

# Value-Added Services in Mobile Commerce: An Analytical Framework and Empirical Findings from a National Consumer Survey

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## Abstract

*Although little is known about consumers' attitudes towards wireless marketing channels, many organizations are today making considerable investments to take advantage of the new business possibilities offered by wireless technologies - encouraged by optimistic, yet contradictory forecast on the future volume of m-commerce. This paper highlights the importance of setting out from the consumer perspective when developing m-commerce strategies, proposing an analytical framework that can be used to assess whether, and in what ways, specific mobile services are likely to offer added value for wireless Internet users. The paper reports on a national consumer survey conducted to investigate the Finnish consumers' willingness to use a number of initial mobile services, and to investigate whether consumers recognize the value offered by these applications. The results indicate a rather low willingness to use mobile services in general, but an exceptionally high willingness to use certain applications. The results do not, however, support the supposition that m-commerce is likely to increase the overall volume of Internet commerce significantly by penetrating into untapped markets (non-PC users).*

## 1. Introduction

Mobile commerce, or e-commerce over wireless telecommunication networks, is becoming one of the major topics of interest for the IS research community and a key priority for many business organizations. The Internet as a place to do business may not, as yet, quite have lived up to the expectations, as it has not achieved true mass adoption [27, 29]. Nevertheless, despite the fact that - or perhaps even because - e-commerce has not reached the volume and the explosive growth figures commonly predicted in the mid-1990s, the eyes of scholars and industry representatives are now on the opportunities offered by wireless media, envisaging that

the next - or the real phase of e-business growth will be in the area of mobile commerce (see e.g. [35]).

Predictions, based on both anecdotal and empirical evidence, on the future popularity and volume of m-commerce have been widely presented in the academic literature and the business and technology press. In general, the forecasts have been highly contradictory: While some authors and research firms believe that the demand for m-commerce services will skyrocket over the next five years [33], with mobile access dominating the scene as a means for Internet access by 2005 [37, 38], others are far more careful in their predictions [1, 2, 23, 25]. Although this may seem like a mobilephile vs. mobilephobe debate, such contradictions are natural when a new technology is launched [31], and could be seen in the early years of e-commerce as well.

The fact remains, nonetheless, that many empirically supported (optimistic) predictions rely on indirect units of measurement rather than direct empirical studies on consumers' willingness to embrace m-commerce. Many scholars and analysts have, for instance, asserted that there is a huge market potential for mobile applications primarily supporting their assumptions with predictions of the global penetration rate of mobile devices [5, 6, 8, 12, 14, 21]. Although this is an issue that is related to how the concept m-commerce is defined, we argue that the popularity of m-commerce cannot be measured by the popularity of mobile devices, just as the popularity of e-commerce cannot - as has been proven - be measured by the popularity of computers. M-commerce goes far beyond mobile telephony [38], meaning that a substantial volume of m-commerce should not be seen as an obvious outcome of high penetration rates of mobile phones. Rather, mobile devices with wireless Internet connections should be seen as a prerequisite for m-commerce. After all, just because a retail sale is possible on a device, it does not make it probable [25].

It has also been pointed out that the proportion of population able to use e-commerce via Web-enabled PCs

still is rather limited, and that the linkage of mobile phones and Internet obviously has an enormous potential to increase the overall volume of e-commerce [6, 12, 21, 22], as many consumers who are not yet Internet adopters due to (i) the greater hardware *investments*, and (ii) the *proficiency* with PCs needed in the PC-based e-commerce will now access the Internet due to the lower costs involved (cf. [16]) and their familiarity with the device. It has been argued that the learning curve for m-commerce is much faster than for other information and communication technology (ICT) application services [38], and that m-commerce applications are likely to be user-friendlier than corresponding PC-based applications. Ropers [29] points out that today's Internet relies on the PC as the access device, which means that daily usage is limited to consumers who can afford and are able to operate a PC. The author raises the question of how much e-business results would benefit from a wider market that included older people, consumers in emerging third-world countries, and those who cannot afford or simply do not want to use a PC [29]. According to Daitch et al. [8], wireless Internet access, transactions and applications will far exceed those conducted on PCs. This conjecture seems to be supported by a number of non-academic empirical studies: Data compiled by Media Metrix [26] shows that about 20% of the U.S. households who own non-PC digital devices, including cellular phones, do not own a PC. According to research conducted by e-MORI [19] in six markets, including Finland, the number of people interested in using m-commerce is eight times as many as those currently using e-commerce.

A wireless, mobile device has been seen as the optimum tool to handle a great number of different commerce-related tasks, and in many sectors the benefits offered by such a medium are, indeed, intuitively unparalleled. Nevertheless, we argue that a launch of business-to-consumer (B-to-C) Internet services - or a prediction of the future market potential of a specific service, wired or wireless, should be preceded by an assessment of the suitability of the offering for being traded over different electronic media, including empirical studies on the target consumers' needs, wants and expectations.

In the area of 'wired' Internet commerce, many companies, especially early embracers of B-to-C e-commerce, seem to have neglected the consumer perspective when formulating their Internet strategies. Hence, many Internet ventures and investments have been characterized by a 'technocist focus', which can mean a neglect of customer orientation and other factors influencing consumers' purchase behavior [4]. This technological blindness has been typical for the business concepts and models in many purely Web-based companies, which may explain why many ambitious Internet projects have collapsed.

The understanding of consumer behavior in the Internet environment is limited since electronic shopping is only beginning to penetrate mass markets [30]. As is pointed out by Shuster [31], there are, however, almost no direct, comprehensive studies on consumer behavior and

preferences related to wireless Internet in the public domain. In accordance with these arguments, this research has the following aims: (i) to propose an analytical framework that is useful for assessing whether, and in what ways, a specific service/application is likely to offer added value to consumers over a wireless medium; (ii) to empirically investigate the Finnish consumers' willingness to use a number of initial mobile applications (relating to the presented framework), also (iii) investigating whether m-commerce is likely to increase the overall volume of Internet commerce significantly by penetrating into untapped markets, and (iv) identifying the primary target groups for the suggested m-services in terms of gender and age.

## 2. Analytical Framework

The adoption of B-to-C e-commerce has been surprisingly slow in comparison to early predictions by experts. The frontrunners have been the industry sectors in which consumers are offered indisputable benefits by the new medium as compared to the physical marketplace. In the same way, the 'winners' in m-commerce will be the industry sectors/products/services offering wireless users indisputable benefits in comparison to (a) the physical marketplace and (b) wired electronic channels.

Based on this logic, which suggests that different channels (physical, wired, wireless) vary in suitability in terms of marketing and distributing different products and services, we propose an analytical framework that can be used to evaluate, theoretically, the suitability of specific services/applications for m-commerce. In the framework, a distinction is made between the value offered by the wireless Internet technology in itself; *wireless value*, and the value emerging from the actual mobile use of a device; *mobile value*. Wireless value can be created through the use of any wireless device, irrespective of the service/application (a *service-independent* phenomenon), whereas mobile value is created only through certain types of wireless services (a *service-dependent* phenomenon).

### 2.1. Wireless Value

As is pointed out by Varshney and Vetter [35], mobile and wireless systems are not the same even though there is considerable overlap: wireless interfaces do not necessarily need to support mobility. In addition to such obvious advantages of wireless technologies as using your computer without any cables, an important benefit of the wireless Internet is the opportunity to use a wireless device (mobile phone, PDA) to do almost all types of e-commerce related activities without having to invest in - or connect using - a computer. Besides offering obvious *convenience* benefits (cf. [21]), this may bring significant advantages for consumers that lack *proficiency with computers*, but are familiar with mobile phones (cf. [29]). Moreover, there may be *cost savings* involved for consumers who are satisfied with the (still) limited

computing power offered by handsets, especially as owning a mobile phone already is a matter of course for most consumers, especially in Europe.

Tang and Veijalainen [34] assert that the main force for the rapid acceptance rate of m-commerce is its increased convenience and efficiency in performing simple transactions compared with the stationary machines, thereby implying that *wireless value* is likely to be a main driver for m-commerce.

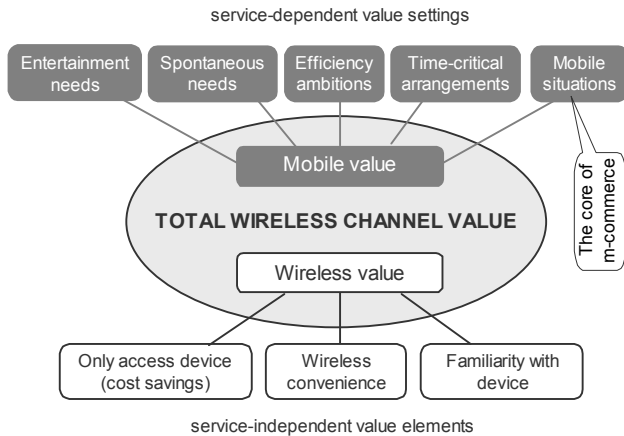


Figure 1. The analytical framework

## 2.2. Mobile Value

Mobile value, or m-value, signifies the value arising from the mobility of the new medium, i.e. making use of the Internet-connection while ‘on the move/road’. M-commerce has, in fact, been defined as “e-commerce for users on the move” [38]. M-commerce not only extends the benefits of the Web, but also allows for unique services enabled by the convergence of the Internet with mobile technology [20]. Through a conceptual analysis, we have identified five different settings in which mobile value is created:

(i) **Time-critical arrangements:** Applications for situations (arising from external events) when immediacy is desirable [9, 24]. Time-critical situations arise from *external events*, which means that the always-on connectivity of the medium is an important feature in this regard, as it allows for on-demand push-technological solutions (alerts and reminders) on certain topics that the user recognizes as time-critical (such as alerts for stock traders).

(ii) **Spontaneous decisions and needs**, which are internally awakened and not a result of external events (such as alerts, etc.). In general, these needs are related to products and services that are characterized by the purchasing decision being straightforward, meaning that the if/when/where decisions do not require careful consideration. Spontaneous needs can also be entertainment-related, efficiency-related or even time-critical in nature.

(iii) **Entertainment needs;** killing time/having fun, especially in situations when not being able to access wired entertainment appliances. Entertainment needs are

generally also *spontaneous* in character, especially in mobile settings.

(iv) **Efficiency ambitions;** aiming at productivity (e.g. of working time). M-commerce gives time-pressured consumers the ability to use the ‘dead spots’ in the day (e.g. during the daily commute between home and work) more effectively [9, 28]. According to Maginnis et al. [18], the chief benefit, so far, of portable computing devices has been to increase worker productivity.

(v) **Mobile situations**, i.e. services that are, in essence, of value *only* through a mobile medium, as needs for such services predominantly arise when away from home, ‘on the move’. Examples include the widely discussed *localization* services (for instance routing), ‘roadside’ services such as vending/parking machine payments, etc. As these types of services are of value exclusively in mobile settings, they are likely to constitute the core of m-commerce.

It should be noted that the *personalization* of services, which has been pointed out as a value-adding feature in m-commerce by numerous authors (e.g. [7, 21, 29]), obviously might be an additional benefit for many users. It is, however, not only a controversial issue, but also one of the foundation pillars of wired e-commerce, and hence not a benefit that can be reaped only through a mobile medium. Thus, personalized services do not - at least not unquestionably - offer m-value from a consumer perspective, although they intuitively fit well with mobile media. Rather, personalized services should be seen as a prerequisite for m-commerce due to the imperfect usability (the limited screen size) of handsets and the situations and settings in which many m-transactions are likely to be made.

In accordance with this line of reasoning, we argue that the mobile Internet is going to obtain a dominant channel position in product/service categories where the use of mobile applications offers customers indisputable m-value, thereby grasping the very essence of m-commerce. In some cases (cf. mobile situations), these services will be valuable (and available) exclusively through mobile devices. For services that do not bring mobile value, but only wireless value, it can be hypothesized that mobile devices will be used primarily for reasons of convenience or because of a lack of alternative ways to connect to the Internet. In these cases, we believe that mobile channels are likely to remain in a secondary position due to the higher usability offered by desktop PCs and/or iTVs.

## 3. Mobile ‘Killer’ Applications: A Brief Literature Review

It seems to be widely agreed that the success of m-commerce will strongly be affected by the ability of businesses to offer, already at an early stage, the right products and services to consumers. With m-commerce still in its infancy, a topic of interest among scholars, and a main focus of the business/technology press has been to identify, typically through conceptual analyses, the products and services that are suitable for wireless media,

i.e. the 'killer applications' of m-commerce.

It should be noted that the concept 'killer application' can be interpreted in a number of different ways, ranging from applications that rapidly are adopted on a broad scale, to ones that directly generate the highest revenues for the service providers. Considering the fact that (i) we strongly feel that the success of m-commerce most probably will not depend on the economic fortune of a particular business venture, and (ii) this research focuses on the B-to-C arena, the concept 'killer (or success) application' is, for the purpose of this paper, operationalized according to the former definition, i.e. as an applications that reaches widespread popularity among masses of consumers.

Due to the novelty of the phenomenon, the academic literature offers few contributions in the area of prospective m-commerce success applications, whereas the issue has gathered much greater attention in the online and offline business and technology press. In addition, many market research institutions and industry players have made important contributions, including extensive empirical studies on the subject. Although commercial publications are not principally cited in academic research, we feel that the current state of the research in this specific area of m-commerce necessitates a deviation from this principle, especially as commercial research reports generally are very up-to-date, and also contribute to the directions taken by the industry. The aim of this section is to list some of the commonly hypothesized initial success applications in m-commerce, and to point out the controversy among experts and/or researchers in this regard.

In the case of the wired Internet, *e-mail* is without any doubt one of those most successful applications, one that has played a significant role in the rapid increase of households Internet connections. Most scholars seem to agree that e-mail will emerge as an initial killer m-application (e.g. [13, 14, 21]). This assumption is supported by the results of consumer surveys conducted by e.g. the Yankee Group [15], Greenfield Online [32], BWCS [11], and Accenture [3], but challenged by the findings from studies conducted by Strategy Analytics [10] and Strategis Group [1], the latter study surprisingly indicating that 65 percent of the users of mobile devices in the U.S. have no desire for wireless e-mail services.

According to Ghosh and Swaminatha [13], major applications are Web access for *information services* such as weather reports, sport scores, etc. However, in a consumer survey the Yankee Group [15] discovered limited interest in such applications, with only 19% of European mobile users interested in information services. Kannan et al. [14] argue that the most significant possibilities in m-commerce lie in the marketing of services, ranging from e.g. *interactive games, gambling,*

*travel bookings, banking,* and in dynamic transactions where continued interactivity is essential and useful, for instance *auctions* and *stock trading* (cf. [21]). Mobile applications related to the financial industry are, generally speaking, interesting, as the wired Internet certainly has brought big changes and new opportunities in terms of providing financial services to consumers. In 2000, online services were offered by 94% of all banks in Europe [21], and wireless technologies are expected to expand the benefits offered by online banking. Surveys show that 29% of the Europeans are either interested or definitely interested in mobile banking [15], whereas 12% of the consumers have an interest in trading stocks/checking stock quotes over a mobile device [32]. According to Varshney and Vetter [35], a mobile device could turn into a business tool, replacing bank, ATM, and credit card, thus allowing for value-added services such as *micropayments for purchases at vending machines* and *payments in shops*. More advanced financial activities such as *loans negotiations* and *sending notifications of claims to insurance companies* could also become feasible through mobile channels.

According to Vittet-Philippe and Navarro [38], the radical changes brought about by e-commerce in the financial services industry will pale in comparison with the revolution which m-commerce may bring to the *retail* sector, where it will offer many retailers the opportunity for service differentiation and the development of new channels to promote and sell goods. Batstone [1], on the other hand argue that retail will be the most unpredictable sector and the biggest sinkhole for failed mobile experiments. According to Forrester Research [25], mobile phones will account for only 3 % of total online retail sales in Europe by 2005, whereas PCs will capture more than 80%. According to Strategy Analytics [33], successful m-commerce applications will include *prepaid account recharging, electronic ticketing, vending/parking machine payments, and online shopping and payment for various goods and services*. As argued by Varshney and Vetter [35], mobile computing could bring along important applications such as *emergency management, real-time control systems, and remote operation of appliances*. A survey conducted among Finnish consumers by Nokia Networks [22] indicated that the most demanded product/service category for m-commerce is likely to be *movie and theatre tickets*, closely followed by *travel-related services, books, magazines and music*. In general, the study showed that the most popular services for m-commerce are likely to be the same as they have been for e-commerce, although far more demanded. Yet, the respondents, paradoxically, perceived m-commerce as less reliable, less useful, less practical and less safe in comparison to wired e-commerce [22].

## 4. Research Questions

In the brief literature review above we listed a number of commonly proposed potential success m-applications. Departing from this discussion, we picked out some of the most frequently mentioned applications (as well as some other interesting m-services), and used the analytical framework presented in section 2 to evaluate, theoretically, the suitability of each of the service for a mobile channel by assessing whether, and in what ways, a specific application is likely to offer *mobile value* to consumers. The m-applications selected for empirical investigation can be seen in Table 1, which also shows the sources of mobile value for each of the services (i.e. the results of the conceptual analysis in which the framework was applied).

Building on the preceding discussion, the following four research questions can be stated:

[RQ1] *To what extent are the different m-services subject of investigation likely to gain popularity among Finnish consumers in the early years of m-commerce?*

[RQ2] *In which consumer groups, in terms of gender and age, do we find the primary target groups for the m-services subject of investigation?*

[RQ3] *Do consumers recognize the mobile value offered by the m-services subject of investigation, i.e. are consumers likely to favor m-services that offer a broad range of mobile value, and do some sources of m-value stand out as especially relevant?*

[RQ4] *Will m-commerce be able to increase the overall market for Internet commerce?* This research question is investigated in a number of different ways; (i) do consumers that are *not yet Internet adopters* show a willingness to engage in mobile commerce?; (ii) do consumers that have *not yet embraced e-shopping* show a willingness to engage in mobile commerce?; (iii) are persons that perceive high *barriers* to e-commerce in terms of *costs of entry* and a *low proficiency with computers* likely to engage in m-commerce?

## 5. The Empirical Study

### 5.1. Sample and Data Collection Procedures

In order to obtain a sample representative for the target population, which was defined as the Finnish population in the age groups 16-74 years, a multistage probability sampling method was used because of the large size of the population and hence the sampling frame. This was done by randomly selecting 15 municipalities - one city and two rural municipalities from each of the five Finnish counties - from which a sample of 1000 consumers was randomly drawn based on the relative population in the chosen municipalities, otherwise in line with the demographic characteristics of the Finnish population in general. The sample was purchased from the Finnish Population Register Center, which ensured that a sample representative of the target population was obtained.

Mobile Service	M-value, source				
	TC	S	EN	EF	M
Read and receive news (through subscription services or browsing)	●	●	●	●	
Send/receive emails	●	●		●	
Routine bank services (pay bills, check accounts, etc.)	●	●		●	
Book travel tickets	●	●		●	
Remote activation/control of home appliances (heating system, sauna, car)	●	●			●
Calendaring and alerting Internet services (not using phone-internal functions)	●			●	●
Stock trading on the Internet	●			●	
Play online games on the Internet		●	●		
Listen to/download music from the Internet		●	●		
Online chat with strangers		●	●		
Shop for goods on the Internet (books, flowers, groceries, etc.)		●		●	
Electronic payment in physical shops		●			●
Take part in Internet auctions	●				
Book cinema or theatre tickets		●			
Restaurant table reservations		●			
Advanced (non-routine) banking services (e.g. loans negotiations, ordering credit cards)				●	
Fill out and send damage reports (notifications of claim) to insurance companies				●	
Receive personalized shopping offers					

**Table 1. Sources of mobile value offered by the applications subject of empirical investigation**

A mail survey was developed to collect data from the sample of Finnish consumers. A first mailing of 1000 questionnaires and returning envelopes took place on January 12, 2001, with a second mailing to all non-respondents three weeks later. 8 questionnaires were returned undelivered due to incorrect addresses. A total of 497 returns were received by February 28. Of these, 485 questionnaires were usable, giving an effective response rate of 48.5%. The responding sample was manually checked for possible nonresponse error on a number of variables (gender; age group; area of residence; native language), as this was possible even with the anonymous survey design. In the questionnaire, the respondents were instructed to indicate the likelihood (on a 5-point scale: 5 = yes, definitely; 4 = likely; 3 = not sure; 2 = unlikely, 1 = definitely not) that they would use a mobile device connected to the Internet for a number of different purposes. In addition to this, the respondents were instructed to indicate how strongly they agree or disagree with a number of statements relating to their perceived magnitude of some barriers to embracing Internet commerce with a special relevance in m-commerce settings. For this, a five-point Likert scale was used (5 = strongly agree, 1 = strongly disagree).

### 5.2. Data Analysis and Results

Of the respondents, 208 (43.5%) were males, and 270 (56.5%) females. All age groups were represented in proportions corresponding well to the population demographics. Only 5.6% of the respondents reported that

they did not know what the Internet is, and did therefore not complete the rest of the questionnaire. 43.1% were regular Internet users, 24.3% use it occasionally, and 11,3% had only tried. 6.6% had not yet tried, but reported that they were interested to. Another 6,6% had not yet tried, and had no intention to do it. 31,7% reported that they had made purchases over the Internet. As many as 40.1% had not yet made any purchases, but were interested to, whereas 28% had no intention to make purchases over the Internet.

85.7% of the respondents owned a GSM phone, 7.6% a WAP-enabled phone, and 4.4% a palm device. Only 8.2% reported that they do not own a mobile device of any kind. 32.3% of those who owned a mobile device reported that they intend to upgrade it within a time frame one year, with an additional 23.6% intending to upgrade it within the next two years. 41.2% of the owners had no intention to upgrade their mobile device within the next two years.

**5.2.1. Research Questions 1 and 2.** In general, the results (see Table 2) showed a rather low willingness among the respondents to use the suggested m-services. However, a remarkably high portion of the respondents indicated a willingness to use *m-mail* and *routine bank services*. Somewhat surprisingly, *reservation of cinema/theatre tickets* and *remote control of home appliances* were seen as much more interesting m-services than e.g. *playing online games* and *reading/receiving news* even in the younger age categories.

As different m-services address different needs and customer segments, the study aimed at, relating to *RQ2*, investigating whether there are significant variations in

Mobile Service:	All respondents (N = 445)			
	Mean Interest <sup>1</sup>	Median	Std. dev	
	(%)			
Send/receive emails	3.97	79.5	4.00	1.16
Routine bank services	3.64	66.7	4.00	1.25
Book cinema/theatre tickets	3.26	53.7	4.00	1.24
Remote activation of appliances	3.14	47.0	3.00	1.24
Restaurant table reservations	3.00	39.7	3.00	1.21
Calendar/alerting services	2.94	32.1	3.00	1.13
Read and receive news	2.77	33.3	2.00	1.21
Booking travel tickets	2.71	28.3	2.00	1.00
Payment in physical shops	2.69	29.3	2.00	1.18
Buying products online	2.65	26.1	2.00	1.17
Receive personalized offers	2.64	25.3	3.00	1.12
Listen to/download music	2.46	25.4	2.00	1.29
Play online games	2.14	17.4	2.00	1.18
Send insurance damage reports	2.12	12.5	2.00	1.04
Online chat with strangers	2.05	13.2	2.00	1.14
Stock trading	1.95	9.6	2.00	1.02
Take part in Internet auctions	1.94	6.6	2.00	.92
Advanced banking services	1.89	9.8	2.00	1.03

**Table 2. Mobile willingness of all respondents**

the m-willingness between respondents in different age groups and of different gender. As data from attitude measures such as Likert scales generally are treated as interval scale data [36], all the sample subgroups were analyzed for differences by comparing the mean scores. Hence, we used the *t*-test to investigate whether there are

significant variations in the m-willingness between women and men. The test reported significant variations on five variables: Women were more eager to *reserve cinema/theatre tickets*, whereas men showed a significantly higher willingness to use m-services for *stock trading*, *remote control of home appliance*, *playing online games*, and *taking part in Internet auctions*. Interestingly enough, women showed a higher willingness to use mobile services on 11 of 18 variables.

In order to test the relevance of the variable *age* in terms of m-willingness, we used one-way analysis of variance, as there were five levels of this independent variable. The test indicated, as could have been expected, significant variations between respondents in the different age groups, with the oldest age group typically showing a much lower m-willingness than the other groups, and especially the youngest respondents (see Table 3).

Mobile Service:	Mean / age group					Sig.
	16-22	23-35	36-50	51-65	66-74	
Send/receive emails	4.15	4.11	3.93	3.89	2.73	.000**
Routine bank services	3.99	3.90	3.51	3.31	2.94	.000**
Book cinema tickets	3.59	3.44	3.03	3.12	2.73	.002**
Appliance remote control	3.15	3.35	3.22	2.85	2.67	.015*
Restaurant reservations	3.04	3.11	2.88	2.97	2.87	.626
Calendar/alert services	3.29	3.01	2.95	2.71	2.20	.001**
Read and receive news	2.99	2.69	2.75	2.84	2.20	.158
Booking travel tickets	2.63	2.65	2.69	2.86	2.69	.489
Payment in street shops	3.08	2.79	2.60	2.50	1.80	.000**

Mobile Service:	Int. <sup>1</sup> (%)	Source of m-value				
		TC	SP	EN	EF	M
Send/receive emails	79.5	●	●		●	
Routine bank services	66.7	●	●		●	
Book cinema/theatre tickets	53.7		●			
Remote activation of appliances	47.0	●	●			●
Restaurant table reservations	39.7		●			
Read and receive news	33.3	●	●	●	●	
Calendar/alerting services	32.1	●			●	●
Payment in physical shops	29.3		●			●
Booking travel tickets	28.3	●	●		●	
Buying products online	26.1		●		●	
Listen to/download music	25.4		●	●		
Receive personalized shopping offers	25.3					
Play online games	17.4		●	●		
Online chat with strangers	13.2		●	●		
Send insurance damage reports	12.5					●
Advanced banking services	9.8					●
Stock trading	9.6	●				●
Take part in Internet auctions	6.6	●				

Buying products online	3.18	2.74	2.49	2.47	1.73	.000**
Personalized offers	2.83	2.80	2.60	2.48	1.87	.006**
Listen to/download music	3.42	2.61	2.23	1.92	1.87	.000**
Play online games	2.41	2.20	2.13	2.20	1.73	.038*
Send damage reports	2.15	2.07	2.13	2.20	1.73	.533
Online chat with strangers	2.71	1.99	1.84	1.94	1.73	.000**
Stock trading	2.14	1.99	1.83	1.99	1.40	.067
Take part in Net auctions	2.14	1.99	1.85	1.90	1.60	.141
Advanced banking serv.	1.99	1.80	1.91	1.94	1.67	.615

N(16-22)=73 N(23-35)=135 N(36-50)=116 N(51-65)=103 N(66-74)=15  
 \* Significant at the .05 probability level  
 \*\* Significant at the .01 probability level

**Table 3. M-willingness of respondents in different age groups**



**5.2.2. Research Question 3.** A further aim of the study was to explore if consumers are likely to favor m-services that offer a broad range of mobile value, and if some sources of m-value stand out as especially relevant. Tables 4 and 5 show the services ranked according to the reported m-willingness using the *mean score* and the *portion of interested respondents* as measures. From the tables we can see, with some exceptions (especially *reservation services for cinema/theatre tickets* and *restaurant tables*, as well as *receiving personalized shopping offers*), a pattern where services offering mobile value on several dimensions are perceived as more interesting by the respondents than those offering m-value on only one dimension. Furthermore, the patterns indicate that consumers seem to recognize especially the mobile value arising from the opportunity to meet *spontaneous needs* and *time-critical needs*, whereas they do not acknowledge m-value that is *entertainment- or efficiency-based* equally well. Services offering m-value by satisfying *mobile needs* did not rank among to the top three applications.

Mobile Service:	Mean	Source of m-value				
		TC	SP	EN	EF	M
Send/receive emails	3.97	●	●		●	
Routine bank services	3.64	●	●		●	
Book cinema/theatre tickets	3.26	●	●			
Remote activation of appliances	3.14	●	●			●
Restaurant table reservations	3.00		●			
Calendaring/alerting services	2.94	●			●	●
Read and receive news	2.77	●	●	●	●	
Booking travel tickets	2.71	●	●		●	
Payment in physical shops	2.69		●			●
Buying products online	2.65		●		●	
Receive personalized shopping offers	2.64					
Listen to/download music	2.46		●	●		
Play online games	2.14		●	●		
Send insurance damage reports	2.12				●	
Online chat with strangers	2.05		●	●		
Stock trading	1.95	●			●	
Take part in Internet auctions	1.94	●				
Advanced banking services	1.89				●	

**Table 4. Recognition of m-value: rank by mean scores**

**Table 5. Recognition of m-value: rank by portion of interested respondents**

**5.2.3. Research Question 4.** As was pointed out in section 1, there is anecdotal and empirical evidence to suggest that there are significantly more people interested in using m-commerce than those currently using wired e-commerce. As stated in *RQ4*, the plausibility of this supposition is explored with a threefold statistical analysis. First, we investigated, using the *t*-test, if there are significant variations in the m-willingness between (i) consumers who have made purchases on the Internet (*e-commerce adopters*), and those who have not yet embraced e-shopping (*EC non-adopters*), and (ii) between *Internet adopters* (i.e. the respondents who reported that they use the Internet regularly or occasionally) and

*Internet non-adopters* (respondents who have not yet used the Internet). By conducting these tests, we wanted to explore if the respondents representing the ‘untapped market’ actually do show a high willingness to engage in m-commerce, and if their willingness is significantly different from that of the embracers of wired Internet/e-commerce. Hence, the higher the mobile willingness of the EC/Internet non-adopters in comparison to their counterparts, the stronger support we would find for the hypothesis of a wider market for m-commerce than for wired e-commerce.

As can be seen in Table 6, EC adopters reported, however, a higher willingness to use mobile services than *non-shoppers* on all the variables, with significant variations between the subsamples on all applications except for *reading/receiving news*, *booking travel tickets*, and *advanced banking services*. When comparing the mean values of *Internet adopters* and *non-adopters*, we found significant differences on all the variables except the willingness to *receive personalized shopping offers* ( $p = .051$ ). For all the services investigated, the current (wired) Internet users were much more willing to embrace m-commerce than the non-Internet users (see Table 7.)

Mobile service	Mean, (% interested)		Sig. <i>t</i>
	EC adopters	EC non-adopters	
Send/receive emails	4.27 (86.6)	3.82 (75.9)	.000**
Routine bank services	3.85 (68.6)	3.53 (65.5)	.010*
Book cinema/theatre tickets	3.72 (71.8)	3.05 (45.6)	.000**
Remote control of appliances	3.48 (57.4)	2.99 (42.4)	.000**
Restaurant table reservations	3.34 (51.8)	2.84 (34.2)	.000**
Calendaring/alerting services	3.13 (41.6)	2.85 (27.9)	.024*
Buying products online	3.11 (41.6)	2.44 (18.9)	.000**
Payment in physical shops	3.00 (41.3)	2.54 (23.7)	.000**
Read and receive news	2.90 (39.2)	2.71 (30.5)	.116
Receive personalized offers	2.84 (31.5)	2.55 (22.6)	.014*
Booking travel tickets	2.83 (32.7)	2.65 (26.4)	.084
Listen to/download music	2.66 (30.1)	2.36 (23.2)	.020*
Play online games	2.32 (21.7)	2.05 (15.5)	.030*
Send insurance reports	2.29 (14.0)	2.03 (11.5)	.012*
Online chat with strangers	2.21 (17.0)	1.96 (11.2)	.041*
Stock trading	2.32 (16.2)	1.78 (6.5)	.000**
Take part in Internet auctions	2.24 (10.5)	1.80 (4.4)	.000**
Advanced banking services	2.02 (13.3)	1.83 (8.2)	.073

**Table 6. M-willingness of EC adopters/non-adopters**

Mobile service	Mean (% interested)		Sig. <i>t</i>
	Internet adopters	Internet non-adopters	
Send/receive emails	4.11 (83.5)	3.22 (56.4)	.000**
Routine bank services	3.72 (68.3)	3.09 (52.7)	.004**
Book cinema/theatre tickets	3.43 (60.3)	2.36 (21.4)	.000**
Remote control of appliances	3.28 (51.6)	2.59 (30.3)	.001**
Restaurant table reservations	3.12 (43.0)	2.27 (18.2)	.000**
Calendaring/alerting services	3.07 (37.5)	2.44 (12.7)	.000**
Buying products online	2.81 (30.6)	1.96 (8.9)	.000**
Payment in physical shops	2.84 (34.0)	2.05 (12.7)	.000**
Read and receive news	2.83 (35.6)	2.36 (16.1)	.005**
Receive personalized offers	2.70 (27.8)	2.39 (14.9)	.051
Booking travel tickets	2.74 (28.9)	2.39 (19.6)	.032*
Listen to/download music	2.53 (26.7)	1.80 (12.5)	.000**
Play online games	2.18 (18.1)	1.82 (10.7)	.027*
Send insurance reports	2.21 (13.9)	1.79 (7.7)	.006**
Online chat with strangers	2.09 (13.2)	1.64 (7.2)	.005**
Stock trading	2.05 (10.9)	1.52 (3.6)	.000**
Take part in Internet auctions	2.00 (6.6)	1.65 (1.8)	.004**
Advanced banking services	1.94 (11.1)	1.64 (5.4)	.038*

**Table 7. M-willingness of Internet adopters/non-adopters**

In section 1, we conveyed a supposition that the overall volume of e-commerce may experience a significant growth with mobile technologies, as many consumers who are not yet Internet adopters due to the greater hardware investments and the proficiency with PCs needed in wired e-commerce will now access the Internet due to the *lower costs* involved and their *familiarity* with mobile device. In order to investigate the plausibility of *RQ4* with reference to this issue, we conducted the *t*-test to find out if respondents who perceived high *barriers* to e-commerce in terms of *costs of entry* and a *low proficiency with computers* show a significantly different m-willingness than respondents who did not perceive barriers in this respect. For this, the *aggregate mean value* was calculated (by combining the obtained scores for all the individual m-applications subject of investigation), and used as an indicator of the respondents' general m-willingness.

Barrier	N		Mean <sup>1</sup>		Std dev		Sig. (2-t) <i>t</i>
	A	D	A <sup>2</sup>	D <sup>3</sup>	A	D	
Cost of entry	172	205	2.62	2.71	.65	.73	.208
Limited proficiency	113	250	2.53	2.77	.74	.66	.004**

<sup>1</sup>m-willingness, aggregate value      \*\* significant at the .01 probability level  
<sup>2</sup> respondents who *agreed* or *strongly agreed* to perceiving barrier  
<sup>3</sup> responded who *disagreed* or *strongly disagreed* to perceiving barrier

**Table 8. M-willingness of respondents agreeing (A) and disagreeing (D) to perceiving entry barriers**

As can be seen in Table 8, the respondents who disagreed to perceiving barriers in terms of cost of entry and a limited computer/Internet experience show a higher willingness to use mobile services than those who agreed to perceiving barriers, with significant differences between the two groups on the variable *limited computer/Internet proficiency*, but not on *cost of entry*.

## 6. Discussion and Conclusions

Although the obtained mean scores indicated a rather low willingness among the respondents to use most of the m-services subject of investigation, a number of facts should, nevertheless, be kept in mind when interpreting the results: First, for some of the proposed 'success' applications, the observed willingness was remarkably high both when examining the mean values and the proportion of the respondents who reported that they "definitely" or "likely" would use such services: Even when comparing the observed m-willingness, using the latter indicator, to the results of other similar (non-academic) studies (e.g. [15, 32]), the figures for the top applications are exceptionally high. Moreover, the results do, in fact, indicate that more than a quarter of the Finnish consumers are likely to use as many as 12 of the 18 suggested initial m-applications.

Second, it should be noted that the low average willingness can, at least partly, be explained by the speculative nature of the questions: As some of the mobile services suggested are not yet available, and as the vast majority of the respondents most likely have not tested a single one of the available ones, their appreciation of the associated benefits may at this point be limited. It is, after all, hard to state the likelihood of using something that does not exist and/or you have not tried. According to Lonegran [17], companies attempting to predict consumer interest in brand new products or service concepts are often greeted with a disappointing show of interest from the end user. The author correctly points out that the ongoing challenge is to demonstrate the benefits of the new offering to the user. A number of new technology companies have, according to Shuster [31], erred in launching products by failing to educate potential users about the benefits and uses of the new technology.

Whereas it is not surprising that the *m-mail* and *routine bank services* constitute the two top applications given the exceptionally high adoption rate of online banking in Finland, the popularity of *reservation services* (cinema/theatre tickets and restaurant tables) was somewhat surprising, as was the unexpectedly low popularity of commonly hypothesized killer applications such as *online games*, *music*, and *news services*. Many proposed m-commerce applications are likely to be highly personalized, using personal preferences as well as geographic location information. As is pointed out by Ghosh and Swaminatha [13], many consumers may consider these services value-added, while others consider them invasive. Interestingly, the results of this study indicated reluctance by the average consumer to accept personalized shopping offers on his mobile device.

One objective of this research was to investigate in which consumer groups, in terms of gender and age, we find the primary target groups for the m-services subject of investigation. The observations did not, however, present any obvious tendencies based on the independent variables gender and age, with the exception that the oldest consumers, as could have been expected, constitute an insignificant target group for most mobile services.

Although the youngest users are likely to form the primary customer group for most m-services, especially entertainment-related applications, the observed m-willingness was, relatively speaking, surprisingly high even in the older age groups.

In this paper we have argued that at a very early development stage, an analysis should be carried out to assess whether different m-services are likely to provide added value to consumers. An adoption of this consumer-centric approach would most probably contribute to better decision-making and to fewer business failures than what has been experienced in the area of wired e-commerce. The analytical framework presented suggests that sources of *wireless value*, which are service-independent in character, should be separated from the service-dependent sources of *mobile value*. The framework was applied to evaluate their suitability of a number of commonly proposed success applications for mobile settings by assessing whether they add mobile value from the consumers' point of view. The results of the study indicated, although not unequivocally, that services offering m-value on several dimensions are perceived as more interesting by the respondents than those offering m-value on only one dimension. Although it was theorized that applications satisfying *mobile needs* will constitute the core of m-commerce as they are of value exclusively when provided through a mobile medium, the empirical evidence suggested that consumers, at this point, seem to recognize particularly the mobile value arising from the opportunity to meet *spontaneous* and *time-critical* needs. *Entertainment-* or *efficiency-based* m-value was not acknowledged equally well. It should, however, be pointed out that no general conclusions should be drawn from the observed patterns with reference to the *relative* importance of the m-value dimensions, since the perceived magnitude of any offered dimension is not only a service-dependent, but also a user-dependent phenomenon.

One of the main purposes of this research was to investigate whether m-commerce will be able to increase the overall market for e-commerce. The results of the study do not support this supposition, as current *Internet adopters* reported a significantly higher willingness than *non-adopters* to use nearly all the suggested mobile applications. In the same way, the respondents who already had some *e-shopping experience* showed, on all variables, a higher likelihood to use mobile services than respondents lacking e-shopping experience, with significant differences on 15 of 18 services investigated. Moreover, the respondents who disagreed to perceiving Internet entry barriers in terms of *cost of entry* and a *limited computer/Internet experience* showed a higher willingness to use mobile services than those who agreed to perceiving barriers, which gives further evidence contradicting the 'wider market hypothesis'. More precisely, the results suggest that consumers see the mobile Internet and m-commerce primarily as a supplement rather than as a substitute to the wired Internet and e-commerce.

This study has helped to develop our understanding of

the mobile Internet as a medium for commercial use in the B-to-C arena, a sector where the lack of empirical academic studies is striking due to the novelty of the phenomenon. Although the findings rest upon a rather extensive empirical investigation, the questions were, nevertheless, not only speculative, but also rather general in nature. Hence, this research should be seen as a preliminary study reflecting the mass users' perceptions, and not as conclusive research on the future popularity of different types of mobile applications. Although this research has given some (although limited) indications of the target customer groups for certain applications, they have been based only on the variables gender and age. Other variables certainly need to be taken into account when identifying the target groups, and empirical studies on the willingness of respondents in more narrowly defined target groups should be conducted. It should be noted that the study conducted was a national consumer survey measuring how likely a mass market of consumers will use these new types of services. We speculate that this could be the reason why the surveyed sample did not show strong interest for those suggested applications, e.g. stock trading, that are of likely interest only for a narrowly defined market. Further research should be carried out in order to clearly identify and measure the interest of more carefully selected customer groups to use targeted services, for instance the actual stock traders' willingness to use m-stock trading applications. It should also be pointed out that the results of the study are valid only for the Finnish society, which is characterized by a very high penetration rate of mobile phones, and a very high adoption rate in terms of Internet usage. More empirical studies should be carried out in cross-cultural settings to widen our knowledge of the near future market potential for mobile value-added services.

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