

# ADOPTION OF MOBILE SERVICES IN FINLAND

## *Conceptual Model and Application-based Case Study*

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**Keywords:** Adoption, Mobile service, TAM (Technology Acceptance Model), TPB (Theory of Planned Behaviour), J2ME, Finland.

**Abstract:** This paper offers both theoretical and empirical contributions relating to the consumers' motives for and barriers to adopting mobile services. A case study of a mobile service is introduced to validate the factors that facilitate and trigger, and respectively hinder the acceptance of mobile services in Finland. The factors affecting the service adoption were researched based on a conceptual model that was a modified version of the Technology Acceptance Model (TAM) and of the Theory of Planned Behaviour (TPB). Based on the findings from a survey conducted with a sample of 52 Finnish campus students, the factors that affect consumers' attitudes towards mobile services were discovered. Usefulness was revealed to have the strongest impact on attitude towards a mobile service, with context information and attitude acting as significant determinants of the intention to use the service. This study attempts to help mobile service providers choose right development and marketing strategies for mobile services and enhance the adoption and diffusion of mobile services.

## 1 INTRODUCTION

For a long time Finland has been a European pioneer for testing new mobile services. But even in Finland, the adoption of mobile services has been modest and the most popular services are still based on SMS messaging. Current mobile services do not fulfil the requirements set by the users since the services have been developed based on technological development instead of users' needs. According to Moore and McKenna (1999) the mobile services are at the chasm, the pioneering and early adopters are using the services, but the masses have not yet followed their lead. Many researches (Hyvönen and Repo, 2005; Bouwman et al., 2007) have studied the factors that affect the adoption of mobile services in the Finnish context but there is still a need to evaluate the adoption factors in real-life case studies. Kaasinen (2005) has studied the user acceptance of mobile services by using the Technology Acceptance Model (Davis, 1989) and built user acceptance on four factors: perceived value of the service, perceived ease of use, trust, and perceived ease of adoption. Bouwman et al. (2007) have researched mobile service adoption from the

perspectives of physical, cognitive, security and economic barriers, and from the perspectives of the perceived entertainment value and perceived flexibility benefits of mobile services. Finnish consumers' usage of mobile services has been studied in a report for National Consumer Research Centre by Hyvönen and Repo (2005). The report focuses on mobile services that Finnish people use, the motives for and obstacles to using the services, and the readiness to pay for mobile services.

The success of mobile services is not only depending on technological maturity of mobile technology and the penetration of mobile handsets; in the end, eventually the users decide on the success of the services. The predictions are hard to make, but there are certain factors that need to be considered when developing mobile services. Muller-Veerse (2000) has identified *ubiquity, reachability, security, convenience and personalisation* as the key drivers for the mobile market today. Rogers (1995) has developed 'Rogers' basic five' factors, later increased with two more factors (Moore and Benbasat, 1991) that influence the adoption and diffusion of new technologies throughout a social system: *relative advantage, compatibility, complexity, triability, observability, image* and

*trust.* According to Rogers mobile services are likely to be adopted if mobile solution has some clear advantages over existing products or services. Mobile services should also be compatible with existing practices, values, and skills of potential adopters, and easy to understand and use. If it is not possible to experiment with the service before making an adoption or rejection decision, and if the benefits offered by the service are not visible, then adopters are likely to perceive uncertainty and risk in adopting the service. Today the mobile phone is more like a reflection of one's identity, so if the adoption and use of mobile service is perceived to communicate one's personality and enhance the image and status, it has more potential to be adopted. It is also important that the mobile service adopter perceives the service provider to be trustworthy.

There are several factors inhibiting the use of services, although the technology maturity is no longer an obstacle and even so the adoption and diffusion of mobile services has not yet proceeded as fast and wide as have been assumed. Development of technology is commonly seen as an important prerequisite, or even as a reason, for people to adopt new mobile services. According to Gillick and Vanderhoof (2000), the new mobility experience, i.e. the anytime and anyplace access to desired products and services, will be the greatest benefit for the consumer. However, Figge (2004) claims that the ubiquity alone is not enough to ensure a user acceptance and the success of a mobile application: as the user's problems vary with the context in which he or she accesses service, the service based on information of the specific context is likely to become the user's favourite. Gilbert and Han (2005) identified one key barrier of attracting a critical mass of adopters as the lack of compelling content, and another as the differences among adoption patterns in individual market segments. Aarnio et al. (2002) proposed two major reasons above all inhibiting the use of mobile services; the high pricing and the restricted quality of services.

Hyvönen and Repo (2005) have stated that mobile services are not adopted linearly according to the assumptions of diffusion theory. Their studies state that the socio-demographic factors do not essentially affect the adoption of mobile services; instead, the best way to explain the use of mobile services is to research the general attitudes towards new technology, mobile services and devices. In a survey by Cheong and Park (2005) conducted in Korea, *perceived playfulness* was found to be influential in predicting the behavioural intention to use mobile Internet. Whereas findings from a

consumer survey conducted in Finland (Anckar, 2002) indicated that m-commerce adoption mainly appears to be driven by a need for solutions that add *convenience and flexibility to daily routines* rather than excitement and entertainment. Anckar (2002) also found out that consumers perceive the ability to satisfy *spontaneous and timecritical needs* as the most important driver of m-commerce adoption.

This paper researches and validates factors that facilitate and trigger, and respectively hinder, the adoption of mobile services in Finland. Finland has been selected as a case country since it is considered as a pioneer of mobile technologies. In August 2007, 97% of Finns had at least one mobile phone (Statistics Finland, 2007). The findings from the survey conducted in autumn 2007 (Invest in Finland, 2008), based on information on four million mobile phones from three telecom operators, showed that Finns change their mobile phones every 2.7 years. More than 70% of the phones in use had a colour screen and half included a camera. The 3G phones gained an 18% share of the market, which was more than double the figure in 2006. In the study in which participated over 1500 Finns aged 15-64 in year 2006, one quarter of those surveyed reported having browsed web pages with their mobile phones (Ittiukko, 2007).

Furthermore the paper studies what kinds of services are likely to be adopted; and how businesses can enhance the adoption and diffusion of mobile services. In order to validate the adoption factors in practice this paper presents a real life case study of launching the mobile service. The case mobile service was based on downloadable Java application, not yet eagerly adopted at least in Finland. It was tested in a delimited user group of students and personnel in Finnish campus area in the field trial. Mobile service offered information about internal news, events, announcements and schedules of the study community, as well as a mobile flea market for buying and selling own things through mobile channel. The aim of provided services was to enable easy access for essential information despite the time and place. Especially students require multi-channel services due to their mobile lifestyle.

This paper is organized as follows: chapter 2 represents the conceptual model of mobile service adoption and chapter 3 describes the empirical evaluation of case mobile service. In chapter 4 the feedback questionnaire of the case study is presented and the results of the survey are analysed. The paper concludes with the limitations of the survey and the suggestions for future work.

## 2 CONCEPTUAL MODEL OF MOBILE SERVICE ADOPTION

In our study, we developed a modified version of the Technology Acceptance Model (TAM) (Davis, 1989) and the Theory of Planned Behaviour (TPB) (Ajzen, 1991) for researching the adoption of mobile services. According to TAM, a consumer's behavioural intention to use a "system" is determined primarily by its usefulness and ease of use. In TPB, the intention to use a "system" is explained by attitudes toward a certain behaviour, subjective norm and perceived behavioural control. TAM and TPB have both been widely used among researchers and found to be very useful in explaining consumers' attitudes and intentions toward a given behaviour. TPB is a general theory of human behaviour while TAM is specific to information systems.

Studies on acceptance of new technology indicate that traditional adoption models need to be extended and modified to better explain the adoption of the innovations. This study modifies TAM by proposing additional acceptance factors associated with mobile services, Rogers (1995) and Figge (2004) having especially influence on the creation of construct items stated in Figure 1. Attitudinal construct was adopted from TPB (e.g. Karjaluoto and Alatalo, 2007). Mobile service adoption model was decided to be based on utilitarian-oriented aspects. Thus, the pure entertainment factors, such as perceived enjoyment and playfulness were not included as construct items. Figure 1 shows the created conceptual model for case mobile service with causal links between the construct items (Ervasti, 2007).

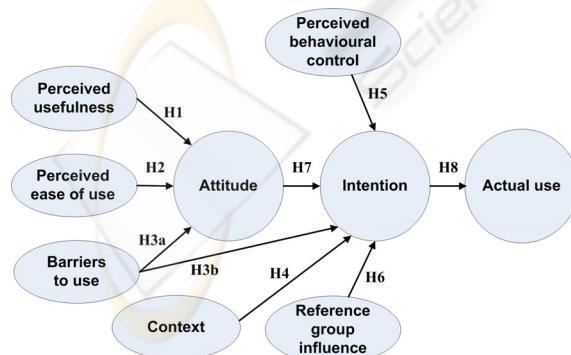


Figure 1: Conceptual model for mobile services.

Perceived usefulness (PU), perceived ease of use (PEOU) and barriers to use (BU) are posited as

antecedents of attitude (ATT) toward mobile services. Barriers to use are also conceptualised with context (CON) as an antecedent of intention (INT) to use mobile services. Perceived behavioural control (PBC), reference group influence (REF) and attitude are antecedents of intention, which, in turn, affects actual use (USE). (Fishbein and Ajzen, 1975; Davis, 1989; Ajzen, 1991; Moore and Benbasat, 1991; Thompson et al. 1991; Davis et al., 1992; Taylor and Todd, 1995; Venkatesh and Davis, 2000).

Based on the conceptual model in Figure 1, the following hypotheses for mobile services were created:

*H1: Perceived usefulness of mobile services positively affects attitude toward mobile services.*

*H2: Perceived ease of use of mobile services positively affects attitude.*

*H3a: Perceived barriers to use mobile services negatively affect attitude.*

*H3b: Perceived barriers to use mobile services negatively affect intention to use mobile services.*

*H4: Utilisation of context-specific information on mobile services positively affects intention.*

*H5: Perceived behavioural control of mobile services positively affects intention.*

*H6: Reference group influence positively affects intention.*

*H7: Positive attitude toward mobile services positively affects intention to use mobile services.*

*H8: Intention to use mobile services is positively associated with actual use of mobile services.*

In order to further evaluate and develop the conceptual model with related hypotheses, the use and adoption were tested in a real-life case study of mobile service.

## 3 THE EVALUATION OF CASE MOBILE SERVICE

The practical evaluation of the mobile service adoption was made in the case study, named Mora. The case mobile service focused on additional value of mobility, which means the possibility to access, produce and send information, products and services at anytime and from anywhere, regardless of the user's location or the time of day. The major aim of the mobile service was to provide essential information for the end-users as the administration of the campus area defined. Mora service was

evaluated in a delimited user group of students and personnel in Finnish campus area. Mora was launched at the campus, focused on technology and economics education, in Finland in September 2007, in order to research the adoption of mobile services among campus' students and personnel.

The technical implementation of the case mobile service is based on a client-server approach to providing a mobile access to intranet of campus area. The contents of Mora were internal news, events, announcements and schedules of the study community, as well as a mobile flea market. Mobile flea market enabled users to sell and buy things such as studying material easily and quickly. In later development the mobile service could also provide pleasure, fun, and enjoyment. The mobile client Mora works as an interaction channel between customer and service provider by providing personalised information to the user (Ervasti, 2007). The server side application carries most of the functionality. The client side of Mora is Java mobile application (J2ME) that works in most common mobile phones.

The main technical building blocks of a personalised mobile service concept are the service provider's existing information systems, mobile service, customer database and mobile application. The main building blocks (adapted from Alahuhta et al., 2005) of the Mora service concept are introduced in Figure 2:

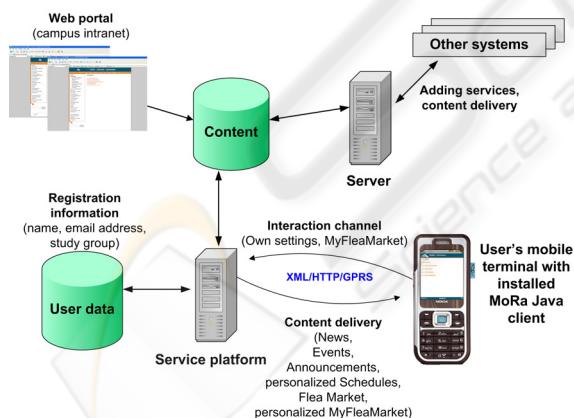


Figure 2: Overview of the Mora mobile service.

The major source of information for most of the data and communication processed in the Mora service is the existing information system, the campus' web intranet. This required adaptation of the content from web-based content to mobile content. The user database is utilised for providing personalised services for customers. The existing

database is used as the basic information source for user-related information (name, email address, study group), besides the basic personal data the database could contain more detailed information on customer's special preferences. The mobile end of the concept utilised mobile Java technologies. The concept approach of using mobile application has several benefits both for the end user and the service provider. Java application provides versatile content delivery and interaction channel, a service provider can create a fully branded mobile service concept and the application is unobtrusive and convenient to use, avoiding the spam effect. When compared to browsing, the application-based approach offers better possibilities for improving usability in mobile services. In addition, the optimisation of data traffic between the terminal and servers is easier to implement in mobile applications. The small size of the displays also favours application-type services.

The case mobile service started with an information and marketing campaign advertising Mora web pages and giving presentations about the field trial to various student groups and personnel in the campus area. The purpose was to make the test-users feel they were privileged to have the mobile service like Mora exclusively on their campus, and have the opportunity to participate in the service testing and development. These initial Mora users were encouraged to compete for the best development ideas. In the adoption of application-based mobile services, the key barrier to overcome is to get the users to do the first download (Nokia, 2003). Therefore, Mora instructions presented simple steps for starting the use of Mora as follows: 1) Registration via web page; 2) Downloading the Mora mobile application via SMS or web page; 3) Setting up the required connection settings; 4) Setting up the mobile client preferences.

The test-users were able to post questions for us during the whole field trial and separate events for getting help in downloading and installing the application were arranged to further ease the adoption process. Users had also an opportunity to test the Mora service with separate test phones in case a user's own mobile phone didn't support the application. The nature of the marketing campaign was selected due to the time and costs limitations. In future research the diffusion of mobile services by viral marketing should also be considered and researched.

## 4 FEEDBACK QUESTIONNAIRE AND ANALYSIS OF THE MORA MOBILE SERVICE

The feedback from the Mora mobile service was collected after two months' field trial through online and paper questionnaires. The feedback questionnaire was created based on the hypotheses in conceptual model (Figure 1). All of the questionnaire's construct items consist of multiple variables, and a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with 3 (cannot determine) as a neutral anchor point was used to measure the variables. In Table 1 is presented the feedback questionnaire for the case study (adapted from Venkatesh et al., 2003).

During the field trial, the Mora mobile service gathered 67 registered users and the survey resulted in 52 completed feedback forms. The results were treated and analysed anonymously (Ervasti, 2007). The analysis of the research data was done by using SPSS 14.0 software. A small number of questionnaire forms were incompletely filled in and the answers were ambiguous in some places. The ambiguity was resolved by interpreting the answer in the least favourable way for the question presented. The rather small amount of sample data restricted the number of feasible analysis methods. The analysis was conducted using the basic frequency and descriptive calculations. The regression analysis was utilised by first examining the effect of the independent variables on the dependent variables according to the set hypotheses, and then testing the combined effect of the explanatory variables as stated in the conceptual model.

Of the respondents, 11.5% were female and 88.5% male and the majority were less than 25 years old. By nationality, 69.2% of the sample were Finnish and 30.8% foreign; the foreign respondents' nationalities mostly representing Nigeria, Russia and

Hungary. Most of the survey respondents had a monthly income of less than 1,000 euros and a relatively new mobile phone in use, the handset's age being under two years for the majority. The sample's monthly mobile phone expenditure was mainly under 30 euros, and most used their phone more for private than business purposes.

The survey respondents' attitudinal valuations of the Mora mobile service are presented in Table 1 with mean values and standard deviations. In perceived usefulness, the respondents mostly agreed with the statement "Using Mora gives me topical information". In perceived ease of use, most agreed with the statement "I quickly learned to use Mora", and they were also aware of the kind of mobile services they can use with their mobile phones. Most users agreed with the statement that Mora downloading and installation was easy. Users disagreed with the statements concerning perceived barriers to use. Fear of technical features, required effort in downloading and installing the application, or even the data transmission billing weren't seen as obstacles in adopting mobile services. The utilisation of time and date-related contextual information in Mora services was seen as more useful than the utilisation of location-specific information. The respondents weren't especially eager to spend time providing their personal details to make the content in Mora more relevant to their needs.

When examining the perceived behavioural control, the respondents found it important that they could control the use of Mora by deciding when and where to use the service. The reference group influence was perceived as rather irrelevant in this survey. The attitudinal construct showed that the respondents had a more preferable attitude toward downloadable applications than toward SMS-based mobile services. Most agreed with the statement "Using the mobile phone as a channel to access the content of school intra is a good idea". The respondents reported that they were willing to use

Table 1: Feedback questionnaire items and attitudinal dimensions of test-user responses to Mora mobile service.

Construct item	Variable	Mean	s.d.
Perceived usefulness			
PU1	Using Mora gives me topical information.	4.29	0.610
PU2	Using Mora saves me time / helps me accomplish things more quickly.	3.77	1.022
PU3	Using Mora gives me personal information.	3.39	1.150
PU4	Using Mora gives me information that is of interest to me.	3.81	0.817
PU5	I find Mora useful in my daily life	3.90	1.053
Perceived ease of use			
PEOU1	I know what kind of mobile services I can use with my phone.	4.14	1.167

Table 1: Feedback questionnaire items and attitudinal dimensions of test-user responses to Mora mobile service (cont.).

PEOU2	It was easy for me to download and install Mora in my mobile phone.	3.88	1.211
PEOU3	I quickly learned to use Mora.	4.62	0.718
PEOU4	I find Mora easy to use.	4.33	0.964
PEOU5	My interaction with Mora is clear and understandable.	4.00	1.085
PEOU6	I find it easy to get Mora to do what I want to do.	3.92	1.100
Barriers to use			
BU1	Fear of technical features is an obstacle to me adopting mobile services.	1.63	1.085
BU2	Difficulty and effort caused by the downloading and installation of the application in a mobile phone is an obstacle to me adopting mobile services.	1.76	1.205
BU3	Knowledge of data transmission billing is an obstacle to me adopting mobile services.	2.51	1.528
Context			
CON1	I would view the content of Mora related to a specific time or date (e.g. exam day, weekend) as useful.	4.39	0.750
CON2	I would view the content of Mora related to me being in a specific location (e.g. campus restaurant, library) as useful.	4.10	0.953
CON3	I would be prepared to spend time providing my personal details (a user profile) to make the content of Mora more relevant to my needs.	3.78	1.112
Perceived behavioural control			
PBC1	I find it important that I can choose between different styles in Mora.	3.17	1.354
PBC2	I find it important that I can easily control the use of Mora (that I can decide when and where I use Mora).	4.50	0.828
PBC3	I find it important that I can easily stop using Mora.	4.44	0.978
PBC4	It would be important for me to be in control in terms of the ability to filter the content of Mora related to my interests/needs.	4.19	0.793
Reference group influence			
REF1	I started to use Mora because it was recommended to me by someone I know.	2.71	1.576
REF2	I started to use Mora because my friends are using it.	2.12	1.199
REF3	I would have been more likely to start to use Mora if the message containing a link for downloading the application was forwarded to me by someone I know.	2.83	1.424
REF4	I recommended Mora to people I know.	3.49	1.271
Attitude			
ATT1	Using mobile services (downloadable applications) is pleasant.	3.90	1.159
ATT2	Using Mora is pleasant.	4.08	0.710
ATT3	Using mobile services (SMS-based) is pleasant.	3.38	1.223
ATT4	Using mobile technology to access a variety of services is interesting.	4.31	0.707
ATT5	Using the mobile phone as a channel to access the content of the university intranet is a good idea.	4.73	0.528
Intention			
INT1	I feel positively about Mora.	4.54	0.503
INT2	I am willing to use Mora in the future, if possible.	4.48	0.641
INT3	I would use Mora regularly in the future.	4.02	1.038
Actual use			
USE1	I am using Mora every day.	2.58	1.226
USE2	I am using Mora every week.	3.71	1.226
USE3	I regularly check what's new with Mora.	3.40	1.302

Mora in the future. However, the actual use of Mora wasn't that regular since it happened more on a weekly than daily basis.

71.2% of respondents reported having used other mobile services in addition to Mora and 67.3% of them had used downloadable applications, whereas only 38.5% SMS-based services. 57.7% of respondents reported having used entertainment services, and 55.8% had used both the information and news services and email; 38.5% had used instant messaging, and 23% banking and financial services. 17.3% of respondents had experience of VoIP, 11.5% of ticket reservation, 7.7% of shopping, and 5.8% of travel booking.

Table 2 shows the standardised coefficients and t-values of the tested hypotheses regarding mobile services (t-statistics indicating the significance of individual variables when the t-value is  $> 2$  (Schwager, 1995).

Table 2: Hypotheses examination.

Hypothesis	Standardized Coefficient $\beta$	t-value	Sig.
H1: PU to ATT	.419	3.164	.003
H2: PEOU to ATT	.303	2.182	.034
H3a: BU to ATT	-.173	-1.205	.234
H3b: BU to INT	-.050	-0.345	.731
H4: CON to INT	.539	4.430	.000
H5: PBC to INT	.250	1.828	.073
H6: REF to INT	.237	1.707	.094
H7: ATT to INT	.572	4.882	.000
H8: INT to USE	.381	2.913	.005

The strong coefficient of H1 shows that there is a positive and direct relationship between PU and ATT. Thus, the perceived usefulness of mobile services is a strong predictor of attitude and H1 was supported. It can also be seen that the PEOU of mobile services was directly and positively associated with ATT, providing support for H2. H3a and H3b address the role of BU, the coefficients were negative, but very low, which indicates that barriers to use have no significant influence on either attitude or intention, thus H3a and H3b were not supported. Next, the strong coefficient of H4 indicates that context-related information acts as a strong and positive predictor of intention to use mobile services, so H4 was supported. H5 and H6 hypothesise that PBC and REF have a positive and direct relationship with INT. Both coefficients are similar with low magnitudes, therefore neither H5 nor H6 were supported by the data. H7 states that the more favourable attitude a person forms toward mobile services, the higher his or her intention to use

those services. The relationship was found to be positive and statistically significant. The final hypothesis, H8, argues that INT is directly associated with USE, and the coefficient is strong and positive. Thus both H7 and H8 were supported.

Figure 3 illustrates the standardised coefficients for the conceptual model.

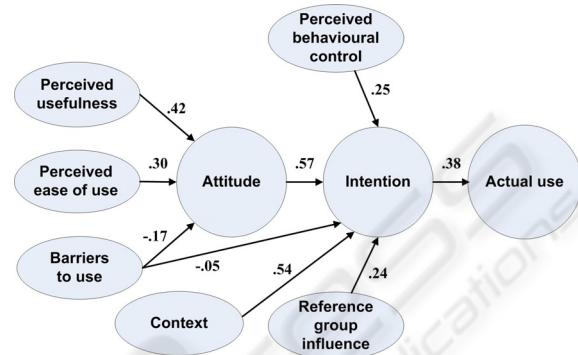


Figure 3: Conceptual model results.

During the field trial it was noticed that mobility does not provide enough added value for the users when the Mora service is in its current form. Consumers were not attracted to the service because they already had an easy and familiar way to access almost the same content via the web, so they felt that the Mora is just a mobile substitute for the campus' web intranet. Even though the challenges with marketing the Mora service and establishing test-users' interest were recognised and actions were taken to overcome them, one reason for the somewhat modest use of the Mora service was that the benefits of the service weren't enough visible to potential adopters. For Mora service users, the easiness and flexibility of the service should have been stressed even more, i.e. that service can be used at any time and in any place, freeing the users from the traditional time and place constraints even more efficiently than Internet services. Another significant obstacle was the effort required in downloading and installing the application. To diminish this problem several separate events were arranged where guidance and support in service adoption was offered to users.

## 5 CONCLUSIONS

This paper introduces a conceptual model for mobile service adoption that is a modified version of established adoption models. The developed conceptual model was evaluated and validated in the

real-life case study of mobile service, through which we have gained practical insights into application-based mobile service development and promotion, as well as having identified the factors affecting the adoption of mobile services in Finland.

The findings from the survey suggest that perceived usefulness of mobile services is the strongest predictor of attitude toward mobile services. That is also supported by previous studies (e.g. Rogers, 1995) on consumer acceptance of new technologies. People will adopt a technology when the added value offered by technology fulfills their needs. Hence, compatibility with users' needs (*ibid*) is a critical variable for predicting technology adoption. Ease of use wasn't perceived as having a strong relationship with acceptance of mobile services, contrary to (*ibid*), so it can be reasoned that usefulness is a stronger determinant of attitude toward mobile services than perceived ease of use. Utilisation of contextual information was found to have a strong impact on intention to use mobile services and proves that consumers desire relevant and personalised services.

The respondents did not perceive the technical features of mobile services, the downloading and installation process or data transmission billing as significant barriers to adopting mobile services as prior researches suggest (Aarnio et al., 2002; Nokia, 2003). When examining the impact of control and social norms, the results of the survey were not congruent with the theoretical background (Ajzen, 1991; Rogers, 1995) either, since perceived behavioural control and reference group influence weren't stated as important determinants of service adoption. A preferable attitude toward mobile services was however proved to have a strong impact on intention to adopt services, whereas the intention in the end didn't act as a good predictor of actual use.

Based on the case study findings, it is suggested that the extended and modified conceptual model can be used to guide industry players' evaluation of the adoption potential of new mobile services. Case study results can be used to help mobile service providers choose right development and marketing strategies for mobile services and accelerate the diffusion of services. However, further and more extensive studies should be conducted in order to attain a more profound understanding of the issues concerning consumers' drivers for adopting (or rejecting) mobile services. Similar research need to be done in other countries as well in order to obtain benchmarks for comparing the differences in adoption characteristics in different countries, and to

further validate the conceptual model. In an international comparison, Finland is an advanced information society especially when it comes to mobile communication. Thus, the study findings might vary in other countries with far lower mobile phone penetration rates and different mobile communication culture. However, when compared to Japan, Finland is far behind in the versatility of mobile communication: in Japan, a nation of 127 million the number of mobile internet subscribers recently passed 100 million (The Guardian, 2007). The conceptual model should also be extended further to include more factors that reflect the unique characteristics of the usage intentions of mobile services. Further attention should be devoted to the comparison of rival models in explaining consumer attitudes and intentions.

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