Adoption of a mobile information- and navigation service

-A qualitative pre-adoption study from multiple perspectives

Mattias Karlsson
pm03maka@stud.hh.se

Mats Lantz
vi02mala@stud.hh.se

School of Information Science, Computer and Electrical Engineering (IDE)
Halmstad University

Abstract

In spite of rapid advancements in the mobile industry adoption rates of more advanced mobile services are slow. This phenomenon has previously been addressed from an end-user perspective. However, today's mobile market evolves around multiple actors with different roles, suggesting the need for multi perspective adoption studies. In this paper the adoption decision is studied in a pre-adoption phase using a mobile information/navigation service. Rogers' diffusion of innovations was used as a framework for studying the adoption intention of two different actors, the end-users and the content providers. By conducting qualitative interviews with the two actors, we discovered factors and dependencies with importance for the intention to adopt. Specifically, our results show that the actors perceived the mobility of the service and the dynamic information as beneficial, but there was a conflict between them regarding how information should be captured from the end-users and then transferred to the content providers.

Keywords: pre-adoption, mobile services, multi-perspective, innovation characteristics, adoption intention

1. Introduction

The rapid growth in the mobile industry has extended the functionality of the mobile phone; it has created services which purpose is not only to initiate telephone conversations. With the help of mobile Internet and other mobile technologies, e.g. 3G, GPS, and Bluetooth, the progression of new mobile services which supports text, images and videos has become a reality. However, the commercialization of mobile services in Europe has apart from SMS and other small services been surprisingly slow (Carlsson *et al.*, 2006; Kargin & Basoglu, 2006). This is by no means exclusive to Europe, it's a worldwide problem. Both Japan and Korea, forerunners in the m-commerce field with services like I-mode, have problems with adopting new mobile Internet services (Funk, 2005). However, with the help of different adoption theories, e.g. TAM (Technology Acceptance Model), UTAUT (Unified theory of acceptance and use of technology), and diffusion of innovations, scholars have tried to understand this phenomenon and identify the determinants of successful or unsuccessful adoption outcomes in the m-commerce field (Carlsson *et al.*, 2006; Kargin & Basoglu, 2006; Pedersen & Nysveen, 2003; Sell *et al.*, 2004). In these studies different factors affecting the adoption of mobile services from an end-user perspective are identified. However, the end-users are not the only player in the wireless market affecting the adoption process.

In Mallat's (2006) adoption study, i.e. a study about consumer adoption of mobile payments, the value of use is dependent on a second actor, the service provider, not so much on more users. In her study, one of the adoption factors identified was the importance of network externalities for successfully building a user base. That is, the value of use for a single adopter depends on the total number of users

within the network (Katz & Shapiro, 1986). In this case, Mallat (2006) identified a relationship between the end-users and the service provider which indicates that there are mobile payment services which are dependent on the relationship of two (or more) different actors to reach a higher acceptance level. This is also in accordance with Lyytinen and Yoo (2002), who claim that mobile services can change the individual, organizational and intra-organizational infrastructure and that they often indirect or direct affect each other in this process.

In this paper, the adoption process is studied from the view of two different actors, the end-users and the content providers. The service tested was a prototype of a mobile information/navigation service. For mobile information/navigation services, the adoption of new services has been relatively slow, both for the end-users and the content providers (Stein *et al*., 2005). Though, as the prototype has not yet reached the market, it's only possible to study the adoption of this service in a pre-adoption phase. To do this, we utilize Rogers' (2003) diffusion of innovations and his three most recognized characteristics of innovations, i.e. relative advantage, compatibility, and complexity, as a framework for our pre-adoption study. In addition to this, the network externalities factor and identified factors for mobile information/navigation service research are used as an extension of Rogers' framework.

According to Karahanna *et al.* (1999), most of the research describing end-user beliefs and attitudes draws on data from cases where IT already is in use. However, they also claim that the beliefs formed during use of a product are not necessarily the same set of beliefs that initially led to adoption of the innovation, which makes the pre-adoption phase an interesting phase to study. To study the adoption in a pre-adoption phase also complies with Lyytinen and Yoo's (2002) call for IS researchers that need to be active in the research of new technology and services from the beginning. Not when the technology or service has already entered the market.

The previous discussion also gives us the paper's research question: what factors influence the adoption of a mobile information/navigation service from the end-user perspective and the content provider perspective? With this approach, the purpose of the paper is threefold. *First*, to study the adoption process and find factors from the view of two different actors, and in this process also discover possible dependencies that affects the adoption process, which is relevant for mobile information/navigation services. *Second*, to study this from a pre-adoption phase, where the factors and beliefs affecting the adoption are different from an existing product. *Third*, our study will how a mobile information/navigation service could be implemented and produced by a service provider in order to satisfy content providers and end-user demands.

This paper will continue in the following way: next section presents adoption and acceptance theory and how this paper is using Rogers' (2003) diffusion of innovation and a description of the network externalities factor, and the section concludes with research on other mobile information/navigation services. Thereafter, in section 3 the mobile information/navigation prototype used for our study (with its functions) and the methodology used are presented. In section 4 the results of the study are described and in section 5 the findings are discussed and the paper is concluded.

2. Theory

One of the most well known adoption theories used is the diffusion of innovation and the innovation-decision process (Rogers, 2003). The actual innovation-decision process is conceptualized as the following five phases: (i) knowledge, (ii) persuasion, (iii) decision, (iv) implementation, and (v) confirmation (Rogers, 2003). It is during the second phase that a potential adopter forms a favorable or unfavorable attitude towards an innovation by assessing the characteristics of the innovation.

These characteristics as perceived by adopters are central within Rogers' (2003) diffusion of innovations theory. They are categorized into the following five characteristics: (i) relative advantage, (ii) compatibility, (iii) complexity, (iv) trialability, and (v) observability, which are seen as important determinants for the rate and pattern of innovation adoption and diffusion (see Table 1). However, Tornatzky and Klein's (1982) meta-analysis indicates that the three first characteristics are the ones

consistently related to adoption and utilization decisions. It's the three first characteristics that are also used in our pre-adoption study; the other two is hard to test for a product not yet on the market.

Percieved characteristics of innovations	
Perceived characteristics of innovations	Definition
Relative advantage	The degree to which an innovation is perceived as being better than the idea it supersedes.
Compatibility	The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters.
Complexity	The degree to which an innovation is perceived as relatively difficult to understand and use.
Trialability	The degree to which an innovation may be experimented with on a limited basis.
Observability	The degree to which the result of an innovation are visible to others.

Table 1. The five characteristics of innovation

Another adoption and diffusion factor of considerable importance is that of network externalities. This concept holds that the value of use to any single adopter is positively affected by the size of the network of other users (Katz & Shapiro, 1986). This is even more relevant in the case of interactive communication technology since it differs from non-interactive innovations in the sense that later adopters expand the value of use for early adopters (Rogers, 2003). Consumers' adoption decisions today are influenced by the sales history of the innovation and the existing user base, but perhaps more important on the expectations on the future of the innovation (Katz & Shapiro, 1986). Within the m-commerce field these types of relations have been studied by Mallat (2006), who found network dependencies between end-users and merchants of a mobile payment system. A related concept to the network externalities factor is the concept of critical mass, i.e. when the amount of users for an innovation has reached a certain point, a critical mass, the innovation becomes self-sustaining (Rogers, 2003).

In addition to Rogers' (2003) diffusion of innovations, TAM (Davis *et al*., 1989) stands out as one of the more utilized frameworks for predicting and explaining users' intention to adopt. While this model being effective in predicting IT use, it has received critique due to the limitations in its two constructs, perceived usefulness and perceived ease of use. Pedersen and Nysveen (2003) argue that reducing user perceptions of technology adoption to these two constructs most likely will leave out important factors affecting user perceptions such as self-identification and social-identification. Anckar *et al.* (2003) specifically questions the validity of TAM in the context of m-commerce adoption. His critique is based on the assumption that users' decisions relating to m-commerce will be different from those relating to technology adoption decisions in general. One of the critiques he points out is the limitations TAM has in recognizing alternative competing technologies, and in recognizing the potential existence of perceived critical benefits and barriers to technology use.

Another model proposed is Venkatesh et al's. (2003) UTAUT (Unified theory of acceptance and use of technology). This model is essentially a unification of eight different IT-acceptance models, all with their own set of acceptance determinants. Although extensive, Carlsson *et al.* (2006) points out that this framework is developed to describe and explain organizational adoption of information technologies, whilst mobile technology has the characteristics of being more individual, more personalized and focused on the services made available by the technology.

Camponovo and Pigneur (2003) argue for the importance of understanding the different actors in the wireless market. In addition to the end-users, there are device and technology actors, service and content actors, and network and access area actors in the m-commerce space. Most of these actors, if not all of them, are usually connected to each other when delivering an end-to-end solution to the customers (Camponovo & Pigneur, 2003). The maturing of mobile Internet, though, with the help of

3

services and technologies, seems to be changing the roles and making the service and content providers more and more independent of the network actors (Vesa, 2006). This is no different for mobile information/navigation services. The content providers have usually been the tourist offices, but could essentially be comprised of any actor wanting to distribute information in the service, e.g. hotels and resorts (Stein *et al.*, 2005). The end-users are every user using the service, not just the tourists.

However, as Stein *et al.* (2005) acknowledges, the adoption of mobile information/navigation services that attracts the end-users and the content providers have been relatively slow. Besides the mobile advantage that the services provide and other usability issues, research on this subject has revealed some significant functions that the services have supported or needed to support in order to be perceived as a more useful service. Though, it's worth to mention that these studies have mostly been acceptance and usability studies from an end-user perspective. For example, Almer *et al.* (2004) and Schwinger *et al.* (2002) have acknowledged the power of user related presentation, *customization*, of information alongside the possibility of linking this information to a geographical position. They also claim that this will play a crucial role in the acceptance of digital tourism information services. When linking an object to a geographical position in an, for example, electronic guidebook it's important that the service supports the *navigation* to this object. Therefore, Brown and Chalmers (2003) recognize that the service needs to show where the attractions are and what they are, and at the same time it's important for the users themselves to see where they are and how to get there, on the map and in real life (Berger *et al.*, 2003; Stein *et al.*, 2005).

Another important factor, not necessarily connected to a map function, is the type of *content* that is available and provided to the end-user (Corigliano & Baggio, 2004). However, the content may have to be *dynamic*; it's not the same info showing all the time (Cheverst *et al.*, 2000). There is also an issue with how the users receive the information, by *pull or push* (Broadbent & Marti, 1997; Schwinger *et al.*, 2002). Pull means that the end-users themselves can ask for the information and push means that they will get the information without asking for it. The push function could also be related to *context* information, i.e. information that somehow is related to the environment and then sent to the end-user (Cheverst *et al.*, 2000; Schwinger *et al.*, 2002).

For the content providers, however, there haven't really been any acceptance studies for mobile information/navigation services. The validity of these factors can therefore be questioned for the content-providers, but as they are important factors for the end-users it is used as a framework for possible factors influencing the adoption of a mobile information/navigation service for both the end-users and the content providers (see Table 2).

Mobile information/navigation services framework	
Factor	**Definition**
Customization	How the service can be personalized and changed
Navigation	Where the location is, what it is, how I can get there, and where I am
Content	The different kind of information
Dynamic	How up-to-date the information is
Push or Pull	How the information is retrieved
Context	Information taken from the situated environment

Table 2. Possible factors influencing the adoption of a mobile information/navigation service

3. Method

In this paper, the pre-adoption of a mobile information/navigation service is tested from both the end-user and content provider perspective. To find adoption factors for these two actors, a qualitative interview study was conducted. In qualitative research an interview study can be used for understanding the relations, feelings and perspectives of the people interviewed (Patton, 1990). The method discussion will from here on continue in the following way; first, a discussion about the prototype tested, how it functions and what platforms the two different actors are exposed to. Second, the selection process for the study will be discussed, followed by a description of the actual interview process and a discussion about the analysis of data.

3.1 Prototype

In order to test the acceptance of the mobile service from a user perspective and a content provider perspective a prototype was created. The prototype consists of two separate platforms that are connected to each other. The main part of the system is the *mobile platform*; it's the application that the user has on the mobile phone and interacts with in order to get the necessary information. With the mobile platform, the user can navigate a map and find different points of interest (see Figure 1). The user can also locate and find information about these points of interests (see Figure 2). The user has an option to customize what type of interest they want to see, by choosing different 'skins' like restaurants, hotels, stores etc., or choosing a specific point/location from a list, and it is also possible to update the points of interests' information with the help of GPRS. The application stores the map and the information in the phone's memory, which means that the user is only connected to the Internet when they are updating the information. This particular service does not have GPS installed and can't recognize any other context-sensitive information.

Figure 1. Mobile application with the map and points of interest
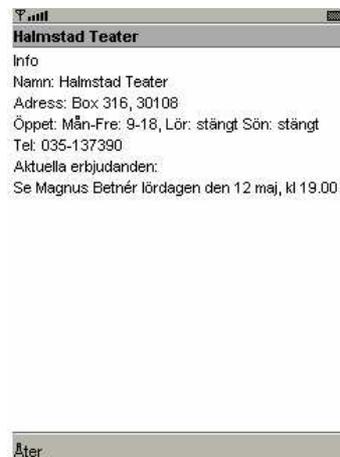

Figure 2. A point of interest information screen

The updates wouldn't be possible if the system didn't have a database with information, and this is managed with the *administration platform*. In the administration platform, the content providers can log in and register information about their organization. They can register data about their organization's location; opening hours, phone number, and mail (see Figure 3). They also have the opportunity to register comments, e.g. to show what they are selling or what special offers they have, and this is the information that will be seen in the application. With the help of time stamps, the content providers can register as many posts with comments as they like, but the mobile application will only display the post that's current active, i.e. the post is activated according to the current date and time.

Figure 2. The administration platform used by the content providers

3.2 Selection

The sampling process for both tests was based on getting purposeful and information rich cases for study in depth. According to Patton (1990), a purposeful sampling is where one beliefs that the subjects can give relevant and interesting information for the specific research at hand. In the selection process for the end-users, the variation of respondents were found from two distinctive characteristics; the age difference, between 15-65, and from those that owned a mobile phone not older than three years. The spread in age was based on our understanding that they would have more or less knowledge of mobile services according to age. The mobile phone condition was based on the assumption that they would be able to run the service on their own mobile phone and in that way perhaps relate to it. In the end, the end-user test was conducted with five people, two males and three females, and they were all found around the campus of Halmstad University. Their ages were 20, 27, 35, 46, and 60, and the mobile condition applied to four of the five respondents.

For the second test, with the content providers, the characteristics were connected to location (centre or sub-centre), size (chain of shops or local shop), and type of business (e.g. clothing or restaurant). These characteristics were based on getting diverse shops according to what kind of marketing control and marketing size they have. In the end, the content provider test was conducted with four organizations that all are situated in Halmstad, and where three of them can be considered to be situated in the city centre. Three of the four organizations can also be considered to be chains, i.e. they have affiliates that are located outside Halmstad, and the organizations we captured all had different type of businesses (restaurant, gym, culture, and shop). To find the right respondent in every organization, we wanted individuals with insights into the organization's marketing process, which could be a CEO, a marketing director or other individuals in the management staff. To get the individuals with these conditions we asked for the person in charge of their marketing campaign(s). The individuals we did interview all had an executive position in the organization, either on a local level or as a senior manager, and they were all, directly or indirectly, involved with their own organization's marketing campaign(s).

3.3 Interview

To get the end-users and the content providers to understand the prototype and how it functions, we explained the concept of the prototype as described earlier. However, to allow them to reflect on their behaviour, feelings and attitude, the respondents also did a walkthrough of the prototype. This walkthrough was not meant to be used for testing the graphical interface or the usability of the prototype, like other walkthroughs, e.g. a cognitive walkthrough (Dix *et al*, 2004; Nielsen & Mack, 1994), but rather to familiarize the respondents with the service in order for them to be able to relate to

the service during the interview. This was also noticeable with the written tasks that were provided to the respondents, as we helped the respondents if they had any problems completing the tasks. The end-users completed tasks on the *mobile platform* and the content providers completed tasks on both the *administration platform* and the *mobile platform*. The actual tasks involved, among other things, were to create a store and the related comments in the administration platform for the content providers, and for the end-users one of the tasks they needed to complete was to find information about a specific store. To conclude the walkthrough, the respondents had a chance of asking us some questions if there were something they didn't understand or didn't fully grasp.

The actual data collection was made possible with a semi-structured qualitative interview with both the end-users and the content providers. The duration of this interview was approximately 35 minutes and Rogers' (2003) three characteristics of innovation; relative advantage, complexity and compatibility, was used as a framework for the interview guide and the questions. Some of the questions were also related to the framework of mobile information/navigation services (see Table 2) and the network externalities factor. The questions were adjusted to better fit the context according to the respondent interviewed and the platform tested, but the two qualitative interview-guides also shared some common questions, e.g. the end question "would you adopt this service and start using it". The interview guide for the end-users consisted of 40 questions and the interview guide for the content providers consisted of 45 questions. During the interview, one researcher was asking the questions while the other listened and took notes of the answers with the help of a protocol, but as the interview was recorded with an mp3-player, the data collection was also transcribed.

3.4 Analysis

To analyze the data, our interview guide and the framework that was used to create the interview guide were used as a descriptive analytic framework. According to Patton (1990) it is possible to group answers according to the topics used in the interview guide. Rogers' (2003) three characteristics of innovation can directly be linked to the adoption process and as we used it for our interview guide it's natural to use it in our analysis. This means that we analysed the answers for every interview, first for the end-users and then for the content providers, and sorted the results according to the framework used in the interview guide. However, some of the questions had answers that weren't related to predefined topics or questions. The answers were therefore controlled and then sorted in the correct topic or registered in a new topic. After this, we identified factors for the two different actors by finding situations that shared a common denominator. The factors were then cross-checked against each other in order to find possible factors indicating dependencies with relevance for the adoption process.

4. Results

The results are presented according to Rogers' (2003) three characteristics (relative advantage, compatibility and complexity), the network externalities factor, and additional findings not related to the framework. The end-users' results are first presented, followed closely by the content providers'. For Rogers' (2003) characteristics, the results are presented according to the factors identified by the two actors, and this could be factors related to the mobile information/navigation service framework or new identified factors. The last question, the intention to adopt, is presented on its own together with the factors that are motivating or preventing an adoption of the service.

4.1 Relative advantage

End-users
For the end-users, one advantage was that the service together with the mobile technology could be used everywhere, anytime, something that other similar stationary services couldn't provide.

"It's a new way to utilize your mobile phone. It's really a transition from the Internet to the mobile phone. […] Internet will always be there but this [the mobile phone] is what we bring with us everyday."

The respondents also saw an advantage in the different categories and personalization options provided by the service. They thought that it was a useful and welcome function that could help them to find the right information.

"The idea of categorizing the information according to my own interests sounds like a great thing, for example when I look for night life".

Another relevant factor for the end-users was the ability to find new and updated information in the service. Many people thought that the updated information would give the application an extra edge compared to the yellow pages (the paper copy) and a paper map. This advantage was, however, connected to how often the content providers would update, and this was very important to the majority of respondents. Some of the respondents also thought that the information could be static in some situations, but they mainly saw this possibility when they would travel to a new town or as a tourist.

"I would want the latest offer, because you don't search for an organization's main attraction, it's of no interest to me if it's static".

"I would not appreciate outdated offers, but in some situations it's ok if the info is static".

The respondents primarily recognized the opportunities of the service as a citizen in Halmstad, but they also saw the potential of the service as a tourist. As a tourist, the service could especially assist when finding places in a never before visited town and this was according to the respondents a significant advantage.

"I see big potential for this service, especially as a tourist. They could use it to find places and locations"

To summarize, four important factors for the end-users have emerged from the relative advantage characteristic; **mobility**, **customization**, **dynamic information,** and **navigation**.

Content providers
The interviewed content providers were generally positive towards the service and saw it as having future potential. One of the more salient advantages identified was the dynamic nature of the information and the speed with which it could be distributed or changed.

"In general, services that you can update, services which are fast, where the communication is fast are valuable today. It's positive that you can change the information along the way."

"You can distribute it [the information] when you want to, and delete it when you want to. If something's wrong you can change it yourself, without the need to call anyone. It's convenient to do it yourself."

Some respondents even pointed to more traditional paper based marketing media as potentially outdated and questionable when it comes to generating revenue. Other factors frequently mentioned were the mobility and accessibility of the service, i.e. you always have your phone with you and it's portable. However these factors were also used when describing the service as a complement to stationary use of computers for seeking similar information.

"I browse the Internet on my mobile phone, but that's only when I don't have access to a computer. When in front of my computer, which is almost everyday I don't use my phone to access the Internet. So it's mostly if you're somewhere without access to a computer."

Together with the advantages identified amongst the content providers, it should be noted that the majority perceived the service as a complement, and not a replacement to their current marketing channels.

To summarize, the factors identified as relative advantages for the content providers were **dynamic information** and **mobility**

4.2 Compatibility

End-users

The compatibility of the service for the end-users was mainly related to needs, but values and beliefs was also a factor in this process. All respondents thought that the information displayed was very convenient (opening hours, telephone number, address, and offers) even though some suggested that more diverse information could perhaps have made the service more attractive.

"Address is a given and opening hours, telephone numbers and offers should also be there. Perhaps even a link to the homepage, if the store has one".

How the end-users wanted the information to be displayed was also a subject discussed by the respondents. Most of them didn't want the information to be automatically displayed to them when they were wandering around in the city. They felt more secure and less irritated if they themselves could search for the information in the service without a shop sending the information to them, e.g. with the help of a positioning system.

"I don't think I would like that [push], but there's probably someone that would want it that way."

"It would be like the people handing out newspapers on the streets".

The respondents were also concerned with the price and cost of the service. Most of them didn't want to pay extra for the information updates but they could consider paying a small, one time fee for the actual service. Overall, they thought that the stores and organizations should pay to distribute, because it was their information.

"(No) I'm thinking that the companies have an interest in me as a customer, so should I pay them for more than the things I buy [...] memberships are for the most part free today, so should I really have to pay for offers, it's basically the same idea."

The majority of respondents were uncomfortable by the idea that organizations and stores could monitor their movement and in that way use the information to send it to the respondents without their authorization. However, some respondents thought that it would be acceptable if they had requested this service themselves.

"Big brother is watching you [...] I can imagine that a store wants to see if I have looked at their competitors' offers. I don't think they should be aware of that. No, I want to make active choices myself."

To summarize, the factors identified regarding the compatibility characteristic were **content, pull, cost,** and **privacy**. Of these four factors, content and push had been identified in the mobile information/navigation service framework, where push was part of the *push or pull* factor.

Content providers

All four content providers perceived it as manageable to distribute and administrate the information themselves. They estimated their resources as sufficient and also expressed a clear preference towards

9

being in control of their own information. In addition, some respondents perceived themselves as familiar with similar systems as a reason for the almost non-existent problems regarding the administration of information on the platform. A reoccurring theme in the answers throughout the interview concerned the revenue, or at least potential revenue, following adoption.

"If you pay for it you want to get something back, otherwise there's no idea of using it."

The potential revenue also influenced the content providers' perception of a suitable payment model and the price they were willing to pay. All respondents with a positive attitude towards adoption saw a higher price in order to get a greater exposure as natural. Respondents considered and saw both a subscription fee and payment for use, i.e. pay for every update of the information, as possible payment solutions.

"It's like when you pay for an ad on the front page of a newspaper, it's usually more expensive."

However, as stated above these perceptions were in all cases affected by potential revenue and to some extent also by the installed user base. The possibility to measure and give feedback on the number of current and future users and their satisfaction with the service and offered products were of significant importance to all of the respondents. Moreover it was perceived as interesting and beneficial to get more detailed information on user behavior, such as where end-users have been and what they have looked at.

"I'd like as detailed information and feedback as possible, and I think that it's more important than to do know how many users are actually using the application."

To summarize, the factors identified for the compatibility characteristic for the content providers were **control**, **revenue**, and **feedback.**

4.3 Complexity

End-users

Many of the users didn't have any real problems of using the service or understand it. However, they did discover some usability issues that confused them in some way. For example, the arrows that were supposed to give directions in the service, when finding a specific location, were either too small or too confusing for the end-users. Another potential usability issue identified by the respondents was if the map would get too overcrowded with information.

"I don't want too many [points of interests], it could get cluttered and I think it's enough [right now]".

To summarize, the end users only recognized one factor for the complexity characteristic, possible **usability** issues affecting the adoption**.**

Content providers

All of the respondents perceived the administration platform as easy to use. Except for some minor usability issues the system was described as logical, unproblematic and with good usability. The critique essentially involved minor considerations regarding the navigation between pages. However, when assessing the mobile platform, respondents indicated the need for extended search functionality in order to reduce the amount of navigation required to find a specific location. They also noted how the map potentially could be overloaded with information reducing the usability. Some respondents also expressed a concern regarding their customers experience or willingness to use this type of service on a mobile device.

To summarize, as with the end-users, the content providers identified one complexity factor, possible **usability** issues affecting the adoption**.**

4.4 Network externalities

End-users

The end-users perceived the service as useful with a limited number of stores, if they updated often, but they saw the potential of the service grow if there were more stores represented. However, some of the respondents thought that it wasn't the overall number of stores that are important, instead, it's the number of stores catering to their own interests.

"I think you should cover the different categories. If it says 'stores' then there should be some stores. I can't say it makes difference if it's one or twenty, or well if it's just one point in every category on might start to wonder. The most important thing is that there is information where you've said there's going to be information."

Content providers

From the perspective of the content providers an important factor was the current or future user base. In one case, this was even a crucial factor for adopting the service.

"Well, hmm, there must be an extensive amount of users, or there is no meaning. A thousand wouldn't be enough, we need much more. One would like to know which customers are coming back".

Also, several respondents felt the need to wait until they had a clearer picture of how the service would be received by the end-users and to some extent other organizations. For example, one of the respondents speculated that if other organizations were connected to the service it would be possible to collaborate in marketing campaigns.

4.5 Additional findings

In addition to the three characteristics and the network externalities factor, other factors were identified that couldn't directly be sorted to these specific categories. For the end-users, they conceived additional **communication** abilities, through the service, as an extra functionality but they didn't reflect on the possibility that it would be a relative advantage or something that was founded in their own needs and values. For the content providers, they recognized **customization** as something that could be beneficial for the end-users, which indirectly could affect them and it wasn't therefore perceived as a relative advantage or something that can be traced to the compatibility characteristic.

"It's a good thing if the user can customize the service so it doesn't show a lot of information they're not interested in."

These factors, **communication** for the end-users, and **customization** for the content-providers, are perceived as beneficial for intention to adopt.

4.6 Intention to adopt

Both the end-users and the content providers were explicitly asked if they had any intention to adopt the service and start using it. They were also asked about what factors are motivating and preventing their future adoption of the service. For the end-users, every respondent were interested in adopting the service and start using it. However, for the content providers, one of the organizations was reluctant in their intention to adopt the service. The decisive motivating factors, for both the end-users and the content providers, were **mobility** and the ability to **find/distribute information** in the service (see table 3). The end-users also saw the **usefulness** of the service, while the content providers saw the new technology and the new info channel as other motivating factors. The major preventing factor for

intention to adopt, by both actors, was **cost** (see table 4); they didn't want to pay a large sum to use the service. Though, the content providers also saw the new channel as a preventing factor.

Motivating factors for intention to adopt						
Actor	Mobility	Find/distribute information	Usefulness	New technology	New info-channel	Navigation
End-users	2	2	2			1
Content providers	3	1		2	2	

Table 3. Motivating factors for intention to adopt.

Preventing factors for intention to adopt									
Actor	Usability	Inexperience	Cost	Hardware requirements	Uncertainty about revenue	New channel	The service is not yet established	Content provider activity	Target audience	Too much ads
End-users	1	1	2	1				1		1
Content providers			1		1	2	1		1	

Table 4. Preventing factors for intention to adopt

5. Discussion and Conclusion

The research question we have addressed in this paper is the following; what factors influence the adoption of a mobile information/navigation service from the end-user perspective and the content provider perspective? Our purpose with this question was to discover the adoption factors from the view of two different actors, and also to discover possible dependencies between the two with relevance for the adoption process. In table 5 the reported factors from the two actors are presented together with Rogers' (2003) three characteristics of innovations, relative advantage, compatibility, and complexity. The factors that are bold are showing shared factors between the two actors and the factors that are in italic are showing a conflict between the two actors. The factors that don't have a special formatting aren't specifically related to the relationship of the two actors, but they are nevertheless important factors for the intention to adopt.

Influencing factors for the two actors		
	End-users	Content providers
Relative advantage	**Dynamic information** **Mobility** Customization Navigation	**Dynamic information** **Mobility**
Compatibility	*Privacy* Pull Content Cost	*Feedback* Revenue Control
Complexity	Usability	Usability

Table 5. The identified factors for the two actors from Rogers' three characteristics.

As can be seen in table 5, in the *relative advantage* characteristic we found that both actors perceived **mobility** and **dynamic information** of the service as an advantage compared to other services, in

addition, the end-users also conceived **navigation** and **customization** as relative advantages. Amongst the end-users mobility was conceived as one of the relative advantages with the greatest impact. This is however not surprising since all of the respondents lacked previous experience with more advanced mobile services, and therefore exclusively compared the studied prototype with stationary equivalents. The content providers also perceived mobility as a relative advantage, but they recognized this both as an end-user and as a content-provider exploring a new marketing channel. The mobility factor is therefore a dependency between the two actors in the sense that it has positive influence on both actors decision to adopt. It is also worth mentioning that the results first and foremost show that both actors perceived the service and the mobile nature of the service as a complement to similar stationary services. Another dependency was the **dynamic information** advantage, as content providers saw the advantage in fast dynamic information distribution through a complementary marketing channel, while the end-users also perceived such information as advantageous. However, the end-users also responded that the information could be static, but that it depended on their role as a user and where they were located, i.e. if they used the service as a tourist or as a citizen.

The above reasoning leaves us with the image of an end-user seeing this type of service as a complement under certain conditions, and a content provider also suggesting this kind of complementary or partial adoption pattern. Our results are in accordance with the discussion made by Mallat (2006), that traditional adoption models needs to be extended in order to better describe situations where innovations constitutes a complement to existing technologies, and are preferred under certain conditions.

For the *compatibility* characteristic, the end-users perceived **privacy, content, pull** and **cost** as important factors, while the content providers perceived **feedback**, **control,** and **revenue** as important factors. It was not surprising to see **cost** as a factor for the end-users, as they didn't want to pay a substantial amount for the service, and they particularly didn't want to pay fees for the updates as they saw the service as a marketing channel for the content providers. In contrast, none of the content providers questioned that the service would have a cost i.e. demanded that it should be free. They saw it as natural to pay for this kind of service, and instead had a stronger focus on price in relation to potential **revenue**.

Two of the other identified compatibility characteristics, **privacy** and **feedback***,* acts as a barrier and are obstructing the adoption of the service for both actors. The end-users don't want to submit personal information or be tracked by the content providers, which were also apparent with how users wanted their information in the service, by **pull** i.e. retrieving it themselves. The content providers, at the same time, want some kind of feedback in order to get potential **revenue** from the service. Hence, one could also say that revenue and pull, indirectly, are connected to the privacy-feedback conflict between the two actors. These types of conflicting dependencies could be resolved by negotiating suitable levels satisfying both sides. In these negotiations, we believe it's essential that the end-users really understand the actual opportunities their increasing openness could give them, and that the content providers really show how they collect the information and for what purposes it is used. This is even of greater importance in services where user data easily can be captured without the users' awareness, e.g. with the help of positioning technologies.

For the *complexity* characteristic, we identified some small **usability** issues for both actors. We don't, however, see them as major factors inhibiting the adoption for this specific prototype, as they saw no real problem with the service. Though, it could still hinder the adoption if studied in a post-adoption phase, when they have had time to interact and test the application for a long period of time.

Regarding the *mobile information/navigation service framework,* the factors identified in our framework were also recognized by the end-users when using Rogers' three characteristics. However, the context factor wasn't conceived as a factor affecting the adoption and it was therefore not evident in our results. This is perhaps not as surprising as it sounds as the prototype tested didn't support any context-sensitive information, and it might have been of importance if it was part of the service when tested. For the content-providers, some of the factors identified in the framework were also found

when using Rogers' three characteristics. However, our results show that they also perceived organizational and profitability factors as important, for example feedback and revenue, and that this framework needs to be extended when studying the role of content providers in mobile information/navigation services.

As for the *network externalities* factor, the existing or potential user base was an influencing adoption decision factor. Our results indicate, however, that this factor is of less importance to potential end-user adopters, as it was more important to have content providers that catered to their interests. Our results, therefore, suggest that the content providers to a larger degree are dependent on a critical mass of users in their adoption decision than the other way around. We believe these results are possibly a reflection of the content providers' investment considerations, involving a greater risk and a higher cost than for the end-users.

The network externalities factor, together with the perception that the service is seen as a complement, has implications for IT-professionals. Since the results suggest a greater decision uncertainty amongst content providers one might consider the option of using already existent groups of end-users when launching services similar to the one investigated in this paper. Besides the possibility of supporting larger consumer groups in their already established habits and needs with the help of IT, this can be done in a variety of ways. To mention a few, developers and service providers could extend a service already established with additional functionality, or make the same service available through a different media. There's also the option of launching a new service building on specific end-user needs, gradually extending the functionality to attract and hopefully include a different target audience in the already existing base of users.

The *intention to adopt question* wasn't part of Rogers' characteristics and the factors identified were therefore separated from this framework. Though, the motivating and preventing factors are more important for our discussion, as almost all end-users and content providers thought that they would adopt the service. The primary motivating factors were mobility and information, and cost was the primary preventing factor. Besides these, we also identified some adoption factors not recognized in our mobile information/navigation service framework or in the three characteristics. For example, the content providers saw the new channel as a preventing factor or as a motivating factor. We believe that this difference was connected to organizational culture and how fast they usually adopt a new service, i.e. if they are slow adopters or early adopters. As some of these answers gave us spontaneous feedback not related to the factors identified in Rogers' characteristics, it shows that the factors identified by the respondents in Rogers' three characteristics were perhaps not consistent with all beliefs affecting the intention to adopt.

The inconsistence of Rogers' characteristics was also shown in the additional findings. The two additional factors found, the **communication** factor for the end-users and the **customization** factor for the content providers were difficult to categorize into Rogers' characteristics. Although neither was perceived to be a relative advantage or a need, the factors were perceived as important to the specific service. One of the reasons for this could be some of our hypothetical questions or our inability to categorize these factors when the respondents didn't perceive them as an advantage, need, value, or past experience.

It is also worth to point out that Rogers' characteristics and the factors identified could differ when tested in a post-adoption phase, as Karahanna *et al.* (1999) claims that there are differences between the two phases. In our study, it's hard to generalize factors that are specific for this phase, but the contradicting factors, the privacy issue and the feedback issue, wouldn't perhaps have been as strong in a post-adoption study. In fact, many of the compatibility issues or needs are hard to perceive as important when an actual innovation has reached the market. We believe that they tend to see the benefits of the service first, not so much of how it's compatible with their own beliefs. This is not to say that compatibility isn't important in a post-adoption phase, but it's perhaps more important in how it's compatible with other existing ideas and innovations. This was partly discovered in our study, but it's hard to see this benefit for the respondents when the adoption hasn't reached the market yet. Also, it's

easier to see how other factors, like status and peer-pressure, affect the adoption process in a post-adoption phase as they weren't as visible in our study.

To conclude our paper, the study has contributed in the following way to existing adoption studies and mobile information/navigation services:

a) It has shown how the two different actors, the end-users and the content providers, have perceived different factors as important in order for them to adopt. Specifically, it has shown that both actors conceive the **mobile** and **dynamic** aspect of the service as advantages, but it has also shown that they need to sort out **privacy** and **feedback** issues in order for the adoption rate to grow among both actors and to create a critical mass.

b) By studying the adoption in a pre-adoption phase and from the view of two different actors, our study can be added to the few pre-adoption studies in existence, at the same time it shows the relevance of multi-perspective adoption studies. Particularly since earlier adoption studies for mobile navigation/information services have focused on the end-users and the factors identified for the content providers in our study were slightly different than these studies.

c) The study has also shown implications for developers of services similar to the one discussed in this paper. The need for the service to support different end-user roles, and suggestions of possible diffusion strategies has been discussed.

For future research, the factors identified in our study needs to be validated with a larger sample study, as it is impossible to generalize our findings for larger populations, and this could very well be done with a quantitative study. Furthermore, if the prototype hit the market, it would also be interesting to study the adoption in a post-adoption phase, as the factors identified in a post-adoption phase are, as perceived by Karahanna *et al.* (1999), different from the pre-adoption phase.

References

Almer, A., Luley, P., Schnabel, T., & Nischelwitzer, A. (2004). A Mobile Solution for Location Based Tourism Information in Rural Areas. In *Proceedings of the Eleventh International on Information Technology and Travel and Tourism,* Cairo, 2004.

Anckar, B., Carlsson, C., & Walden, P. (2003) Factors Affecting Consumer Adoption Decisions and Intents in Mobile Commerce: Empirical Insights. In *Proceedings of 16th Bled eCommerce Conference*, pp. 886-902.

Berger, S., Lehmann, H., & Lehner, F. (2003). Location Based Services in the Tourist Industry. *Journal of Information Technology and Tourism,* Vol. 5, No. 4, pp. 243-256.

Broadbent, J., & Marti, P. (1997). Location aware mobile interactive guides: usability issues. In *Proceedings of the Fourth International Conference on Hypermedia and Interactivity in Museums*, Paris.

Brown, B., & Chalmers, M. (2003). Tourism and Mobile Technology. In *Proceedings of European Conference on Computer Supported Cooperative Work*, Helsinki, pp. 335-354.

Camponovo, G., & Pigneur, Y. (2003). Analyzing the M-Business Landscape, *Annales des telecommunications*, Vol. 58, No. 1-2, pp. 59-77.

Carlsson, C., Carlsson, J., Hyvönen, K., Puhakainen, J., & Walden, P. (2006). Adoption of Mobile Devices/Services – Searching for Answers with the UTAUT. In *Proceedings of the 39th Annual Hawaii international Conference on System Sciences – Volume 06*.

Cheverst, K., Davies, N., Mitchell, K., Friday, A., & Efstratiou, C. (2000). Developing a Context-aware Electronic Tourist Guide: Some Issues and Experiences. In *Proceedings of Human Factors in Computing Systems*, Hague, Netherlands, pp. 17-24.

Corigliano, M. A., & Baggio, R. (2004) Mobile technologies diffusion in tourism: modelling a critical mass of adopters in Italy. In *Proceedings of the 11th International Conference on Information Technology and Travel and Tourism*, Cairo, Egypt, pp. 16-26.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, Vol. 35, No. 8, pp. 982-1003.

Dix, A., Finlay, J., Abowd, G. D., & Beale, R. (2004). *Human-Computer Interaction*. Pearson, Essex.

Funk, J. L. (2005). The future of the mobile phone Internet: an analysis of technological trajectories and lead users in the Japanese market. *Technology in Society*, Vol. 27, pp. 69-83.

Karahanna, E., Straub, W. D., & Chervany, N. L. (1999). Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs. *MIS Quarterly*, Vol. 23, No. 2, pp.183-213.

Kargin, B., & Basoglu, N. (2006). Adoption Factors of Mobile Services. In *Proceedings of the International Conference on Mobile Business,* Copenhagen, Denmark.

Katz, M. L., & Shapiro, C. (1986). Technology Adoption in the Presence of Network Externalities. *The Journal of Political Economy*, Vol 94, No. 4, pp. 822-841.

Lyytinen, K., & Yoo, Y. (2002) Research Commentary: The Next Wave of Nomadic Computing. *The Journal of Information Systems Research*, Vol 13, No 4, pp 377-388.

Mallat, N. (2006). Exploring Consumer Adoption of Mobile Payments – A Qualitative Study. Presented at *Helsinki Global Mobility Roundtable*, Helsinki, Finland.

Nielsen, J., & Mack, L. R. (1994). *Usability Inspection Methods*. John Wiley & Sons, New York.

Patton, M. Q. (1990). *Qualitative Evaluation and Research Methods (2nd ed)*. Sage Publications, Newbury Park, California.

Pedersen, P. E., & Nysveen, J. (2003). Usefulness and self expressiveness: extending TAM to explain the adoption of a mobile parking service. In *Proceedings of 16th Bled eCommerce Conference*, pp. 705-717.

Rogers, E. M. (2003). *Diffusion of Innovations (5 ed.)*. The Free Press, New York

Schwinger, W., Grün, C., Pröll, B., & Retschitzegger, W. (2002) *Context-Awareness in Mobile Tourism Guides – A Comprehensive Survey*. Technical Report, Johannes Kepler University Linz,

Sell, A., Patokorpi, E., Walden, P., & Anckar, B. (2004). Adoption of Mobile Communication Technology: an Empirical Study on Females Working in Elderly Care. In *Proceedings of 12th European Conference On Information Systems*, Finland.

Stein, A., Sharma, P., Hawking, P., Zeleznikow, J., Nugent, D., Dawson, L., & Foster, S. (2005). Emerging Issues in Location Based Tourism Systems. In *Proceedings of the Fourth International Conference on Mobile Business,* Sydney, Australia, pp. 75-81.

Tornatzky, L. G., & Klein, K. J. (1982). Innovation Characteristics and Innovation Adoption Implementation: A Meta-Analysis of Findings. *IEEE Transaction on Engineering Management*, Vol. 29, No. 1, pp. 28-44.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, Vol. 27, No 3, pp. 425-478.

Vesa, J. (2006). Evolving role of mobile service mediary: Is the I-mode business model becoming extinct? Presented at *Helsinki Global Mobility Roundtable,* Finland.