Social influence, in terms of other peoples' recommendations and perception of approved behavioral patterns, was also a strong determinant of adoption. Attitude towards technology, trust, and risk all had positive association with adoption decision, as expected.

Interestingly, cost was not a significant determinant of mobile ticketing adoption in our data. This can largely been explained by the fare structure of Helsinki city public transportation. Mobile ticketing is less

Table 2 Total variance explained

Factor	Initial eigen values			Rotation sums of squared loadings		
	Total	Percentage of variance	Cumulative percentage	Total	Percentage of variance	Cumulative percentage
Risk	15.924	37.914	37.914	4.897	11.659	11.659
EOU	3.554	8.463	46.377	4.035	9.607	21.266
Context	3.199	7.617	53.994	3.846	9.157	30.422
Trust	1.846	4.394	58.388	3.521	8.384	38.806
Comp	1.568	3.733	62.121	3.268	7.780	46.586
Useful	1.462	3.480	65.601	3.023	7.198	53.784
Soc. inf.	1.333	3.173	68.774	2.728	6.496	60.280
Mobi	1.261	3.003	71.777	2.598	6.187	66.467
Cost	1.150	2.739	74.516	2.244	5.343	71.810
Attitude	.913	2.174	76.690	2.050	4.880	76.690

Table 3 Regression coefficients

	B	Std. error	Beta	*t*	Sig.
(Constant)	5.090	0.130		39.157	0.000
Prior exp.	–1.184	0.203	–0.263	–5.846	0.000
Compatibility	0.980	0.091	0.435	10.732	0.000
Social influence	0.359	0.082	0.160	4.372	0.000
Mobility	0.303	0.083	0.134	3.631	0.000
Attitude	0.349	0.083	0.154	4.212	0.000
Trust	0.384	0.085	0.170	4.502	0.000
Risk	0.327	0.083	0.145	3.936	0.000
Context	0.334	0.086	0.146	3.873	0.000
Ease of use	0.277	0.087	0.122	3.195	0.002
Usefulness	0.204	0.083	0.090	2.451	0.015

costly than using cash to buy a single ticket. A more economical alternative would be to use a smart card ticket but in case the use does not have the smart card or has forgotten to top it up then the mobile alternative is more readily available.

The contextual factors, including lack of cash, unexpected need to use public transportation, expiration of a periodic travel card, and hurry, were also found significant in determining future use of mobile ticketing. Our data indicates that the users are likely to resort to mobile ticketing when no other means for paying are available. Together with mobility, that is, freedom from spatial and temporal constraints, these contextual factors represent the mobile dimension of the service and define the competitive advantage of mobile ticketing service compared with other service options.

An interesting finding was that mobility seems to be compartmentalized into category of its own in consumers' decision space. Intuitively it could be related to performance gains offered by mobile technology and, as such, would be closely related to the concept of usefulness. In our model mobility seems to have a stronger effect on adoption decision than the usefulness factor. This result suggests that mobile services have unique benefits that are different from the general usefulness of technology.

Our study contributes to mobile commerce research by empirically testing the effect of use context and mobility on mobile ticketing adoption. Our key contribution is the finding that mobility and contextual elements play a very significant role in the adoption of mobile services and that these two factors should be more closely integrated into the existing adoption models to increase their predictive power. The effect of these factors on the adoption of different types of mobile services is plausible, given the contextual and ubiquitous nature of the mobile services use in general.

From a managerial point of view, our results suggest that the relative advantage of mobile services lies on the ubiquitous service access and on the ability of mobile users to solve different contextual problems such as queuing by using mobile services. Our findings indicate that mobile service developers should build on the relative advantages of mobility and contextual responsiveness when developing new mobile services. In other words, the developers should seek usage situations, where other means of payment are less feasible (e.g. lack of cash or no service personnel in a service location). At the same time, however, the services should satisfy the requirements related to ease of use, compatibility, reliability, and possibly also social esteem or attention to gain wide consumer acceptance.

Table 4 Model summary

Adjusted			
R	R^2	R^2	Std. error
0.754	0.569	0.555	1.505

While our study provided several interesting issues for both practical development and academic research on mobile services, future research is needed to further develop the model outlined in this paper. The current study examined direct relationships between different adoption determinants and the adoption intention. The model could be further developed by looking for mediating effects and causal structures between different variables and conducting further path analysis as postulated by prior behavioral models [33, 34]. In addition, the current study is limited to mobile ticketing and the model should be tested with a wider variety of different mobile services and applications. Additional explanatory factors to enhance the model could be found from consumer behavior literature. An important avenue for future mobile commerce research postulated by our findings is to study more closely the contextual factors and their effect on the mobile user behavior. Furthermore, studies of contextual factors in actual use situations should be of interest.

6 Appendix

(Table 5)

Table 5 Measurement items, factor loadings and Cronbach alpha measures

Measurement items by factor	Factor loadings
Risk, **c**ronbach $\alpha = 0.91$	
Mobile phones are reliable enough devices for purchasing mobile tickets	0.674
Mobile networks are reliable enough for purchasing mobile tickets	0.707
In mobile ticket use the risk of problems due to low battery or lost network connection is small	0.808
The risk of technical problems in mobile ticketing system is small	0.853
The risk that I make errors when ordering a mobile ticket is small	0.627

Table 5 Continued

Measurement items by factor	Factor loadings
The risk of billing error is small	0.674
The risk of not receiving the ticket or receiving it after a long delay is small	0.770
Ease of use, $\alpha = 0.95$	
Learning to use the mobile ticket is easy for me	0.808
Purchasing a mobile ticket is easy	0.841
Purchasing a mobile ticket is clear and understandable	0.813
It is easy for me to perform the actions required to purchase a mobile ticket	0.845
Use context, $\alpha = 0.87$	
I use/expect to use mobile tickets if..	
Travel card has no value or the period is expired	0.725
I have no cash for purchasing the ticket	0.794
I'm in a hurry or need the ticket fast	0.702
I need the ticket unexpectedly and have not prepared for purchasing it	.749
If there are queues in points of ticket sale	0.705
Trust, $\alpha = 0.94$	
Helsinki public transport is a trustworthy mobile ticket provider	0.769
My mobile operator is a trustworthy mobile ticket intermediary	0.785
Helsinki public transport is a capable and competent mobile ticket provider	0.772
My mobile operator is a capable and competent mobile ticket intermediary	0.781
Compatibility, $\alpha = 0.77$	
Purchasing mobile tickets is compatible with my other use of the mobile phone	0.639
Purchasing mobile tickets is a suitable method for me to purchase single tickets	0.726
Using mobile tickets is compatible with my style and habits	0.773
Mobile ticket is compatible with my way to use public transportation	0.776
Usefulness, $\alpha = 0.91$	
It's faster to buy tickets with a mobile phone	0.794
It's easier to buy tickets with a mobile phone	0.818
It's more effective to buy tickets with a mobile phone	0.735
Mobile phone is a useful device for purchasing tickets	0.490
Social influence, $\alpha = 0.78$	
Mobile ticket users are forerunners	0.791
Using mobile tickets is trendy	0.831
Using mobile tickets gives me more respect	0.739
People whose opinion I value have recommended mobile ticket to me	0.632
Mobility, $\alpha = 0.83$	
Purchasing a ticket with a mobile phone reduces queuing	0.545
Purchasing mobile tickets is independent of time	0.747
Purchasing mobile tickets is independent of place	0.756
I can substitute the need for cash or travel card by purchasing a mobile ticket	0.622
Cost, $\alpha = 0.79$	
Mobile ticket is inexpensive	0.861
The price of the ticket when purchased with a mobile phone is reasonable	0.841
Mobile ticket is the most affordable single ticket type to me	0.650
Attitude, $\alpha = 0.91$	
Purchasing a ticket with a mobile phone is a good idea	0.694
Purchasing a ticket with a mobile phone is wise	0.738
I like the idea of purchasing a ticket with a mobile phone	0.658

References

1. Anckar B, D'Incau D (2002) Value creation in mobile commerce: findings from a consumer survey. JITTA J Inf Technol Theory Appl 4:43–64
2. Herzberg A (2003) Payments and banking with mobile personal devices. Commun ACM 46:53–58
3. Stafford TF, Gilleson ML (2003) Mobile commerce: what it is and what it could be. Commun ACM 46:33–34
4. Frolick MN, Chen L-d (2004) Assessing m-commerce opportunities. Inf Syst Manage 21:53–61
5. Siau K, Shen Z (2003) Building customer trust in mobile commerce. Commun ACM 46:91–94
6. Hung S-Y, Ku C-Y, Chang C-M (2003) Critical factors of WAP services adoption: an empirical study. Electron Commer Res Appl 2:42–60
7. Teo TSH, Pok SH (2003) Adoption of WAP-enabled mobile phones among Internet users. Omega 31:483–498
8. Coursaris C, Hassanein K (2002) Understanding m-commerce—a consumer centric model. Q J Electron Commer 3:247–271
9. Lyytinen K, Yoo Y (2002) Research commentary: the next wave of nomadic computing. Inf Syst Res 13:377–388
10. Weilenmann A (2003) Doing mobility: towards a new perspective on mobility. In: Proceedings of the 26th information systems research seminar in Scandinavia, Haikko, Finland

11. Weiser M (1991) The computer for the twenty-first century, in scientific American, pp 94–104
12. Kleinrock L (1996) Nomadicity: anytime, anywhere in a disconnected world. Mobile Netw Appl 1:351–357
13. Jarvenpaa SL, Lang KR (2005) Managing the paradoxes of mobile technology. Inf Syst Manage 22:7–23
14. Luff P, Heath C (1998) Mobility in collaboration. In: Proceedings of CSCW '98
15. Perry M, O'hara K, Sellen A, Brown B, Harper R (2001) ''Dealing with mobility: understanding access anytime, anywhere.'' ACM Trans Comput–Hum Interact 8:323–347
16. Kakihara M, Sørensen C (2004) Practicing mobile professional work: tales of locational, operational, and interactional mobility. INFO J Policy Regul Strategy Telecommun 6:180–186
17. Kristoffersen S, Ljungberg F (1998) Representing modalitites in mobile computing. In: Proceedings of interactive applications of mobile computing, (IMC'98), Rostock, Germany
18. Dourish P (2004) What we talk about when we talk about context. Pers Ubiquit Comput 8:19–30
19. Dey AK, Abowd GD, Salber D (2001) A conceptual framework and a toolkit for supporting the rapid prototyping of context-aware applications. Hum–Comput Interact 16:97–166
20. Kakihara M, Sørensen C (2001) Expanding the 'Mobility' concept. ACM SIGGROUP Bull 22:33–37
21. Lee I, Kim J, Kim J (2005) Use contexts for the mobile internet: a longitudinal study monitoring actual use of mobile internet services. Int J Hum–Comput Interact 18:269–292
22. Schmidt A, Beigl M, Gellersen H-W (1999) There is more to context than location. Comput Graph 23:893–901
23. Belk RW (1975) Situational variables and consumer behavior. J Consum Res 2:157–164
24. Sinha I (1994) A conceptual model of the role of situational type on consumer choice behavior and consideration set. Adv Consum Res 21:477–482
25. Dabholkar PA, Bagozzi RP (2002) An attitudinal model of technology-based self-service: Moderating effects of consumer traits and situational factors. J Academy Market Sci 30:184–201
26. Gehrt KC, Yan R-N (2004) Situational, consumer, and retailer factors affecting Internet, catalog, and store shopping. Int J Retail Distrib Manage 32:5–18
27. Belk RW (1974) An exploratory assessment of situational effects in buyer behavior. J Market Res 11:156–163
28. Mattson BE (1982) Situational influences on store choice. J Retail 58:46–58
29. Hirschman EC (1982) Situational perception of product prototypes within the product class of consumer payment systems. J Gen Psychol 106:123–140
30. Wendel S, Dellaert BGC (2005) Situation variation in consumers' media channel consideration. J Academy Market Sci 33:575–584
31. Harrison S, Dourish P (1996) Re-placeing space: the roles of place and space in collaborative systems. In: Proceedings of CSCW'96. Boston
32. Tamminen S, Oulasvirta A, Toiskallio K, Kankainen A (2004) Understanding mobile contexts. Pers Ubiquit Comput 8:135–143
33. Davis FD, Bagozzi RP, Warshaw PR (1989) User acceptance of computer-technology—a comparison of two theoretical-models. Manage Sci 35:982–1003
34. Fishbein M, Ajzen I (1975) Belief, attitude, intention and behavior: an introduction to theory and research. Addison-Wesley, Reading
35. Mathieson K (1991) Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. Inf Syst Res 2:173–191
36. Agarwal R, Prasad J (1999) Are individual differences germane to the acceptance of new information technologies? Decis Sci 30:361–391
37. Moon JW, Kim YG (2001) Extending the TAM for a world-wide-Web context. Inf Manage 38:217–230
38. Bruner II GC, Kumar A (2005) Explaining consumer acceptance of handheld Internet devices. J Bus Res 58:553–558
39. Han S, Harkke V, Mustonen P, Seppänen M, Kallio M (2004) Mobilizing medical information and knowledge: some insights from a survey. In: Proceedings of 12th European conference on information systems, Turku, Finland
40. Kleijnen M, Wetzels M, de Ruyter K (2004) Consumer acceptance of wireless finance. J Fin Serv Market 8:206–217
41. Rogers EM (1995) Diffusion of innovations. Free Press, New York
42. Tornatzky LG, Klein KJ (1982) Innovation characteristics and innovation adoption implementation: a meta-analysis of findings. IEEE Trans Eng Manage 29:28–44
43. Moore GC, Benbasat I (1991) Development of an instrument to measure the perceptions of adopting an information technology innovation. Inf Syst Res 2:192–223
44. Wu J-H, Wang S-C (2005) What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. Inf Manage 42:719–729
45. Kim H-W, Chan HC, Gupta S (2005) Value-based adoption of mobile internet: an empirical investigation. Decision Support Systems (in press)
46. Luarn P, Lin H-H (2005) Toward an understanding of the behavioral intention to use mobile banking. Comput Hum Behav 21:873–891
47. Lee MSY, McGoldrick PJ, Keeling KA, Doherty J (2003) Using ZMET to explore barriers to the adoption of 3G mobile banking services. Int J Retail Distrib Manage 31:340–348
48. Jarvenpaa SL, Tractinsky N, Vitale M (2000) Consumer trust in an Internet store. Inf Technol Manage 1:45–71
49. Pavlou PA (2003) Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model. Int J Electron Commer 7:101–134
50. Featherman MS, Pavlou PA (2003) Predicting e-services adoption: a perceived risk facets perspective. Int J Hum–Comput Stud 59:451–474
51. Bhattacherjee A (2002) Individual trust in online firms: scale development and initial test. J Manage Inf Syst 19:211–242
52. Grabner-Kräuter S, Kaluscha EA (2003) Empirical research in on-line trust: a review and critical assessment. Int J Hum–Comput Stud 58:783–812
53. Gefen D, Karahanna E, Straub DW (2003) Trust and TAM in online shopping: an integrated model. MIS Q 27:51–90
54. Gefen D, Straub DW (2004) Consumer trust in B2C e-commerce and the importance of social presence: experiments in e-products and e-services. Omega 32:407–424
55. McKnight HD, Choudhury V, Kacmar C (2002) Developing and validating trust measures for e-commerce: an integrative typology. Inf Syst Res 13:334–359
56. Ghosh K, Swaminatha TM (2001) Software security and privacy risks in mobile e-commerce. Commun ACM 44:51–57
57. Dahlberg T, Mallat N, Öörni A (2003) Consumer acceptance of mobile payment solutions—ease of use, usefulness and trust. In: Proceedings of 2nd international conference on mobile business, Vienna, Austria
58. Hair Jr JF, Anderson RE, Tatham RL, Black WC (1998) Multivariate data analysis, Upper Saddle River. Prentice-Hall NJ