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Adoption of Mobile Services across Different Technologies

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Abstract

The future of mobile telephony is expected to rely on mobile services and the use of mobile services will be an integral part of the revenues to be generated by third generation mobile telephony. The adoption of new mobile services contradicts this proposition as it has been much slower than expected. Basic services such as search for information, ring tones, and icons and logos are still the most popular services. Based on our empirical evidence from a survey conducted in Finland, we can state that ownership of technologically advanced mobile phones encourages users to try out new services, but the adoption rate of them is nowhere close to SMS, which still reaches a much wider audience.

1. Introduction

The commercialisation of mobile services is approaching a critical stage in Europe. The development of mobile services – or mobile commerce or mobile Internet – has been intense for years but adoption has not progressed as expected. Japan and Korea have typically been considered forerunners in adoption rates of mobile services but even there, rather basic services such as messaging and ring tones have been most successful (Funk, 2005; Srivastava, 2004; Kim et al., 2004). Such services have during recent years been popular also in Europe (Carlsson et al., 2005; Mylonopoulos & Doukidis, 2003), but more advanced services have not yet found their ways into the everyday lives of consumers.

Europe is gaining much attention due to third generation mobile telephony (3G), which is expected to take off commercially in 2005-6. Initially 3G was limited mostly to Hutchison's networks in various countries but this is changing rapidly as more conventional mobile operators are launching their networks. From the perspective of service development, this is a significant step as 3G has been planned to be the basis of new business growth and to generate new revenues from services. Multimedia and web

browsing are examples of new services attributed to 3G (UMTS Forum, 2003; Pagani, 2004).

Although many promised new services have been attributed to 3G (Robins, 2003; UMTS Forum, 2003), they have in fact already reached mature stages. Even services, which rely on graphical browsing or multimedia messaging have approached basic availability for regular users. Furthermore, most service types have been available for users already for a number of years. Information services, ticketing and different forms of entertainment are examples of service types which can be used over a number of mobile technologies, including SMS (Short Message Service, e.g. text messaging). Studies of the mobile Internet tend to neglect this because they do not consider SMS to be an Internet technology (cf. Ishii, 2004; Funk, 2005).

In this paper we will work with mobile technologies and the adoption and use of mobile services. We particularly focus on the relationship between service adoption and the diffusion of mobile phones of different levels of technology. The adoption of services is analyzed through three distinctive features of the evolution of technologies for service provision: messaging, browsing and packet based data transfer. In other words, we compare how differences in the adoption of services relate to three technologies: basic GSM (Global System for Mobile Communications), WAP (Wireless Application Protocol) and GPRS (General Packet Radio Service).

This is a particularly interesting issue from the adoption point of view. Amidst the hype generated around promising mobile services, we should bear in mind that platforms representing all three technologies can support most of the services. There are technical solutions available to facilitate the elementary use of novel services such as MMS (Multimedia Messaging Service) which are supported SMS and the World Wide Web (WWW). Furthermore, the majority of users do not use the services for which they have a technological potential in their advanced mobile phones (Ishii, 2004; Ministry of Transport and Communications Finland, 2004).

If we find that some technologies are better promoters of service adoption than others, it would have significant strategic, commercial and theoretical value. Ordinarily, too much attention has been given cutting edge technology at the expense of user value (cf. Balasubramanian et al., 2002).

We begin by presenting a general overview of the features of the central technologies used for service provision in Europe. Then we present how adoption is generally described in acceptance models of technology and discuss their applicability to studies of the adoption of mobile services. We use empirical evidence from a recent (2004) consumer survey in Finland to illustrate and support conclusions on consumer adoption of mobile services.

2. The Evolution of Service Technologies

The digitalisation of mobile communication laid a new ground for service provision. In Europe, this took place through the GSM standard. Figure 1 illustrates the evolution of GSM networks and other service supporting technologies.

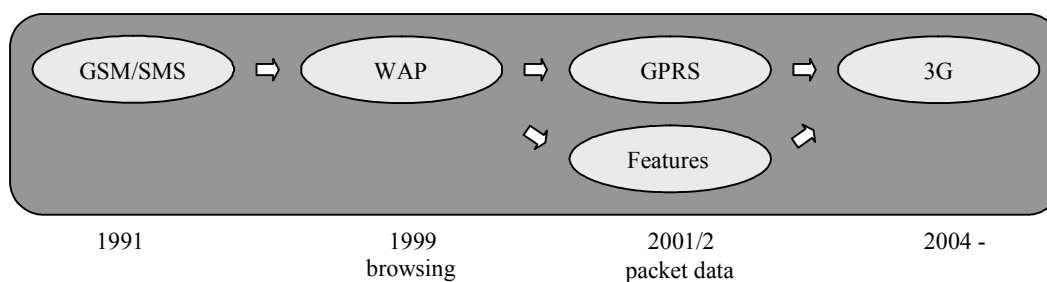


Figure 1: Evolution of GSM service technologies, adoption by the mass market

The Global System for Mobile Communications (GSM) was launched in 1991. It incorporated a short message system (SMS), which became surprisingly popular after 1995 as users began sending messages to each other. Later, SMS became a major platform for the supply of a wide range of services. Services based on SMS reach a wide audience, but are cumbersome to use as they require typing and knowledge of service codes.

The Wireless Application Protocol (WAP) was introduced to enhance usability and availability. It was meant to bring the Internet and Internet services into mobile phones. The first devices and services were available at the end of 1999. Very quickly, WAP turned out to be a major disappointment. Services were not very developed and a majority of users did not seem encouraged to try WAP services (Eriksson et al., 2001). Neither was the Internet community particularly willing to try it (Teo & Pok, 2003). Nevertheless, from the perspective of service development, WAP was a big step forward as it made Internet browsing possible on mobile phones.

General Packet Radio Service (GPRS) is an enhancement to the GSM network. It is often referred to as 2.5G, to position it as a standard between GSM (2G) and UMTS (3G). GPRS is important for service provision because it made packet based data transfer possible. Users do not need to stay connected all the time to use services and they only pay for downloaded data instead of connection time. Overall, GPRS is faster and cheaper to use than circuit data over GSM. The Enhanced Data for Global Evolution (EDGE) offers complements to packet based data transfer. EDGE is similar to GPRS and three times more efficient but significantly less widespread among users.

A number of technological advances took place alongside the introduction of GPRS in Europe. For example colour screens, cameras and Multimedia Messaging Services (MMS) became available. Such features were first introduced in high-end smart phones, which operate with the Symbian OS that supports third party services. Java became more mature, which led to the birth of a market for downloadable applications, in particular games. Even streaming video to mobile phones became functional (Repo et al., 2004).

3G is a generic term that describes the next generation of mobile communication and 3G refers in particular to high speed and multimedia data services. 3G is also intended to support a concurrent usage of multiple services and to bridge the gap between mobile phones and computing (UMTS Forum, 2003). Currently, commercial UMTS has been deployed in 17 European countries and 12 countries elsewhere with the majority of deployments taking place in 2004 (UMTS Forum, 2005). From a historical point of view, third generation mobile telephony seems more evolutionary than revolutionary (Nokia Networks, 2003). Much of the infrastructure needed for service provision has been developed and turned commercial already before 3G.

3. Theoretical Insights into Technology Acceptance

We approach the adoption of mobile services from the perspective of technology acceptance. This approach has previously been used in a number of studies on mobile services (Knutsen, 2005; Carlsson et al., 2005; Amberg et al., 2004; Pagani, 2004; Teo & Pok, 2003; Samtani et al., 2003; Hung et al., 2002, for example). The technology acceptance models have typically not been tested in the studies but have been used as conceptual tools to identify central issues. We shall do the same.

Of the acceptance models, the Technology Acceptance Model (TAM) is best known (Davis et al., 1989) and is repeatedly used in studies which focus on users. In studies on the adoption of mobile services, results have fairly well complied to central factors in the TAM: perceived ease of use and perceived usefulness (Pagani, 2004; Teo & Pok, 2003). A number of modifications and changes to the original TAM model have been made. The most prominent of these is the Unified Theory of Acceptance and Use of Technology (UTAUT) which states that there are three direct determinants of intention to use (performance expectancy, effort expectancy and social influence) and two direct determinants of usage behaviour (intention and facilitating conditions) (Venkatesh et al., 2003).

Technology acceptance models originate from organizational contexts and it is questionable if they should be used in non-organizational contexts (see Venkatesh et al., 2003). In the case of mobile telephony this is an important issue because mobile phones are consumer mass market products and mobile services target this market (Alahuhta et al., 2005). The acceptance of mobile services incorporates both the acceptance of mobile phones and mobile services (cf. Dholakia & Dholakia, 2004; Wareham & Levy, 2002). Therefore, the acceptance of mobile services is likely to be related to the acceptance of mobile technology (cf. Carlsson et al., 2005). We acknowledge this by first examining the technologies users possess.

With these reservations in mind we will use the TAM as a starting point. As we are focusing on the initial steps of large scale consumer acceptance a very basic model suits our purposes. Perceived ease of use and perceived usefulness are found in the original TAM and its derivatives (Davis et al., 1989; Venkatesh et al., 2003) (cf. fig. 2). We add the elements of enjoyment and new possibilities, which are mobile services such as ring tones, icons and logos, and games. We examine adoption in the form of actual use.

Adoption depends on ease of use according to the TAM. It is reasonable to assume that more advanced mobile phones in more advanced mobile networks are easier to use for mobile services than basic mobile phones in simple GSM networks. We look at the ease of use through the technology used for mobile services. Services based on SMS are more cumbersome to use than browsing through WAP, which is made faster and cheaper through GPRS. Basic service functionality satisfies this assumption as users need not be aware of all functions of their mobile phones.

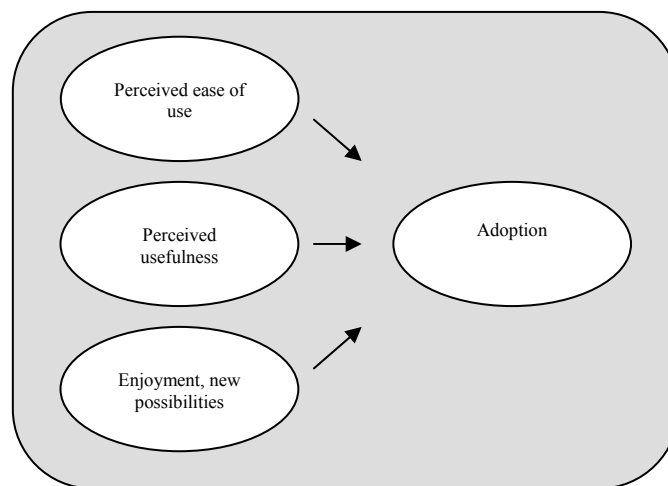


Figure 2: Factors affecting adoption

The asynchronous adoption of different types of services relates to perceived usefulness, enjoyment and new possibilities (cf. Carlsson et al., 2005). Some services have not been as successful as others because their business ideas or business models have not yet been understood or considered attractive by users. According to our line of thinking, if users find services to be useful or enjoyable, they will use them.

The enjoyment factor has been a concession to leisure use in acceptance theories (see Venkatesh et al., 2003; cf. Rogers, 1995). In this paper it is likely to show up because the majority of users are non-professionals. With an adaptation of the Braudel Rule (Keen and Mackintosh, 2001; Braudel, 1992) we can state that a mobile service should change the limits of the possible in the structure of everyday life in order for it to be adopted, used and to create enjoyment.

4. The Empirical Study

We carried out an empirical study on the Finnish market of mobile services to analyze the relationship between technology development and adoption of services. The survey was a traditional empirical study with random sampling. A sample of 1,000 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 484 (48.4 per cent) responded. The response rate is on a very acceptable level for a mail survey.

The gender distribution of the respondents was 57.7% females and 42.3% males, which means that the female are slightly over represented compared with the population. The respondents between 36-50 years of age formed the largest age group with 33.1% followed closely by the age group of 51-64 -year-olds with 32.7%. Respondents between 16-22 years of age totalled 11.5% and the 23-35 -year-olds amounted to 22.7%.

Data from the survey is analyzed with cross tabulations. Differences between service adoption and user possession of different generations of mobile phones are tested with the Pearson Chi-Square test. Statistically significant differences are reported ($p < .05$).

In an international comparison, Finland is an advanced information society especially when it comes to mobile communication. 90 per cent of Finns aged 15-74 years have

mobile phones (Nurmela et al., 2003). This means that virtually everyone has a mobile phone: not having one is making 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 five minutes of speech and 1-2 SMS per day. The taxation value for private calls on a business phone is 20 euros. Nokia has a market share of around 80 per cent of the mobile phone sales in Finland. Accordingly, service providers adjust their offerings to Nokia phones, which helps to reinforce interoperability.

Mobile phones and subscriptions are sold separately in Finland. This allows a separate study of the acceptance of mobile phones and services. Users are free to choose amongst the supply of phones and the supply of subscriptions and services. WAP portals operated by mobile operators are closed from subscribers with other operators. Otherwise, the service supply is open and third party service providers are numerous.

The Finnish mobile market experienced two radical changes in 2003. Firstly, users were allowed to keep their phone number when changing their mobile operator. This led to enhanced competition as record-breaking numbers of users switched operator. 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 one hand, price competition was enhanced; on the other hand, the market leader began differentiating its supply 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 messages to a maximum of 1 euro. This has resulted in decreasing revenues for the network operators and this trend appears to continue in 2005.

4. Analysis of Adoption

The adoption of mobile services involves both the acceptance of new, service enabling mobile phones and the acceptance and use of the services. All owners of GSM phones can use services based on SMS, but the supply of service varieties increases if one can use a more advanced phone. We begin by briefly discussing what types of phones users have and which services they use; then we find out how service adoption is related to the type of mobile phone in use.

4.1 Phone Types

In our survey, respondents informed us of the phone models they have from which we tracked down the service enabling technology. We make a distinction between GSM and WAP users and users of more advanced mobile phones. The category labelled advanced includes phones with GPRS and MMS and smart phones. The distribution of technologies is presented in figure 3.

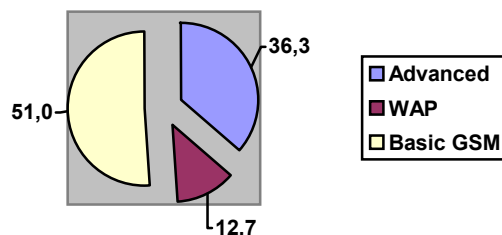


Figure 3: Mobile phones according to technology, %.

Basic GSM phones account for half of all mobile phones, which has a significant impact on the type of mobile services that can be used today. This result is in line with previous similar surveys. The share of advanced phones is growing at the expense of WAP and basic GSM phones, but changes take place slowly. Nine months earlier basic GSM accounted for 58%. This study also confirms that user upgrade intentions of mobile phones do not provide reliable information on upgrade rates (Carlsson et al., 2004). Features such as colour display, radio and Java seem to be the main drivers for upgrades.

4.2 Phone Types

To study the use of mobile services, we asked the respondents to report on their trial and regular use. Trial use means that the user has tried or used the service occasionally; regular use means that the service is being used on a daily, weekly or monthly basis. Services with relatively widespread use (over 7 per cent have tried or use regularly) include a number of services (Table 1). The services have been grouped in four categories: communication, entertainment, reservation and purchasing, and information services.

Service use was in general very moderate and services were being tried out more than used on a regular basis. Communication services were most popular, although mobile e-mail and MMS were not used nearly as much as SMS. SMS remained the only widely used mobile service; virtually all Finns sent SMS on a regular basis.

Mobile services were also used to acquire information. Especially search services had widespread trial and regular use. News and weather services were used and the Internet browsed regularly by almost 10% of Finns and tried out by even more. Nevertheless, all information services were being tried out more than regularly used.

Widespread regular or trial use of entertainment services was limited to ring tones, and icons and logos. Sending commercially produced humoristic messages and listening to music were emerging entertainment services.

Banking, and reservation and purchasing services had not become part of the everyday lives of many consumers. Especially the regular use of these services was small.

There are evident mix ups between mobile services and features of mobile phones in the survey results. Mobile services generally refer to services used over data connections, but users may well consider calling services as well. Search services, for example, are often used by calling designated call centres; music is more listened to over the radio than as streamed media; preinstalled games are played more than purchased new games. Internet

use may also be WAP browsing more than browsing on the World Wide Web. We believe that mix ups are a problem, which all detailed consumer surveys on mobile services will have to deal with, also in the future. We also believe the mix ups partly explain why the use of many services was now smaller than in previous studies on the Finnish market (cf. Carlsson et al., 2004). Users have become somewhat more acquainted with the concept of mobile services and can respond more accurately.

Table 1: Use of mobile services

Services		Trial use	Regular use	Aggregate
Com- muni- cation	SMS	4.6	91.6	96.2
	Mobile email	14.6	8.0	22.6
	MMS	10.3	7.9	18.2
Entertainment	Icons and logos	45.5	12.7	58.2
	Ring tones	40.6	17.0	57.6
	Humorous messages	19.7	4.9	24.6
	Listening to music	8.9	5.4	14.3
	Games	5.2	2.8	8.0
Reservations and purchases	Payment	9.9	4.9	14.8
	Reservation of movie ticket etc.	11.0	2.6	13.6
	Routine m-banking	6.6	5.4	12.0
	Shopping	9.8	2.1	11.9
	Making reservations, purchasing flight/train tickets	5.2	2.4	7.6
Information	Search services	27.3	35.5	62.8
	News and weather	15.0	9.7	24.7
	Internet browsing	11.3	9.0	20.3
	Checking time tables	9.9	3.3	13.2
	Event specific services	8.5	3.5	12.0
	Location based services	4.9	3.5	8.5
	Health care services	4.0	4.0	8.0

If the mix ups are distributed evenly across the technologically categorized user groups, their effect is minimized. We do believe that users with more advanced phones are generally more aware of supply and therefore likely to make less mix ups. This would make our analysis conservative.

4.3 Service Use According to Phone Type

We used cross tabulations to study if there were differences in the use of mobile services according to the type of mobile phone used. Use was defined to include both trial and regular use. The phones were divided into three categories: basic GSM, WAP and advanced (Table 2).

The results show that the use of mobile services was connected to the phone type in use with statistical significance. The more advanced the phone in use, the more mobile services were used. Accordingly, users with WAP phones used services more than users

of basic GSM phones and users with advanced phones more than users with WAP phones.

Table 2: Use of mobile services according to technology.

Services		Basic GSM	WAP	Advanced	p-value
Com- muni- cation	SMS	94.6	98.1	97.3	-
	Mobile email	11.3	22.0	37.4	.000
	MMS	11.9	14.6	30.3	.000
Entertainment	Icons and logos	47.9	66.0	72.6	.000
	Ring tones	47.7	58.0	72.4	.000
	Humorous messages	16.4	28.0	35.4	.000
	Listening to music	8.2	12.0	26.0	.000
	Games	4.6	0.0	16.4	.000
Reservations and purchases	Payment	10.7	18.0	21.9	.017
	Reservation of movie ticket etc.	11.7	12.0	18.4	-
	Routine m-banking	10.8	8.0	15.8	-
	Shopping	13.8	4.0	13.6	-
	Making reservations, purchasing flight/train tickets	5.2	4.0	13.6	.010
Information	Search services	57.2	72.0	68.8	.038
	News and weather	16.6	24.5	39.7	.000
	Internet browsing	10.8	14.0	37.9	.000
	Checking time tables	8.8	8.0	23.8	.000
	Event specific services	5.6	14.0	21.2	.000
	Location based services	8.7	6.0	10.9	-
	Health care services	9.7	4.0	8.3	-

The results show that the use of mobile services was connected to the phone type in use with statistical significance. The more advanced the phone in use, the more mobile services were used. Accordingly, users with WAP phones used services more than users of basic GSM phones and users with advanced phones more than users with WAP phones.

As expected, the use of services such as Internet browsing, MMS, mobile e-mail, ring tones, listening to music, and games were most common among users of advanced phones. This is not surprising as many of these services have been developed with advanced phones in mind.

However, there were exceptions to the general trend, meaning that the use of some services was not related to the type of phone. SMS was used by all and had not been replaced by technologically more advanced communication services. Location based services and routine m-banking, reservation of movie tickets and shopping were not connected to phone type. These services are often supplied through different technologies, including SMS.

We also studied how the phone type related to trial and regular use of mobile services. It appears that there were more both regular and trial users of mobile services among those with advanced phones. They used services such as MMS, mobile e-mail, ring tones and

schedules more regularly than users with GSM and WAP phones. The advanced phone users browsed the Internet and listened to music more than others; they were also ahead on trying out games and on ordering news and weather services more often than others. Both users with WAP and advanced phones used search services more often than users with basic GSM.

5. Analysis of Adoption

Mobile service technology and service supply evolves rapidly but their adoption lags behind even in advanced markets in Asia and Europe. Basic services such as messaging (or e-mail in Japan), ring tones and icons and logos are the most popular mobile services (Carlsson et al., 2004; Kim et al., 2004; Srivastava, 2004; Ishii, 2004). This holds true also in our study with search services being the only newcomer in a mass market scale.

We studied the adoption and use of mobile services from the perspective of technology acceptance. This is a popular approach in studies on mobile services. Perceived ease of use and perceived usefulness explain the adoption of mobile services (Teo & Pok, 2003; Pagani, 2004, for example). Yet the application of technology acceptance models to mobile services is questioned as acceptance models originate from an organizational context (Venkatesh et al., 2003). By contrast, the market of mobile services is a consumer market and factors focusing on enjoyment and new possibilities were therefore included. This is a concession of acceptance models to leisure use (see Venkatesh et al., 2003; cf. Rogers, 1995).

The acceptance model explains the popularity of a wide variety of services in our study. We assumed that services need to be widely used in order to be considered useful or to create enjoyment. Useful services include search services, messaging and a few information services. Enjoyable services include ring tones and icons and logos. Of course, the categorization of services may overlap (see Carlsson et al., 2005 where these load on the same factor), but in general they are different by nature.

The importance of perceived ease of use was supported in the design of services. The most popular mobile services were simple by design, but in a number of services, technological advancement seemed to promote service use. Technological improvement could lead to a better user experience (cf. Teo & Pok, 2003). Acceptance models support the connection between ease of use and popularity.

In fact, we found a notable connection between technology levels and service use. Those who used phones supporting GPRS were more likely to use new services than WAP and GSM phone users; similarly, those with WAP phones were more likely to use services than users of basic GSM. On the other hand, WAP did not turn out to be as successful as a service provision platform although it was launched as “the mobile Internet” (cf. Barnes, 2003; Sadeh, 2002; Andersson, 2001).

The connection between phone type and service use is an interesting result. The connection is not obvious because all GSM users can use the majority of mobile services through SMS technology. GPRS and related advanced technologies will possibly appear as drivers for increased service use. Some phone types would seem to encourage service use more than others. Such drivers have been studied and compared earlier by comparing basic GSM with more advanced phone types (cf. Carlsson et al., 2004).

We encourage future studies on the connection between technological bias and social factors. Interest in mobile technology has been noted to explain well the use and adoption of mobile services (Carlsson et al., 2005; Hyvönen & Repo, 2004). This would imply that those who first acquire technologically advanced phones are also more likely than others

to use mobile services. In that case the connection between phone type and service use would become weaker.

Of course, we must still keep in mind that overall service use is very moderate. All in all, mobile services have not really found their way into the everyday lives of Finnish consumers - with a few notable exceptions such as SMS and search services. No rapid growth in the use of services has been taken place during recent years (Carlsson et al., 2005; Eriksson et al., 2001)

References

- Alahuhta, P., Ahola, J., Hakala, H., (2005): Mobilizing Business Applications, Technology Review 167, Tekes, Helsinki. Available at: www.tekes.fi/julkaisut/Mobilizing.pdf
- Amberg, M., Hirschmeier, M., Wehrmann, J., (2004): The Compass Acceptance Model for the Analysis and Evaluation of Mobile Services, International Journal of Mobile Communications, Vol. 2, No. 3, pp. 248 - 259.
- Andersson, C., (2001): "GPRS and 3G Wireless Applications", John Wiley & Sons, New York.
- Balasubramanian, S., Peterson, R. A., Jarvenpaa, S. L., (2002): Exploring the Implications of M-Commerce for Markets and Marketing, Journal of the Academy of Marketing Science, Vol. 30, No. 4, pp. 348 - 361.
- Barnes, S., (2003): The Wireless Application Protocol as a Platform for Mobile Services, "Mbusiness: The Strategic Implications of Wireless Communications", Elsevier, Amsterdam.
- Braudel, F., (1992): The Structures of Everyday Life: The Limits of the Possible, "Civilization and Capitalism: 15th - 18th Century", University of California Press, Berkeley.
- Carlsson, C., Hyvönen, K., Repo, P., Walden, P., (2005): "Asynchronous Adoption Patterns of Mobile Services", Proceedings of the 38th Hawaii International Conference on System Sciences (HICSS-38), Island of Hawaii, USA, January 3 - 6, 2005.
- Carlsson, C., Hyvönen, K., Repo, P., Walden, P., (2004): "It's All About My Phone! Use of Mobile Services in Two Finnish Consumer Samples", Proceedings of the 17th Bled eCommerce Conference, Bled, Slovenia, June 21 - 23, 2004.
- Davis, F., Bagozzi, R., Warshaw, P., (1989): User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, Management Science Vol. 37, No. 8, pp. 982 - 1002.
- Dholakia, R. R., Dholakia, N., (2004): Mobility and Markets: Emerging Outlines of M-commerce, Journal of Business Research, Vol. 57, No. 12, pp. 1391 -1396.
- Eriksson, P., Hyvönen, K., Raijas, A., Tinnilä, M., (2001): Mobiilipalvelujen käyttö 2001: asiantuntijoille työtä ja miehille leikkiä? (Mobile service use 2001: Work for professionals and play for men?), National Consumer Research Centre, Helsinki.
- 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.

- Hung, S.-Y., Ku, C.-Y., Chang, C.-M., (2002): "Empirical Test of a WAP Adoption Model", Proceedings of the Fourth International Conference on Electronic Commerce, Hong Kong, China, 2002.
- Hyvönen, K., Repo, P., (2004): "Diffusion of Mobile Services in Finland", Proceedings of the 3rd International Business Information Management Conference (IBIMA), Cozumel, Mexico, December 14 - 16, 2004.
- Ishii, K., (2004): Internet Use via Mobile Phone in Japan, Telecommunications Policy, Vol. 28, No. 1, pp. 43 - 58.
- Ito, M., (2005, forthcoming): Mobile Phones, Japanese Youth, and the Re-Placement of Social Contact, "Mobile Communications: Re-Negotiation of the Social Sphere", R. Ling and P. Pedersen (Eds.), Springer.
- Kangas, P., (2003): Suomen telemaksujen hintataso 2003 (Price levels for telecommunication charges in Finland in 2003), Ministry of Transport and Communications Finland, Helsinki.
- Keen, P.G.W., Mackintosh, R., (2001): "The Freedom Economy: Gaining the mCommerce Edge in the Era of the Wireless Internet", Osborne/McGraw-Hill, New York.
- Kim, J., Lee, I., Lee, Y., Choi, B., (2004): Exploring E-Business Implications of the Mobile Internet: A Cross-National Survey in Hong Kong, Japan and Korea, International Journal of Mobile Communications, Vol. 2, No.1, pp. 1 - 21.
- Knutsen, L. A., (2005): "M-service Expectancies and Attitudes: Linkages and Effects of First Impressions", Proceedings of the 38th Hawaii International Conference on System Sciences (HICSS-38), Island of Hawaii, USA, January 3 - 6, 2005.
- Ministry of Transport and Communications Finland, (2004): Mobiilipalvelumarkkinat Suomessa 2003 (The Mobile Service Market in Finland), Publications 24, Ministry of Transport and Communications Finland, Helsinki.
- Mylonopoulos, N. A., Doukidis, G. I., (2003): Introduction to the Special Issue: Mobile Business: Technological Pluralism, Social Assimilation, and Growth, International Journal of Electronic Commerce, Vol. 8, No. 1, pp. 5 - 22.
- Nokia Networks, (2003): A History of Third Generation Mobile, Nokia Networks, Espoo.
- Nurmela, J., Parjo, L., Ylitalo, M., (2003): A Great Migration to the Information Society: Patterns of ICT Diffusion in Finland in 1996 - 2002, Statistics Finland, Helsinki.
- Pagani, M., (2004): Determinants of Adoption of Third Generation Mobile Multimedia Services, Journal of Interactive Marketing, Vol. 18, No. 3, pp. 46 - 59.
- Repo, P., Hyvönen, K., Pantzar, M., Timonen, P., (2004): "Users Inventing Ways to Enjoy New Mobile Services - The Case of Watching Mobile Videos", Proceedings of the 37th Hawaii International Conference on System Sciences, Island of Hawaii, USA, January 5 - 8, 2004.
- Robins, F., (2003): The Marketing of 3G, Marketing Intelligence & Planning, Vol. 21, No. 6, pp. 370 - 378.
- Rogers, E.M., (1995): "Diffusion of Innovations", The Free Press, New York.
- Saaksjarvi, M., (2003): Consumer Adoption of Technological Innovations, European Journal of Innovation Management, Vol. 6, No. 2, pp. 90 - 100.
- Sadeh, N., (2002): "M-commerce: Technologies, Services and Business Models", John Wiley and Sons, New York.

- Samtani, A., Tze, T. L., Hoon, M. L., Gin, J. G. P., (2003): Overcoming Barriers to the Successful Adoption of Mobile Commerce in Singapore, *International Journal of Mobile Communications*, Vol. 1, No. 1-2, pp. 194 - 231.
- Srivastava, L., (2004): Japan's Ubiquitous Mobile Information Society, *Info*, Vol. 6, No. 4, pp. 234 - 251.
- Teo, T.S.H., Pok, S.H., (2003): Adoption of WAP-Enabled Mobile Phones Among Internet Users, *Omega* Vol. 31, No. 6, pp. 483 - 498.
- UMTS Forum, (2003): Mobile Evolution: Shaping the Future. Available at: http://www.umts-forum.org/servlet/dycon/ztumts/umts/Live/en/umts/Resources_Papers_index Last accessed March 31, 2004.
- UMTS Forum, (2005): 3G/UMTS Commercial Deployments. Available at: http://www.umts-forum.org/servlet/dycon/ztumts/umts/Live/en/umts/Resources_Deployment_index. Last accessed January 26, 2004.
- 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 - 78.
- Wareham, J., Levy, A., (2002): Who Will Be the Adopters of 3G Mobile Computing Devices? A Probit Estimation of Mobile Telecom Diffusion, *Journal of Organizational Computing and Electronic Commerce*, Vol. 12, No. 2, pp. 161 - 174.
- Watson, R. T., Pitt, L. F., Berthon, P., Zinkhan, G. M., (2002): U-Commerce: Expanding the Universe of Marketing, *Journal of the Academy of Marketing Science*, Vol. 30, No. 4, pp. 333 - 347.