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Past, present and future of mobile payments research: A literature review

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Abstract

The mobile payment services markets are currently under transition with a history of numerous tried and failed solutions, and a future of promising but yet uncertain possibilities with potential new technology innovations. At this point of the development, we take a look at the current state of the mobile payment services market from a literature review perspective. We review prior literature on mobile payments, analyze the various factors that impact mobile payment services markets, and suggest directions for future research in this still emerging field. To facilitate the analysis of literature, we propose a framework of four contingency and five competitive force factors, and organize the mobile payment research under the proposed framework. Consumer perspective of mobile payments as well as technical security and trust are best covered by contemporary research. The impacts of social and cultural factors on mobile payments, as well as comparisons between mobile and traditional payment services are entirely uninvestigated issues. Most of the factors outlined by the framework have been addressed by exploratory and early phase studies.

Keywords: Mobile payments (m-payments); Literature review; Future research

1. Introduction

Mobile phones have transformed telephony profoundly. They are equipped with functionalities which surpass telephony needs, and which inspire the development of value-added mobile services, the use of mobile phones as access devices, and mobile commerce in general. The number of mobile phones in use far exceeds any other technical devices that could be used to market, sell, produce, or deliver products and services to consumers. These developments open lucrative opportunities to merchants and service providers.

Purchased products and services have to be paid for. Initially, fixed-line telephony billing systems were modified to charge mobile telephony. Later, mobile telephony billing systems were introduced, and used also to charge various mobile services when such services emerged. Yet, payments based on billing systems have several limitations. These include comparatively high payment transaction fees, merchant and service provider complaints about unfair revenue sharing, and the necessity to provision services to billing systems [66,80]. In some areas, such as the European Union, credited payment services to third parties require a (limited) credit institution license. The lack of suitable payment instruments has for a long time been regarded as a factor that hampers the development of mobile commerce.

Mobile payments are payments for goods, services, and bills with a mobile device (such as a mobile phone, smart-phone, or personal digital assistant (PDA)) by taking advantage of wireless and other communication technologies. Mobile devices can be used in a variety of payment scenarios, such as payment for digital content (e.g., ring tones, logos, news, music, or games), tickets,

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parking fees and transport fares, or to access electronic payment services to pay bills and invoices. Payments for physical goods are also possible, both at vending and ticketing machines, and at manned point-of-sale (POS) terminals.

A mobile payment is carried out with a mobile payment instrument such a mobile credit card or a mobile wallet. In addition to pure mobile payment instruments, most electronic and many physical payment instruments have been mobilized. Furthermore, mobile payments, as all other payments, fall broadly into two categories: payments for daily purchases, and payments of bills (credited payments). For purchases, mobile payments complement or compete with cash, cheques, credit cards, and debit cards. For bills, mobile payments typically provide access to account-based payment instruments such as money transfers, Internet banking payments, direct debit assignments, or electronic invoice acceptance.

In the early 2000s, mobile payment services became a hot topic and remained so even after the burst of the Internet hype. Hundreds of mobile payment services, including access to electronic payments and Internet banking, were introduced all over the world. Strikingly many of these efforts failed. For example, most, if not all, of the dozens of mobile payment services available in EU countries and listed in the ePSO database in 2002 [5] have been discontinued. To facilitate the development of better mobile payment services, it is important to understand the lessons of this history by learning what previous studies have discovered about mobile payments and about the mobile payment services markets, as well as what issues have remained unanswered.

The aim of this paper is to summarize findings from past mobile payments research, and to suggest promising directions for future research. There are a number of factors that highlight the significance and usefulness of such a literature review. Firstly, the field has seen a growing number of publications, yet a thorough review of existing work is missing. The lack of published literature reviews impedes the progress in the field; review articles are critical to strengthening an area as a field of study [88]. Secondly, research so far seems fragmented, and lacks a roadmap or an agenda. Reviewing existing literature not only leads to a better understanding of the state of the research in the field, but it also discerns patterns in the development of the field itself. Finally, a synthesis of existing findings allows researchers not to repeat similar work, and discover important gaps. In other words, it closes areas where a plethora of research already exists, and at the same time uncovers those areas where research is lacking [88].

Another contribution of this literature review is the proposed theoretical framework, around which the review is organized. Webster and Watson [88] recommend that the best reviews need to be conceptually structured, and based on a guiding theory. Our framework provides a guiding structure that allows us to effectively accumulate knowledge, and to interpret previous findings. Because the framework itself aims to explain relevant factors in the mobile payment services market, basing the literature review on the framework ensures that the review is comprehensive and holistic, and reveals research gaps that could otherwise be overlooked. The framework not only helps to explain the existing body of knowledge on each factor of the framework, but, more importantly, it also provides an overview of the mobile payment services market, illustrating how the various perspectives and research findings fit together as part of the big picture.

2. Framework for the literature review

The framework used for the review of literature applies two guiding theories. They are the *five forces model* developed by Porter [68], and the *generic contingency theory*, which emerged from the work of Lawrence and Lorch [41], Perrow [67], and Thompson [81]. The framework is used to classify past research, to analyze research findings of classified studies, and to propose meaningful research questions for future research for each factor.

The prime actors in the mobile payment services market are mobile payment service providers and their customers. Various parties assuming these roles in the market include consumers, merchants, financial institutions and telecom operators. Additional parties, typically vendors of handsets, software, networks and other technologies may also be involved. The power and the interests of these parties impact how technologies and other resources are orchestrated into mobile payment services, and how these services are offered to and used by the market. Moreover, mobile payment services compete for the attention of customers and other parties against physical and electronic payment services. Mobile payment services are a natural choice to pay for mobile services. Yet, to succeed, mobile payment services may have to offer added value and be available for other relevant payment environments as well.

Porter's [68] competitive factors strategy model, or the five forces model, describes both the key role of a mobile payment service provider, and other market factors. The model applies insights from industrial organization theory to analyze the competitive environment on the level of business units [3], and relates the average profitability of the participants in an industry to competitive forces [30]. The basic proposition is that organizational performance mainly depends on the industry structure. According to Pearce and Robinson [65] and Johnson [29], the strengths of Porter's model are that it provides one simple approach to analyze industry structure, identify and determine the attractiveness of an industry, reveal insights on profitability, inform important decisions about whether to leave or enter industries or sectors, and develop strategic options to improve relative performance in the industry or influence relative position in the industry. As one of the most influential management tools for strategic industry analysis [3], the model has been applied by numerous practitioners and academics [30]. The above arguments suggest that the

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model is well suited to guide the classification of literature on the mobile payments services markets.

In addition to the competitive forces within the mobile payments services markets, other factors are believed to impact these markets as well, for example, technology and standards, regulatory activities and legislation, established purchase and payment habits, or national economy infrastructures. If we regard a mobile payment services market as the unit of analysis (organization), these other factors become contingency factors, which influence the performance of the unit but are beyond the influence and control of that unit, as defined in the contingency theory. Contingency theory therefore is also well suited to classify mobile payments research and to capture the environmental factors which are characteristic to the mobile payment services markets.

The roots of contingency theory are typically seen in open systems theory and in Cyert–Simon–March stream of theory (e.g., [23,89]). Contingency theory emphasizes the importance of environmental influences, especially technology, on the management of organizations, and suggests that there is no single best way to manage or organize. The identification of contingency factors is one typical research theme. In addition to technology, other typical contingency factors include cultural, social and economic factors. In the context of mobile payment services markets, it is natural to include regulation, jurisdiction and standardization factors too because financial services and telecommunication are among the most regulated industries, and the use of standards is characteristic to telecommunication.

Two features of contingency theory make it useful for our purposes. Contingency theory is described as a mid-range theory which falls between two extreme views [21,89]. According to one extreme view, it is possible to find universally true theories, whereas the other one claims that each unit of analysis is unique and has to be analyzed based on situational factors. Contingency theory postulates that environmental factors are important but also that the impacts of environmental factors are systematic, rather than entirely situational. The contingency approach is useful for the classification of mobile payment research, since, for example, mobile payment services differ between markets, such as Japan, various European countries, or the USA, but they do so in systematic ways, for instance due to differences in payment technology infrastructure, regulation, laws, or habits.

The other useful feature of contingency theory is the "environment – strategy – performance" link [21]. The theory claims that the environment, such as the amount and type of regulation, impacts the structure of the organization, by, for example, influencing which entities have incentives to become mobile payment service providers. This, in turn, impacts performance, such as adoption interests of merchants and consumers. Another example is that enhanced technology makes it possible to provide enhanced services, which in turn increases interest toward the services.

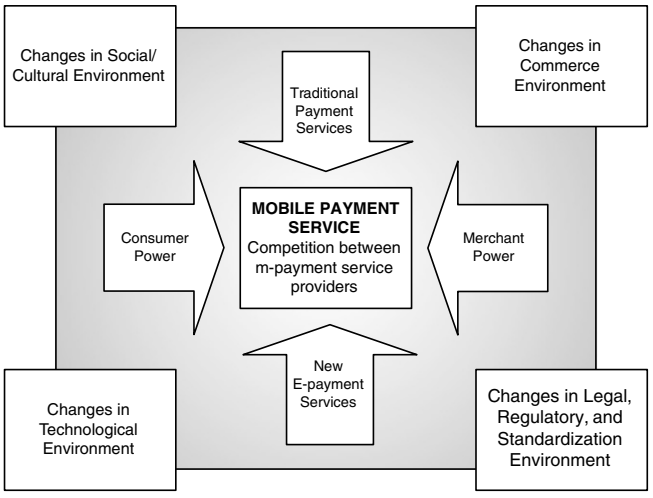

Fig. 1. Framework of factors impacting the mobile payment services market.

The resulting framework is presented in Fig. 1. The framework is multi-faceted since it includes both market factors and contingency factors. The inner facet of the framework, that is competitive factors, describes the five main competitive forces of the mobile payment services markets. The outer facet of the framework includes contingency factors, that is, technological, social/cultural, commercial, and legal/regulatory/standardization.

In addition to the theoretical basis described above, the framework has also been influenced by research models proposed in earlier studies [10,28,27]. Jayawardhena and Foley [28] proposed that changes in technological, cultural, commercial and legal factors, together with the competitive forces of financial services market, drive financial services development. Javalgi and Ramsey [27] suggested that information technology and telecommunication, social/cultural, commercial, and government/legal factors impact the diffusion of global eCommerce. Dahlberg and Mallat [10] combined these two models to describe factors which characterize mobile payment services markets and impact the diffusion of these services.

We stress that the framework can be used as a meta-model to classify the existing literature, and as a research model to examine the different factors that influence the mobile payments services market. The framework is useful for these purposes because: (1) it is based on guiding theories, is conceptually sound, and draws from previous research; (2) it helps to bring clarity to the multiple topics and to the vague, conflicting terminology present in professional and academic mobile payment literature; and (3) it shows clearly what factors impact the mobile payments services market and services development, another issue in need of clarity.

3. Research method

To determine the current state of and future directions for mobile payment research we conducted an extensive

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literature review. The first phase of the review was to determine the review scope and relevant source material. Since mobile payments are an interdisciplinary topic similar to electronic and mobile business, relevant articles are published in a wide variety of journals. Furthermore, mobile payment research is still an emerging research area and most of the contemporary research is published in conference proceedings. Therefore, we included both academic journal papers from various disciplines and also conference proceedings in our search. Despite a potentially lower quality of the conference proceedings, they are informative for charting the current research topics in this rapidly progressing area of research, and for identifying gaps to be covered by future research. We also expect that the best conference papers will evolve to journal articles and thus serve as leading indicators for the focus of future journal publications. Book chapters were excluded from the search as they are not peer reviewed.

We started the literature search with a wide systematic scan of online academic journal and conference databases. The following databases were searched:

- ProQuest Direct
- EBSCO Business Source Premier
- ScienceDirect
- IEEE Xplore
- ACM Digital Library
- AIS eLibrary
- M-lit online bibliographical database dedicated to mobile business literature
- Google Scholar for academic conference papers

From the papers identified we also went backwards by reviewing other work of the authors as well as citations in the papers [88]. Search was based on the descriptors "mobile payments", "m-payments", and "wireless payments" that were to be found in the title or abstract of the paper. We excluded papers where mobile payments were just a minor section of a research on mobile commerce or e-payments.

To ensure the quality of the conference papers we focused our search on a few established conferences in the fields of IS, electronic commerce and mobile business that are listed in Table 1. Not all of the selected conferences had published papers about mobile payments. The IEEE proceedings include various conferences that were searched through the IEEE Xplore. Some of the papers published in the IEEE proceedings were highly technical, addressing mostly engineering and computer science topics, and were thus excluded from the review. The selected conferences utilize a selective peer review process, with the exception of the Mobility Roundtable conference, which was included due to its high relevance and since recent and ongoing research is presented there. The search resulted in 73 papers, which were published between 1999 and August 2006.

In the second phase of the review we classified the papers into the nine categories according to our framework. The classification proceeded as follows. Two researchers independently reviewed the title, abstract and discussion/conclusions sections of the paper and determined its main topic, for example, consumers. The researchers then classified the paper to the corresponding factor within the framework. The two classifications were subsequently compared and, in case of differing results, a third researcher repeated the classification. The most common factor was then selected. Some publications focused on several factors, but not on any in detail, which called for a new classification of 'multiple categories' papers. Several other papers presented market overviews [11,19,53,84], summarizing the state of mobile payments, its challenges or potentials – such papers were classified as 'overviews'. Two of the papers focused in detail on two factors and relationships between them, so they were included in both categories [83,91].

Table 1
Conferences included in the literature search

Conferences by topics
Information Systems
International Conference on Information Systems, ICIS
Hawaii International Conference on System Sciences, HICSS
Americas Conference on Information Systems, AMCIS
European Conference on Information Systems, ECIS
Pacific Asia Conference on Information Systems, PACIS
Australasian Conference on Information Systems, ACIS
IEEE Conference proceedings
Electronic Commerce
Bled Electronic Commerce Conference, BLED
International Conference on Electronic Commerce, ICEC
International Conference on Electronic Business, ICEB
IADIS International Conference on E-Commerce
IADIS International Conference on WWW/Internet
Mobile Commerce
International Conference on Mobile Business, ICMB (previously mBusiness)
Mobility Roundtable

Next, we analyzed methodologies used. We first classified each research to 'empirical' and 'conceptual' and then divided the 'empirical' further to 'qualitative', 'quantitative' and 'design research'. Most technical papers proposed conceptual constructs but some mainly described technologies, therefore we divided conceptual studies into proposed constructions and descriptions. The reader should note that all studies regarding the technology factor that were classified as 'empirical' evaluated the proposed construction.

4. Results of the analysis

4.1. Descriptive findings

As the previous section explained, our literature search followed established procedures and criteria that ended up in the classification of 73 mobile payment publications. Fig. 2 reveals a number of papers that address topics

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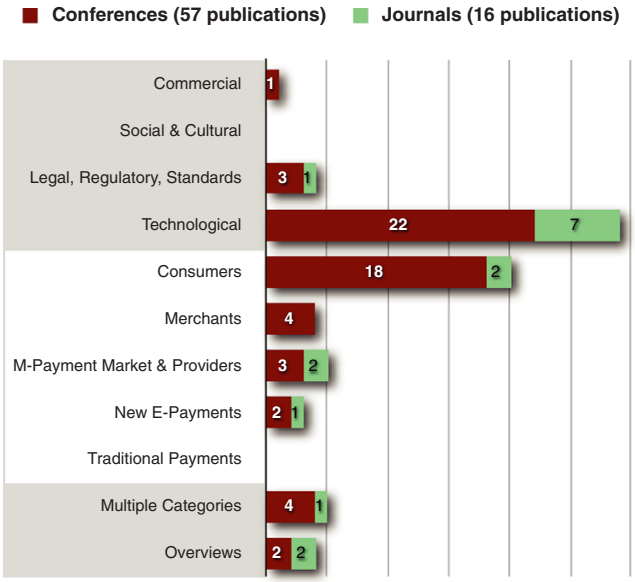

Fig. 2. Mobile payment papers by conference/journal publication.

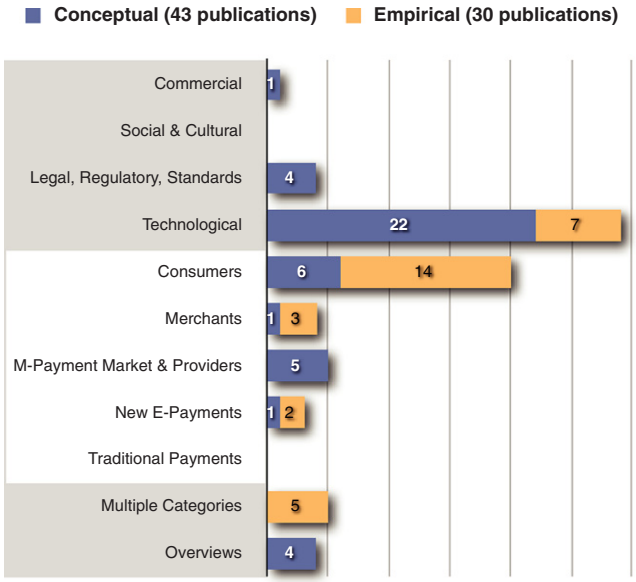

Fig. 3. Mobile payment publications by empirical/conceptual approach.

within each of the framework's factors. As a reminder, two of the reviewed papers addressed two factors in detail: one dealt with both Consumers and Merchants [83], and another one with both Consumers and Technological issues [91].

The classification in Fig. 2 shows that Technology is the most researched factor with 29 publications, followed by 20 publications that focused on Consumers. Mobile Payment Services Market & Providers, Merchant Power, Legal/Regulatory & Standards, as well as New E-Payments have each been the focus of just a few studies. Some articles have studied many factors simultaneously, which may be important to discover how the factors influence each other. There is only one paper that deals with the Commercial Environment changes, and none that addresses mobile payment's Social & Cultural influences, and its relation to Traditional Payments.

In addition to the classification of mobile payments articles based on their topic as well as a method used, our literature review also revealed how many papers have been published in journals, as opposed to conference proceedings. The summary is shown in Fig. 2 as well. Of all the papers reviewed, 57 were published in conference proceedings and 16 in journals. The highest number of journal publications has a technological focus. Other factors have been marginally represented in journals, which highlights the importance of this special journal issue.

Further analysis revealed that 30 mobile payment publications were based on empirical research methods, while 43 were conceptual (see Fig. 3). The highest number of empirical studies has been conducted in the area of Consumer Power (70% of all the papers in this factor). Technological papers on mobile payments are mostly conceptual, with only seven (less than 25%) empirical verifications of proposed constructions.

Table 2
Breakdown of methods used in the empirical studies

Method used	Number of papers
Interviews	9
Focus groups	4
Open-ended web surveys	2
Quantitative surveys	9
Experiment/simulation	1
Design research	5

Another interesting finding is the breakdown of methods used in the 30 empirical studies. There have been 15 qualitative studies (interviews, focus groups, and open-ended surveys), 10 quantitative studies (surveys and experiment/simulation), and 5 design research studies where a working system or a prototype was built to evaluate the results(see Table 2).

4.2. Findings for the contingency factors

The four outer factors of our research framework are changing social/cultural, commercial, technical, and legal/regulatory/standards environment. These contingency factors have significant impacts on the mobile payment services market but are outside of the influence and control of the market. The ability to understand and explain these impacts is important for both researchers and managers [28].

4.2.1. Changing social and cultural environment

People's social and cultural environments affect their consumption habits, buying behavior, and thus their needs for new payment services. Changes in these environments can trigger various needs and thus affect the supply and demand of new payment services. Examples include, but are not limited to, changing payment cultures, greater mobility of people, and increased appreciation for leisure

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time. Mobile payment research on these factors was expected to compare the characteristics of various social and cultural environments, and to examine which characteristics affect the development and success of mobile payments services markets.

We did not identify any academic papers that would have investigated the effects of social and cultural changes on the demand and development of mobile payment services. Relevant research reports and studies within related fields (other payment services or wireless communication) have identified specific social and cultural issues that may be important to mobile payment studies. These include distinguishable payment cultures in various countries, industry strengths, electronic banking readiness of consumers, strong mobile phone inclination of certain nations [2]; cultural similarity and adoption timing [77]; demographics and lifestyle characteristics, or cultural differences in developed and developing countries [50]. Since we found no studies on mobile payments that would have addressed such issues, it is especially important for future research to study how the social and cultural factors influence mobile payments services markets. We propose the following research questions for future research:

RESEARCH QUESTION 1.1: What are the cultural and lifestyle differences between countries that affect the demand for mobile payment services?

Research on mobile commerce has discussed the impact of lifestyle and cultural differences on the formation of mobile commerce market and on the adoption of mobile services. These studies have enhanced knowledge on mobile commerce adoption and also questioned some common but ambiguous conceptions such as the positive impact of commuting on the use of mobile services [76]. Influential lifestyle and cultural factors should be charted in the context of mobile payment services as well. A specific part of the overall culture and lifestyle of the society is that of the payment culture. To address this issue we propose:

RESEARCH QUESTION 1.2: How do the characteristics of different payment cultures and systems between countries impact the development and success of mobile payment services markets?

International banking statistics (e.g., The Bank of International Settlements or European Central Bank) demonstrate that different payment cultures exist, for example, the cash-centric culture of Japan, the account/giro-centric cultures of Germany and Scandinavia, and the wide use of cheques in the USA and France [2]. It is important for future mobile payments research to recognize these differences and to examine how they impact mobile payment services. A unique opportunity for cultural studies within the Euro currency countries of the EU is open during the time that payments are harmonized into the Single Euro Payment Area (SEPA) in these countries. Empirical multi-cultural comparisons are suggested as a suitable approach for research questions 1.1 and 1.2.

4.2.2. Changing commercial environment

Changes in the commercial environment include the development of the Internet and mobile networks into commercial channels, as well as increasing automation and self-service orientation of payment services. Other aspects of this factor include the structure and development of financial, telecommunication and ICT infrastructures and markets within the studied environments. Changes in the commercial environment may trigger the development of new or enhanced mobile payment services. We expected that mobile payments research in this factor had looked at how market structures, business practices and infrastructures have changed, and how these changes influence the development and success of mobile payments.

The literature search provided only one paper addressing this factor. Hampe et al. [24] discuss the foundations of mobile electronic commerce and analyze those characteristics of mobile telephony that offer potential for mobile telecommunication service providers to take a greater role in retail payments. The authors suggest that increasing integration of mobile telecommunication and electronic commerce, and the growing use of ubiquitous mobile computing will enhance the role of telecommunication companies as payment service providers.

Research on this factor is clearly underrepresented. Thus, there is a need for rigorous research on how commercial environments impact the development and success of mobile payment services. We propose the following research questions for future research:

RESEARCH QUESTION 2: What is the impact of the financial services market structures on the development and success of mobile payment services markets?

The structures of financial services markets within various countries may support or inhibit the development of mobile payment services. In bank-centric financial systems most entities have bank account, payment transactions are typically transfers between accounts, and banks have a strong mediator role. In market-centric financial systems, the proportion of bearer-held instruments (issued and traded through capital markets) is important, cash and cheques could be used frequently for payments, and banks have a less dominant role. It is important for mobile payments research to understand how different financial systems and also how the degree of electronification of financial services influences mobile payment services markets.

RESEARCH QUESTION 3: What is the impact of the telecommunication infrastructure on the development and success of mobile payment services markets?

Differences in information and telecommunication infrastructures between countries may guide the development of payment services. Japan, for example, is characterized by a strong mobile telecommunication infrastructure and a relatively weaker fixed-line Internet infrastructure. The mobile on-line payment services may, for that reason, find a strong basis for their development. In the US, on the

other hand, fixed-line Internet infrastructure has been prevailing and Internet-based payment systems, such as PayPal or iTunes are actively developed [4].

RESEARCH QUESTION 4: How do the telecommunication market structures in a given country impact the organization of the respective mobile payment services markets and the developers of the mobile payment services?

The impact of telecommunication market structures can be examined by comparing, for example, the consequences of NTT Docomo's dominant position in Japan to those of more open telecommunication markets in the US and especially in Europe. While different telecommunication market structures have been analyzed in the context of mobile telecommunication market in general, similar studies should be conducted in the context of mobile payment services. Expert interviews and comparative case studies are suggested as a suitable approach for solving research questions 2–4.

4.2.3. Changing technological environment

Technological environment consists of wireless and other related technologies which are used to develop and produce mobile payment services. Some of these technologies develop slowly, such as mobile network technology or transaction protocols. Some other technologies have very short development cycles, such as mobile handsets and their components. Continuous development of technologies facilitates more reliable, user friendly, versatile, and functionally rich mobile payment services.

Research on technologies was expected to analyze the strengths and limitations of various technologies and to propose new technological advancements to improve mobile payment services and remove identified technical limitations. Research was also expected to evaluate the implementability of proposed technologies, as well as to achieve expected technical and technology enabled improvements with prototypes, pilots and with evaluations of implemented payment services. Studies were expected to apply constructive approaches and to verify the proposed construction with evaluative empirical evidence.

By taking into consideration the large number of failures and the current status of mobile payment services, we expected to find research on the following four technology themes: security and trust mechanisms including comparisons of various technology alternatives, mobile payment transaction protocols including roaming between mobile networks, comparisons of the benefits and limitations of main mobile payment service architectures, and descriptions of near field communication (NFC) and short range wireless technologies in general.

It is not surprising that the technological environment has been the most researched factor as calculated by the number of papers. The analysis of the 29 papers revealed that the themes shown in Table 3 have been investigated. As expected, proposals of technical constructions for mobile payment systems and mechanisms addressing overall architecture, security and trust, transaction protocol details, and the use of short-range wireless technologies are well represented. On the other hand, there were no real technical comparisons over alternative security and trust mechanisms. What was even more surprising is that research on roaming between networks is almost non-existent. The absence of transaction standards other than those for voice and basic messages in the second and third generation mobile telecom specifications prevents interoperability (roaming) between networks for mobile payment transactions and advanced mobile commerce transactions in general. This problem is discussed briefly in [32]. Comparisons between system 'architectures' are missing as well. Most notable exceptions are [66,80] who discuss the limitations of billing-based mobile payment services and propose improvements.

As a whole, the analyzed literature covers only fragments of technologies used to develop and produce mobile payment services. Even by reading all the papers shown in Table 3, one probably finds it difficult to form a high-level holistic understanding of the technology base of mobile payments. There are, however, specific topics which are comparatively well covered. Firstly, the technical security and trust issues have been addressed in several large research projects and the issues are thus well

Table 3
Focus of mobile payment publications in technological factor

Theme of research	References	Descriptions, speculations	Proposed, constructions	Empirical, Proto, Field
Proposals of m-payment systems	[1,15,18,20,22,39, 43,49,56,66,75]	0	11	5
Proposals of tools or mechanisms for m-payment transactions	[25,79,85,90]	2	2	1
Proposals of protocols for m-payment transactions	[36–38,44,48,80]	0	5	0
Proposals of tools or mechanisms for security and trust	[18,32,40,56,57]	1	4	2
Technology descriptions with a focus on security and trust	[25,55,57,58]	2	2	0
Technology descriptions of m-payments	[6,71,91]	3	0	0
Of total 29 of papers, 4 papers address 2 themes		7	22	7

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understood (e.g., [32,57,58]). Secondly, several recent papers address the use of NFC and short-range wireless technologies such as Bluetooth, Infrared, radio frequency identification (RFID) (e.g., [6,71,91]). The mentioned papers, however, mainly list and describe these technologies and their layers. Thirdly, authentication and accountability in secure electronic transaction (SET) environments used, for example, in the connection of Visa credit cards have been covered. Kungpisdan et al. [36–38] describe in detail how accountability disputes can be resolved with their logic protocol and how their symmetric key protocol can be used to improve transaction security as compared to those of SET and iPK. DiPietro et al. [18] explain an authentication scheme for financial transactions in SET environments. The SET standard preceded the current EMV (Eurocard, Mastercard, Visa) standard.

In only seven papers, constructions proposed were also evaluated empirically. In six cases evaluation was done with (laboratory) prototypes [20,32,39,56,66,85] and in one case [49] with a field experiment. Thus, evaluations of implemented mobile payment systems or services have not been conducted.

We conclude that despite the large number of papers, many issues in the technology environment have not been investigated thoroughly and some issues seem to be poorly understood. Academics investigating mobile payment services need to have a more profound understanding of the underlying technology to guarantee that their studies provide contributions. Based on the analysis, we offer three research questions for future research:

RESEARCH QUESTION 5: What are the technological and technology-related strengths and limitations of the main technology 'architectures'?

Current mobile payment services typically apply one of the following technology architectures: (1) mobile billing systems (mobile network elements/billing and/or separate billing software), (2) stored value account systems (e.g., wallets) usually with light authentication (e.g., SIM-card, intelligent network subscriber register, and/or mobile handset identifications), where handsets can use short range wireless technologies (e.g., to communicate with vending machines), (3) account based systems with strong authentication needed to commit large value payments (e.g., EMV services based on the 4D secure model and the use of wireless PKI for authentication), and (4) use of mobile handsets to access electronic payment services (e.g., payment with an Internet banking service), often with proprietary strong authentication (e.g., credentials issued by a bank to its customers). There is a clear need for studies which systematically describe the technical composition of main architecture alternatives, and compare typical use situations, strengths and limitations of each architecture for providing mobile payment services. The wide variety of mobile payment pilots, service launches and the numerous failures of past efforts motivate this research. Research could also help the positioning of proposed constructions, and assist in separating case-specific idiosyncratic features from generic concepts. Such understanding could be used to plan, validate and describe the context of research on other mobile payment issues. Solving this research question could start with a literature review which would capture the characteristics of the main 'architectures', analyse their use areas, strengths and limitations, as well as list main mobile payment service providers. Case studies, expert interviews, and surveys among mobile payment service providers could then verify and complement the findings of literature reviews.

RESEARCH QUESTION 6: What security and trust mechanisms fit various types of mobile payment services?

The centricity of security and trust in mobile payment services is the motivator for this research question. There is a trade-off between security and, for example, ease of use. It is not clear whether we have too little or too much security in various types of mobile payment services. This issue could also be investigated from legal and behavioral perspectives since trust is both a technical and a social phenomenon. Exploration of this research question could start with user and expert interviews, continue with case studies followed by design research and comparative field studies.

RESEARCH QUESTION 7: Can standardized transaction protocols and interoperability mechanisms help to solve the roaming problem between networks to facilitate mobile commerce and payment transactions?

This urgent research question has been addressed by numerous practitioners, so far with limited success. This difficult issue seems well suited for academic research; it has been able to successfully solve other difficult technological problems, related to the architecture of relational databases, programming languages, Internet and data communication. The proposals of academics – often backed by visionary practitioners – have opened up developments of practical technological tools and services. The best way to solve this research question is probably to use theoretical deduction and to test the theoretical constructions with logical, conceptual testing.

4.2.4. Changing legal, regulatory, and standardization environment

Changes in the legal, regulatory and standardization environment deal with evolving jurisdiction, regulations and other norms with requirements to comply. These contingency items may trigger needs for new or enhanced payment services, and drive or hinder the development of mobile payments. Mobile payments research on this factor was expected to examine the impact of regulation, legislation and standardization on the development and success of mobile payment services markets.

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Cross-border mobile transactions can be complex due to a complicated web of law and regulations [72]. Previous studies on the regulation of international mobile payment services suggest that unifying regulation and legal frameworks such as the EU directives in the European Commission may reduce complexity and support the development of international mobile payment services [33,72]. Karnouskos and Vilmos [33] present the secure mobile payment service (SEMOPS) initiative as an example of an international mobile payment project that aims to respond to the challenges presented to an international mobile payment service.

The process of standardization for mobile payments has been another focus of the prior mobile payment research [33,45,46]. The cited studies identify various organizations that aim to standardize and develop mobile payment services but also note that none of these organizations has a dominant role in standardization and that there are differences in the requirements and in the preferences they set for standards [33,45]. Currently, the mobile payment services market is at a pre-standardization phase where no collective standards have been achieved and where various industries and consortia, most notably the financial and telecommunication industries, compete to form the dominant standard [45]. Some studies which have looked at the mobile payment services market from the point of view of multiple actors have discussed the standardization of mobile payments and emphasized the need for a technological and organizational consensus between the players in the industry [62–64].

The current research on legislation and standardization of mobile payments provides an informative description on the complexities and problems surrounding these topics. Yet, there are no good solutions to solve these legislation and standardization issues. We thus propose the following research questions for future research:

RESEARCH QUESTION 8.1: How much and what kind of legislation is needed to support mobile payment services within specific countries and markets, and also internationally?

Legislation concerning mobile payments, such as the e-money directive in the EU, is only currently being formulated. Important questions for future research include the role and the extent of regulation needed to provide a viable, fair and secure environment for various parties in the mobile payment services market.

RESEARCH QUESTION 8.2: What regulatory bodies should have the authority to regulate mobile payment services within countries and internationally?

Previous studies have emphasized the need to unify laws and regulation to facilitate the development of international mobile payment services. It may be complicated, however, to determine the responsibilities and division of work between the national and international legislative bodies. Future research should therefore address this question and examine the most optimal mechanisms and bodies for regulating international mobile payment services.

RESEARCH QUESTION 9: How should effective standardization be formed for mobile payments and by whom?

Prior studies which have emphasized the need for common standards for advancing the mobile payment services markets [62–64] motivate this research question. Prior studies have also detected that the current state and the outlook of the standardization process for mobile payments is problematic [45,46]. Future research could therefore try to determine critical parties needed to support common standards and make suggestions for effective forums and mechanisms through which standards can be advanced more effectively. Research approaches suitable to address research questions 8.1–9 include expert interviews and case studies, augmented with legal analysis.

4.3. Findings for competitive factors

The five inner factors of our framework are consumer power, merchant power, traditional payment services (barriers to entry), new e-payment services (substitutes), and mobile payment service providers. These competitive factors drive the developments of mobile payment services markets and determine market structures.

4.3.1. Consumer power

Consumers place demands on mobile payment services and drive their success by adopting and using specific services. Information systems research has developed and applied various technology acceptance [16] and diffusion models [73]; it was expected that research had explored the suitability of such models in mobile payments context, and possibly modified them to suit the specific characteristics of this context. We also expected to find studies which investigate consumer attitudes towards paying with mobile devices and examine which characteristics of the new payment services drive or inhibit the adoption. Consumers may be willing to accept the non-fulfillment of some criteria, but reject services based on specific weaknesses. Thus, we expected to detect empirical research where the criteria would have been rated on their importance in order to reveal which of the indicators mattered most to consumers. On the other hand, we also expected to find qualitative studies which would supplement quantitative findings with more in-depth explanations of consumers' attitudes and expectations. Such consumer-centric research would ensure that payment service providers, when implementing their services, will fulfill the real needs of consumers, not just the assumed ones.

Method-wise we expected to find case studies, surveys or design research where potential users had indicated what problems other methods of payments have, and what their payment habits, preferences and behaviors are. We also expected to find investigations on existing users and their daily use of mobile payment services. The existing users

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could provide insights grounded in their first-hand experience, and such studies might also have revealed findings which differ from projected views and expectations of both mobile payment service providers and non-users.

The analysis of mobile payments consumer research revealed that most of the studies did indeed investigate adoption factors (see Table 4). This is not surprising since technology adoption is a popular topic in information systems research. It seems especially important in an emerging area such as mobile payments.

As also expected, adoption/acceptance research often involved traditional acceptance models. The research was mostly based on the *technology acceptance model* (TAM) [16] and *diffusion of innovations model* [73]. The analysed studies often used the models as the base of their research, investigating whether the models' theoretical constructs are also likely to influence the intention to use, and the actual use of a mobile payment service (e.g., [7,8,13,14,34]), or examining whether consumers are ready to adopt mobile payments based on the assumed factors [17]. Some studies proposed additional factors that are considered specific to the mobile payment environment, such as cost [34,51,52,69,83,95], network externalities [51], trust and security [13,12] or mobility [52,95]. Table 5 summarizes the various acceptance factors proposed. The factors in italics and with a minus sign are the ones that would negatively affect adoption, such as high perceived risk of using a procedure. The especially important adoption factors for mobile payment services seem to be ease of use, trust and security, usefulness, cost, and compatibility (see Table 5 for the authors of the studies).

Further analysis revealed that a number of consumer adoption studies did include users who already had experience with mobile payments [14,51]. These participants could comment on their concrete experience with mobile payment services.

As shown in Table 4, there have also been attempts to categorize mobile payment services. Classification of services may help researchers in this still emerging field where confusing initiatives take place. A consumer-centric view means that studies had focused on characteristics that matter to consumers, which may help adoption studies [93]. Properties used to classify mobile payment services have included, for example, registration requirements, value of payment, and cost of transactions [93]. Another classification included Internet payment services, POS mobile payments, payment for mobile commerce services, and person-to-person mobile payments [82]. In another classification study [47], security items that mattered most to consumers were confidentiality and encryption.

Table 5
The constructs used to study consumer adoption

Constructs	References
Attractiveness of alternative (–)	[51]
Cost (–)	[34,51,52,69,83,94,95]
Convenience	[8,14,17,69]
Context	[52]
Compatibility	[7,8,14,42,51,52]
Ease of use	[7,8,13,14,12,17,34,51,52,83,94,95]
Expressiveness	[95]
Mobility	[52,95]
Network externalities	[51]
Observability	[7]
Privacy	[8,17]
Risk (–)	[8,51,52,83]
Security	[8,17,69,94]
Social influence	[14,34,42,52]
Speed of transaction	[8,14,17]
System quality	[34,42]
Technology anxiety (–)	[42]
Trialability	[7]
Trust	[14,12,51,52,94,95]
Usefulness	[7,8,13,12,17,34,52,94,95]

As can be seen in Table 4, the methodologies used to study the consumer factor are balanced between quantitative and qualitative approaches. Researchers conducted surveys for quantitative data, and mostly focus groups for qualitative data. This has ensured that a number of perspectives have been covered. A few papers were conceptual as they presented models and frameworks but did not validate them empirically.

To sum up, in order to launch mobile payment services that will be adopted by consumers, it is crucial to understand user adoption factors. This is a relatively well explored issue with both quantitative and qualitative studies. The findings include the direct experience of actual users. The adoption factors can be further explored to discover more specific recommendations that can be applied by mobile payment service providers. What seems still to be missing as well is research that would explore the extent to which consumers should have an influence on the development of these services. Research questions offered for future research are:

RESEARCH QUESTION 10: What are specific needs of consumers regarding the adoption factors established in existing research?

Table 4
Focus of mobile payment publications in consumer factor

Theme of research	References	Empirical qualitative	Empirical quantitative	Conceptual speculative commentary
Consumer adoption/acceptance	[7,8,12–14,17,34,42,51, 52,69,70,83,95]	4	7	4
Classification and analysis of m-payment solutions with a consumer-centric view	[47,82,93,94]	1	1	2
Consumer value perceptions	[10]	1		

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To advance consumer adoption research, each adoption factor should be investigated in more detail. Cost, for example, was identified as an important adoption factor. Research should find out what will be an acceptable cost to consumers, in various payment scenarios and for various products and services. Similarly, usefulness has been confirmed as an important adoption factor. Further research should reveal what consumers mean when they think of "usefulness" in the context of mobile payment services. Qualitative studies using interviews or focus groups would help to reveal further details about the adoption factors identified in the previous research.

RESEARCH QUESTION 11: How should consumers be involved in the development of mobile payment services?

Consumer influence on the development of new mobile payment services most likely contributes to their success. The consumer power needs to be understood in order to build mobile payment services that consumers will use. However, consumers do not necessarily have a direct influence on service providers at an early stage of service development, and with limited consumer influence, the risks of solutions failure may increase. A possible research approach could be conducting case studies of existing initiatives and learning from them how consumers can be successfully involved in such projects, and identifying mistakes that should be avoided in the future.

4.3.2. Merchant power

Similar to consumers, merchants are adopters of payment solutions. Merchants create the market for financial institutions and other mobile payment service providers by accepting payments with mobile payment instruments (acquirer role) or even by issuing them (issuer role). Their active participation in promoting a payment service is crucial to consolidate a large number of points of acceptance. Research was expected to look into the role of the merchants in terms of adoption and market development actions. Adoption factors were expected to be studied with a focus on understanding how to design mobile payment services for merchants. In terms of market development, we expected to identify studies on merchants' participation to network externalities creation.

Surprisingly, we identified only four papers focusing exclusively on merchants. Three of them uncovered the various barriers to the merchant adoption [54,83,78]. Researchers found barriers such as high costs (transaction fees), complexity (ease of use), lack of relative advantage, low compatibility, and the interdependence between consumers and merchants at an early stage of development. One of the papers proposed an original POS architecture for effective payment processes and consumer loyalty enhancement [60].

In terms of methodologies, it was surprising to us that merchant adoption had not been studied with quantitative data and surveys, as had been the case in consumer adoption research. Quantitative studies are needed to add to the existing qualitative results and contribute to a better understanding of merchant adoption factors. The analysis results for the merchant factor literature are shown in Table 6.

The number and diversity of publications is disappointing compared to the number of consumer studies. We propose the following research questions for future research:

RESEARCH QUESTION 12: How to involve merchants in the design and development of mobile payment services?

The participation of merchants in the design and development of mobile payments services is crucial. There is a need to better understand what roles merchants should have in the development process. Many failures of payment services may be explained by the lack of involvement of merchants during the early stages of design. Researchers need to discover how the active participation of merchants should be organized in order to maximize the chance of success. Design science research seems useful for addressing this research question.

RESEARCH QUESTION 13: How should merchants redesign their business processes to realize potential value from the mobile payment technology?

Previous studies suggest that incompatibility of mobile payments with existing business was one of the main barriers to merchant adoption [54]. Future research therefore needs to investigate the role of process redesign in the use of mobile payment services and thus enhancement of existing businesses.

RESEARCH QUESTION 14.1: What are the appropriate incentives to attract merchants to an existing mobile payment services network?

Merchants need incentives to adopt mobile payments. At the same time, the participation of the merchants is the key in securing a high number of acceptance points for mobile payment instruments. A more profound understanding and analysis of merchants expectations and incentives is thus needed.

RESEARCH QUESTION 14.2: How can merchants effectively enhance network externalities of an existing mobile payment service?

Future research needs to explore how merchants can best attract customers and other merchants to an existing mobile payment services network. Case studies appear useful for addressing research questions 13 and

Table 6
Focus of mobile payment publications in merchant factor

Theme of research	References	Empirical qualitative interviews	Conceptual speculative commentary
Merchants adoption/ acceptance	[54,78,83]	3	0
Mobile payment POS architecture for merchants	[60]	0	1

14. Research is helpful to uncover patterns related to the merchants' role and also the "chicken- and-egg" dilemma.

4.3.3. The traditional payment services

International banking statistics (e.g., The Bank of International Settlements or European Central Bank) show that popular payment instruments used for the payments of daily purchases include cash, cheques, debit and credit cards [2]. The development of mobile commerce establishes the basic demand for mobile payment services. If mobile payments diffuse, then the use of some traditional payment services has to decrease at least proportionally. Mobile payment instruments may threaten the position of current payment instruments and new parties may enter the payment services markets (e.g., mobile network operators). New features of mobile technology such as contact-less payment schemes may make some traditional instruments disappear (e.g., contactless magnetic cards). It is, however, also possible that mobile phones are just a new access channel for current card and account-based payment services. Thus, we expected to find research which had compared traditional and mobile payment services, and also research on which properties mobile payments should be able to offer in order to replace traditional payment services.

None of the found articles focused solely on the comparison between traditional and mobile payment services. Four multiple categories papers written by Ondrus and Pigneur tackle the confrontation between traditional and mobile technologies [61–64]. Their findings indicate that cards were still preferred to phones for payments in Switzerland from an industry point of view. Moreover, their results suggest that mobile payments are more likely to become a complement for existing payment instruments at the early stages of development. Similarly Dahlberg and Öörni [14] report that in Finland mobile payment instruments are marginally used to pay for both daily purchases (as compared to five other payment instruments) and for invoices (as compared to four other payment instruments). We propose the following research questions for future research:

RESEARCH QUESTION 15: What features of traditional payment services could slow down the proliferation of mobile payment services?

If consumers are satisfied with traditional payment instruments, as the study of [14] implies, then future research should clarify what specific factors hinder the diffusion of mobile payment services. Mobile payment services may need to offer valuable properties that traditional payment services do not have, and at the same time include the most valuable properties of the services replaced.

RESEARCH QUESTION 16: What are the dynamics between mobile and traditional payment services?

Mobile payment services may complement or substitute traditional payment services. Researchers should investigate which payment instruments are used in various payment scenarios to improve knowledge about payment habits and their changes. The ability to discover in which scenarios traditional payment services are not appropriate will provide hints about where and when mobile payment services should be used. Consumer and merchant surveys, as well as payment service provider interviews seem appropriate approaches to tackle research questions 15 and 16.

4.3.4. New electronic payment services

When electronic commerce created need for electronic payment services, financial institutions brought to markets new services extending traditional card and account-based payment instruments, and introduced Internet banking/payments, e-invoices, and e-direct debit/credit assignments for bill and invoice payments. A few new intermediaries such as PayPal, Peppercoin and Paystone seem to have succeeded in fulfilling some of the needs of online merchants and consumers; apparently credit card-based services were not adapted fast enough or appeared vulnerable to fraud and identification theft. Thus, a new generation of payment service providers were able to emerge to complement, and sometimes compete with, existing service providers. We expected to find research which compared e-payment services with mobile payment services. These studies were expected to focus on the underlying differences between the two payment methods and their applicability for specific payment scenarios.

We found only four papers that had addressed this factor. As a reminder, we only reviewed articles which compared mobile and e-payment services. Chou et al. [9] evaluated various payment technology alternatives using technological, economic, and social factors. The results showed that payments charged to the telecom bill were the least preferred alternative. Jaring et al. [26] analyzed various micropayment methods and discussed their current status in Finland.

Salut and Galuszewska [74] described the impact of e-payment solutions on the banking industry. We identified a lack of depth in comparisons between e-payment and m-payment services; therefore, we propose the following research questions to address this issue in the future.

RESEARCH QUESTION 17: What features of new e-payment services threat the proliferation of mobile payment services?

Electronic and mobile payment services differ in numerous ways. Each service must embed unique properties which make it superior for certain payment scenarios. There is a need to investigate how electronic and mobile payment services compete.

RESEARCH QUESTION 18: What are the dynamics between mobile payments and new e-payment services?

The complementarity and substitutability of electronic and mobile payments merits research as well. By solving research questions 17 and 18, it becomes possible to understand for which situations electronic and mobile

payments are most appropriate. Expert and focus group interviews, as well as surveys seem useful research approaches.

4.3.5. m-Payment market and providers

At the time of writing, it was still uncertain whether and when large-scale adoption and use of mobile payments would happen. Financial institutions, mobile operators, and incumbent mobile payment service providers try to understand this issue. They launch isolated initiatives to meet to specific market needs. The business value of mobile payment services and the roles of the players in the mobile payments service markets are unclear. One scenario is that the current payment service providers will be able to keep control over the payment process and mobile network operators will create the new channel by providing mobile network infrastructure. At the other extreme, some incumbents have launched mobile payment services where financial institutions and mobile operators are used only as vendors with limited roles. In addition, some merchants have taken an active role and become payment service providers (e.g., public transportation operators). These developments could become a threat to financial institutions especially, unless they respond to these developments. We expected to find research on mobile payment services industry rivalry and on the capabilities or lack of capabilities of various players.

We have identified five papers that focused exclusively on this factor, and, additionally, several ''Multiple Categories'' papers provided important insights. Some researchers have conducted analysis on current mobile payment services and their characteristics [31,35]. This helps to compare the features of mobile payment services. In order to investigate the roles and ambitions of various actors, some studies have exposed the strengths and weaknesses of selected payment service providers [87,92]. Vilmos and Karnouskos described the SEMOPS project that intended to give birth to a European standard for mobile payment architectures [86]. To justify their proposed architecture, they discussed the current market requirements and explained how SEMOPS could be deployed in such an environment.

Using a higher level of abstraction, Ondrus et al. [59] claimed that a more complete analysis of the mobile payment services market should take into account various interrelated perspectives such as the market (value propositions and customers segments), the actors and their agendas. Following this proposal, Ondrus and Pigneur adopted a multi-actor multi-criteria approach in order to analyze the market from multiple perspectives [61,63]. One aspect of their research was the evaluation of a merchant's role in a situation where the merchant disrupted a market by becoming a payment service provider. They also found that retailers have a preference for self-operated payment services. This might be a signal that merchants are tempted to launch their own services (at least in Switzerland), as some of them already do to a certain extent in other countries (e.g., IKEA and public transport operators). The analysis of past studies is shown in Table 7. Four research questions for future studies are outlined.

RESEARCH QUESTION 19: What are the optimal roles of different players in the mobile payment value chain?

The organization of the mobile payment services value chain has a significant role in the development of mobile payment services. As long as the roles of key players are unclear, mobile payment services will proceed at a slow pace. Alternative value chain models with benefits and drawbacks for each player could be analyzed with economic modelling and design research, and be backed by interviews and expert panels. These approaches are also applicable to research questions 20 and 21.

RESEARCH QUESTION 20: How should inter-firm cooperation in the mobile payment services markets be organized? Is ''cooperation'' possible?

Studies carried out in different parts of the world have come to the same conclusions about the need for cooperation between various players to create sustainable markets for mobile payment services. A critical question for future research is to examine how this type of ''coopetition'' can be achieved and what incentives are needed to secure collaboration between players.

RESEARCH QUESTION 21: What are the competitive impacts of mobile payment services operated by merchants?

As merchants could become mobile payment service providers, research should investigate the competitive consequences of such cases. Large retailers with high business transaction volume could threaten financial institutions' payment service business. An interesting example from Hong Kong is the Octopus service. One possible scenario is that financial institutions will aban-

Table 7
Focus of mobile payment publications in m-payment market & providers factor

Theme of research	References	Empirical qualitative interviews	Empirical quantitative survey	Conceptual speculative commentary
Analysis of existing m-payment solutions and characteristics	[31,35]	0	0	2
Framework to analyze the actors and their value proposition	[59,61,63,64]	3	0	1
Analysis of strengths and weaknesses of the actors	[87,92]	0	1	1
Proposition of a mobile payment system	[86]	0	0	1

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don micro-payment markets, which offer low fees, and focus more on macro-payments transactions. Additionally, other economical, technological, and organizational impacts could be studied.

RESEARCH QUESTION 22: What is the business value of mobile payment services and how can it be measured? The roles and participation of various parties in the mobile payment service market is linked to the business value of mobile payment services. Lack of previous studies motivates this research. Related sub-issues include measures which capture business value, the effects of network externalities, and the value of IT in this context.

5. Discussion and conclusions

This paper reviewed an extensive amount of existing mobile payment studies, proposed a conceptual framework with four contingency and five competitive factors for analyzing mobile payment research and markets, and outlined roadmaps for future research in nine specific research areas.

Fig. 4 below reflects the amount of research conducted in each factor of our framework. The black boxes indicate a factor where no previous research was found. The factors with less than 20 papers in each are marked as grey areas. The white areas indicate the most researched factors with over 20 papers in each.

The two most studied factors in contemporary mobile payments research are mobile payment technologies, and consumer perspective of mobile payments. Yet, the technology basis is only fragmentarily covered. The social and cultural factors impacting mobile payments, as well as traditional payment services in comparison to mobile payments were discovered as the uncharted black areas of past research. Most of the factors in our framework are grey areas: exploratory, early phase studies have been conducted but there is a need for more rigorous and detailed research projects that provide deeper insights.

Based on our findings, we want to emphasize three aspects which we believe are important for conducting mobile payment research. One critical theme to investigate is the optimal portfolio of payment instruments and services. It seems that the relationships between mobile payments, electronic payments, traditional payments, and banking services are unclear. There is still confusion about whether mobile payments are just a new access channel to existing services, or a new payment instrument, or both.

Secondly, we have emphasized that researchers have focused more on the Business-To-Consumer (B2C) and C2C scenarios, while B2B mobile commerce may also need mobile payment services. By mentioning this deficiency in the literature, we hope that researchers will open new paths of research addressing the mobile payment issues related to B2B services.

Thirdly, to improve the quality and relevance of mobile payment research, we also recommend that researchers collect more empirical data backed by guiding theories and understand the underlying technologies better. We do not claim that conceptual papers would be unimportant or useless. Yet, we believe that more theory based empirical research is needed to enhance the current understanding of the mobile payment services markets.

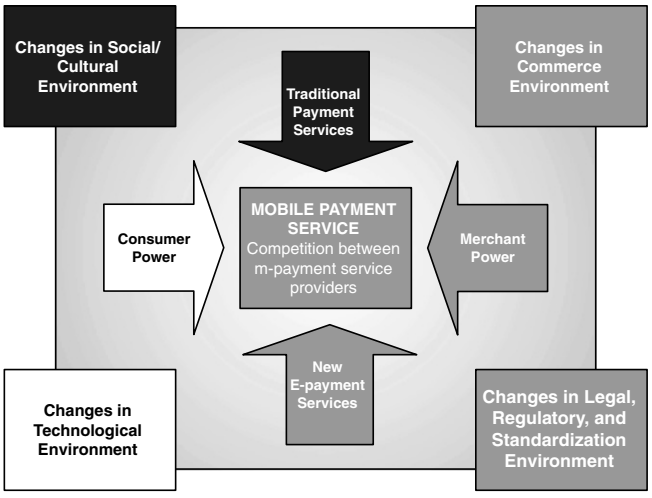

Fig. 4. Research in various factors of the framework.

For practitioners, our study summarizes the existing research findings and organizes them based on a set of factors. Our review suggests that practitioners should direct technological development towards closer cooperation with users and merchants. Furthermore, our findings indicate that the business models of mobile payment services need to evolve from limited proprietary solutions towards cooperative and standardized solutions in order to succeed. From a future research point of view, it would be useful for the practitioners community if research would map the efforts of mobile payment services to the proposed framework and then provide a thorough analysis on each service.

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