A review of mobile services research: Research gaps and suggestions for future research on mobile apps

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Preface

This working paper is part of the MOVON research project funded by the Research Council of Norway. The project includes business partners COOP and inFuture and research partners University of Karlstad and Centre for Applied Research (SNF) at the Norwegian School of Economics (NHH). The main purpose of this working paper is to review literature on mobile services to reveal shortcomings and gaps in the research on mobile services with particular relevance to the MOVON project. Based on the review, gaps in the literature are identified, and five avenues of future research are proposed to fill these gaps. The working paper is mainly written by Herbjørn Nysveen, but contributions from both Siv E. R. Skard and Per E. Pedersen have also been integrated.

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Abstract

The working paper starts with an overview of the growth in research on mobile services. Based on the increase in the research on mobile services the last few years, the fact that the last general review article on mobile services we identified was published in 2010, and the change to more app-based mobile services, we argue for the importance of conducting a review to identify gaps in the literature that should be guiding future research on mobile services. The methodology applied to identify articles for the review is described along with an overview of the journals from which the articles are selected. The main categorization of the articles includes conceptual, qualitative, and quantitative contributions.

The analysis starts with a description of the mobile services studied within each of the main categories of the articles. The analysis shows that articles sometimes operate with rather generic descriptions of the mobile service category studied – e.g. mobile commerce, mobile marketing, mobile data services, etc. The next part of the analysis is a review of the main topics studied in the articles. The conceptual articles typically focus 1) definitions, opportunities and challenges of mobile services, 2) description of success criteria, 3) implications of mobile services, and 4) description and discussion of system design and modelling processes. The main focus of the qualitative studies is on success criteria. Also, a few articles look into issues of business models and system design and modelling processes. The quantitative studies constitute the largest category of articles. A lot of these studies look into success criteria – and a large part of this topic is covered by adoption studies focusing antecedents of successful adoption of various mobile services. It is an interesting observation that surveys seem to be the dominating methodological design in the quantitative studies.

Based on the review, the main gaps identified are 1) only a few studies look into app-based mobile services. This seems reasonable as app-based mobile services are a rather novel type of mobile services, but it is still worrying due to the apparent success of these services. 2) Only a few studies look into effects of using mobile services, and when compared to the large amount of adoption studies, this is emphasized as an interesting path for future research. 3) Only a few studies seem to focus on mobile services developed for specific contexts. A few exceptions are, for example, two studies investigating in-store mobile services – mobile services tailored to support the shopping experience in a specific store. We see this as an interesting direction for future research as we also expect a growth in such types of mobile services in the years to come. 4) We also observe that a rather small part of the studies are applying experiments as the methodological design. To improve

the validity of mobile services research, we argue for the importance of applying more experiment based research designs.

1   Introduction

The use of *mobile devices* is common among consumers in most parts of the world today. According to eMarketer.com (2014) (http://www.emarketer.com/Article/Smartphone-Users-Worldwide-Will-Total-175-Billion-2014/1010536), there are about 4.55 billion users of mobile devices. According to their figures, this number is predicted to increase to 5.13 billion users by 2017, corresponding to 69.4 percent of the world's population. However, although a growth in the number of users is expected, the growth rate is expected to decrease from 8.5 percent in 2012 to 3.6 percent in 2017. There are several reasons for the diffusion of mobile devices, but the advantage of ubiquity is probably among the main driver for the growth. Statistics from the same source shows a development from 1.55 billion *mobile phone Internet* users in 2012 to 2.97 billion mobile phone Internet users in 2017. These numbers refer to Internet use by mobile phone at least once a month. The trend towards using *smartphones* open up a lot of new opportunities for businesses and customers, and more and more users take advantage of smartphones. The numbers from www.eMarketer.com (2014) show that the number of smartphone users worldwide will increase from 1.13 billion in 2012 to 2.50 billion in 2017. This corresponds to 33.8 percent of the worldwide population and 48.8 percent of the total number of mobile phone users. In *Norway*, 79 percent of the population has a smartphone. In the segment between 15 – 29 years, as much as 93 percent have a smartphone. This indicates that the Norwegian market is ahead of the development and that Norwegian users are ready for mobile services of various types.

Looking at the research on various facets of mobile devices and services, Figure 1 shows the growth of research on mobile services in the period from 2000 to 2013.
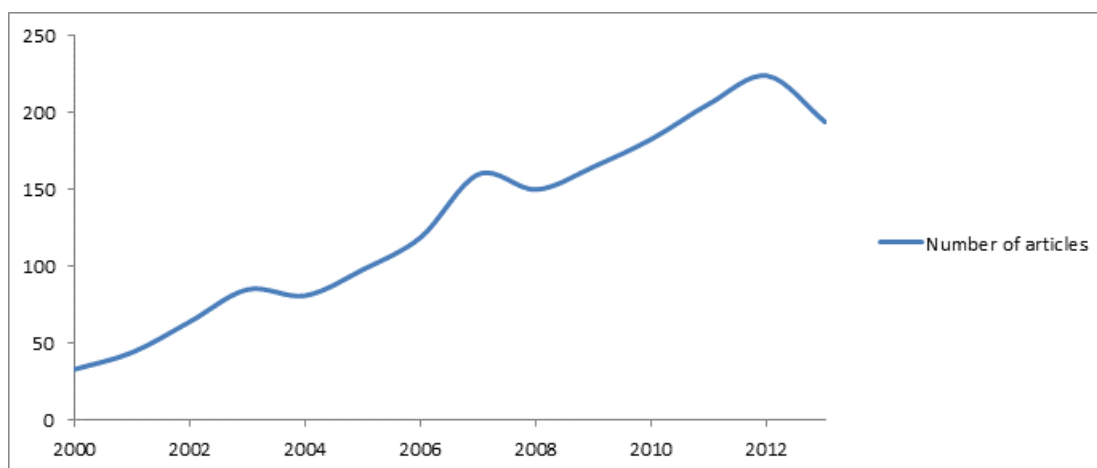

Figure 1: Growth in research on mobile services. (Numbers from Business Source Complete from EBSCO. Search term "Mobile". Search limited to Title, Article, Peer-review, Full text, Academic journal, English)

Figure 1 shows that the number of articles on mobile services has increased steadily since 2000. While 33 articles were identified based on our search criteria in 2000, as many as 194 articles were published in 2013.

1.1   Purpose

There has been conducted general reviews and state-of-the-art studies on mobile marketing and mobile services by several researchers (e.g. Ngai and Gunasekaran, 2007; Shankar and Balasubramanian, 2009; Shankar et al., 2010; Varnali and Toker, 2010). Based on our knowledge of the literature, there do not seem to be any broadly published review or state-of-the-art articles published after 2010. Based on the recent developments in smartphone adoption and use and the change from open mobile Internet to closed mobile app solutions (Kourouthanassis and Giaglis, 2012), including how this changes the possibilities for access to and the quality of mobile services, as well as the increase in articles published after 2010 on the topic, we argue for the need and relevance of an updated review in this research field. Hence, the purpose of this report is to give a picture of the main directions in the research on mobile commerce. For a more precise description of the facets of mobile services we are focusing, please see Appendix 1 for search terms used for selection of articles.

1.2   The MOVON project

MOVON – a Norwegian acronym for "The Mobile Retail Experience" – is the name of a research project focusing possible advantages of the unique characteristics of the mobile phone and the ability to connect the physical and the digital world in retail. First of all, the project focuses in store/warehouse mobile solutions. Second, the mobile solutions will be based on applications (apps) and developed specifically for retail in the consumer construction and home improvement market. Third, applications will be developed to support payment, visual presentations of products and solutions, and context aware shopping. An important research activity in the project is to systematically experiment with various versions of the app developed. Experimental research designs will be applied to study the influences of various app characteristics on measures of the effectiveness and efficiency of consumer retail services.

1.3 Outline

The rest of this working paper is organized as follows: In chapter 2 we give a description of the methodology applied in this study. This includes a description of the search terms and the process for selection of articles reviewed in this study. In chapter 3 the main purpose is to highlight the type of mobile services studied in the mobile service research literature. This chapter also includes a description of all of the 13 articles in this literature using experimental research designs – as these articles have a particular interest for the MOVON project. Chapter 4 presents a general overview of the literature. In chapter 5 we aim at establishing a framework reflecting the main research trends revealed in the review conducted. The main point with this chapter is to categorize the literature and provide a description of the research in each of the categories defined. Based on the knowledge we reveal from the review, we propose directions for future research on mobile services with particular relevance to the MOVON project in chapter 6.

2   Research method

The selection of articles was conducted in March and April 2014. The search for articles was conducted in Business Source Complete from EBSCO. The search terms and combination of search terms used are available in Appendix 1. Some constraints were applied in the search process. We used no limitations for search terms (search through the whole text), but we delimited the search to Article (Document type), Peer-reviewed journals, Full text articles, Academic journals (Publication type), and articles written in English. Based on all of the search term combinations presented in Appendix 1, we came up with 1.389 articles.

Some of the search term combinations revealed the same articles as other search term combinations. Hence, some of the articles were registered two or more times. After deleting articles registered more than one time, the total number of articles left was 639. We also wanted to delimit the review to articles with a certain quality. As a proxy for quality, the Association of Business Schools (ABS) Academic Quality Guide version 4 (2010) was used. Hence, we deleted all articles that were not published in ABS registered journals. In addition, three articles were deleted because some of the search terms fitted with the author of the article, not the content of the article. We were then down to 270 articles.

Although the quality criteria were important for us, we also had to strike a balance between quality and relevance of the journals. We therefore decided to include all articles revealed through the search procedure from International Journal of Mobile Marketing. Although this journal is not ABS registered, it is highly relevant for our review. By including the 45 articles revealed from International Journal of Mobile Marketing, the base of articles went up to 315.

By using a manual identification procedure based on search terms, we also revealed articles about aggregate production planning (APP), application service providers, various topics matching the search terms in articles from the 70ties and 80ties with limited relevance, etc. Consequently, we saw the need to make a further manual sorting of the articles to make sure the base of articles were relevant for the purpose of the project. After this manual sorting, 189 articles were left for the analysis.

As a final step, we used the search term "Mobile" in ISI Web of Science. The search was limited to Title. In this search we asked for the 60 articles that were mostly cited. This measure was conducted to make sure our base of articles also included the most cited (meaning; most relevant) articles in the research area. Based on the criteria of manual evaluation of relevance, not overlapping with articles already revealed, and the quality criteria of ABS, 23 new articles were added to the pool of articles,

increasing it from 189 to 212. The procedure for selection of articles ended here; leaving us with 212 articles as the base for the review. Table 1 gives an overview of the journals where the majority of the articles are published.

Table 1: Number of articles in various journals (Journals with fewer than five articles are not reported)

Journal	Number	Disiplin	ABS
Communications of the ACM	22	Information Management	3
Communication of the Association for Information Systems	8	Information Management	2
Decision Support Systems	13	Information Management	3
Information and Management	7	Information Management	3
Information Systems Journal	5	Information Management	3
International Journal of Electronic Commerce	12	Information Management	3
International Journal of Mobile Marketing	45	Marketing	Not listed
Journal of Computer Information Systems	11	Information Management	2
Journal of Interactive Marketing	5	Marketing	3
Journal of Targeting, Measurement & Analysis for Marketing	5	Marketing	1
Journal of Business Research	5	Business	3

Table 1 shows that as many as 45 articles are from International Journal of Mobile Marketing. We also see that the majority of articles are published in Information Management Journals and Marketing Journals. This illustrates the cross-disciplinary character of the research on mobile services. It is also interesting to see that none of the journals listed in Table 1 are on the highest ABS level, which is four.

Although the dominating journals are presented in Table 1, the articles reviewed in this report come from a broad variety of journals. The journals, along with the number of articles in parentheses, are listed alphabetically. American Economic Review (1), Applied Economics (3), Applied Economics Letters (1), Behaviour and Information Technology (4), Business Horizons (1), Business Strategy Review (2), Decision Sciences (1), European Journal of Operational Research (3), European Management Journal (1), Financial Management (2), Group Decision & Negotiation (1), Information Economics and Policy (2), Information Society (1), Information Systems Management (2), Information Systems Research (1), International Economic Review (1), International Journal of Advertising (2), International Journal of Production Economics (1), Journal of Advertising (2), Journal of Advertising Research (4), Journal of Brand Management (1), Journal of Information Technology (1), Journal of Interactive Advertising (1), Journal of Management Information Systems (3), Journal of Marketing (3), Journal of Non-Profit & Public Sector Marketing (1), Journal of Product Innovation Management (1), Journal of Regulatory Economics (1), Journal of Retailing (1), Journal of Retailing and Consumer

Services (2), Journal of Service Research (3), Journal of the Academy of Marketing Science (2), Journal of the Associations for Information Systems (1), Management Science (1), Marketing Letters (2), Marketing Review (1), MIS Quarterly (2), MIT Sloan Management Review (2), Organization Science (1), Psychology and Marketing (4), and Systems Research and Behavioral Science (1). From this list, we see that some of the articles have been published in top quality journals (listed as ABS 4) – journals such as Journal of Marketing, MIS Quarterly, Information Systems Research, and Journal of Product Innovation Management.

The articles were also categorized based on their empirical versus non-empirical approach. The number of articles in these categories and some characteristics of them are reported in Table 2.

Table 2: Conceptual versus empirical studies

Type of article	Number of articles	Characteristics of articles
Conceptual	65	Theoretical discussions, Conceptual models, Scenarios, Reviews
Empirical (Qualitative)	19	Focus-group interviews, In-depth interviews, Case studies
Empirical (Quantitative)	111	Mainly surveys analyzed by structural equation modelling
Empirical (Quantitative – econometric)	17	Model development, large data

The results summarized in Table 2 illustrate that most of the studies are empirical and that quantitative empirical studies dominate the empirical category. Among the quantitative studies, surveys are the dominating methodology. Only 13 studies used experimental research designs. Also, 17 studies, typically from economics journals, developed econometric models and used data from various secondary data sources. Although they often have a strong focus on model development, most of these articles simulate or test the model empirically. They are therefore categorized as quantitative in Table 2.

We also see that many of the articles apply traditional qualitative methodologies, such as interviews and case studies. It should also be mentioned that qualitative pre-studies were reported in a few of the articles categorized as quantitative. Quite a few of the articles have a conceptual character, mainly discussing the phenomenon under investigation from a theoretical point of view. Some of these articles also present reviews of existing research on different types of mobile services.

3   Type of services

In this section we concentrate on identifying and reporting the type of mobile services that have been focused in the articles. It varies a lot how clearly the services are specified in the articles, and in some of the articles the mobile services studied are referred to more as a category of service.

3.1   Conceptual and qualitative studies

A broad range of mobile services have been analyzed in the reviewed articles. Focusing first on the conceptual and qualitative articles, these articles often discuss rather broad categories of services – such as mobile advertising, mobile marketing and mobile commerce. What is included in these categories varies from article to article. Many of them mention *communication* services (such as SMS and MMS). Others discuss services related to *social coordination* (mobile social network, mobile social media, group-oriented services). *Transaction* based services are also discussed, and examples of these are payment/banking, mobile banking, and payment. Other examples of services are pizza ordering, health services, auction services, and brokerage services. The issues of situation- and location sensitivity of the services are discussed in several of these articles. Only a few articles discuss mobile services related to the business-to-business context. Examples of such services are Real time *supply chain coordination* and Mobile *e-procurement* services.

Keeping to the conceptual and qualitative articles, three articles make an explicit point out of categorizing mobile services. Swilley and Hofacker (2006) divide what they term mobile marketing into three main sub categories. They are *Promotion* (advertising, promotion, entertainment, music, games, video), *Transactions* (information, location, travel, shopping, entertainment, music, ringtones, games, video), and *Service* (information, news, weather, traffic, consumer service). Stoica, Miller and Stotlar (2005) divide what they call M-Commerce applications into *Remote access* (email, web-browsing), *Information services* (news, weather, horoscopes, stock prices, sports scores), *Directory services* (restaurant guide, movie guide, telephone directory, hotel guide), *Operations and maintenance* (Fleet/inventory management, supplier-buyer relationships), *Location-based services* (Where is the nearest (ATM, Restaurant, etc.), town/travel navigator), *Entertainment* (games, gambling, chat), and *Interactive transactions* (banking, stock trading, ticket booking, mobile Internet shopping, insurance, car rental). Based on what is described as the two major attributes of m-commerce – mobility and reachability – Liang and Wei (2004) divide mobile commerce into the following six categories; *Time-critical* services, *Location-aware and location-sensitive* services,

Identity enacted services, *Ubiquitous communications and content delivery* services, *Business process streamlining*, and *Mobile offices*.

Three of the review articles also categorize sub-categories of mobile services. The article by Shankar et al. (2010) categorize retail mobile marketing practices into *Mobile website creation and maintenance*, *Mobile emailing and messaging*, *Mobile advertising*, *Mobile couponing*, *Mobile customer service*, and *Mobile social network management*. Shankar and Balasubramanian (2009) classify mobile media advertising methods into *Text messaging, Integrated content, Games, Interactive voice response, WAP sites, Ringtones and ring-back tones, Viral, Geotargeting, Advertising on mobile broadcast, Sponsorships/subsidizing cellphone costs,* and *Mobile telemarketing*. Deighton and Kornfeld (2009) divide interactive marketing into five main paradigms; *Thought tracing* (people search the web for information and browse for entertainment), *Activity tracing* (people integrate always-on computing into everyday life), *Property exchanges* (people participate in anonymous exchanges of goods and services), *Social exchanges* (people build identities within virtual communities), and *Cultural exchanges* (people observe and participate in cultural production and exchange).

3.2   Quantitative studies

All of the quantitative studies were also reviewed for the purpose of getting an impression of what kind of mobile services they had been investigating. Also in this category of the literature, it varies somewhat across the studies how detailed the studied services are described. We start by giving a brief overview of the mobile services studied in the surveys. As this review is a preparation for an empirical experiment studying antecedents and/or influences of mobile apps, we have described all of the 13 articles using experiments (chapter 3.2.2) a bit more in detail.

3.2.1 Surveys

Most of the quantitative studies are surveys conducted among mobile users or consumers. A list showing all of the service labels used in the articles reporting surveys is available in Appendix 2. From the list in Appendix 2 we see that many studies have focused on SMS (SMS, SMS advertising, SMS for personal communication). Also, a few studies have looked into MMS. Continuing with specific services, we find studies investigating mobile ring tones, paying for parking, mobile gaming, mobile ticketing, and mobile insurance services. We do, however, see that some of the service descriptions

are more generic and are related to advertising (SMS advertising, mobile social advertising, mobile advertising), mobile commerce, mobile services (mobile service, mobile data service), mobile shopping, mobile Internet, mobile banking, mobile payment, mobile brokerage, and mobile coupons. A few of the studies also have their main focus on mobile devices and not on services enabled by devices. Some of the articles did not really specify the mobile service but had a general description of commerce or service in mobile context.

Two of the articles reporting surveys on mobile services give examples of *categories* of services. Fang et al. (2005-2006) describes various task types that can be done on wireless technology. The tasks listed are Managing address book, Sending/receiving e-mail, Checking flight information, Purchasing movie tickets, Reading the news, Banking online, Playing games, Checking weather information, Purchasing books, Purchasing clothes, Sending short messages, and Trading stocks. The study by Jin and Villegas (2008) describes various mobile services used and the share of consumers that typically use these services. Starting with the most popular mobile services, the following services are revealed (share of users in parenthesis); Short text mail (100%), Communication with friends (100%), Taking photos and uploading them (73%), Playing games (44%), Listening to music (43%), Mobile net (38%), Downloading the ring tone (33%), Business (13%), Checking mail (12%), Opening commercial message (12%), Making reservations and researching traffic (10%), Banking (10%), Searching weather (8%), Searching news stories (8%), Look at homepage and bulletin board systems (4%), Shopping (4%), and Send complaints to companies (2%).

3.2.2 Experiments

The study by Yang and Wang (2007) compares *information delivery systems* with automatic summarization for mobile commerce. The main point in the article is that it is impossible to download and visualize large documents on handheld devices. Therefore, information has to be summarized into a shorter document. The study compares a fractal summarization model and a traditional summarization model. One result is that the fractal model results in a broader coverage of information subtopics compared to the traditional model. Given the somewhat peripheral relevance for the MOVON project, we do not dig deeper into the results of this article.

Vance et al. (2008, p. 82) looked at *m-commerce portals* ("*viewable by the Internet-enabled mobile devices*"). More specifically, they studied the influence of navigational structure and visual appeal on ease of use, trust, and intention to use. The study compared respondents from France and US in order to manipulate uncertainty avoidance (France is associated with high uncertainty avoidance

while US is associated with low uncertainty avoidance). A free simulation experimental design was applied. First the respondents took part in a pre-test to reveal their levels of trust (online and in general on institution-based level). Then they were exposed to a sequence of screenshots showing the purchase process for the service investigated – "Amazone Anywhere". After viewing the screenshots, a post test was implemented where trust and system quality characteristics such as navigational structure and visual appeal were measured.

A study by Ono et al. (2012) compares motives for *store browsing intention* with mobile devices. Two contexts are compared; mobile online store and physical store. Respondents were asked to imagine their most recent shopping experience in a specific mobile-based store while the respondents in the other group were asked to imagine their most recent shopping experience in a physical store. Interesting differences in the significance of value motivation, role motivation, adventure motivation, social motivation, gratification motivation, and idea motivation were revealed.

QR codes in advertisements are used more and more, and Narang, Jain and Roy (2012) compared advertisements with and without QR codes among consumers with high and low involvement in the advertised product. The results show that level of product involvement has a significant effect on attitude to advertisement, attitude to brand, and purchase intention. QR code (present or not) did not influence the three dependent variables significantly. The interaction between product involvement and QR code significantly influences all three dependent variables. The highest score for the three dependent variables was in the low product involvement/no QR code condition. The lowest score for the three dependent variables was revealed in the high product involvement/no QR code condition.

An interesting study by Massey et al. (2007) divides customers into various segments based on their technology readiness (explorers, pioneers, sceptics, paranoids) – where explorers scored highest on optimism and innovativeness and lowest on discomfort and insecurity while paranoids are at the other end of the scale scoring lowest on optimism and innovativeness and highest on discomfort and insecurity. The main result from the study is that the relationship between usability evaluation (content, ease of use, made for the medium, emotion, promotion) of online service interfaces and technology readiness segments (only explorers and sceptics were compared empirically) are moderated by type of website (*hedonic* (Yahoo and ESPN) versus *utilitarian* (Mapquest and Fodors)) and access method (web via *personal computer* versus web via *wireless device* (PDA from HP – HP Jornada 568)). This means that usability evaluations in various segments depend on which type of device the sites are accessed with (personal computer versus wireless PDA).

A study by Kristensson, Gustafsson and Archer (2004) compared characteristics of innovations for mobile services (originality, value, realization, number of ideas) across different user groups (professionals, advanced users, ordinary users). The researchers invited users to come up with innovative new mobile services. The innovation task was limited to idea generation based on *SMS*. Results indicate that ordinary users came up with the most original ideas and the ideas considered to have the highest value. The potential for realization was highest for the ideas developed by professionals and advanced users. No differences were revealed for the number of ideas across the three user groups.

Koeningstorfer and Groepel-Klein (2012) applied a quasi-experimental design. A quota sampling technique was used based on gender and age (young versus old; mean age = 43 years). The respondents were asked to accomplish a task (find a suitable restaurant) and were given the choice between solving the task with *mobile Internet* or a non-Internet based medium. Respondents were recruited on the street in a city and sat down at a restaurant to accomplish the task and answer the questionnaire. The interviewer measured the time it took the respondents to accomplish the task. About 65 percent of the respondents chose to use traditional media while about 35 percent chose to use mobile Internet to solve the task. The results show that the higher the level of innovativeness in men (versus women) the more likely it is that they will use mobile Internet to solve the task rather than a non-Internet based medium. Also, the findings reveal that the lower the desire for social contact in women (versus men) the more likely it is that they will use mobile Internet to solve the task rather than a non-Internet based medium. Age did not influence the relationship between innovativeness and social desire. The study also found partly support for the hypothesis that a higher level of technology optimism in younger (versus older) consumers, the more likely it is that they will use mobile Internet to solve the task rather than a non-Internet based medium (no influence of gender for this hypothesis). The study also found support for the prediction that consumers would perceive the ease of use of the Internet device more negatively the more time it took them to use it to solve the task. Such a relationship was not revealed for traditional non-Internet media. In a follow up study (based on a similar methodology) respondents could choose between an *iPhone*, a *laptop* and print version of Yellow Pages to solve the task. Three different tasks were used (each respondent only solved one task). Results show that the respondents used significantly less time to solve the tasks when using iPhone and laptop compared to using the print version of Yellow Pages.

An article by Kleijnen et al. (2005) focused on image congruency and adoption of (measured as attitude to- and intention to use) wireless services/mobile phone. In a between subject design, respondent were asked to answer a questionnaire related to image of mobile banking, actual self-image, and ideal self-image. Then the respondents were randomly assigned to a private versus public

context manipulation. Then they answered the rest of the questionnaire measuring attitude to use and intention to use a *wireless banking/financial service*. Results show that respondents with high image congruence (versus low image congruence) are more positive towards adopting the wireless service (both when it comes to attitude and intention). Furthermore, self-image congruence and ideal-self congruence were revealed to have equally strong influence on adoption. Regarding the manipulation of context, the results indicate that attitude to adopt is more positive in a public context (compared to a private context) (the result for intention to adopt seems not to be reported). Finally, comparing public context/high image congruence and private context/high image congruence, no differences were revealed in attitude to use and intention to use. In a follow-up experiment, the public context was divided into friends versus colleagues. The procedure and service were similar to the first experiment (except friends versus colleagues were manipulated rather than private versus public). The findings show that consumers evaluate (attitude to use and intention to use) the wireless service more positively in a friend context compared to a colleague context. Comparing attitude to use and intention to use the service between friend/low image congruence and colleagues/low image congruence, no differences were found.

Describing their study as an experiment, Cyr et al. (2006) investigated the influence of design aesthetics on usefulness, ease of use, enjoyment, and loyalty. The service focused was the City Guide version of *wap.lonelyplanet.com*. First, respondents familiarized with the mobile device they should use (Nokia 6600). Then they were given a description of a task asking them to use the specific CityGuide to select a restaurant in San Francisco. The site listed four restaurants. Respondents used between 5 and 15 minutes to choose a restaurant. The structural model tested showed positive effects of design aesthetics on usefulness, ease of use and enjoyment. Ease of use positively influenced usefulness and enjoyment. Both usefulness and enjoyment were revealed to affect loyalty positively.

In a study from 2005, Bruner II and Kumar (2005) compare effects of a desktop PC, a *wireless phone simulator (they ran a wireless interactive interface on a computer) and a PDA*. The reason for the simulator solution is said to be lack of real mobile services back in the beginning of this decade. Respondents first answered a questionnaire about demographics. Next, they explored the technology they should use. After that they were instructed to visit the website of a specific company (name of company not specified in the article), search for information, and make some decisions. Finally, they completed the questionnaire. Although a model with many variables were studied, the interesting results of relevance to use is that the wireless phone were revealed to be perceived as less easy to use than the desktop computer whereas the PDA was revealed to be equally easy to use

as the desktop computer. The PDA was found to be more fun to use than the desktop computer while the wireless phone was found to be less fun to use than the desktop computer.

Looking into the effects of mobile advertising, Banerjee and Dholakia (2008) manipulate location based versus not location based advertising, private versus public contexts, and task congruence versus incongruence. In a between-subject design, respondents first read an introduction to the study, then scenarios were described, and then the respondents answered the questionnaire. *The ads were for music albums and t-shirts/jeans*. This means task congruence was manipulated as leisure related activities while task incongruence was manipulated as work related activities. The results did not find any differences in perceived usefulness between location-based versus not location-based ads. However, mobile ads were found to cause lower perceived usefulness in the private location condition (compared to public location). Mobile ads were also revealed to be perceived as less useful in situations with lower task congruity. Looking into interaction effects, mobile ads in situations with lower (versus higher) task congruence led to lower (versus greater) perceived usefulness in the public context condition. No such interaction effect was revealed in the private context condition. Finally, location based advertising was revealed to create more positive responses in the public context condition while this was not the case in the private context.

Given the purpose of MOVON, the most interesting (and methodologically elegant) experiment is reported by Ittersum et al. (2013). The first study was a between subject design among 66 students. Results indicate that in general, neither overspending nor underspending is desirable. The second study was a two (budget constraint versus no budget constraint) by two (spending feed-back available versus spending feed-back not available) between subjects design. Feed-back refers to continually feed-back on the price of the groceries a consumer has in her shopping cart. The 194 respondent were recruited from a panel of American consumers. The experiment was run in an experimental online grocery store. First, the respondents were informed that they should shop for groceries in an online store and to behave as they usually did in a grocery store. Then they were informed about how to register for the store and the feed-back system. Customers in the spending feed-back group continually got information about the name of the products and spending while customers in the no spending feed-back group only got continually feed-back on the name of the products chosen. The third experiment was conducted in a real store with 198 respondents. This time the feed-back was given based on a *wireless (iPad) device with a shopping tracker mounted on the shopping cart*. Manipulation was as in experiment 2, and the main purpose was to validate results from experiment 2. Results showed that "Real time spending feed-back (a) increases spending among budget shoppers but (b) decreases spending among non-budget shoppers" (Ittersum et al., 2013, p. 24). The results also showed that "*In response to real-time spending feed-back, (a) budget*

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shoppers purchase more items" (Ittersum et al., 2013, p. 24), but no support was found for non-budget shoppers purchasing fewer items. The study also revealed that "*In response to real-time spending feedback, (a) budget shoppers purchase relatively more national brands and (b) non-budget shoppers purchase relatively more store brands*" (Ittersum et al., 2013, p. 24). All these results were similar for experiment 2 and 3. A final result from the article is that "*Real time spending feedback (a) improves the shopping experience of budget shoppers but (b) reduces the quality of the shopping experience of non-budget shoppers*" (Ittersum et al., 2013, p. 25). Part (a) of this last hypothesis was supported both in experiment 2 and 3 while part (b) only was supported in experiment 2).

Adhami (2013) used eye-tracking and neuroscience methods along with a pre- and post-survey. The sample was 30 respondents between 25 and 45 years who first filled in a survey measuring respondents' brand and mobile usage pattern. Then the respondents opened and browsed the app, selected product, proceeded to check-out, and made a purchased (respondents did not click the final purchase button, so no purchase was actually completed). Then a survey measured respondents brand and mobile usage pattern again. The results showed that the responses from the questionnaire did not match very well with what was measured with eye-tracking and EEG (meaning; respondents did not say what they were actually thinking/feeling and/or seeing). Results also showed that apps impact brand perception and that users' experience influence whether customers make a purchase or not.

4   A general review

In this chapter we review the articles with a focus on the main idea or the main empirical result documented in the articles. Given that we reviewed 212 articles, it was necessary to narrow down to the most significant findings in the articles. The discussion is mainly based on the reading of title, abstracts and keywords, but we have also browsed the text in many of the articles to make sure we have understood the main findings of each article.

The chapter is organized with sections reflecting the four categories presented in Table 2. In addition, we have strived to subcategorize each of these four sections into meaningful sub-topics based on the content of the articles reviewed.

4.1   Conceptual articles

Among the conceptual articles, a wide array of topics was covered. We categorized the articles into four main sub-categories based on the content of the articles.

4.1.1 Definitions, opportunities, and challenges

Some of the articles discuss what mobile commerce is (e.g. Swilley and Hofacker, 2006; Stanford and Gillenson, 2003). The article by Swilley and Hofacker (2006) also divide mobile commerce into different types of mobile commerce and elaborate on differences between types of mobile commerce/mobile marketing. Another related line of articles discuss opportunities and challenges of various types and forms of mobile commerce (e.g. Varshney, 2005; Urbaczewski et al., 2003; Frolick and Chen, 2004). Some of the articles discuss opportunities and challenges related to specific types of mobile systems or services. Opportunities and challenges are related to several factors, such as understanding technology, systems, and consumer segments. Some of the articles implicitly also touch upon the somewhat complex interplay of stakeholders in offering mobile services (e.g. Reuther, 2008).

4.1.2 Success criteria

Many of the articles discuss one main factor that is critical for the success of mobile services. Examples of factors include technology (Liang and Wei, 2004), organizational readiness (Liang and

Wei, 2004), customer preferences (Magura, 2003), interface design (Tarasewich, 2003; Lee and Benbasat, 2004), personalization (Liao, 2005), trust (Siau and Shen, 2003), location-based services (Rao and Minakakis, 2003; Romanov, 2012); security and privacy (Goodman and Harris, 2010; Gosh and Swaminatha, 2001; Timpson and Troutman, 2009; Herzberg, 2003; Wicker, 2012), and social networking (e.g. Perey, 2008; Humprey and Laverie, 2011).

Seven of the articles in this category focused success criteria for *adoption* of various mobile services. Islam and Fayad (2003) pointed to challenges related to multiple devices, personalization, network heterogeneity, and seamlessness as critical for adoption success. Wang (2012) points to the significance of attitude towards the services and the brand offering the services. In addition, service security, privacy and convenience are identified as critical for adoption. Characteristics of the consumer are also covered because the ability and motivation of the consumer are included among the factors of importance for adoption of mobile services. Vatanparast and Asil (2007) look at four main criteria for adoption. These are related to the consumer (privacy, purpose, performance), the message (content, credibility, and customization), the device (interface, interactivity, and intelligence), and the media (price, process, and policy). One article by Malhotra and Segars (2005) is based on the adoption criteria proposed by Rogers (1961); relative advantage, behavioral compatibility, needs compatibility, trialability, and complexity. Spurgeon (2005) discusses the importance of "conversational interaction" as critical for adoption while Mallat et al. (2004) present a more general discussion of the adoption of mobile financial services in the future. Only one of the seven articles is concerned with criteria for the adoption of mobile commerce among organizations (Stoica et al., 2005). This article treats factors such as business structure, business strategy, organizational culture, technology factors, and governmental factors as important.

4.1.3 Effects and implications of mobile business

Only four articles focus on mobile business effects. Hennig-Thurau et al. (2010) discuss the impact of new media. According to the authors, new media are associated with being digital, pro-active, visible, real-time, ubiquitous, and networks. Also according to these authors, mobile services fit well with such associations. In particular, they discuss effects related to customer interaction and customer relationships. Whittaker and Smith (2008) discuss changes in healthy behavior among consumers using a mobile health care service. The article by Barnes (2002) looks at the effects of mobile advertising and lists potential effects such as attention, attitude to the advertisement, advertisement click, subscription, and purchase. Both the articles by Smutkupt et al. (2010) and Balasubramanian et

al. (2003) discuss the implication of mobile marketing and m-commerce to marketing and marketing strategies.

4.1.4 System design and modelling processes

The articles in this category are of limited relevance to our project. Stender and Ritz (2006) look at B2B mobile commerce processes. Soroor et al. (2009) focus on a system for real-time supply chain coordination. Other articles with a system description approach are Ye (2007), Figge (2004), and Ahluwalia (2005). Raisinghani (2001) divide his article into two main parts. First, the wap architecture is discussed. Second, critical success factors for m-commerce are discussed. In the second part, speed, billing, and security are highlighted as key success factors.

4.1.5 Other topics

Among the other topics covered were an article focusing the use of mobile devices in research (e.g. as a platform for surveys) (Li and Townsend, 2008), an article focusing legal issues related to mobile Internet (Pitkänen et al., 2003), and a praise to Java-based mobile agents (Wong et al., 1999). It is worth noting that only one article had an explicit focus on business models for mobile services (Clayton et al., 2004). Three short articles have an explicit focus on apps. One of them describes Siri (Geller, 2012). Another one discusses the growth of available mobile ads (Anthes, 2011). The third has a focus on how apps can be used as a financial communications tool (Hodge, 2011).

4.2   Empirical – qualitative articles

As for the conceptual articles, several articles reporting qualitative empirical studies focus on success factors for mobile services.

4.2.1 Success criteria

With a focus on mobile advertising, Yaniv (2008) points to the advantage of multiple channels, careful targeting, use of incentives to motivate users, interactive response capabilities, and real-time triggering as the most critical success factors. Focusing downloadable apps, Chiem et al. (2010) list technology, governmental regulations, market characteristics, and socio-cultural factors as critical

success factors. Gebauer and Shaw (2004) point to technology characteristics (functionality, portability, user support) and task characteristics (structure, frequency, time away from the office, need for emergency handling) as factors influencing usage of a mobile business application. Usage is also proposed to influence efficiency and effectiveness of the business.

Similar to the conceptual articles, some of the success criteria articles have an explicit eye on success criteria for *adoption*. Sarker and Wells (2003) suggest five categories of success factors for adoption of handheld devices; individual characteristics (age, culture, technological self-efficacy and prior experience), communication/task characteristics (number of interacting participants, immediacy of response, volume of communication, communication objectives), modality of mobility (type - travelling, wandering, visiting – and extent), technology characteristics (interface characteristics, network capabilities), and context (economic factors, social factors, critical mass of subscribers and available services). With a focus on multi-access technologies in online consumer auctions, Vesa and Heck (2005) propose perceived appropriateness of technology, media-richness of multi-access technology, support of multiple modes of communication, and experience in the use of multiple channels as antecedents for the adoption of multi-access technologies in online consumer auctions. For adoption of mobile payment, Pope et al. (2011) point to governmental, technological and socio-economic factors as critical for adoption. A final article in this sub-category looks at factors influencing adoption of wireless advertising messages (Peters et al., 2007). Results show that process gratifications (e.g. fill time and entertainment), socialization gratifications (commercial and personal relationships), and content gratifications influence attitude to wireless advertising. Whether the service is adopted or not is also proposed to depend on monetary and social costs (sharing private information).

Two studies have an explicit focus on mobile apps. Bhave et al. (2013) discuss factors of importance for liking and preference for mobile applications (including in-app advertising) of the so-called generation Y. Involvement with the app, hindrance caused by the ad, screen size, contextualization, personalization, relevance, credibility, permission, control and incentives are the most critical determinants revealed. Adhami (2012) describes a development process for a Pizza app. Regarding factors of importance for adoption of the app, he suggests to make it easy, make it delicious, and make the customers come back.

4.2.2 Business models

Only one of the conceptual articles had an explicit focus on business models for mobile services. Of the qualitative studies, two articles discuss mobile business models. Sgriccia et al. (2007) describe four factors of the mobile industry that it is important to acknowledge to succeed with a business model. These factors are value chain dynamics, technological opportunities and barriers, governmental regulations, and user culture. Alvarez et al. (2009) have a somewhat similar approach, discussing macro factors in the businesses environment that will influence what they call the mobile value network. These factors are regulatory, economic, cultural and technological factors.

4.2.3 System design and modelling processes

An article by Ngai et al. (2007) presents an architecture of an RFID-integrated m-commerce system for a container depot. The system is described and sample screens of interfaces are presented. Also, Bose and Chen (2009, p. 158) propose a framework for "analyzing customers' context based behavioral data to provide suitable services to customers".

4.2.4 Other topics

The main message in the article by Nielsen and Fjuk (2010) is that the usage of mobile Internet is just an extension of the computer or PC based Internet. Thus, they claim that the mobile Internet has not led to any form of new usage. Based on this, they argue that the expectation that new killer apps will lead to a lot of new usage is wrong. An article by Martinsons (2008) discusses specific challenges facing m-commerce in China. Huang et al. (2003) discuss the importance of learning from "failure" with electronic commerce. They discuss the efforts of First Atlantic Bank of Nigeria and find that it would have been more difficult for the bank to introduce a mobile banking service as promptly and readily without prior learning from the implementation of their Internet bank. The starting point in the article by Davis and Chaudhri (2012) is that mobile services are increasingly used to experience fun. On this ground, the researchers discuss factors enhancing consumers' playful behavior when using mobile services.

Given the purpose of the MOVON project, the article by Hosbond and Skov (2007) deserves some extra attention. Basically, the article describes two systems for micro mobility marketing. These are systems promoting goods within retail supermarkets. Both systems are based on an interactive interface mounted on the shopping trolleys. The first system, Context-Aware Shopping Trolley (CAST),

is a system where the consumer feeds the system with their shopping list. Based on this, the system shows the location of the products in the store, it shows the visual appearance of the product, it describes any relations between the products, and it gives general information about the products. The shopping list is updated when products from the list are placed in the trolley. The system also calculates the sum of the products in the trolley. The second system, Personal Shopping Assistant (PSA), is a system where the consumer has a personal profile (that the consumer can edit whenever she likes), where the consumer writes down her shopping list, and the system stores historical shopping data. The customer authenticates herself and activates the system by the personal shopping card. The system then gives access to the shopping list, it shows graphically the store plan, it has a price check function, recipes are suggested based on the content of the shopping trolley, advertisements for products close to the user is given (based on personal profile and historical data for highest relevance), and the sum of the products in the shopping trolley is given continuously. A final part of the article discusses issues related to permission and disturbance of using such systems, the content and context of such systems, as well as their user experience and usability.

4.3 Empirical – quantitative articles

When observing the quantitative studies, it is interesting to notice the considerable number of them investigate success criteria for mobile services – often within an adoption perspective. So we will start by looking at studies of success criteria for various mobile services. The discussion also includes a section on criteria for the adoption of advertising/marketing services and sections on various smaller topics.

4.3.1 Success criteria

General success criteria

In a Delphi study (Huang, 2012), success factors for mobile marketing were divided into 1) Success factors for m-marketing development (accuracy, content, entertainment and richness, mobility, privacy, etc.), 2) Success factors for m-marketing use and deployment (permission, opt-in, brand trust, interactivity, frequency, etc.), and 3) success factors for m-marketing impact (acceptance, value/profit, and relationship).

Adoption of mobile services

A gratification study by Grant and O'Donohoe (2007) finds that convenient entertainment, social stimulation, experiential learning, escapism and purchasing information and advice are the main motives for using *mobile phones*. Escape motivation, information motivation, socialization motivation, economic motivation, and privacy motivation (security motivations were not found to be significant) were revealed as significant elements in explaining mobile phone usage by Jin and Villegas (2008).

Two studies were found explaining adoption of *mobile apps* – defined as "small programs that run on a mobile device and perform tasks ranging from banking to gaming and web browsing" (Taylor et al., 2011, p. 60). Yang (2013) found influences of subjective norms, perceived usefulness, ease of use, and enjoyment on attitude to use while behavioral control and usefulness were significant antecedents of intention to use mobile apps. Usefulness, gender, income and intention to use were revealed as antecedents of actual usage of mobile apps. From a social network perspective, Taylor et al. (2011, p. 62) found that consumers are more positively disposed to use various types of mobile apps to the extent her most influential contacts uses these apps. They did not find strong support for the hypothesis proposing that the influence will be stronger if the relationship with the contact is social compared to not social.

Looking into antecedents of *text messaging (SMS)* adoption, Kim et al. (2008) found direct or indirect influences of monetary value, network factors, interface convenience, context controllability, usefulness, ease of use and enjoyment (no significant influence of media richness was revealed) on continued intention to use. Lu et al. (2010) find significant influences of enjoyment, network externalities, usefulness, communication effectiveness and service costs (no significant influence was revealed for ease of use) on actual usage of SMS among Chinese consumers. Studying *multimedia messaging (MMS)*, media richness, usefulness, ease of use, and enjoyment were all revealed to have direct or indirect influences on intention to use (Lee et al., 2007). Also, Chang and Pan (2011) revealed direct or indirect effects of facilitating conditions, previous experience, ease of use, and relative advantage on the intention to adopt MMS.

Chandra et al. (2010) studied antecedents of the adoption of *mobile payment* with a special focus on trust in payment system. They found influences of service provider's reputation and perception of technology characteristics (risk and assurance) on trust in payment system. Trust in the payment system was revealed to have both a direct and indirect effect (through ease of use and usefulness) on intention to adopt the payment system. Direct influences of perceived cost, perceived risk, relative advantage, compatibility, image and initial mobile trust on intention to adopt mobile payment were

revealed by Lu et al. (2011) while indirect influences were found from Internet payment trust and initial mobile trust.

Kim et al. (2009) found direct or indirect influences of relative benefits of mobile banking, personal propensity to trust, structural insurance in mobile banking and initial trust in mobile banking (no significant influences of firm reputation were revealed) on intention to use *mobile banking*. Sripalawat et al. (2010) uncovered negative effects of device barriers, perceived risk, lack of information and perceived financial costs on the intention to adopt m-banking while positive influences were revealed for subjective norm, perceived usefulness, perceived ease of use, and self-efficacy.

Kim et al. (2007) studied the indirect influence of benefits (usefulness, enjoyment) and sacrifices (technicality, perceived fee) through perceived value and direct influence of perceived value on the intention to adopt *mobile Internet* and found significant effects of all of these antecedents. Vatanaprast and Qadim (2009) compared an adoption model across US, UK (West), Russia, Japan and China (East). Intention to use was found to influence actual usage of mobile Internet inn all five countries. Ease of use was also found to influence intention to use and usefulness in all five countries. Usefulness influenced intention to use significantly in the three Eastern countries but not in the Western countries. Stationary Internet experience (not for UK) and mobile experience had positive influences on ease of use in the other four markets. The study by Venkatesh et al. (2012) found influences of performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit on the intention to use mobile Internet. Studying wireless Internet for mobile commerce, Lu et al. (2005) found support for a causal link from facilitating conditions through wireless trust to intention to use.

Many of the articles focused *mobile data services* (MDS). Qi et al. (2009) revealed direct or indirect (through attitude to the service) influences of voice experience, innovation experience, brand experience, usefulness, ease of use and flow on the intention to use mobile data services. Lu et al. (2009) found influences of performance expectancy, effort expectancy and social influence on the intention to adopt a 3G MDS system. Some of these main effects were moderated by age, gender, experience, income, and location. Karaiskos et al. (2012) found direct influences of perceived usefulness, perceived enjoyment, and social factors on intention to use MDS while perceived ease of use and perceived value were revealed to be non-significant. Yang and Jolly (2006) revealed positive influences of emotional and functional value on attitude to use MDS, negative influence of social value, and no significant influence of monetary value. Direct and/or indirect influences of qualities of MDS, facilitating conditions, personal innovativeness, mobile trust, perceived usefulness, perceived

ease of use, and social influences (negative effect) were also found on the intention to use MDS (Lu et al, 2008). Comparing American and Korean consumers, Yang and Jolly (2009) later found positive influences of functional value and emotional value and negative influence of social value on the attitude to MDS among the American consumers (no influence was revealed of monetary value). Attitude and subjective norm both had a positive influence on the intention to use. Among the Korean consumers, functional value (positive), emotional value (positive), monetary value (negative), and social value had significant effects on the attitude to MDS. Further, attitude to MDS was found to have an effect on intention to use (no significant influence was found of subjective norm on intention to use). Testing a comprehensive model, Hong and Tam (2006) report influences of intention to use mobile data services from usefulness, ease of use, service availability, monetary value, enjoyment, need for uniqueness, and social influence on usage intention. Also, gender (but not age) was found to influence usage intention. Hong et al. (2013) found effects of ease of use, usefulness, playfulness, and social norm on the intention to continue to use MDS. However, the significance of these antecedents varied across levels of cognitive age among the users.

There are also a few articles studying adoption of *mobile services*. Ho (2012) finds that novelty of location based personalized mobile services and the opportunity to get involved in a community through the use of such services will increase customers' intrinsic motivation to use the services. He also finds that intrinsic motivation positively influenced intention to use the services. Regarding extrinsic motivation, he finds that the accuracy and the precision of location-based personalized mobile services positively influence extrinsic motivation to use the services and that extrinsic motivation is associated positively with intention to use the services. Ho (2012) also proposes that extrinsic and intrinsic motivation influence initial usage intention more strongly than subsequent usage intention and finds support for this for extrinsic motivation. Kleinen et al. (2007) consider m-channel value to be the main driver of intention to use. They find that benefits such as time convenience and user control (no significant influence was found for service compatibility), positively influence m-channel value and that costs, such as risk and cognitive effort, have negative influences on m-channel value. Finally, m-channel value is revealed to affect intention to use the mobile service. Time consciousness was found to moderate the influences of time convenience, risk and cognitive effort. Malhotra and Malhotra (2009) found positive influences of perceived utility of the service, ease of using the service and flat fee pricing on the adoption of wireless web services. Mallat et al. (2009) revealed positive direct or indirect effects of ease of use, usefulness, compatibility and mobility on usage intention for a mobile ticketing system. The main contribution in their work is the inclusion of usage context as a factor influencing usage intention. Context elements such as "I have no cash for purchasing the ticket" and "I am in a hurry and need the ticket fast" are found to

influence usage adoption. The study by Mort and Brennan (2007) finds positive effects of purchase involvement, product involvement and innovativeness (no significant influence was revealed for mobile device self-efficacy) on the use of mobile services. Also, their study reveals indirect influence on mobile service usage of utilitarian value (through purchase involvement and product involvement) and indirect influences of hedonic value (through purchase involvement). Finally, self-efficacy, financial resources, usefulness, ease of use and credibility are found to positively influence usage intention of mobile services in a study by Wang et al. (2006).

For *mobile commerce*, Chong et al. (2012) compared antecedents of adoption between Malaysian and Chinese consumers. They found significant effects of trust, costs, and social influences in both consumer segments. Variety of services was found to influence adoption positively for Malaysian consumers but not for Chinese consumers. Surprisingly, ease of use, usefulness and trialability were not found to be significant antecedents of adoption in any of the two consumer segments. Mahatanankoon (2007) found indirect influences of personal innovativeness and individual playfulness through optimum stimulation level. Optimum stimulation level was revealed to influence adoption directly and through users' degree of text messaging usage. Results from Wu and Wang (2005) show influences of perceived risk, costs, compatibility and usefulness on intention to use m-commerce. Only indirect influence of perceived ease of use was revealed (through perceived usefulness). Their results also show that intention to use is significantly associated with actual usage. Testing a TPB model, Khalifa et al. (2011) find influences of attitude to m-commerce and subjective norms (no influences of behavioral control was revealed) on intention to use. The interesting contribution from their article is the inclusion of attitude confidence as a variable proposed to moderate the effect of attitude to m-commerce on intention to use m-commerce (which is supported). Also, their model proposes that exposure to mobile commerce is a factor influencing attitude confidence and that trial, communication and observation drives exposure to mobile commerce. They find support for all of these propositions. Earlier, Khalifa and Shen (2008) revealed similar results as Khalifa et al. (2011) showing positive influences of attitude to m-commerce and subjective norm on intention while no influences was found for behavioral control. An additional contribution in their work is that perceived consequences are found to positively affect intention to adopt m-commerce and that cost, convenience, privacy, efficiency and security influence intention to adopt indirectly through perceived consequences. A main point in the article by Zhang et al. (2013) is that privacy concerns over m-commerce influences intention to engage in m-commerce. They find that education level, age, and experience (no significant influences revealed for income level and gender) predict privacy concerns over m-commerce - and through that intention to use. Finally, through a CIT study, Maity (2010) finds that ease of use, usefulness, and subjective norms stimulate

attitude to m-commerce while behavioral control, self-efficacy, role of alternative channels, outcome expectations, and degree of comfort are inhibitors of attitude to m-commerce. In a study of mobile shopping for fashion in Korea (Ko et al., 2009), usefulness, ease of use and enjoyment show positive influences on perceived value (and through this intention to use) while instant connectivity is found to be negatively associated with perceived value.

Some of the articles presenting empirical studies on adoption do not belong to any of the sub-categories above. Studying a context aware service, Kwon et al. (2007) find direct influences of ease of use and usefulness on usage intention. In addition, indirect effects are found for personal innovativeness (through ease of use), self-efficacy (through ease of use), perceived sensitivity to contextual pressure (through ease of use and usefulness), and ease of use (through usefulness). Nysveen et al. (2005) found positive influences of ease of use, usefulness, enjoyment, expressiveness, normative pressure and behavioral control on intention to use. Comparing various types of mobile services (SMS, contact (flirt), payment, gaming), they found that the significance of these antecedents were sensitive to type of service. Also, Fang et al. (2005-2006), studying the influence on adoption of usefulness, ease of use, playfulness and security, found that the significance of these antecedents varies across task types. In a study of mobile information and communication technology in less developed countries, Meso et al. (2005) found influences of perceived technology reliability and accessibility of mobile ICT to be the main antecedents of mobile ICT usage (while both ease of use and usefulness were found insignificant). Chang et al. (2009) studied the adoption of web applications via voice cellular phone (as far as we understand, this was a form of Interactive Voice Response (IVR) system). The results showed direct and/or indirect influences of ease of use, usefulness, fun, attitude, social norm and behavioral control on the intention to use the system. Turel et al. (2010) focus hedonic digital artifacts of mobile service. They find that overall value of hedonic digital artifacts strongly influences intention to use mobile services. Visual/music appeal value, playfulness value, and value for money (no significant influence was revealed for social value) are found to be the drivers for overall value of hedonic digital artifact. Going one more step back in the model, escapism and enjoyment are found to significantly influence playfulness value. Building on consumer behavior research on adoption and information system research, Xu et al. (2010) studied the intention to migrate from one technology platform to another (3G platform) in Hong Kong. Influences from technology perceptions (ease of use, usefulness, enjoyment, compatibility, monetary value, superiority of service), external influences (friends and family influence, media influence, image), and complementarities (hardware-software platforms, software platforms-applications, applications-services) were proposed to influences migration intention. All of the propositions were supported or partly supported. Using a conjoint analysis – and studying consumers

intention to use mobile office systems – Lou et al. (2013) found that the importance ranking of antecedents was as follows: Usefulness (most important), ease of use, result demonstrability, security, communicability, compatibility, image, and risk (least important). Lee et al. (2007) studied a mobile commerce system in the insurance industry and found that task-technology fit was critical for effective adoption of the system. Furthermore, position experience, cognitive style, and computer self-efficacy were individual factors found important in predicting task-technology fit (while gender and age were found insignificant).

Adoption of mobile advertising/marketing

Explaining the intention to redeem mobile coupons, Dickinger and Kleijnen (2008) found that attitude, economic benefits, redemption effort, perceived control, and fear of spamming had a say (no influence of past use of coupons or social norms). Looking at permission based marketing, Im and Ha (2013) revealed significant influences of social norms, ease of use, usefulness, risk, attitude, and intention to disclose personal information on the intention to use such a service. Xu (2006-2007) revealed positive effects of entertainment, credibility and personalization on attitude to mobile advertising in China (no significant influence of informativeness and irritation). Tsang et al. (2004) revealed significant relevance of entertainment, credibility, attitude and intention in explaining behavior related to mobile advertising. Zhang and Mao (2008) found direct or indirect influences of information usefulness, sociality usefulness, self-efficacy, disposition to trust, usefulness, ease of use, trust, and subjective norms (entertainment usefulness was not found significant) on the intention to adopt SMS advertising among young Chinese consumers. With a gratification approach, Vatanprast and Butt (2010) found that consumer purpose, consumer performance, device interface and message content are among the most important factors affecting the use of mobile advertising. Factors such as device intelligence, device interactivity and message credibility were ranked as somewhat less important. A comprehensive study is reported by de Marez (2007) looking at the influence of 19 antecedents of mobile marketing adoption. Most of these antecedents are based on traditional perspectives of adoption. An interesting approach in the study is the focus on potential moderating influences of type of adopter (early adopter, early majority, later adopter) and mobile marketing in different types of service (mobile news versus mobile television). The results show some sensitivity of type of adopter and type of service. In a study of SMS advertising, Carroll et al. (2007) find influences of permission, content, wireless service provider control (trust that the WSP will monitor and control mobile communications), and delivery of the message (important that customers have a close relationship to the brand/actor delivering the ad) to influence adoption of SMS advertising.

Combining a survey and a focus group analysis, Ktoridou et al. (2008) point to the value-added elements of ubiquity, convenience, instant connectivity, personalization, and product and service localization of mobile commerce.

Two studies focus on the criteria for adoption of advertising/marketing by companies (not consumers). Okazaki and Taylor (2008) look at factors influencing multinational companies' intention to adopt SMS advertising. The potential for brand building effects, potential for location-based marketing, technological possibilities, and privacy/security concerns influence their intention to adopt SMS advertising. A study by Wang and Cheung (2004) finds that innovation orientation, perceived advantage of e-business, IT resources, firm size, and CEO risk taking propensity influence travel agencies' intention to develop mobile e-business.

4.3.2 Post adoption studies

Post adoption behavior refers to use of a service over time. Choi et al. (2011) found that intrinsic motivation (ease of use and enjoyment) and extrinsic motivation (usefulness – while monetary value was not revealed to be significant) had positive relationships with the continuer user group for *mobile data services*. Also, type of service had a positive relationship with the continuer user group – favoring utilitarian services before hedonic services. *Mobile data services* were also studied by Lee et al. (2009), revealing negative influence of system quality on service usage decrease but no significant influence of information quality. The study only explained 5 percent of service usage decrease (R^2=.05). Chen et al. (2012) found hedonic value, satisfaction and perceived usefulness to have direct positive influences on continuance intention for an *information-oriented mobile service* (InstaFind) while information quality, system quality, process quality, confirmation, and usefulness were found to have positive indirect influences. Lee et al. (2007) tested a model predicting positive influences of perceived usefulness, perceived enjoyment, perceived ease of use and perceived monetary value on satisfaction with *mobile Internet services*. Satisfaction was proposed to influence continuance intention. The model was fully supported. In addition, this article studied indirect influences of uncertainty avoidance, individualism, context and time perception. The indirect influences were found for many of the antecedents of satisfaction. Kim et al. (2013) revealed direct and indirect positive influences of utilitarian motivation, social motivation, hedonic motivation, perceived value and satisfaction on mobile engagement intention (keep engaging their *smartphones*). Kondo et al. (2012) found direct and/or indirect influences of perceived expectations, perceived quality, and perceived value on satisfaction. Satisfaction was found to positively influence loyalty while no significant influence was found for satisfaction on switching costs. Some differences were found

between *hedonic and utilitarian services* and between consumers in Japan and USA. Loyalty was also focused in a study by Lin and Wang (2006), revealing positive influences of perceived value, trust, customer satisfaction and habit on customer loyalty in a *mobile commerce* context. Also in a *mobile commerce* context, Chong (2013) found influences of ease of use (direct), usefulness (direct and indirect through satisfaction), enjoyment (direct and indirect through satisfaction), trust (direct and indirect through satisfaction), perceived cost (direct) and satisfaction (direct) on continuance intention.

4.3.3 Multichannel studies

Five articles discuss synergies between the mobile channel and other channels. Davis and Sajtor (2008) present a categorization of customers interacting with TV shows through SMS. The categories relate to the number of potential viewers, those who interact with the TV show through SMS, the repeaters who interact more than once, etc. Nysveen et al. (2005) find that adding SMS/MMS to the line of brand channels contribute positively to brand satisfaction, relationship investments, and usage of the brand's main channel. A somewhat different topic is discussed by Kim et al. (2005), looking into the potential of device convergence. Given the heterogeneity of consumers, they conclude that partial convergence is the most plausible development. This is also substantiated by Barwise (2001) predicting that despite convergence, new media will be distinguishable from each other also in the future and that something similar to the PC will continue to be the dominant device. An article by Barrett (2012) describes the mobile marketer accelerator. Marketers can answer some questions about their marketing activities in the accelerator. Based on this information, the accelerator provides suggestions for how mobile marketing should be integrated into the marketing mix for the company.

4.3.4 Innovation

Khansa et al. (2012) analyze all patents related to m-commerce filed with the United States Patent Trademark Office from 2001 to 2010. Based on this, the type of patents for each year, and the development in types of patents, are described and discussed. They wrap up the article with a discussion of how m-commerce innovations (in particular those developed the last few years) empower consumers to co-create. A second study investigate what kind of governance mechanisms that are applied in different stages of an innovation process when many organizations work together to innovate mobile services (Reuver and Bouwman, 2012). The main findings in this study are that

power based mechanisms dominate the earlier stages of development while trust based mechanisms dominate the implementation, roll-out and commercialization stages.

4.3.5 Studies on effects of mobile services

Studying the impulse purchasing behavior for SMS services, Davis and Sajtos (2009) found that consumers with high level of SMS service involvement have higher level of SMS service specific impulse purchase behavior. They also revealed that consumers with high levels of generalized impulse purchasing tendency have higher level of SMS service specific impulse purchase behavior. Studying an iPhone app and four manufacturers, Cameron et al. (2012) found that personalized coupons yielded a higher level of coupon redemption, and more redemption for products and brands that were new to the customers. Another study shows effects of text messaging advertising on brand attitude and purchase intention (Rettie et al., 2005). A study by Murphy (2013) refers to the success of a mobile parking service in Montréal, pointing to a growth of more than 200 000 transactions each month (from the 1 million transactions already processed). Studying a "pseudo" mobile advertising campaign for 1) durable and 2) non-durable goods, Okazaki et al. (2007) revealed positive (direct and/or indirect) influences of brand trust, mobile advertising trust, attitude to brand, attitude to mobile advertising on mobile campaign recall. The influence of attitude to brand on mobile campaign recall was found to be stronger for durable goods relative to non-durable goods. Finally, Pihlström and Brush (2008) found influences of various values (conditional value, epistemic value, monetary value, convenience value, emotional value and social value) on repurchase intention, willingness to pay more, and word-of-mouth for information and entertainment mobile services. The significance of some of the influences was moderated by type of service (information versus entertainment). Also, the article by Nysveen et al. (2005) discussed in section 4.3.3, shows positive effects on customer-brand relationships of adding mobile services to brands' existing line of channels.

4.3.6 Other studies

There are also some articles that do not really fit into the categories discussed above, covering a wider variety of topics. Here we present a brief overview of the main topics and contributions in these articles. Chae and Kim (2003) argue that mobile Internet is more personal than stationary Internet, provides instant connection to a higher degree than stationary Internet, and has a lower level of available resources than stationary Internet. Based on these assumptions they conduct a survey at three points in time finding that preferred products to buy, preferred communication

service, and preferred content on the Internet vary between users of stationary and mobile Internet. The study by Verkasalo (2007) has a descriptive character and describes the time allocated to using different type of mobile services, aggregated data traffic for various mobile services, and intention to use various mobile services in the future. Jih and Lee (2003-2004) found that online retail shopping motivators, market segments, and life style indicators influence willingness to make purchases with cellular phones. The five most important shopping motivators were 1) to avoid traffic jam and parking headaches, 2) to avoid self-shipping trouble, 3) convenient shopping time, 4) private shopping, and 5) disturbance free shopping. Life style indicators included were 1) enjoying leisure, 2) work achievement, 3) valuing brand, and 4) valuing friendship. Regarding segments, the conservative and pragmatic users were found to be more willing to make purchases through wireless devices than the information and convenience segments. A main point revealed by Venkatesh et al. (2003) was that the usability ranking of organizations' wireless presence was lower than the organizations' web presence. They pinpoint that wireless experiences often are about saving time, varying location, and convenience. Hence, they suggest that relevance, structure, and personalization are the keys to create good experiences for consumers using wireless devices. Li and Segal's (2012) study gives an overview of smartphone penetration in categories of mobile services used, growth in smartphones by region (Canada), etc. Buhalis and Licata (2002) discuss the general change in eTourism intermediaries – that the value chain is disintermediated as consumers order their own tickets directly without using traditional travel agencies and tour operators. Although the main focus of the article is not on mobile devices, results from their study show that 76 percent of the respondents agree or strongly agree that mobile devices will be the most prominent eTourism distribution platform in 5 years (2007) while the corresponding results for 2017 is estimated to 90 percent. Focusing viral marketing, Schulze et al. (2014) study the effectiveness of sharing mechanisms on product success among high versus low utilitarian products. The "products" chosen were Facebook apps (because they typically spread through viral marketing). Main result is that "*Unsolicited and incentivized broadcast messages from friends are the least effective sharing mechanisms for primarily utilitarian products*" (Schulze et al., 2014, p. 13). This result contrasts results showing that unsolicited and incentivized messages work for low-utilitarian products (games and entertainment products). An article by Bertini and Cabornero (2012) discuss implications for operators of selling iPhones.

Najafabadi (2012) discuss barriers of mobile marketing in the agricultural section in Iran. This is a topic related to criteria for adoption, although focusing on barriers for adoption. The phone companies, socio cultural factors, government policy and regulations, technical issues, and security are the barriers pinpointed in the article. Okazaki et al. (2009) found that prior negative experience, information privacy control, trust, and perceived risk were factors influencing the degree of

regulatory control in mobile advertising. Samy's (2012) study discusses the use of mobile technology in airline marketing. Results show that the most significant mobile services for airlines are ranked as follows: Mobile booking (most important), real time flight status, time table display, mobile on board flights, receive deals and offers, real time baggage information, airport guide, loyalty program access, flight disruption messaging, mobile payment, aircraft seat map, mobile check in, travel itinerary management, and social media interactivity (least important). Wais and Clemons (2008) study the importance of the sender of mobile advertising messages. Their main finding is that people prefer to receive promotional messages (advertisements) from people they know (belonging to their community) or friends and that the risk of brand damage also is lower if the sender is someone belonging to their community or their friends. Barutçu (2007) finds that consumers are positive to mobile marketing tools such as mobile advertisements, mobile discount coupons, mobile entertainment, location-based services, mobile Internet, mobile banking and overall mobile marketing. There are some differences across demographic groups, Internet vs not Internet users, and levels of shopping orientation.

4.4   Empirical – quantitative (econometric) articles

Some of the articles present model development and econometric analyses relevant for the mobile service sector. These articles are published in journals such as Information Economics and Policy, Journal of Regulatory Economics, Journal of Econometrics, European Journal of Operational Research, and International Economic Review. Most of these articles only have peripheral relevance for the MOVON project. They are only briefly commented on in this section.

Using a conjoint analysis technique, Kim (2005) estimates preferences for mobile service upgrades among consumers in Korea and finds that consumers have a more positive preference for video telephony compared to global roaming services and multimedia mobile Internet. Bang et al. (2013) apply a counterfactual analysis based on vector autoregression. Their main result is that the performance impact of mobile channels depends on time criticality and information intensity of the product and the fit between these two product characteristics and channel characteristics (access and search capabilities). Briglauer et al. (2011) study own-price elasticities for fixed and mobile voice telephony among private users and find that access is inelastic while calls are elastic. Implication for regulation is discussed. Hausman and Kuersteiner (2008) present a methodological contribution – comparing ordinary least square (OLS) and feasible generalized least square (FGLS). They compare the two methodologies using data on regulation of mobile telephony service prices and find that a size corrected FGLS is a better test than OLS. Mbiti and Weil (2013) describe characteristics such as

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the fee schedule, distribution of withdrawal amounts and transaction frequency, and size of M-Pesa - a money transfer system based on mobile phones in Kenya. Tomak and Keskin (2008, p. 887) build a model "*to assess the impact of immediate gratification on the profit maximizing behavior of a monopolist firm which produce an information good with network externalities*". Also, the model is tested for sensitivity for various levels of network externalities. Thompson Jr. and Garbacz (2007) find that growth in information networks is positive for the global productive efficiency, in particular for the poorest nations. Three articles focus on the diffusion of mobile services. With a focus on how interpersonal communication can influence the adoption of brands, Libai et al. (2009) compare within-brand influence (communication with adopters of the brand in focus) and between-brand influence (communication with adopters of competing brands). Studying the market growth of the cellular industry in Western Europe, they find what they call a "dual pattern" – "*characterized by a fast takeoff for a follower, followed by a widening gap in favor of the first entrant*" (Libai et al., 2009, p. 19). Lee and Cho (2007) find that the diffusion rate for mobile subscriptions in Korea increases with per capita GDP and decreases with the number of main telephone lines. Lee and Lee (2009, p. 3143) develop a "*framework for forecasting demand for new services based on the diffusion of incumbent services*". Papamichail and Papamichail (2007) describe an algorithm offering a real time solution for developing decision aids in e-commerce and discuss implications for the development of such decision aids in mobile and traditional e-commerce applications. Tang et al. (2013) develop a framework for predicting customers' preferences based on context information of mobile users. The framework is evaluated on a mobile user's context dataset. Kwon and Sadeh (2004) apply case-based reasoning and multi-agent intelligence to develop a prototype for context-aware comparative shopping. They find that such systems improve pay-offs and total sales.

Four of the articles in this category have an explicit focus on apps. Garg and Telang (2013, p. 1253) develop a "*method to use public data to infer the rank-demand relationship for the paid apps on Apple's iTunes App Store*". Carare (2012) uses ranking data of the top 100 apps from Apple's app store to illuminate the causal relationship between the best seller rank information today on tomorrow's demand. Boudreau (2012, p. 1409) studies the link between the numbers of software app developers and patterns of innovation and finds – among other things – a clear relationship "*between the number of producers on platform and the number of software varieties that was generated*". Finally, Jung et al. (2012, p. 929) "*empirically analyze both free and paid products on the top 100 Free and Grossing charts in the Korea App Store using Weibull parametric survival analysis on the product level*".

5   A framework summarizing the main trends in the literature

Several conclusions can be drawn from the review, but we will limit the discussion here to points we consider to be particularly relevant for the positioning of future empirical studies in the MOVON project. A summary of the review is presented in Figure 1.
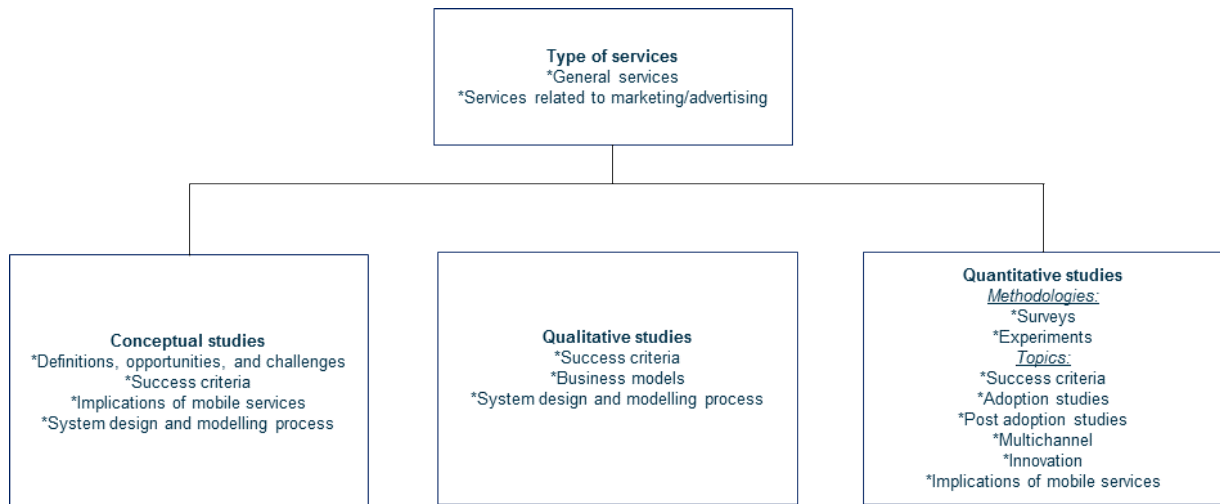

Figure 1: Main result categories

A lot of different mobile services are discussed in the articles reviewed. One observation is that the services sometimes are not very well specified and that terms like mobile services, mobile data services, mobile commerce, etc. sometimes are used without any well-specified definition. Given the fact that the type of service moderates the influences reported in some of the studies reviewed (e.g. Kondo et al., 2012; Choi et al., 2011), we want to point out that the type of service need to be clearly specified in future studies because antecedents of adoption and effects of use can vary across specific types of services. Typically studies have investigated mobile services targeting consumers. Some of the studies have a specific focus on mobile services for the purpose of marketing and/or advertising – also targeting consumers. Only a few studies investigate mobile services intended to be used (not just offered) by companies and in business-to-business relationships.

Regarding the conceptual studies, some of them look into definitions of mobile services and discuss possible advantages/opportunities and challenges of such services on a more general level. Most of the studies in this category discuss general success criteria for mobile services. Often these articles focus on a single success criterion, for example discussing the importance of trust or privacy for the success of mobile services. Seven of the articles have an explicit focus on success criteria for adoption

of mobile services. Only a few studies focus on the implications of mobile services system design and modelling processes.

Also among the qualitative studies, success criteria are the topic mostly discussed. In this category of studies, criteria for successful adoption are also the dominating "success perspective". The category covers success criteria for both general mobile services and more marketing/advertising related mobile services. Only four of the studies looked at business model issues and/or system design and modelling processes.

The category of quantitative studies includes the largest number of studies. First, it is worth mentioning that this category is dominated by surveys. Thirteen of the studies described their methodological approach as experiments. We do, however, see that some of the studies that are not categorized as experiments have used quasi-experimental approaches – but they are not many. Regarding topics, the quantitative studies also have their main focus on success criteria for mobile services. The absolutely dominating approach when it comes to studying success criteria is the adoption approach. We find a large number of articles investigating antecedents of adoption of various mobile services. We also find quite a few post adoption studies – typically looking into antecedents of continuous usage of mobile services and antecedents of satisfaction and loyalty to mobile services. A few articles focus synergies between mobile channels and other channels. Two articles have an innovation perspective – focusing governance mechanisms for innovation processes for mobile services and the development of innovations/patents related to mobile services. Finally, we have identified a few studies illuminating the effects of using mobile services.

In chapter 1.2 we presented a brief introduction to the main purposes of the MOVON project. In short, MOVON is about in-store/warehouse (builders' merchant) mobile services; these mobile services should be based on apps; and the apps could include functionalities such as payment, visual presentations of products and solutions, and context aware shopping. The MOVON project will apply experiments as the dominating research design in order to reveal as valid conclusions about influences of consumers' app usage as possible. This review presents a broad set of results for a broad set of mobile services studied in a broad set of contexts. For the purpose of guiding research positioning relevant for the purposes of the MOVON project, we specify what we believe are the main shortcomings and gaps in existing research on mobile services in chapter 6.

6   Suggestions for future research

Based on the review and the summary of the reviewed categories of results presented in Figure 1, we see several paths for future research on mobile services. These are mainly based on five gaps we have identified in the reviewed literature.

First, there are not many studies focusing mobile apps. This is probably because apps have not been available for many years, and many studies using mobile apps as the context of research are probably "in progress". It is difficult not to notice that much of the recent success of mobile services could be attributed to specialized apps rather than generic mobile Internet services (West and Mace, 2010). The mobile marketing parallel to this trend is the success of many branded mobile apps, particularly in Norway. Of the hundred most popular free apps in App Store in Norway, 19 are branded apps, whereas the corresponding number is 5 in the US App Store (see Appendix 3). It is believed that these apps differ from the traditional browser based services use of mobile Internet, even though functionalities similar to that of mobile apps may also be created using recent HTML-versions. One advantage of apps is that they can customize their look and feel to fit the services and the devices. A disadvantage of apps is that they are platform specific and have to be adapted to different, and often competing, operating systems. Apps also have to be downloaded from app stores, and eventual upgrades also mean that the apps have to be continuously re-installed. This may be perceived as inconvenient by the customers (Mikkonen and Taivalsaari, 2011). Despite these disadvantages, the success of mobile apps is apparent, leaving us with two research questions unanswered in the extant literature on mobile services reviewed above: What characterizes mobile apps as different from other mobile services, and how do these characteristics explain their apparent success? Looking first at their characteristics, it has been suggested that these include the characteristics of their platform (smartphone, development platform, app store and business model), the apps themselves and the users (Kourouthanassis and Giaglis, 2012). The more closed platform ecology of mobile apps and the more mature smartphone users allow mobile apps to be offered that differ significantly from previous mobile services. Reviewing some of these characteristics, Kim et al. (2013) suggest vividness, novelty, motivation, control, customization, feedback, and multiplatforming to be the most important characteristics of branded mobile apps. In a content analysis of 106 branded mobile apps they confirmed the presence of these characteristics. It has been suggested that these characteristics could be abstracted into a higher-level characteristic of "engaging" or engagement (Kim et al., 2013; Bellman et al., 2011). Bellman et al. (2011) show that this higher level of engagement affects branded app effectiveness by giving a richer experience regardless of the content of the service being informational or experiential. This important characteristic of mobile apps is paralleled by engagement as an important characteristic of web apps offered on the traditional Internet as well

(Anderson and Wolff, 2010). Turning to the explanations of these effects, some attempts have been made to adapt traditional adoption models to mobile apps with only moderate success in terms of model fit and explained variance (Kim et al., 2014). This suggest more elaborate explanatory models should be developed that captures the elements of engagement suggested above and links it back to the characteristics of the platform, services (apps) and the users that together trigger this state of engagement. Examples include flow based (Kim and Han, 2014) and customer experience (Peng et al., 2014) models. Even more grounded theoretical approaches may be required if these effect processes have not previously been captured through established theory (Valvi and West, 2015).

Second, we see that the literature is dominated by studies on success criteria for the adoption of mobile services. This means that the main stream of literature considers adoption of mobile services as the main measure of success. An interesting path for future research would be to dig more into possible effects of using mobile services. Only a few studies reported in this review are concerned with effects of using mobile services. However, the review shows that mobile services can influence customers' behavior (Davis and Sajtos, 2009; Pihlström and Brush, 2008) and their brand perceptions significantly (Rettie et al., 2005; Cameron et al., 2012). We have also learned through the review that different versions of a mobile service can influence responses differently (e.g. personalized versus not personalized) (Cameron et al., 2012) and that the influences of mobile services vary across types of products (Okazaki et al., 2007). Given the unique characteristics of mobile apps, studies focusing influences or effects of using mobile apps should have priority in future research. Bellman et al. (2011) pinpoint that mobile apps typically create a high level of engagement among users. Reasons for a high level of engagement can be that apps often are perceived as useful, they are pull based and not push based (the user download the app based on her own interest), and the user decides the level of personalization of the app. Bellman et al. (2011) also speculate about the possible synergies of offering a variety of complementary services in apps. For marketing research, it is important to more deeply understand the possible influences of these characteristics of mobile apps on customers' brand perceptions, customers' willingness to pay, customers' satisfaction with various dimensions of the shopping experience, customers' perception of a brand's service level, just to mention a few potential effect variables. These are just examples of possible influences that are critical to investigate and understand better. Such studies should be complemented with the inclusion of potential moderating influences of factors such as service- and user characteristics.

Third, only a few of the studies investigate mobile services as part of an in-store experience (e.g. Ittersum et al., 2013; Hosbond and Skov, 2007). A possible path for future research would be to study more specified and personalized mobile services used in a context that the mobile service is tailor-made for. Studying mobile services in such a setting would be an important contribution to the

understanding of what we believe will be the future for both mobile apps in general and branded apps in particular. General research on in-store behavior (Park et al., 1989) shows that 1) in situations of low store knowledge and high time pressure, failure to purchase products that consumers intended to purchase is higher, 2) unplanned purchases are higher when consumers shop under conditions of low store knowledge and no time pressure, 3) brand/product switching due to difficulty in locating preferred brand/products occurs more often when consumers shop in situations characterized by low store knowledge and high time pressure, and 4) purchase deliberation is higher when consumers shop under the conditions of high store knowledge and no time pressure. Among the functionalities that can be included in in-store apps are the possibilities to pre-write shopping list, comparisons of products, coupon redemption, advertising and general brand exposure, servicing, store maps, information about where various products/brands are located including directions, real-time spending information, payment and/or delivery option alternatives, etc. All these features have the potential to increase store knowledge and reduce the time needed for shopping, and therefore, they may influence all four shopping conditions discussed by Park et al. (1989) mentioned above. Consequently, the degree of intended purchases, unplanned purchases, brand/product switching, and purchase deliberation are examples of relevant and interesting effects to include when studying the effects of using mobile in-store apps.

Fourth, we also have to mention the methodologies used in existing research. For the purpose of control, and to be able to isolate causal effects, experiments are the preferred research design. Only a few of the studies reviewed have used experimental designs. Although most of the studies are theoretically well founded– and consequently, establish trustworthy causal relationships based on existing theory – experiments would be a stronger methodological approach to test these causal relationships when studying antecedents to mobile service usage and/or effects of mobile service usage. We therefore call for studies applying stronger methodological designs in future research on mobile services. Typically this can be done by studying influences of apps varying along specific criteria (e.g. high or low level of personalization) and randomized allocation of respondent to the different groups using the various versions of the apps. Inclusion of a control group that do not use apps will also be useful. Pre-measures (and not just post-measures after use) can also strengthen the design – depending a bit on which dependent variables that will be included.

Fifth, only a few of the studies look at how mobile services interact with other channels. All companies today use several channels to communicate with and sell products and services to their customers. A key question is therefore how the combination of channels should be designed to create the most positive influences for the brand. Studies focusing synergies between mobile services and other channels are therefore very important to fully understand the complexity of the

channel mix typically applied by companies today (Fulgoni and Lipsman, 2014). On the other hand, the trend seems to be that all possible functions and features are available on all platforms or in all channels, so called omni-channel marketing. An unresolved issue is thus, if consumers will manage fine with one channel and if the interplay between channels is a less relevant research topic in the future.

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Appendix 1: Search terms used for selection of articles

	Title	«Select a field» (åpent)	
Mobile data service **and**			
Adoption	8	16	
Diffusion	0	3	
Acceptance	1	7	
Consumer	3	23	
Customer	0	18	
Shopping	0	4	
Retail	0	6	
Effect	3	13	
Marketing	0	21	111
App **and**			
Adoption	0	41	
Diffusion	0	8	
Acceptance	1	9	
Consumer	1	115	
Customer	0	87	
Shopping	1	37	
Retail	0	18	
Effect	0	83	
Marketing	1	119	517
Mobile Internet service **and**			
Adoption	1	12	
Diffusion	0	1	
Acceptance	0	7	
Consumer	1	18	
Customer	0	18	
Shopping	0	6	
Retail	0	6	
Effect	1	8	
Marketing	0	8	84
Mobile commerce **and**			
Adoption	5	60	
Diffusion	0	8	
Acceptance	3	42	
Consumer	4	151	
Customer	7	87	
Shopping	0	145	
Retail	0	49	
Effect	1	29	
Marketing	1	106	677

Appendix 2: Service labels used in articles reporting surveys

Type of service	Number of articles
Consumer	
SMS advertising IIIII	5
SMS for personal communication	1
Mobile commerce IIIII IIIII III	13
Mobile service IIIII	5
Mobile telecommunication devices	1
Mobile data service IIIII IIIII I	11
Wireless web services	1
Mobile applications	1
Mobile shopping III	3
Mobile social advertising	1
Mobile Internet IIIII I	6
Mobile advertising IIII	4
Mobile phone ringtones	1
Mobile applications II	2
Mobile banking II	2
Mobile payment III	3
Mobile voice	1
MMS II	2
SMS IIII	4
SMS/MMS	1
Information and entertainment mobile services	1
Mobile marketing IIIII I	6
Paying for parking	1
Mobile information and communication technology	1
Mobile ticketing	1
Mobile device IIII	4
Mobile insurance service	1
Utilitarian mobile information services	1
Mobile brokerage	1
Mobile coupons II	2
SMS, Contact, Payment, Gaming (interactivity/process)	1
Information-oriented mobile applications	1
Business	
Mobile office services	1
Mobile e-business	1

Appendix 3: Statistics on branded apps

The hundred top apps based on applications in Norway and US App Store, investigated as of September, 19, 2014

Free apps in Norway:

2. Tele2 Mine sider (MyPage)
(13. Mattilbud (alle matbutikker))
23. DnB (Banking)
(24. BankID (flere banker))
26. Ruter Billett (Ticketing)
29. KappAhl Life & Style (Fashion)
32. NSB (Ticketing)
34. Scandinavian (Ticketing)
50. VG (News)
56. Mitt Telenor (MyPage)
59. Norwegian Reiseassistent (Ticketing)
65. H&M (Fashion)
67. Sats Elixia (Health)
72. Just Eat (Food)
(76. Zalando (nettbutikk))
77. SP1 Mobilbank (Banking)
81. Norsk Tipping (Betting)
82 Posten sporing (Parcel tracking)
(83. SOBAZAAR (nett/mobilbutikk – Telenor))
86. Nordea Mobilbank (Banking)
(89 EasyPark)
96 RedBull Air Race The Game (Game)
97 Ruter Reise (Ticketing)
100. SP1 Engangskode (Banking)

Of these 19 could be termed branded apps in the traditional sense. 5 are either branded apps with functionality similar to the web-based service the brand offers or co-branded apps. Still, the number of branded apps among the top 100 represents 19%. For the next 100 most popular, 17% are branded apps in some sense. Thus, a rather large part of the free apps market is represented by branded apps among the most popular in Norway.

Looking at the 19 apps that are traditional branded apps, 2 are MyPage apps, 4 are Banking apps, 5 are Ticketing apps, 1 is a News App, 2 are Fashion brand apps, 1 is a Health app, 1 is a Food app, 1 is a Game, 1 is a Betting app and 1 is a Parcel Tracking app. Using the classification scheme of Nysveen et al. (2005), 5 may be considered hedonic apps and the other 14 are goal-directed apps. Even some classified as hedonic here have a rather goal-directed functionality (e.g. the betting app from Norsk Tipping).

63

Paid apps in Norway

45. RS App
70 NJFF Hunting Calls

In Norway, two of the most popular paid apps are branded apps. The Norwegian paid branded apps are rich functionality apps related to the offerings of the brand in their physical market (market place, not space). Thus, the brand is used to leverage the brand image of the physical presence of the brand into the online/mobile context with these apps.

Thus, 2% of the top paid apps in Norway is actually branded apps.

Free apps in US

22. CNBC Business News
28. Wallmart Savings Catcher
69. myAT&T
78. Amazon App
91. Starbucks

Thus, the situation in US is very different from in Norway. Here, only 5 of the top free apps in App Store are branded apps. The types of apps though, are fairly similar to those found in Norway. The Wallmart and Starbuck apps though, have some elements that are not found to the same degree in the most popular branded apps in Norway. The Starbucks app is an experience extension app with some coupon/payment functionality. Coupon elements are also found in the Wallmart app. No such apps are among the most popular single brand apps in Norway. You do, however, find coupon apps in Norway, but only as independent or co-branded apps.

One of the reasons may be that there are local brands that are locally big (e.g. banking) but that they can not compete in numbers at a national level. A sign of this is that many travel support and banking service apps are found among the 200 most popular. Thus, 14% of the apps with a popularity rating between 100 and 200 were branded apps. Still, this fraction is lower than the 17% found in the Norwegian apps market by September 2014.

Paid apps in US

None

None top 100 paid apps in App Store in the US are branded apps. This is also somewhat different from in Norway.

This working paper gives a review of research on mobile services. It starts with an overview of the growth in research on mobile services. Following this, the methodology applied to identify articles for the review is described along with an overview of the journals from which the articles are selected. The articles identified are categorized into conceptual, qualitative, and quantitative contributions. Based on the review, several research gaps are identified.

The main relevant gaps identified are:

1) Only a few studies look into app-based mobile services. This seems reasonable as app-based mobile services are a rather novel type of mobile services, but it is still worrying due to the apparent success of these services.

2) Only a few studies look into effects of using mobile services, and when compared to the large amount of adoption studies, this is emphasized as an interesting path for future research.

3) Only a few studies seem to focus on mobile services developed for specific contexts. A few exceptions are, for example, two studies investigating in-store mobile services – mobile services tailored to support the shopping experience in a specific store. We see this as an interesting direction for future research as we also expect a growth in such types of mobile services in the years to come.

4) We also observe that a rather small part of the studies are applying experiments as the methodological design. To improve the validity of mobile services research, we argue for the importance of applying more experiment based research designs.