Asynchronous Adoption Patterns of Mobile Services

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Abstract

The adoption patterns for mobile services are a key challenge for research in mobile technology applications. The early mobile commerce hype was based on search for "killer applications", i.e. mobile services which would launch the field and ensure rapid and profitable growth of mobile technology applications. We have studied how consumers pick up the use of mobile services by comparing the results from two studies of the Finnish consumer market for mobile services. We have tried to describe, what are the determinants of service adoption and the patterns of adoption that we can observe. The approach is straightforward: first we work through a theoretical background of the adoption of innovations, and then we search for explanations for the patterns of adoption. In conclusion, we will assess some steps in the future adoption of mobile services.

1. Introduction

The mobile industry is facing serious challenges in the near future. Handset sales are doing well but mobile operators complain that they suffer from a declining average revenue per user. Something new needs to be invented to increase revenues. Third generation mobile telephony (3G) has been envisioned for years to provide this impetus [1-3] but development so far has been meager [4]. Instead, sunk costs have been invested in license fees for networks [5].

Voice has reached its saturation point a number of years ago in countries with high penetration rates of mobile phones. This means that growth has to be looked for elsewhere. Messaging and value added services (VAS) are typically seen as promises for market growth. In Europe, mobile services were introduced in a larger scale with GSM (Global System for Mobile Communications), which incorporates SMS (Short Message Service). SMS became a highly popular platform for service provision. Initially, it was introduced as an information service from operators to users: SMS was used to inform users that they have messages in answering machines. However, SMS became a greatly profitable business only when it became possible to send messages, which changed the communication world for users and contributed to creating a European mobile culture [6]. Value added services are now facing a similar dilemma. Will they

become popular in the ways they have initially been designed to be? More specifically, can they fulfill the promise of a more extensive service use?
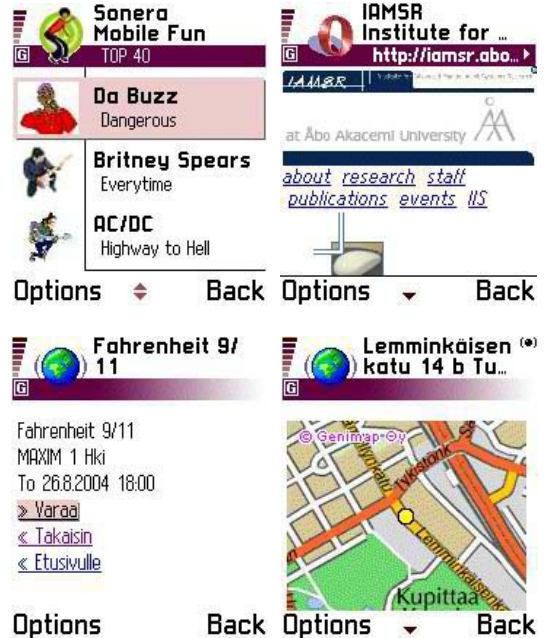

Illustration 1. Screenshots of services on a mobile phone. Ring tones, web browsing, movie ticket purchase, and location on map (left to right, top down).

Service adoption is often attributed to developments in technology. 3G mobile technology in particular is designed to facilitate the use of multimedia services over a broadband network [3]. Currently, 3G is still at an early stage of deployment [7], but on the other hand 2.5G technological solutions such as GPRS (General Packet Radio Service) and iMode already provide basic functionality for advanced services (see Ill. 1). 3G will simply add greater bandwidth and computing power. The big, open question is to develop such content and services that consumers will desire. The traditional way to push new technology solutions to the consumers and then to educate them to desire the solutions is proving to be not the most effective way [8]. Another, more effective but much more demanding way is to work out how mobile services could permanently change the everyday routines in the daily lives of the consumers. The permanent

changes are a function of values created for the consumers, which may be hard to trace and hard to understand. Nevertheless, this is a research direction which should be pursued.

Mobile services are now taking off in Europe both in terms of supply and adoption [9-10]. The adoption rate has been slow, but is picking up speed as service supply grows and replacement sales of mobile phones continue. Nevertheless, adoption seems to take place asynchronously with the developments of technology [8, 11] and there are differences in the adoption of different services. Furthermore, its rate and magnitude cannot be assessed without empirical evidence. Therefore, by studying the adoption of current services we can probably start to understand future service use.

In this paper we study how consumers pick up the use of mobile services. In other words, what are the determinants of service adoption and what patterns of adoption can we observe? First we look at the theoretical background of the adoption of innovations. Then we present and analyze empirical data from two surveys in Finland to monitor and find some explanations for the patterns of adoption. In conclusion, we assess the future of the adoption of mobile services.

2. Theoretical setting

This paper starts off from the theory of the diffusion of innovations (Rogers, 1995). The features of users and the features of technological innovations are used to explain the diffusion of innovations.

In diffusion theory, adopters are categorized into five groups on the basis of innovativeness: innovators, early adopters, early majority, late majority, and laggards. Socioeconomic characteristics such as age, education and social status influence adoption. Those adopting mobile services now are innovators, early adopters and probably also early majority users according to the categorization.

Adoption is also affected by technological features such as relative advantage, compatibility, complexity, and possibilities to try and observe the features. Of these, relative advantage is of greatest importance [12]. Technological features play an important role in the adoption of mobile value added services. In service use mobile phones are no longer used as they have typically been used before. Talking and text messaging (SMS) will remain, but extensive service use is expected to grow alongside [13]. From the point of view of communication, value added services are a disruptive technology because they break the continuity of telephony [14-17]. It is a question of great economic relevance and magnitude.

Even on the technologically advanced Finnish mobile market a half of all consumers use mobile phones, which do not support WAP (Wireless Application Protocol) nor more advanced technologies used for the supply of services [8].

Diffusion theory has reached an established position in innovation research [18, for instance]. Practitioners and academics generally consider it a useful way to study how innovations transform into consumer use. Nevertheless, as Rogers [12] points out, diffusion research traditionally has a pro-innovation bias. We know less about ignorance and rejection to adopt innovations than about successful examples of adoption and diffusion. Mobile services are an exemplary candidate for rejection. They have not yet accomplished the greatly expected commercial breakthrough with the notable exceptions of SMS, ring tones and logos.

The (un)acceptance of innovations is a subject of interest in a number of competing theoretical approaches such as the Technology Acceptance Model [19] and the Unified Theory of Acceptance and Use of Technology [20], but then acceptance is per se seen as a desirable result.

The theory of the social shaping of technology [21-22] also challenges diffusion theory. It holds that technology is shaped in a social context. Some technologies survive the shaping better than others and become more widespread.

After a closer study we have started to suspect that neither of these theories can fully explain the acceptance processes and future growth of mobile services, but it also appears to be a distinct possibility that a good combination of elements from the theories (and possibly some elements from other theories as well) may give us a better understanding of how mobile services will be developed and used. We have studied the acceptance of mobile phones and the technical features they offer in the surveys and some of the TAM and UTAUT elements appear to be supported. Diffusion theory offers some insights on how and why mobile services are accepted and adopted; the technology and the features of the mobile phones are clearly enablers for the services but it also appears that the technology is not a sufficient driver for the services. A missing element appears to be the fact that the mobile services should be value-adding to the extent that they will change the structure of everyday routines [13 - the Braudel Rule], in other words, they would change they way in which we live our daily lives. It appears that the "push approach" for introducing innovations and mobile technology will not work, as most of us will find it unacceptable that somebody else decides how we should work out our daily routines. Then a preliminary conclusion should be that both the enabling technology and the functionality of the mobile services should adapt to a social context.

When compared to acceptance theories and social shaping, the diffusion theory approaches adoption at a macro level. With this in mind we will analyze how features of users and features of mobile technology generally affect how users adopt mobile services.

We use data from two recent consumer surveys, which allows us to trace changes in the adoption of mobile services. We proceed to examine how the different service groups have been adopted by consumers. We then look at benefits and barriers to adoption. Finally, we analyze which factors contribute to the adoption of mobile services.

3. Two consumer surveys in Finland

In an international comparison, Finland is an advanced information society especially when it comes to mobile communication. 90% of Finns aged 15-74 years have mobile phones [23]. This means that virtually everyone has a mobile phone: not having one is to make a statement. There are 4.5 million mobile subscriptions in Finland with a population of 5.2 million. The average user spends 40 euros monthly on mobile communication for 5 minutes of speech and 1-2 SMS per day [24]. The taxation value for private calls on a business phone is 20 euros. Nokia has a market share of around 80% of the mobile phone sales in Finland. Accordingly, service providers adjust their offerings to Nokia phones, which help to reinforce interoperability [25].

The Finnish mobile market has experienced two radical changes in 2003. Firstly, users were allowed to keep their phone number when changing their mobile operator. This lead to enhanced competition as about 17% of the users switched operator according to our subsequent consumer survey. Prices, which had been stable for a number of years, began to fall. Secondly, new low-price mobile operators entered the market. This had a dual effect. On the one hand, price competition was enhanced; on the other hand, the market leader began differentiating by aggressively marketing mobile services. Prices for services such as multimedia messaging and data transfer were significantly reduced during marketing campaigns. For example, the price for MMS was reduced from 59 cents to 5 cents and daily SMS messages to a maximum of 1 euro. In 2003, overall mobile communication expenditure decreased by 6.9% due to enhanced competition [26].

The Christmas season sales in 2003 activated the upgrading of mobile phones in Finland. Especially phones with cameras, color displays and polyphonic ring tones were popular [27].

The rapid changes in the sales of new mobile phones and of the supply of services lead us to use two surveys carried out in Finland. The first survey was based on a random sample and carried out in June-July 2003. The second survey was carried out in January-February 2004 on the consumer panel operated by the National Consumer Research Centre in Finland. The same questionnaire was used in both surveys in order to facilitate comparisons and to possibly trace changes

among the consumers over the 6 months separating the surveys. A summary of the surveys is presented in table 1.

Table 1. Summary of surveys

Random sample	Consumer panel
1000 questionnaires	1154 questionnaires
502 responses	944 responses
50.2% response rate	81.8% response rate
June-July 2003	January-February 2004

The first consumer survey on mobile services (with random sampling) was a traditional empirical study. A sample of 1000 consumers was randomly selected by the Population Register Centre of Finland by using age, mother tongue and residence as criteria.

Paper copies of the questionnaire were mailed to the sample of which 502 (50.2%) responded. The response rate is on a very acceptable level for a mail survey. The gender distribution of the returned questionnaire is 57.7% females and 42.3% males, which means that the female are slightly over-represented compared with the population.

The second survey on mobile services was carried out with the consumer panel of the National Consumer Research Centre in Finland, which consists of 1154 members who have voluntarily joined it. Panelists do not get any financial compensation for their work but they receive a consumer magazine in return for their efforts.

When compared to the whole population of Finland, women and middle-aged persons are over-represented in the panel. This makes the setting interesting, because these are consumer groups who are typically not considered forerunners in the adoption of technology [12], but when developing devices and services for mass markets, their views certainly need to be considered. The panelists are in general more aware than the average consumer of issues related to consumption.

All 1154 panelists were activated in the panel survey. 944 responded, which makes the response rate 81.8%. Such a high response rate was expected due to the voluntary involvement of the panelists. They are, indeed, active consumers. Mobile innovations are complex for ordinary users in terms of technology and functionality. Forming well-grounded opinions on them requires efforts from the respondents. Therefore, the use of a large panel, which consists of involved individuals, is a good way to collect data.

4. Asynchronous adoption of services

We asked the respondents of their trial and regular use of 29 mobile services. Trial use means that the respondent has tried or used the service occasionally. Regular use means that the service in question is being used daily, weekly or on a monthly basis. Table 2 shows the 16 services which at least 10% of respondents had tried or used regularly. The services have been grouped in four categories: communication, entertainment, reservation and purchases, and information services.

Table 2. Use of services

Service			Trial %	Regular %
Communication	SMS	RS	4.2	92.0
		PA	2.7	96.4
	MMS	RS	17.4	14.7
		PA	28.3	8.9
	Mobile email	RS	12.7	13.2
		PA	19.6	9.4
Entertainment	Ring tones	RS	45.6	22.8
		PA	55.1	12.9
	Icons and logos	RS	46.9	19.1
		PA	54.9	10.7
	Listening to music	RS	11.1	5.3
		PA	7.0	3.5
	Games	RS	12.0	3.4
		PA	9.9	1.2
Reservations and purchases	Routine m-banking	RS	16.1	18.8
		PA	20.0	12.3
	Payment	RS	10.1	4.6
		PA	23.2	6.7
	Reservation of movie ticket etc.	RS	8.9	4.6
		PA	18.2	5.2
	Making reservations, purchasing flight/train tickets	RS	6.3	6.0
		PA	10.2	3.1
	Shopping	RS	9.0	3.2
		PA	13.7	2.6
Information	Personalized information messages	RS	20.2	11.6
		PA	24.8	9.0
	Internet browsing	RS	12.8	8.7
		PA	16.0	6.6
	Checking time tables	RS	16.9	7.5
		PA	17.2	5.7
	Location based services (your position, restaurants etc.)	RS	6.5	3.9
		PA	11.6	2.0

RS = Random sample survey, PA = Panel survey

The 13 services that fell out were auctions, checking stock rates, brokerage, advanced m-banking, health care services, insurance services, education services, searching and making a room reservation, chat, adult content, filling in lotto, wireless alerting/security systems, and location of family members.

Only SMS has become a regularly used service for most consumers. Other services are on their way to become adopted in a larger scale. Trial use is typically a number of times greater than regular use. Entertainment services which have to do with ring tones and logos are being tried out on a large scale. Reservation and purchase services as well as information services lag behind.

We also studied which factors were considered to constitute benefits and barriers to the use of mobile services. Benefits were measured with 15 items. Based on a factor analysis (principal component factor analysis, varimax-rotation) we formed three sum scale variables (the cumulative explained variances are; RS 60%, PA 55%). The first variable reflects flexibility provided by mobile phones and services in everyday life (flexibility regarding place, flexibility regarding time, wireless feature of a mobile device, connection to the Internet, RS α=0.83, PA α=0.79). The second variable reflects new dimensions of communication introduced by mobile technology (personalization, uniqueness, new dimensions of communication such as picture, sound or video messaging, enhanced communication, more effective use of time, RS α=0.79, PA α=0.77). The third variable reflects benefits having to do with social status and entertainment value (being trendy, accentuation of social status, entertaining features, "to kill time", RS α=0.84, PA α=0.81).

Table 3. Benefits of the use of mobile services

Benefit	RS %	PA %
Flexibility		
No benefit	5.6	2.5
A small benefit	40.4	23.1
A big benefit	54.0	74.4
New dimensions of communication		
No benefit	10.1	18.5
A small benefit	63.0	60.4
A big benefit	26.9	21.1
Accentuation of social status, entertainment		
No benefit	48.0	58.8
A small benefit	43.7	37.4
A big benefit	8.3	3.8

RS = Random sample survey, PA = Panel survey

The greatest benefit of mobile phones and services is considered to be the flexibility they provide. Mobile services can be used when desired independent of time and place. The new dimensions of communication are considered a small benefit. Only a few consider accentuation of social status and entertainment to be a big benefit of mobile services (Table 3).

The barriers were measured through 14 items. Based on a factor analysis (principal component factor analysis, varimax-rotation) we formed four sum scale variables from the original items (cumulative explained variances

RS 68%, PA 64%). The first variable reflects problems related to usability of services (complexity involved in using mobile services, instructions how to use mobile services are lacking, complexity involved in operating mobile devices, information about existing mobile services is lacking, small screen size of mobile devices, RS $\alpha=0.86$, PA $\alpha=0.82$). The second variable reflects problems having to do with mobile networks and the functionality of mobile devices (slow data connection a/o data transfer, poor coverage of the network, limited capacity of the mobile devices, RS $\alpha=0.71$, PA $\alpha=0.74$). The third variable relates to security risks (fear of privacy invasion, security risks, RS $\alpha=0.83$, PA $\alpha=0.79$). The fourth variable reflects financial barriers (high initial costs, high operating costs, RS $\alpha=0.78$, PA $\alpha=0.79$). The variable "inadequate supply of useful mobile services" is studied as a separate variable.

Table 4. Barriers to the use of mobile services

Barrier	RS %	PA %
Problems with usability		
No barrier	17.3	6.9
A small barrier	56.4	50.6
A big barrier	26.3	42.5
Problems with functionality of network and devices		
No barrier	10.5	5.7
A small barrier	60.7	39.1
A big barrier	28.8	55.1
Security risks		
No barrier	10.9	7.3
A small barrier	47.9	38.5
A big barrier	41.1	54.1
Financial costs		
No barrier	4.3	2.5
A small barrier	35.3	25.1
A big barrier	60.4	72.4
Inadequate supply of useful mobile services		
No barrier	25.5	14.8
A small barrier	46.0	42.2
A big barrier	28.5	43.0

RS = Random sample survey, PA = Panel survey

Table 4 shows that financial costs and security risks are the greatest barriers to the use of mobile services. The rest of the barriers are smaller especially in the random sample, and they show similarities within the samples but differ between the samples.

4.1 Factors predicting the adoption of services

We used logistic regression analysis to study which factors are associated with the use of mobile services. In particular, we studied which factors increase the probability of the use of mobile services. The use of mobile services includes both trial and regular use.

We chose the independent variables that describe on the one hand users and on the other hand devices and services, which would predict the use of mobile services

as completely as possible. The suitability of variables for the models was initially considered with cross tabulations and logistic regression analyses (Backward LR). At first all possible variables were included in the models.

As independent variables describing users in the final models were gender, age and education, attitude to mobile phones and services, and attitudes to new technology in general. The sum scale variable related to the attitude to mobile phones and services was created from responses to seven proposals on mobile phones and services (RS $\alpha=0.81$, PA $\alpha=0.81$). The features of mobile phones and services were described in the final models by phone model, phone ownership and the benefits of and the barriers to use. Selected variables predicted statistically significantly the adoption of at least some individual services.

We first examine the results of the models in general for each service category (table 2) and then proceed in greater detail to the most popular service from each category: MMS (substituted for SMS which is already widely adopted), ring tones, m-banking, and personalized information messages. The results of the four models are presented with odds ratios in Table 5. Only the odds ratios of the main effects are shown. The odds ratio reflects the examined category's relation to the reference category, which is here the variable's last category. Values greater than 1 mean a greater probability compared to the reference group and values less than 1 a smaller probability to use the mobile service. Statistically significantly differing categories ($p<.05$) are marked in bold. Variables predicting the use of individual service are marked with asterisks (*$p<.05$, **$p<.01$ and ***$p<.001$).

Several variables describing users, phones and services predict significantly the use of mobile service categories. Variables associated with individual services vary according to service and between the random and panel samples.

The use of communication services is predicted in the random sample by age, attitude to mobile phones and services, and attitude to new technology, as well as phone model and some benefits to and barriers to use mobile services (new dimensions of communication, inadequate supply of useful mobile services). Additional significantly predicting factors in the panel sample are gender, mobile phone ownership and accentuation of social status or entertainment. On the other hand, inadequate supply does not affect the use of communication services in the panel sample.

Table 5. Factors predicting adoption

	MMS		Ring tones		M-banking		Pers.Info. Msg.	
Odds ratios								
	RS	PA	RS	PA	RS	PA	RS	PA
Gender								**
Male	0.84	0.68	0.89	0.67	1.45	0.99	1.06	**1.79**
Female	1	1	1	1	1	1	1	1
Age groups	*	***	***	***				
− 22	1.16	**4.25**	23.2	∞+	0.93	1.15	0.87	**4.61**
23 − 35	1.31	**2.85**	5.40	6.44	0.91	**1.72**	1.04	**1.72**
36 − 50	0.54	**2.15**	2.06	4.40	0.54	**1.68**	1.02	1.47
51 −	1	1	1	1	1	1	1	1
Education								
Basic	2.11	0.89	1.11	1.36	1.56	1.45	0.82	0.77
Middle	1.94	1.29	0.98	1.57	1.25	**1.51**	0.60	0.92
Higher	1	1	1	1	1	1	1	1
Attitude to mobile phones and services		***		***	**	**	***	**
Non-enthusiastic	0.76	**0.32**	2.80	**0.17**	**0.27**	**0.38**	**0.11**	**0.31**
Neutral	1.10	0.60	2.92	0.57	0.61	**0.45**	0.35	**0.50**
Enthusiastic	1	1	1	1	1	1	1	1
Attitude to new technology		*						
Non-enthusiastic	1.60	**0.46**	0.50	0.44	0.75	0.69	0.51	**0.54**
Neutral	1.35	0.59	0.47	0.42	0.70	0.86	1.01	0.70
Enthusiastic	1	1	1	1	1	1	1	1
Phone model	**	***						
Basic GSM	**0.36**	**0.44**	0.72	0.88	0.74	1.30	0.60	**0.66**
WAP	0.49	**0.43**	1.43	0.68	0.98	0.93	1.02	0.80
Advanced	1	1	1	1	1	1	1	1
Phone ownership				***				
Own	1.08	1.02	1.24	**0.42**	1.04	0.99	1.71	0.81
Employer	1	1	1	1	1	1	1	1
Flexibility			***					
No benefit	0.62	0.52	**0.12**	0.81	0.99	1.36	2.30	0.91
A small benefit	1.35	0.77	**0.31**	1.40	1.30	1.05	0.70	1.10
A big benefit	1	1	1	1	1	1	1	1
New dimensions of communication	**	*				***	***	***
No benefit	**0.23**	0.63	0.32	0.82	**0.29**	**0.27**	**0.00**	**0.24**
A small benefit	**0.50**	1.31	0.70	1.06	0.78	1.06	0.88	**0.61**
A big benefit	1	1	1	1	1	1	1	1
Accentuation of social status. entertainment				*		**		*
No benefit	1.53	0.73	0.25	0.35	0.75	0.65	0.45	0.78
A small benefit	1.66	1.03	0.38	0.58	0.76	1.12	0.64	1.29
A big benefit	1	1	1	1	1	1	1	1
Problems with Usability								
No barrier	0.46	1.50	0.86	1.85	0.98	1.62	0.63	1.41
A small barrier	0.80	1.34	0.74	1.18	0.77	0.93	0.90	0.95
A big barrier	1	1	1	1	1	1	1	1
Problems with functionality of network and devices						*		
No barrier	0.77	0.76	1.24	0.54	1.37	0.99	0.91	0.80
A small barrier	1.34	0.92	0.49	0.92	1.16	1.59	1.05	0.95
A big barrier	1	1	1	1	1	1	1	1
Security risks			*					
No barrier	0.84	0.87	**3.43**	1.45	1.57	0.99	0.84	0.83
A small barrier	1.02	1.11	**2.28**	1.22	1.51	1.14	1.08	1.02
A big barrier	1	1	1	1	1	1	1	1
cont'd	**Odds ratios**							

	MMS		Ring tones		M-banking		Pers.Info. Msg	
	RS	PA	RS	PA	RS	PA	RS	PA
Financial costs			*				*	
No barrier	3.09	1.03	**0.14**	0.72	0.60	0.88	5.93	**0.19**
A small barrier	1.10	1.20	1.32	1.44	0.98	1.46	**0.56**	0.95
A big barrier	1	1	1	1	1	1	1	1
Inadequate supply as a barrier	**		**				**	
No barrier	**3.13**	0.95	1.80	0.59	0.79	0.93	**3.42**	0.69
A small barrier	**2.95**	1.22	**3.02**	0.84	0.95	0.79	**2.24**	1.19
A big barrier	1	1	1	1	1	1	1	1

RS = Random sample survey, PA = Panel survey
+ ∞ is due to zero count in that age group

Significant predictors of the use of MMS, which is the first of the services we examine more closely, are in the random sample age, phone model, new dimensions of communication and inadequate supply of useful services. Young people are more likely than older people, and owners of advanced mobile phones are more likely than those with WAP or basic GSM phones to use MMS. MMS is also more likely used by those who consider the new dimensions of communication to be a benefit of mobile services and less likely by those who consider inadequate service supply to be a barrier to use. In the panel sample, also those enthusiastic about mobile phones and services as well as new technology in general are more likely than others to use MMS. On the other hand, an inadequate supply of mobile services is not associated with the use of MMS in the panel sample.

The use of entertainment services is predicted by age, attitude to mobile phones and services, attitude to new technology in general as well as the benefits of and barriers to use mobile services excluding problems with functionality of network and devices in the random sample. In the panel sample all factors describing users included in the logistic regression models predict the use of some entertainment services. Additionally, new dimensions of communication and accentuation of social status or entertainment predict the use of mobile services.

Variables which contribute significantly to the use of ring tones – the most used entertainment service – include age as well as some benefits and barriers to the use of mobile services (flexibility, security risks, financial costs and inadequate supply of useful mobile services). Ring tones are more often used by younger people than older people and by those who consider flexibility a benefit. Ring tones are less likely to be used by those who consider security risks and the inadequate supply of mobile services to be barriers to use. The connection between costs and the use of ring tones is surprising because those who in general consider the cost of mobile services to be a barrier to use are more likely to use ring tones than others.

In the panel sample, ring tones are more likely to be used by younger age groups than older age groups, by those enthusiastic about mobile phones and services, and

by those whose mobile phones are owned by the employer. Ring tones are more likely to be used also by those who consider the use of mobile services to enhance social status and be entertaining.

Reservation and purchasing services are different from the other services because only a few variables predict significantly the use of each individual service. In general, age and attitude to mobile phones and services, as well as phone model and some benefits of mobile services (flexibility and new dimensions of communication) are included among the predicting factors in the random sample. In the panel sample, an enthusiastic attitude to mobile phones and services is prevalent among users of all these services. Other significant factors include gender, age and education as well as all benefits and two barriers (problems with functionality of network and device, and problems of usability) to the use of mobile services.

The use of mobile banking – the most used service in this group – is predicted only by enthusiasm about mobile phones and services in the random sample. In the panel sample also the benefits of mobile services (new dimensions of communication and accentuation of social status/ entertainment) and problems with functionality of network and devices are associated with the use of mobile banking services. Mobile banking services are more likely to be used by those enthusiastic about mobile phones and services than others. In the panel sample they also are more likely to be used by those who consider the use of mobile services to offer new dimensions of communication and to enhance social status and to be entertaining. It is interesting to note that the use of mobile banking is also more likely among those who consider problems with functionality of network and devices to be small barriers than among those who do not consider problems of functionality to be a barrier at all.

A number of rather different services are categorized as information services in this study, which is why their use is also predicted by many variables especially in the panel sample. In the random sample significant predictors include age, attitude to mobile phones and services, phone model and some benefits and barriers (new dimensions of communication, inadequate supply of services, and cost). Additional significant predicting variables in the panel sample include gender, attitude to new technology in general, phone ownership, accentuation of social status, entertainment, and problems relating to usability.

The use of the most popular information service – personalized information messages – is in the random sample associated with attitude to mobile phones and services and some benefits and barriers to the use of mobile services (new dimensions of communication, inadequate supply and cost of mobile services). Those enthusiastic about mobile phones and services as well as those who consider mobile services to bring new dimensions to communication are more likely than others

to use personalized information messages. Services are less likely to be used by those who consider the inadequate supply and cost to be a barrier to use. In the panel sample, attitudes to mobile phones and services and the new dimensions of communication similarly predict the use of personalized information messages. Additionally, men are more likely than women to use personalized information messages as well as are those who consider the use of mobile services to enhance social status or to be entertaining.

When considering in general the variables predicting the use of mobile services we found that the sociodemographic variables are not important predictors in the random sample. Only age predicts significantly the use of mobile services. It seems that younger people are more active users of mobile services than the older people.

In the panel sample, on the other hand, sociodemographic variables predict the use of most mobile services. Gender, age, and education are significant predictors. There are significant differences between males and females in the use of many services. The findings show that men are more active users of mobile services than women with the exception of MMS, ring tones and logos. The importance of education as a predictor of the use of mobile services is small also in the panel sample.

Our study indicates that attitudes are the best explaining factors for the use of mobile services. Attitudes to mobile phones and services predict significantly most of the studied services. In the panel sample, these attitudes predict the use of all services except SMS. Surprisingly, the attitude to new technology in general is a significant predictor in both samples only in a couple of studied services. However, the two attitude variables together are the only significant predictors of the use of some services. Such services include mobile banking, the purchases of goods, checking time tables in the random sample, and listening to music in the panel sample.

The features of mobile phones and services are not as important explaining factors as the features of users. The mobile phone model owned by the user predicts significantly the use of some mobile services in both samples. The more advanced the phone is, the better are the chances to use service offerings. Many of those with advanced mobile phones also use a larger variety of services. The phone model predicts significantly especially the use of communication services (mobile email and MMS), some information services (Internet browsing), games, and reservation services. Users with WAP phones are more active users of mobile services than users with basic GSM phones.

Another rather important group of predictors includes benefits of and barriers to the use of mobile services although these are individually not particularly important

predictors. For example, security concerns and cost are considered to be barriers to the use of mobile services, but these barriers only predict the use of a few services in the random sample. In the panel sample, they do not explain the use of any of the services. Problems with usability and functionality of network and devices predict the use of only a few services.

Of the barriers, the best explaining factor is the inadequate supply of mobile services. It predicts use in the random sample, but not so much in the panel sample. Benefits predict rather little of the use. The new dimensions of communication (personalization, messaging involving pictures, sound and text) predict the use of some mobile services in the random sample. Flexibility predicts significantly only the use of one service in each sample (ring tones in the random sample and payment in the panel sample).

5. Conclusions

The evolution of mobile telephony from communication to the use of value added services is an interesting phenomenon. This change is notable in three ways, which have precedents in the history of communication and media technology. Firstly, it changes the nature of mobile telephony [cf. 28-29]. Secondly, it is a challenge to the continuity of mobile telephony [cf. 15], making it a financially risky step to take. Thirdly, we cannot yet say how and for what purposes the services will be used in the future [cf. 30-31].

Mobile services are now in an important phase of adoption. We have studied the adoption with two consumer surveys carried out in Finland in 2003 and 2004. The regular use of mobile services is still limited but trial use implies some possibilities for adoption on a larger scale. Some mobile services such as SMS, ring tones, and icons and logos have either been adopted on a large scale or have at least been tried by a majority of users.

We used logistic regression models to examine the use of mobile services. The models appear to fit the data reasonably well (Goodness-of-fit tests: the Chi-squares values are almost the same as the degrees of freedom).

Our analysis indicates that mobile services are adopted according to several patterns. Different groups of services are developed and adopted at a different pace despite having the same technology base. Accordingly, the adoption of mobile services takes place asynchronously with the development of the technology.

Mobile services are according to our study used by rather a small number of users. Most users of mobile services are interested in mobile phones and services, and some in new technology in general. Most of the regular users possess advanced mobile phones, which support the use of most mobile services in a smarter way than WAP or basic GSM phones and make the services either easier

to use or support a more advanced use of standard services. Even so, most of them are still only trying out many of the services. Larger scale regular use (over 10% of respondents) exists only for a few services such as ring tones, logos and icons, and mobile banking in addition to SMS, which is used for conventional communication.

It would seem that the sociodemographic variables explain little about the adoption. Instead, users' relationship to technology seems important, but the meaning of this relationship is not straightforward. Those who enjoy technology are early adopters, but so are some of those who do not. It would appear that services are adopted by those who are not interested in technology once the services are considered useful. This gives a slightly broader picture than diffusion theory typically does [12], where categorized consumer groups bear differences in characteristics. The result makes sense keeping in mind that over 90% of Finns have mobile phones.

Barriers and benefits predict little of the use of mobile services. This is a very interesting result because barriers and benefit typically receive much attention when new markets are evolving. In our study, the small significance of barriers and benefits may be due to our emphasis on the general use of mobile services. Barriers and benefits could be more important predictors of individual services. Nevertheless, the results show that key elements of the traditional technology acceptance and adoption theories do not get support as a way to explain and predict the adoption of mobile services.

Correspondingly, diffusion theory does not give a particularly exact guidance on how the adoption of mobile services is going to proceed. It represents a macro level approach to a subject that might require the incorporation of micro elements. The adoption of mobile services is initiated by users, and mobile services constitute a very diversified supply.

On the other hand, it seems that a social shaping of mobile services is taking place. This means that we do not really know what mobile services will be used. Consumers seem to favor communication and usefulness when asked about future service use. This implies that the use of services is initially perceived as distant.

The introduction and framing of mobile services has for quite some time appeared to balance between entertainment and usefulness. Our results seem to confirm the notion that novelties are initially often perceived as modest and functionally limited toys before they really become the tools for everyday life [29]. Usefulness and an ability to change everyday life routines are indeed prerequisites for large scale adoption. If mobile services can be built to create freedoms in everyday life routines [13] they can gain an important role in how human affairs are conducted and form the basis for a growing, technology-enabled and profitable service industry.

Our results are consistent with previous research [32]. Mobile services still have much less users than envisioned and their usefulness is being questioned by consumers. However, our results show that adoption is taking place and that there is an asynchronous relation to both the evolution of technology [11,8] and between different types of services.

After the premature hype wave in 2000, mobile services are now maturing to a stage where it starts to be possible to expect large scale adoptions. The demand for feature rich mobile phones is thriving and growing, and consumers are trying out mobile services. Gartner Inc. in a recent report still focus on the handset market and fears that an overheated market may hurt sales in 2005 [33]. It is strange that not much is reported on the development of mobile services even as we believe that the year 2005 may be when mobile services are adopted in a larger scale. Of course, as the history of technology points out, it is likely to take more time for consumers to find a central place for mobile services in their everyday life.

6. References

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