Mobile Travel Services

A three-country study into the impact of local circumstances

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Abstract

In this paper we explore the difference in acceptance patterns of mobile services that are related to travelling in three countries: Finland, The Netherlands and New Zealand. The objective of this paper is to understand differences in the use of Mobile Travel Services in three countries that differ with regard to national travel patterns. This paper also contributes to the discussion of the relevance of the Technology Acceptance Model for mobile applications by focusing on the importance of context characteristics, such as the degree of mobility of the user, the social situation people are in, and their need for social interaction. Based on surveys in the three countries as executed in 2009, we use structural equation modelling to find differences in patterns. The paper concludes that context factors have an impact on the relation between the core concepts as used in TAM and DOI approach, and that there is a clear need for closer research in the moderating effect of physical (e.g. mobile and fixed context) and social context, as well as the need for social interaction. Moreover it is clear that country specific characteristics play a role in the acceptance of mobile travel services. As we pointed out in many of our research projects before the acceptance and use of mobile services requires deep understanding from individual, context and technology related characteristics and their mutual interactions.

Introduction

Mobile technology becomes more and more important in society. Mobile services are changing the landscape of almost every society, and industry. One of the industries that is most dramatically affected by the emergence of Internet was the travel and tourism industry. The fabric of the industry changed; travel agencies were replaced by travel websites and portals. Travel Service providers, airlines and other public and private transport companies, hospitality industry, all adopted the Internet. With the emerging mobile, and gps, technologies travelling and hospitality services will be bring these websites and portals services even one more step closer to customer, business travellers and national and international tourist alike, offering services based on location and context information . In this paper we will analyse to what degree consumers in three different countries, e.g. Finland, The Netherlands and New Zealand, are accepting mobile travel services. We focus on national travelling patterns, assuming that due to difference in national geography, size and distance, travel habits differ. Finland for instance has concentration of the population in the southern parts of the country, but still than travelling distances are big and leads to frequent hotel (or other accommodation) usage. While in the Netherlands national travelling is limited, the economic activities are highly concentrated leading to very intensive traffic and impressive records, almost leading to national traffic infarcts. New Zealand at the other is scarcely populated, but dealing with the fact that the main economic activities are spread over the two main islands. So Finland and New Zealand have almost the same size in population but deal with long distances. At the other hand the Netherlands has a population almost 3 to 4 time as big as in the other two countries, but is very densely populated and has relative short distances. With regard to mobile telecommunications, Finland has been for a long time been the international forerunner, gradually losing ground to Asian countries like Japan, Korea and China. The Nokia factor and the high interest in national policy for R&D both play an important role in the Finnish national economy. At the other hand The Netherlands and New Zealand although like Finland have a deregulated and liberalized telecommunication regime, are lagging behind in development of appealing mobile services. New Zealand specifically is lagging behind with rolling out 3G networks. Telecom New Zealand, one of the two main providers, only launched 3G in 2009, and in their first year suffered a series of highly publicized crashes. So the comparison between the three countries and how national inhabitants experience mobile travel services might shed lights on the viability and feasibility of mobile travel services, taking national flavours into account. Next to the practical relevance from the perspective of the mobile and travel industry, the paper also contributes to developing insights on acceptance of mobile services. Next to traditional Diffusion of innovation concept, attitude towards mobile innovation, and Technology Acceptance Model concepts like perceived ease of use and perceived usefulness, this paper explores the role of the physical context, being in a fixed place or travelling, social context, alone or with others, as well as need for social interaction. So the paper has a dual objective: (1) international comparison of the acceptance of mobile travel services in three countries that have significant different profiles with regard to travelling as well as mobile telecommunications, and (2) expanding acceptance research on mobile applications, more specific travel services by including context related concepts that are relevant seen from a travelling perspective. In order to achieve these goals we will first discuss literature in order to develop our conceptual model. Next we will discuss the differences in national travelling behaviour and in the mobile telecommunication in more detail, and based on this discussion formulate very generic expectations with regard to how we expect the model to work out for the individual countries. We will discuss the research approach and results, as well as reflect on them as well as on the limitations.

Literature review

There are several models that can be used to examine the adoption of travel mobile services. To date, Information System (IS) acceptance research has predominantly been influenced by intention-based models rooted in cognitive psychology, that is to say, the theory of reasoned action (TRA) by

Fishbein and Ajzen (1975), the technology acceptance model (TAM) by Davis (1989) and its extensions, and the theory of planned behavior (TPB) by Ajzen (1991).

Specifically, TRA is based on the proposition that people's actual behavior is determined by their intention to behave in a certain way, and that their intention is influenced both by their own attitudes and by subjective factors (social influences). The TPB was proposed as an extension to the TRA, to account for the internal and external constraints (e.g. people's economic situation or experience with a specific service) on behavior (Nysveen et al., 2005b). Finally, TAM predicts people's intentions to use a technology based on their perceptions of its ease of use and usefulness. The adoption of technological products and services has been predominantly explained by TAM (Davis, 1989) and its extensions, TAM2 (Venkatesh and Davis, 2000) and the UTAUT model (Venkatesh et al., 2003). One of the reasons these modifications were developed is the constant development of new and more sophisticated IT devices (Nysveen et al., 2005a).

Perceived usefulness, Perceived ease of Use, use of mobile travel services

With the proliferation of the Internet and e-commerce, researchers have adopted and adjusted TAM to demonstrate the empirical value of TAM for the new World Wide Web (WWW). Also, in mobile contexts, research regarding people's intentions to use mobile devices and services has been based on TAM (Nysveen et al., 2005b). Travel mobile services are different from other mobile services such as GPRS, surveillance, or entertainment (Bouwman et al., 2007), and include services such as checking flight/train time tables, making a reservation/purchasing flight/train tickets, reservation hotel room, etc. The 'always on' and portable characteristics of mobile devises and services permit their users to engage in activities such as meeting with people or travelling while conducting transactions through their Internet-enabled mobile devices (Mahatanankoon et al., 2005). In a study about the adoption of mobile Internet, Ishii (2004) reports, however, that only 10% of total mobile Internet use was performed when the Japanese respondents were traveling on a train or bus. This may be due to that fact that travelers would be more interested in GPS and viewing maps on the devices (Economides and Grousopoulou, 2009), than on mobile Internet. Besides, the Internet activity of making reservations or researching travel could be considered fun if it is for leisure rather than business travel (Schiffman et al., 2003). If we ignore the characteristics of the specific service, combining different core services, as is done in TAM and UTAUT research, we do not get a valid conceptualization of the actual and future use of mobile service bundles (Bouwman et al., 2007). Thus, differences in service attributes cannot be ignored and a model for understanding the adoption of travel mobile services is needed.

The simplified TAM contains the three basic relationships affecting Behavioural Intention (BI) to adopt Information Technology: 1) Perceived Ease Of Use (PEOU) leads to Perceived Usefulness (PU), 2) PEOU leads to BI, and 3) PU leads to BI. These three basic links have been tested in several studies, revealing a high validity in explaining the acceptance of different technological products and services. Simplified TAM has also been tested in the adoption of diverse mobile devices and services: mobile Internet (Cheong and Park, 2005; Hong et al., 2006; Lu et al., 2005), mobile services (Nysveen et al., 2005b), mobile healthcare systems (Wu et al., 2007), mobile games (Ha et al., 2007), mobile banking (Luarn and Li, 2005) and mobile commerce (Wu and Wang, 2005). However, no confirmation of basic TAM has been reported for the adoption of travel mobile services. Thus, we posit the following:

H1: Perceived usefulness has a positive effect on use of mobile travel services.

H2: Perceived ease of use has a positive effect on use of mobile travel services)

H3: Perceived ease of use has a positive effect on use of mobile travel services.

Although TAM represents an early attempt to apply psychological factors to IS and computer adoption (Schepers and Wetzels, 2007), recently there has been increasing concern about its appropriateness and comprehensiveness, and it is increasingly considered too parsimonious (Venkatesh and Davis, 2000) and incomplete (Teo and Pok, 2003) in nature, more appropriate in an organizational context than in everyday context (Nysveen et al., 2005b), deterministic (McMaster and Wastell, 2005) and tautological (Bouwman et al., 2005). In addition, it is considered lacking in its ability to account for social influences and limited in its ability to explain user intentions (Bhattacherjee, 2000). Recently, Schepers and Wetzels (2007) have presented a meta-analysis of TAM based on 51 studies. Two of their main conclusions are that the original TAM relationships are confirmed, mostly based on structural equations modeling, and that the technology under consideration is found to have a significant moderating effect on user behavior. Advanced mobile services may be different from earlier technologies in terms of their acceptance, which would imply that existing models regarding IT adoption may not apply to advanced mobile services in a consumer setting, and that some modifications or combinations are necessary.

Literature also states that TAM may not be sufficiently suitable for an advanced analysis and evaluation of mobile services, because it depends to a large extent on the contextual conditions of the services (Amberg et al., 2004). In their recent study, Bouwman and van de Wijngaert (2009) demonstrate that TAM models are too generic to fully explain people's intention to use mobile technologies. Thus, it would appear that TAM should be extended and complemented by including additional factors that may be especially significant to the adoption of travel mobile services. Additional concepts included in prior research on advanced mobile services relate mainly to user perceptions of enjoyment or playfulness, social influences (subjective norm and image), cost (price or fee), personal innovativeness, and to background characteristics like gender, age, income, education and experience. Also, context-related characteristics, together with task-related and information-related characteristics, have a higher predictive value than TAM-concepts (PEOU and PU) when studying mobile applications (Bouwman and van de Wijngaert, 2009). Although the use context is an essential factor in affecting user acceptance of mobile systems (Mallat et al., 2009), it has with view exceptions, not been studied formally.

Based on the discussion presented above, the aim of our study is to evaluate the impact of different determinants on behavioural intention (BI) concerning the adoption of travel mobile services, by combining existing acceptance models with diffusion theory. In particular, we assume that 1) PU, PEOU and BI may be determined by the personal innovativeness or innovative attitude toward advanced mobile services, and 2) mobility and social factors may create a context for enhancing or hindering people's intention to use travel mobile services and their perceptions of usefulness and ease of use.

Personal Innovativeness

A person's attitude towards mobile innovations is based on the concept of personal innovativeness. Agarwal and Karahanna (2000) conceptualize personal innovativeness in the domain of information technology as an individual trait reflecting a willingness to try out any new technology (in our case advanced mobile services). Innovations create uncertainty about their expected consequences for potential adopters, and individuals who are generally uncomfortable with uncertainty will tend to interact with their social network before making a decision (Lu et al., 2005). Pedersen (2005) also suggests that less innovative people may rely more on the user-friendliness of services, be influenced more by their peers, and put more weight on the self-identifying or socially identifying role of using mobile services. This is seen as a result of the idea that mobile users usually find themselves in social situations (Lu et al., 2005) and that normative pressure from reference groups reduces the perceived risk of adopting a new technology (Teo and Pok, 2003). Overall, using of an innovation is seen as a form of public consumption and it can be significantly influenced by friends and colleagues (Hong and Tam, 2006).

Agarwal and Prasad (1998) have presented a conceptual operational definition of personal innovativeness, indicating that personal innovativeness can moderate the effects of a person's perception on IT-related adoption decisions, thus playing an important role in determining the outcomes of user acceptance of technology (Yi et al., 2006). Individuals with higher levels of personal innovativeness are expected to develop more positive beliefs regarding new technologies (Lewis et al., 2003). Personal innovativeness was initially proposed as a moderator of PU, while it was later re-conceptualized as a direct determinant (Yi et al., 2006). Specifically, Agarwal and Prasad (1998) have found that personal innovativeness can improve people's PU of the World Wide Web, while the results presented by Lewis et al. (2003) suggest that personal innovativeness has a direct, positive influence on the PU of Internet technologies. Earlier, Straub et al. (1995) found that personal innovativeness has a direct positive effect on the PU and PEOU of IT.

With regard to the adoption of mobile services, an innovative attitude towards technological innovations may also enhance the perception of usefulness. In their study into the adoption of wireless Internet via mobile technology, Lu et al. (2005) have found that a user's personal innovativeness has a direct positive impact on PU and PEOU. Additionally, Mao et al. (2005) have theorized about a direct positive effect of personal innovativeness on PU. Based on the results of these studies, we posit that:

H4: People's attitudes towards mobile innovations have a positive effect on perceived usefulness of travel mobile services.

H5: People's attitudes towards mobile innovations have a positive effect on perceived ease of use of travel mobile services.

People's attitudes towards innovations have been used to predict consumer tendencies to adopt a wide variety of technological innovations (Yang, 2005). Specifically, personal innovativeness may influence a person's use of mobile phone service (Mao et al., 2005). Past research has shown that a person's attitude towards technological innovations increases the rate of adoption of WAP services (Teo and Pok, 2003). Additionally, the empirical data analyzed by Yang (2005) indicate that (general) consumer innovativeness is a useful predictor of a person's behavior when it comes to adopting mobile commerce. When we apply these findings to advanced mobile services, we posit that:

H6: People's attitudes towards mobile innovations have a positive effect on the use of travel mobile services.

Context related concepts: mobility versus stationary situations

Because of its inherent design, a mobile phone can be "always on" and is always portable (Mahatanankoon et al., 2005). According to Bouwman et al. (2007), the benefits of mobile services are related to mobility in space. The term mobility and ubiquitous or nomadic computing refers to movement of technologies, people, settings, etc. Compared with traditional e-commerce, mobile computing provides access to information, communication, and services independent of time and place (Mallat et al., 2009). Mobile devices and services offer people the opportunity to move around while maintaining access to relevant services and staying (socially) connected. The nomadic value of mobile services is reflected in concepts like 'anytime anyplace', which are mentioned in almost every paper discussing the potential of advanced mobile services. Pura (2005) discusses value from a more general customer-related value perspective, using concepts like social, emotional, conditional, monetary, convenience-related and epistemic value in explaining BI concerning the use of location-based mobile services. These concepts are too general in nature to capture the real added value of mobile services and service bundles, leading to the conclusion that emotional (positive feelings and fun) and conditional value, i.e. the context in which a service will be used, predict the BI to use

location-based mobile services. Pagani (2004) mentions mobility, availability ('anytime anyplace') and personalization as important perceived benefits of (multimedia) mobile services. Mobility is enabled and facilitated by new technologies (Mallat et al., 2009) and seen as one of the most important benefits.

Advances in mobile technologies and devices allow people to use mobile services anytime and anywhere, providing them with the ability to achieve mobility benefits, not only for traditional communication services but also for more advanced mobile applications. Thus, advanced mobile services can and may be used in a mobility context (on the road, on a train/bus, etc.) or a fixed context (at home, in a meeting, at work, etc.). Applications people would normally access via a PC can now be accessed via mobile devices, when in a setting where users are no longer dependent on fixed connections, and where they can be mobile themselves. While mobility may appear similar to the usefulness construct in TAM (Davis, 1989) or relative advantage concept in the diffusion of innovation theory (Rogers, 1995), the difference is that usefulness is generic to all technologies (such as payment cards and mobile payments) amd relative advantage is generic to all products or services, whereas mobility captures the benefits offered by mobile technology only (Mallat et al., 2009).

In their multi-service analysis of the use of advanced mobile services, Bouwman et al. (2007) find that barriers (physical, economic, cognitive and security) are not hindering the actual use of travel services, while a positive attitude towards mobile innovations has a positive effect. They also report that the perceived flexibility, as consequence of their mobility, is an important predictor for the future use of mobile travel services, whereas the perceived entertainment value contributes less. When the person is traveling and needs to access email quickly, the benefits of mobility actualize, and the mobile service is perceived as useful (Mallat et al., 2009). Although advanced mobile services may be accessed in a mobility context or a fixed context, travel mobile services are expected to be especially more useful and used in a mobility context rather than in a fixed context. Based on the previous discussion, we posit the following:

H7: Fixed context plays a moderating role in the use of travel mobile services.

H8: Mobility context plays a moderating role in the use of travel mobile services.

Social context and the need to interact

Existing literature gives the impression that mobile services are adopted for functional (usability, flexibility, costs) as well as nonfunctional reasons (social status, image, fashion) (Pedersen, 2005). It is likely that mobile telephones are considered a lifestyle product rather than a necessity (Teo and Pok, 2003) and have been marketed as modern and image-enhancing technologies (Katz and Sugiyama, 2005). Mobile devices are predominantly used to interact with others, and considered as symbols of social progress (Meso et al., 2005). Pedersen (2005) states that users' attitudes toward the use of advanced mobile services are developed in social networks and influenced by social norms. Thus, mobile devices and services may be adopted for leveraging social interactivity, defined as the need to use advanced mobile services to socialize, in a social context, shaped by friends and family.

Although mobile services are very much integrated in the daily lives of teenagers (Pedersen, 2005), social interactivity and image may be considered highly significant for many social groups as well (Lu et al., 2005). Moore and Benbasat (1991) define image as the extent to which the use of an innovation is perceived as enhancing one's status in a social system. When the penetration of an advanced mobile technology is not substantial, users may regard that technology as symbolic of fashion and wealth (Lu et al., 2005), and decide to adopt it to enhance their perceived social status. When the penetration of an advanced mobile technology is substantial, users may become dependent to its use in order to interact with their social context. Social information processing

theory (Salancik and Pfeffer, 1978) posits that communication attitudes and behaviors are determined by social context. According to this theory, perceptions of media characteristics, the communication task requirements, and attitudes toward communication media are influenced by social norms.

Social influence is a concept related to social interactivity. Social influence, also known as normative pressure (Nysveen et al., 2005b) or subjective norm (Fishbein and Ajzen, 1975), emphasizes the role of the opinions and behavior of in terms of the perception of the (ease of) use of a system (Fulk et al., 1990). It refers to the degree to which individuals have the impression that important others believe they should (be able to) use the new system (Venkatesh et al., 2003), in our case advanced mobile services. This definition contains the notion that people's behavior is influenced by the extent to which they believe others are of the opinion that they have to, and will be, able to use the technology. Venkatesh and Davis (2000) have extended the original TAM model to TAM2, to reflect the impact of three interrelated social forces: subjective norm, voluntariness and image. In the UTAUT model, social influences are further recognized as being one of the four direct determinants of BI to use, together with performance expectancy, effort expectancy and facilitating conditions (Venkatesh et al., 2003).

Venkatesh and Davis (2000) argue that when important members of a person's social group believe a certain behavior is the right one (e.g., using a certain technology), it will tend to elevate his or her standing within the group. Hong et al. (2006) argue that using mobile services that are widely accepted by group members can often be a way to maintain membership and secure support through increased interactions within the group. Overall, this appears to suggest that social interactivity can explain the adoption of advanced mobile services, like travel mobile services. We can conclude that, in the attempts to explain the acceptance of advanced mobile services, the role of social interactivity, however, has been underestimated.

The relationship between social influences and TAM-related variables has not been examined specifically in any of the earlier studies on advanced mobile services. People's attitudes, behavior and perceptions are affected by the information they receive from their social environment. Social influences may help shape an individual's estimation of his or her confidence in or ability to use a technological system (Lu et al., 2005), as may be the case with advanced mobile services. According to the Social Information Processing Approach proposed by Salancik and Pfeffer (1978), people learn what their needs and requirements should be from interaction with their social network. Based on that, potential users of advanced mobile services may feel that adopting those services and technologies does not require too much of an effort if other people in their social environment inform them the system is easy to use.

In TAM2, Venkatesh and Davis (2000) suggest that, regardless of the context, people's perceptions of the usefulness of a service or technology may increase in response to persuasive social information. The social influence that encourages people to use a technology has been demonstrated to have an indirect impact on their intention to adopt, via PU (e.g., Venkatesh and Davis, 2000) since the link between subjective norm and intention has typically been empirically non-significant (Bhattacherjee, 2000). In addition, Lu et al. (2005) show that social influences can affect a person's evaluation of advanced wireless Internet in terms of its usefulness. In a social context where people show high levels of social interactivity needs, advanced mobile services may be used no matter their usefulness, but due to users' personal innovativeness if this feature is highly valued by the social context. Based on this, we posit the following:

H9: Social context plays a moderating role in the use of travel mobile services.

H10: Need to interact plays a moderating role in the use of travel mobile services.

The hypothesis are summarized in figure 1

Figure 1 Conceptual; model summarizing the main hypotheses.

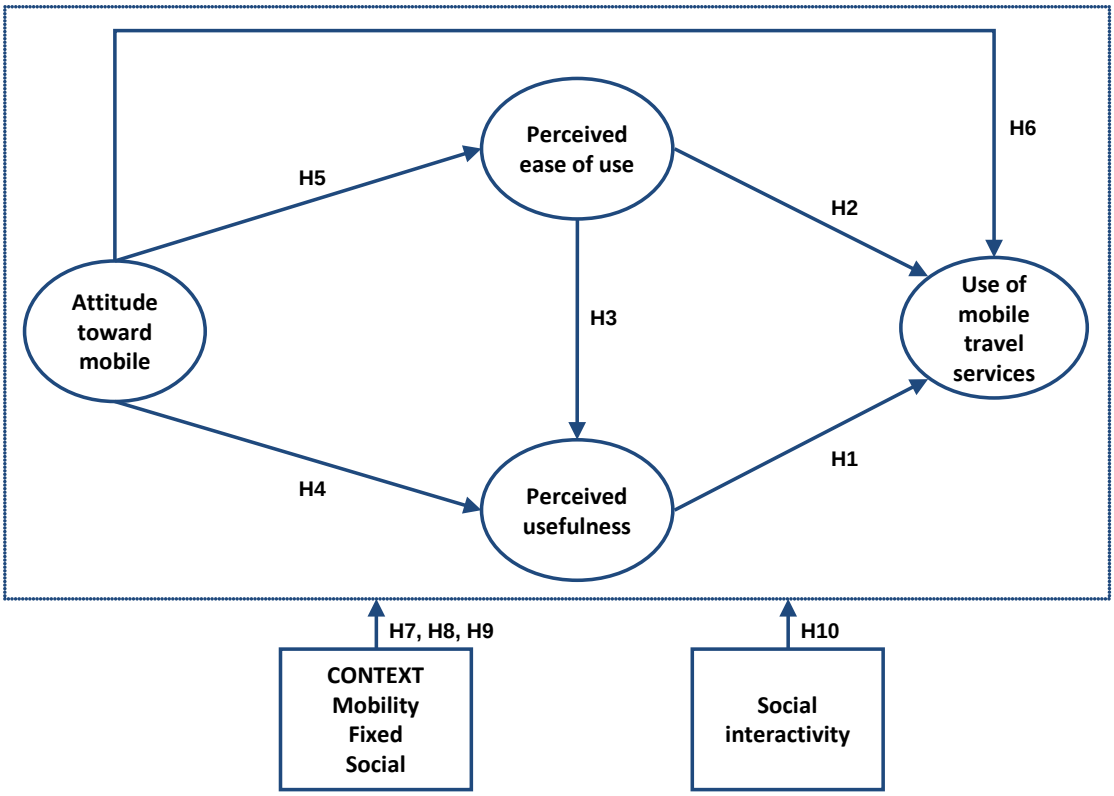

Figure 1: Theoretical model

Country specific expectations

Finland is sparsely populated when compared to most European countries with only 15.7 inhabitants per km2, but most of the population of 5.2 million inhabitants is concentrated to the southern parts of Finland, with around 1,2 million living in the greater capital area around Helsinki. Average commuting distance is 13 kilometres and average travel time spent on commuting around 30 minutes. The most popular means of transportation for commuting is by private car; 80 % of commuter travel is done by car. Other options are public transportation and for longer distances also railway. Travel between cities is taken care of by public or private bus companies and airlines, as well as a state owned railway company. Special needs regarding transportation are seen e.g. in the archipelago, where the inhabitants rely on car ferries linking the islands (http://www.liikenneturva.fi/www/fi/tilastot/liitetiedostot/Tyliikennetilasto.pdf). During holidays and business trips 14 million domestic guests are registered; average stay is 2.7 night (www.stat.fi, last retrieved April 27, 2010). Numerous mobile applications for travellers and tourists are available on the Finnish market and new applications are frequently introduced such as real-time information on buses or trams to passengers' mobile phones (KAMo, VTT). Mobile booking services, buying bus- and train tickets, check-in services, map services, weather forecasts and traffic information, as well as general tourist information are available. In northern Finland the Levi application (mobi.levi.fi) offers the travelers several services among others information about skiing conditions.

In the Netherlands, travelling services are only limited relevant for the Dutch population. The geography of the Netherlands basically implies that travelling from North to South, or from East to West will take you about two hours in this densely populated country the biggest distance between the most Northern and Southern city is 334 km and will take 3 hours by car. Problems are more

related to traffic jams that might occur. Public transport is dense and trains ride in a high frequency. The major cities are connected via train services that operate every 15 minutes. Commuting time is on average 56 minutes a day. During holidays and business trips 18.5 million guests are registered; average stay is 1.8 night (www.CBS .nl, retrieved 1 March 13, 2010). Mobile applications focused on travelling and tourism, are abundant in the Netherlands. There is a specific application for planning of public transport. There are applications for real time travel information, hotel reservations, flight reservations, location services, some of these applications are available via SMS based services, and other applications are specifically developed for Smart Phones.

New Zealand, as a contrast, is well known as a global travel destination. Travelling from the North to the South on the two main islands takes you multiple days by car, due to the fact that about 900 to 1000 km has to be covered. Driving tends to be slow due speed limitations and roads that cross the majestic New Zealand landscape. By airplane it takes 1.5h to travel from Auckland to Dunedin on a direct route. Public transport is exists in all major cities although schedule frequency is closer to the American model than European. Therefore, private cars are the main means of transport. This can cause traffic jams especially in the metropolitan area of Auckland, which has grown faster than expected. There is, however, a well organized intercity bus operation which is targeted for independent travels of all ages. Car rentals are also relatively inexpensive especially the weekly rates. During holidays and business trips 18.7 million domestic guests are registered; average stay is 1.8 night (www.stats.govt.nz , last retrieved April, 24, 2010). Official government web site lists over 12.000 travel related web sites in New Zealand (www.linknz.co.nz).

Mobile applications focusing on traveling and tourism have not really taken off in New Zealand, so few examples exist. One example is Vodafone Compass, which allows the phone to act as a navigation device, and gives directions. Vodafone Live also offers SMS based services where users can find things nearby. Other examples are in-car navigation systems utilizing GPS, for example krusenz.com, which is a GPS audio device which broadcasts local information through the cars radio system. NZ Traffic is an application for iPhones where users can check local traffic conditions.

Seen the difference in geographical, travel and mobile industry conditions we expect that the use of mobile applications is most favorable in Finland and least favorable in the Netherlands, while New Zealand takes a middle position.

Method

Sample and data collection

T use of mobile travel services he Finnish data were collected via a self-administered questionnaire that was mailed to a sample of Finnish consumers in the spring of 2009. The sample was selected from the electronic sampling frame provided by the Finnish Population Register Centre. Random sampling was used, and the sample is representative for the Finnish population between 16 and 64 years. XXX completed questionnaires were returned.

The Dutch respondents were selected from a large panel of 25,000 households that are used regularly for survey research. Potential respondents were first approached via telephone, to ask them whether they would be prepared to participate. Respondents who agreed were sent an e-mail with a link to the online questionnaire. From the 927 respondents approached we received 524 completed questionnaires. The sample was checked with regard to relevant criteria to be sure that the sample was representative of the Dutch population of 18 years and older.

The New Zealand data was collected via a web-based questionnaire. 493 respondents completed questionnaires were returned,. Random sampling was used, and the sample is representative for the New Zealand population between 16 and 64 years.

Questionnaire

The questionnaire consists of three parts, the first of which contains questions about devices and subscriptions. In the second part, items are presented that have to do with people's values and attitudes towards mobile devices, services and innovation, comparable to items that are used in (Anckar and D'Incau, 2002; Cheong and Park, 2005; Bouwman et al., 2007). In the third part, questions with regard to the actual and future use of thirty-one mobile services, as available on the, Finnish, New Zealand and Dutch markets, are presented to the respondents. 5 point self-report scales were used, ranging from non-use to (likely) intensive use. In the questionnaire the services are extensively explained, so that even people who don't have any experience with the service can understand what the service entails. The questionnaire was initially developed in Finland and tested in 2003-2005. In the following years the questionnaire was also used and further developed by the Finnish and Dutch researchers. The questionnaire is translated in English, Finnish and Dutch, and all translation are being done in both directions for validation purposes. The English version is being used in New Zealand.

Measurements and scales

The measures as used in the model testing, were refined by assessing their unidimensionality and reliability.

Table 1 . Reliability and correlation

Finland data									
		Mean	SD	SCR	AVE	1	2	3	4
1	Travel services	1.63	.92	.87	.65	.81			
2	Perceived Usefulness	2.81	.93	.88	.63	.31*	.81		
3	Perceived Ease of Use	3.07	1.04	.92	.74	.16*	.47*	.86	
4	Attitude toward mobile services	1.95	.95	.87	.62	.38*	.45*	.31*	.79
$\chi^2(98)= 405.47$ CFI=.96 IFI=.96 NNFI=.95 RMSEA=.08									
Dutch data									
		Mean	SD	SCR	AVE	1	2	3	4
1	Travel services	1.06	.99	.91	.70	.84			
2	Perceived Usefulness	1.48	.93	.83	.55	.43*	.74		
3	Perceived Ease of Use	2.12	.85	.91	.76	.30*	.43*	.87	
4	Attitude toward mobile services	.97	.82	.85	.59	.30*	.60*	.31*	.77
$\chi^2(98)= 475.14$ CFI=.95 IFI=.95 NNFI=.94 RMSEA=.08									
New Zealand data									
		Mean	SD	SCR	AVE	1	2	3	4
1	Travel services	1.24	.58	.86	.61	.78			
2	Perceived Usefulness	3.59	.71	.85	.60	.32*	.77		
3	Perceived Ease of Use	3.78	.73	.93	.77	.23*	.41*	.87	
4	Attitude toward mobile services	2.86	.91	.88	.64	.36*	.51*	.36*	.81
$\chi^2(98)= 309.17$ CFI=.97 IFI=.97 NNFI=.97 RMSEA=.06									
AVE = average variance extracted. The numbers on the diagonal are the square root of the AVE. Off-diagonal elements are correlations among constructs a Scale composite reliability ($q_c=(Ak_i)_2$ var (n)/[$(Ak_i)_2$ var (n) +Ah_{ii}]; (Bagozzi and Yi 1988) b Average variance extracted ($q_c=(Ak_i)_2$ var (n)/[$(Ak_i)_2$ var (n) +Ah_{ii}]; (Fornell and Larcker 1981)									

Confirmatory factor analysis (CFA) and alpha reliability analysis were used to establish the required convergent validity, discriminant validity and reliability. As can be observed in Table X, the results of the factor models provide an acceptable fit. Because the research contains several multi-

item reflective scales, the psychometric properties of the measures described above were analyzed via the composite reliability index (Bagozzi and Yi 1988) and the average variance extracted index (Fornell and Larcker 1981). Both indexes exceeded the recommended benchmark of .60 and .50 respectively.

Results

The model was tested making use of multi-group analysis. In our first analysis we focused on respondents that indicate that it is not important at all or very important to use mobile services in a certain location. We make a distinction between location that are more or less static. , e.g. public place, at home a t work, in a meeting or just doing a job is affecting our theoretical model. Next we look into more dynamic situations, e.g. on the road, on a business trip, on a train or bus, on vacation. The third step was a multi group analysis were we made a distinction between respondents who attribute limited importance to use in social context and who value use in social context. And finally we made a distinction between people who value social interaction versus respondents who think this is less important. The analyses were done for the three countries separately. Table x, x and x present the results for Finland, the Netherlands and New Zealand.

Table 2 Results for model testing in Finland (MTS = Mobile Travel Services)

Finland	H1 PU -> Use of MTS	H2 PEOU -> Use of MTS	H 3 PEOU-> PU	H4 PI -> PU	H5 PI -> PEOU	H6 PI -> Use of MTS	R^2 Use of MTS
Be able to use in static context							
Not important	NS	NS	.29	.17	.24	.17	.06
Model	CFI=.93 NNFI=.92 RMSEA=.08 Chi-square (98) = 243,46						
Very Important	.21	NS	.36	.26	.32	.33	.19
Model	CFI=.96 NNFI=.95 RMSEA=.08 Chi-square (98) = 247,78						
Be able to use in dynamic context							
Not important	NS	NS	.30	.24	NS	NS	.04
Model	CFI=.94 NNFI=.93 RMSEA=.07 Chi-square (98) = 218,11						
Very Important	.20	NS	.33	.25	.29	.37	.21
Model	CFI=.95 NNFI=.94 RMSEA=.08 Chi-square (98) = 248,44						
Be able to use in social context							
Not important	NS	NS	.35	.21	NS	.17	.05
Model	CFI=.92 NNFI=.91 RMSEA=.08 Chi-square (98) = 239.45						
Very Important	.28	NS	.34	.27	.35	.31	.20
Model	CFI=.95 NNFI=.94 RMSEA=.08 Chi-square (98) = 276.79						
Need for social interaction							
Not important	NS	NS	.32	.36	.27	.29	.18
Model	CFI=.96 NNFI=.95 RMSEA=.07 Chi-square (98) = 225.40						
Very Important	.22	NS	.36	.28	.30	.28	.14
Model	CFI=.94 NNFI=.93 RMSEA=.08 Chi-square (98) = 296.67						

First of all the low explained variance is striking. The explained variance lies between 4% and 21%. In the Netherlands only four models can be tested. The explanation has to be sought in the intensity of use of mobile travel services. It is clear (see table 1) that the mobile travel services are not used very extensively. Finland is leading most people tried using the travel applications, to a lesser degree this also true for New Zealand, while the Dutch consumers are lagging behind. The diversity of services in Finland is more spread as well as s the number of services is higher.

Table 3 Results for model testing in the Netherlands (MTS = Mobile Travel Services)

Netherlands	H1 PU -> Use of MTS	H2 PEOU -> Use of MTS	H 3 PEOU-> PU	H4 PI -> PU	H5 PI -> PEOU	H6 PI -> Use of MTS	R^2 Use of MTS
Be able to use in static context							
Not important	.30	.19	.27	.43	.25	NS	.06
Model	CFI=.93 NNFI=.92 RMSEA=.08 Chi-square (98) = 228,57						
Very Important	.27	NS	.26	.44	.23	NS	.14
Model	CFI=.94 NNFI=.93 RMSEA=.08 Chi-square (98) = 243,46						
Be able to use in dynamic context							
Not important							
Model	No fitting model						
Very Important							
Model	No fitting model						
Be able to use in social context							
Not important	.35	.13	.20	.51	.25	NS	.06
Model	CFI=.93 NNFI=.92 RMSEA=.08 Chi-square (98) = 302,65						
Very Important	.28	NS	.34	.27	.35	NS	.05
Model	**CFI=.95 NNFI=.94 RMSEA=.08 Chi-square (98) = 206,28**						
Need for social interaction							
Not important							
Model	No fitting model						
Very Important							
Model	No fitting model						

Second it is striking that the models have either the same or, as shown in the most cases, more explained variance when the physical or social context is considered to be more relevant. For individual concepts we see the same pattern for Perceived Usefulness and Personal Innovativeness in direct relation to Use of Mobile Travel Services. Both in Finland and New Zealand perceived usefulness as well as the attitude towards mobile innovations appears to play a more important role in explaining use when context is taken in consideration. The patterns with regard to the relation between Perceived Usefulness and use of mobile travel services for the static and dynamic context in Finland and New Zealand are opposing. Where the relation in Finland is non significant in the not-important condition, and weak in the important condition, we find the opposite trend in New Zealand. We don't see this pattern when people attribute relevance to social interactions. So the relation between context of use and the use of mobile travel services and possible explanation of use needs closer scrutiny.

Third the lack of direct relevance of Perceived Ease of Use in relation to the use of mobile travel services is striking in most models. Only the Dutch respondents apparently consider ease of use still an issue. This confirms results of earlier research. In all other models the relation is mediated by perceived usefulness. While personal innovativeness also correlates with perceived ease of use: so if respondents have a positive attitude towards mobile innovations they also expect them to be easier to use. The same goes for a positive attitude towards mobile innovations and perceived usefulness. If people have a positive attitude they also expect the services to be more useful. All these relations are again stronger if users consider the physical or social context to be more relevant.

Table 4 Results for model testing in New Zealand (MTS = Mobile Travel Services)

New Zealand	H1 PU -> Use of MTS	H2 PEOU -> Use of MTS	H 3 PEOU-> PU	H4 PI -> PU	H5 PI -> PEOU	H6 PI -> Use of MTS	R^2 Use of MTS
Be able to use in static context							
Not important	.19	NS	.23	.47	.22	NS	.10
Model	CFI=.97 NNFI=.96 RMSEA=.06 Chi-square (98) = 195.65						
Very Important	.16	NS	.35	.24	.44	.30	.16
Model	CFI=.97 NNFI=.96 RMSEA=.07 Chi-square (98) = 221.63						
Be able to use in dynamic context							
Not important	.21	NS	.17	.48	.25	NS	.11
Model	CFI=.97 NNFI=.97 RMSEA=.05 Chi-square (98) = 182.20						
Very Important	NS	NS	.41	.43	.24	.32	.17
Model	CFI=.97 NNFI=.96 RMSEA=.07 Chi-square (98) = 216.75						
Be able to use in social context							
Not important	.34	NS	.24	.51	.30	NS	.17
Model	CFI=.97 NNFI=.96 RMSEA=.06 Chi-square (98) = 221.27						
Very Important	NS	NS	.35	.23	.42	.34	.17
Model	CFI=.97 NNFI=.96 RMSEA=.06 Chi-square (98) = 195.24						
Need for social interaction							
Not important	.25	NS	.18	.39	.24	.17	.13
Model	CFI=.96 NNFI=.95 RMSEA=.07 Chi-square (98) = 232.61						
Very Important	NS	NS	.25	.39	.39	.35	.17
Model	CFI=.96 NNFI=.95 RMSEA=.08 Chi-square (98) = 226.61						

Conclusions and limitations

In this paper we explored the relation between concepts of Diffusion of Innovation and Technology Acceptance model in relation to mobile travel services. In general usage of mobile travel services is still low. The low explained variance for the models can be attributed to the more or less skewed distribution of the usage patterns. However there are also some interesting results we want to emphasize. An important issue is the context in which these services are being used. The usage in a fixed or in a mobile context might make a difference. Clearly context has an important effect, however there is no clear indication in which direction these effects are working out. The evidence is

mixed, seen the different directions of the effects (see table for an overview of accepted and rejected hypotheses). Interaction effects can be observed for the typical TAM concepts, perceived usefulness in relation to use of mobile travel services, and perceived ease of use in relation to perceived usefulness as well as for the Diffusion of Innovation concept personal attitude towards mobile innovations and use of mobile travel services.

Table 5 Results of hypothesis testing)

Hypothesis	Finland	Netherlands*	New Zealand
1 Perceived usefulness has a positive effect on use of mobile travel services.	mixed	accepted	mixed
2 Perceived ease of use has a positive effect on use of mobile travel services.	rejected	mixed	rejected
3 Perceived ease of use has a positive effect use of mobile travel services.	accepted	accepted	accepted
4 People's attitudes towards mobile innovations have a positive effect on perceived usefulness of travel mobile services	accepted	accepted	accepted
5 People's attitudes towards mobile innovations have a positive effect on perceived ease of use of travel mobile services	accepted	accepted	accepted
6 People's attitudes towards mobile innovations have a positive effect on the use of travel mobile services	accepted	rejected	mixed
7 Fixed context plays a moderating role in the use of travel mobile services	partly	partly	partly
8 Mobility context plays a moderating role in the use of travel mobile services.	accept	-	partly
9 Social context plays a moderating role in the use of travel mobile services	partly	partly	partly
10 Need to interact plays a moderating role in the use of travel mobile services	partly	-	partly

*when possible to test

With regard to country specific expectations our visions was more or less confirmed. In New Zealand and Finland mobile travel services play a more important role, for clearly different reasons in New Zealand due to the physical conditions, and in Finland due to the high national commitment to mobile technology, than in the Netherlands: usage is the Netherlands is simply lagging behind.

It is clear that the research as presented in this paper leaves us with a lot of open questions with regard to acceptance and use of mobile technology. Acceptance and use of mobile services requires deep understanding from individual, context and technology related characteristics and their mutual interactions. This interaction is focussed on the fit of mobile services with day-to-day activities of users and their personal preferences and attitudes, given specific physical and social situations in which the use of the mobile service fits in. Also national physical and industry conditions and the national culture plays their own specific roles.

With regard to practical implications providers of mobile travel services have to be aware that these services are mainly supporting in nature, i.e. helping travellers to find their way around and supporting them by providing relevant travel information. Real transactions in the travel domain

supported by mobile applications will not be reality in the short run. The main impediment is the lack of opportunities for real transactions via the mobile phone. Dealing with e-forms and providing credit card information via mobile phones is still cumbersome. Users will prefer to use the Internet for concluding transactions with the Hotels, Airlines and car rentals. The focus of travel service providers for mobile services has to be focussed on information provisioning, support and after-sales services while consumers are on their way travelling for business or leisure purposes.

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Annex

PM References are to New Zealand questionnaire

Travel services:

Q110. Cheking flight, train and/or bus timetables via a Mobile phone
Q111. Reserving and/or purchasing flight, train or bus tickets
Q112. Reading information about travel destinations and/or making reservation for accommodation via a Mobile phone
Q113. Locating a place (Office, café, hotel, etc.) via a Mobile phone
(score: never used –daily used)

Perceived Usefulness:

Q70. With mobile services I get information I need wherever and whenever
Q71. With Mobile services I can carry out tasks wherever and whenever
Q74. Advanced Mobile services make me more efficient
Q75. With Mobile services I can coordinate tasks wherever and whenever
(score strongly agree- strongly disagree)

Perceived Ease of Use:

Q61. I know how to use Mobile services
Q62. Learning how to use Mobile services is easy for me
Q65. It seems easy to me to learn how to use Mobile services
Q66. It seems to me that using Mobile services is easy
(score strongly agree- strongly disagree)

Personal Innovativeness Mobile services:

Q31. I want my Mobile device, e.g. a Mobile phone, to be the latest model
Q32. I prefer to buy a more expensive Mobile phone with new features instead of a cheaper Basic Mobile phone.
Q35. I want to be among the first one to try out new Mobile services
Q40. My Mobile phone has to be the latest model.
(score strongly agree- strongly disagree)

Physical context (fixed)

Q 30 How important to use mobile services in certain locations (not important at all –to very important)

- In public places
- At home
- At work
- In a meeting
- Doing my job

Physical context (mobile)

Q 30 How important to use mobile services in certain locations (not important at all –to very important)

- On the road
- On a business trip
- On atrain/bus
- On vacation

Social context

Q 30 How important to use mobile services in certain locations (not important at all –to very important)

- With others
- Alone
- Among family

Need for social interactivity

Q48. Without my Mobile phone my social life would suffer
Q49. I use my Mobile phone to keep in Couch with friends and family
Q51. I want my Mobile services to fit my life-style
Q53. My Mobile phone is for my social contacts
(score strongly agree- strongly disagree)