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M-Payment - How Disruptive Technologies Could Change The Payment Ecosystem

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M-PAYMENT – HOW DISRUPTIVE TECHNOLOGIES COULD CHANGE THE PAYMENT ECOSYSTEM

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Abstract

Within developed economies, the field of m-payment appears to be driven by (disruptive) technological innovations. M-payments, similar to e-payments, have been regulated in such a way that banks and other established financial institutions have been able to maintain an unchallenged position in the payment ecosystem. However, disruptive technologies like Near Field Communication, but more importantly cloud technology based solutions might lead to dramatic changes. In the long run this may change the position of banks in the payment ecosystem including their control over "money flows". Yet, for this to happen m-payment solution and service providers need to understand the role of money and payment instruments as well as how payment ecosystems work, in-depth. In this conceptual paper we discuss how the ecosystem of m-payment is expected to change due to technology changes. Based on platform and ecosystems concepts, theories of money and behavioral theories a comprehensive literature review and a qualitative meta-analyses of the m-payment literature is presented. On the basis of the theory review and literature analysis we expect that the role of Over The Top (OTT) providers in the m-payment ecosystems will be driven by cloud-based solutions and threaten the position of traditional players. Banks need regulators to safeguard their control over the money flow.

Keywords: Mobile payment, platforms, ecosystem, theory of money, literature review and meta-analysis.

1   Introduction

During the past ten years, m-payments have been expected to make a major breakthrough in developed economies but in contrast to m-payments in developing economies they haven't lived up to the expectations. Explanations are sought from (1) consumer and merchant behavior, (2) technology, (3) the m-payment ecosystem and (4) regulation. Below we discuss examples about each of these reasons in order to frame research on m-payment (Mas and Rothman, 2008, Dahlberg et al., 2008a, Ondrus et al., 2009, Ondrus and Lyytinen, 2009, Kazan and Damsgaard, 2013, Henningson and Hedlund, 2014).

Behavior. In developed economies, consumers and merchants have numerous different payment instruments and solutions to choose from. Over the years they have developed well-established routines and preferences, which are hard to change. There still are significant differences in the usage of alternative payment instruments by citizens, such as cash, cheques, debit cards, credit cards, money trans-

fer, direct debit, account-based electronic banking payments etc. (Ausubel, 1991, Snellman et al, 2000, Chakravorti, 2000, Stavins, 2001, Schmalensee, 2002, Chakravorti and McHugh, 2002, Schuh and Stavins, 2006, Dahlberg and Öörni, 2006, 2007, Jonker, 2007). For example US households owned close to 900 million general payment cards in the year 2000, that is approximately four per every adult citizen. The 28 billion transactions executed with these cards accounted for 1.9 trillion US dollars (Hunt, 2003). The question is if new technologies will lead to changes in these stable usage patterns?

Technology. Although Short Message Service (SMS) -based payments have been around for a long time, Near Field Communication (NFC) promised to lead to a broad adoption of mobile payments. However, only dedicated payment solutions for transport systems, parking etc. are widely used (Ondrus et al., 2009, Kazan and Damsgaard, 2013) and recently broader NFC card based payment applications find in roads in some countries, like The Netherlands. Still M-payments is marginal not only in relation to the total monetary value of payments as a whole but even in comparison to cash, debit and credit cards. At the same time mobile devices are used increasingly to make purchases from the web and to access card based and (bank) account-based payment services. So, the questions that have become relevant are if new payment technologies and platforms will lead to changes in behavior and into popular m-payment ecosystems?

Ecosystem. Banks, credit card companies and telecom operators have competed for the control over the core assets in m-payment systems and the entire ecosystem (Au and Kaufman, 2008, Dahlberg et al., 2008b). The secure element (SE) functional to user identification and authentication, encryption of payment transactions etc. is one of the key assets. In some countries banks have been able to expand their business with their security solutions, for example by providing strong identification and authentication service to tax authorities and other government agencies, municipalities, merchants etc. The position of banks has remained strong since in most m-payment services money is loaded to this service from a user's (bank) account and also cleared against (the same bank) account. However it is the question if changes in control and assets will lead to a changed ecosystem. For instance questions like, who have the right to collect and use customer data, who is authorized to execute payment transactions and who will control money flows and float, are becoming relevant due to the emergence of new Over The Top (OTT) providers as enabled by changes in regulation.

Regulation. On one hand, regulation has been promoted in order to stimulate telecom operators to open their networks to service providers and to stimulate the service market. This is among those changes in regulation done via the so-called net neutrality regulation. Telecom operators' innovation capabilities have been seriously harmed as a result. As a result, Over The Top (OTT) providers, both technology providers as well as large Internet platform providers, such as Amazon, Google, Apple, PayPal, Sagepay and Square, have been able to develop in-roads into the m-payment ecosystem. On the other hand, the positions of banks and other established financial institutions have for long been protected by sector specific finance regulation. Banks and credit/debit card companies are supervised by central banks, to which they also report data about the usage of various payment instruments. This is an integral part of the monetary system regulation. There have been some antitrust cases especially against Visa and MasterCard with the motive to open up the payment card markets also to other actors (McAndrews and Stafanadis 1999, European Commission 2002, Office of Fair Trading UK 2003). These cases have, however, not challenged the position of banks and established financial institutions within the payment ecosystems.

As myriad of interrelated service provider, merchant, bank, consumer etc. issues appear to impact m-payment services and the motivation for this research comes from the question: *which theories and concepts can contribute to explaining why m-payment services don't succeed in gaining momentum in developed economies*? By understanding these explanatory factors, practical recommendations can be formulated. Next to this practical contribution a balanced view based on alternative theories like theo-

ries on platforms and ecosystems, and domain specific theories, like theory on money, can contribute to the understanding why certain disruptive technologies are or are not making it on the market.

For our research we extend the definitions of Mallat (2007) and Dahlberg et al. (2008a) and define *m-payment as a virtual type of payment enabled by mobile device, in which money is transferred remotely or near-by from a payer to receiver via an intermediary or directly in exchange for a service, a product or as a money transfer.* Mobile devices include handsets and cards and near-by payments include proximity payments. In our view budget limited payments, such as micro payments, are less relevant, since they (alone) will not make m-payment services successful. We explicitly also exclude mobile banking and mobile access to credit cards, since they are extensions of traditional and Internet channels, now made available vie mobile applications. We specifically look into enabling technologies that might have a disruptive effect on the current payment markets.
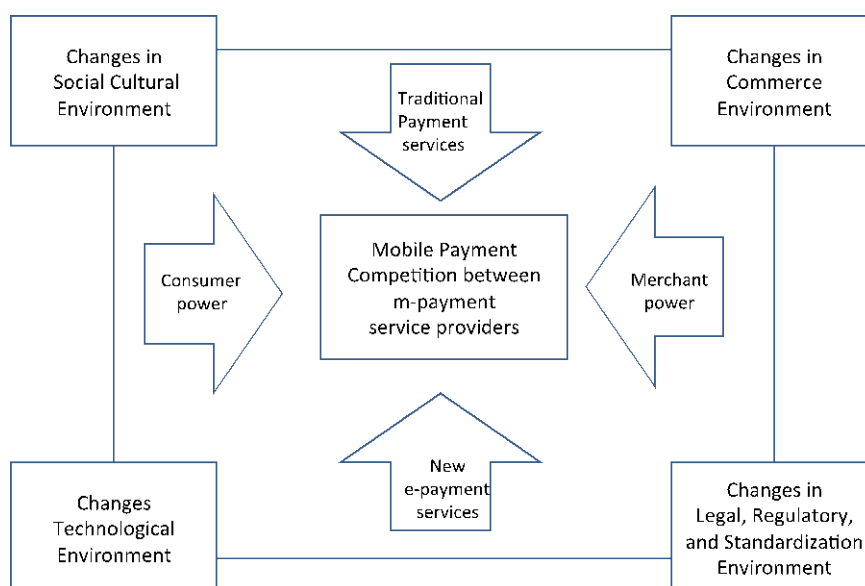

Figure 1.   The mobile payment service market framework by Dahlberg et al. (2008).

Dahlberg et al. (2008a) presented a framework for an m-payment service market shown in figure 1. Their framework is based on a socio-technical approach on information systems. According to the socio-technical approach understanding of both technology and the social system is necessary to explain why information systems are developed and how they are used – e.g. why providers offer, and why consumers want to adopt and use m-payments. Based on that framework we suggest that combined changes in technology, i.e. m-payment platform, and related ecosystem will establish situations, where m-payment services will flourish. Our research contributes both to the research on technology platforms and to the research on ecosystems. Technology platforms are a new area and under researched within information systems research (e.g. Tilson et al, 2010) A technology platform consolidates and integrates technological components and makes value-added services available to users. Some technological components, for instance cloud-based solutions for security, can have a disruptive effect. For instance the role of Mobile Network Operators in an ecosystem is no longer self-evident.

Research on ecosystems investigates, how the participants of an ecosystem interact (Moore, 1993; Iansiti & Levien, 2004; Basole 2009). Review of technology platform, ecosystem and disruptive security technology literature serves as inputs to the analysis on the theory of money and their consequences for m-payment services. These theories and constructs offer new views on mobile payment research.

We conducted also a comprehensive literature review on prior m-payment research literature with a focus on a provider perspective by applying the principles outlined by Petticrew and Roberts's (2008). The review was used to analyze whether or not technology platforms, ecosystems, disruptive technologies and the theories of money have been investigated in prior m-payment research and if so, what are the findings. Finally, we carried out a meta-analysis on prior research related to behavioral theories that we also will shortly discuss in the section on theories and related research.

The statement above suggests that in addition to technological platform and ecosystem innovations the providers of m-payment services and solutions need to understand the nature of money and payment instruments better and deeper. Economists have developed several competing theories of money some of which go back in time hundreds of years. We do not aim to try to determine, which of the competing theories fits best to m-payments, rather we review them in order to understand what m-payment services need to offer to the users of mobile money. The following quote from Smithin (2000b) describes our approach. "*It is true that recent changes in computer technology have led to discussions of a 'cashless society' or 'virtual money'. However, it is fairly obvious … that this is a change of form rather than substance. All that is implied by a cashless society is that it is possible to envisage a payments technology, which makes no use of bits of paper and small metal discs. However, the cashless society is hardly 'moneyless', far from it. The purpose of m-business or m-commerce is also to 'make money', exactly as before. Indeed, under capitalism new technology would not be introduced at all if it could not be made 'to pay' in the traditional sense.*' In the quote we replaced e-business and e-commerce with m-business and m-commerce.

In summary, our paper has two objectives. *Analyze the current state of the art with regard to the relation between payment platforms and ecosystems with a focus on the characteristics of money both conceptually and trough a comprehensive review and a meta-analysis of literature. Secondly, we propose that with new disruptive technologies, such as for instance cloud based security, and changes in m-payment ecosystem, due to the entrance of Over The Top m-payment providers, m-payment services will become more attractive for consumers and current payment practices will dramatically change* by assuming at the same time that the stability and controllability of the monetary system will be sustained.

To achieve the objectives of the paper we discuss in the next chapter first platform and ecosystem concepts and theories, next discuss the relevance of disruptive technologies and finally the theories of money. After the theoretical background, we present the methodology and the results of a recent comprehensive literature review involving 142 articles and the results of a meta-analysis specifically geared towards behavioral aspects. Finally we will summarize our analyses and discuss our findings.

2 Theoretical background and related work

2.1 Platform theory with implications to m-payment services

Platform can be defined from the perspective of product development, from an economic and strategy perspective and from the perspective of Information Systems. From the technical point of view a platform is a set of elements and interfaces that are common to a family of products (Meyer and Lehnard, 1997). From the economic point of view a platform is any product, system, service or even organization that mediates interaction between two or more groups of agents (Evans et al., 2006). From the strategy perspective, platforms are defined as "building blocks (they can be product, technologies or services) that act as the foundation upon which an array of firms (sometimes called business ecosystem) can develop complementary products, technologies or services" (Gawer, 2009). In Information systems literature, the focus is on 'digital infrastructures' (Tilson et al., 2010), 'software platforms' (Hilkert et al., 2011) or 'digital platforms' (Eaton et al, forthcoming). Platform provides core function-

ality shared by the modules that interoperate with it through interfaces, which they operate to facilitate interoperability (Tiwana el al., 2010). So, platforms provide the basis architecture or the building blocks of abstract functionalities. Such building blocks can be reused to support a wider range of possibilities and they support development, deployment and delivery of new products or services on top of the core functions, as is the case in mobile payment platforms.

Platforms make it possible to meet diverse user requirements and fulfill user needs. They enable two- or multisided markets (Ballon, 2009; Evans et al, 2006; Rochet & Tirole, 2003). For example, access to two or more customers groups and/or the creation of positive network effects. Moreover, platforms are intermediaries, which match activities and needs of different groups (=sides). In the case of m-payment the payment platform mediates between banks, consumers, merchants, application developers, and possibly advertisers. Within multi-sided markets, costs and revenues are generated to different market stakeholders, since a platform has distinct groups of providers and users. The platform pays costs and collects revenues while serving these multiple sides and each participant within them. To succeed the platform needs to make all sides better off, for example through transaction costs reduction and needs to collect revenues from each, although one side could be subsidized to increase the total value creation through the platform.

By mediating interactions platforms create network effects. Network effects arise when the core products depends on complementors (Schilling, 2009). Network effects are typical for platforms since the value of a platform depends on the number of consumers using it and/or the number of services offered by other agents. In the context of an m-payment service, the number of consumers is highly dependent on the number of merchants making use of the service and vice versa. The value of a platform grows when the platform matches demands from both sides. The challenge in multi-sided platforms, like m-payment platforms, is to achieve a critical mass of users on each side of the platform in order to make it valuable to the other side (De Reuver et al, in press). In order to make a platform attractive and to kick-start the service there are different approaches.

The m-payment platform service provider could apply innovative pricing strategies, make balanced choices for the combination of platform and service charges, or cross-subsidize (Parker & Van Alstyne, 2012; Rochet & Tirole, 2003). For example, the m-payment terminal could be given free of charge to merchants or marquee users and trendsetters could be invited to use the platform. The inclusion of complementors such as advertisers, application developers offering value-adding applications as well as the provision of security for transactions, needs to be considered as well.

Since there are multiple actors in various roles, an important question is, how to organize and manage the network of firms or the ecosystem around the platform (De Reuver et al, in press). In summary, we conclude that the large ecosystems around such application platforms as Apple store and Android / Google "store" are candidates to serve as the platforms for m-payment, because they already have the critical mass on both sides of the platform. This together with overall growth of mobile/electronic commerce are changes that have taken place largely during the last 10 years, and which offer new opportunities also to m-payments. It would require that m-payment services are able to reduce payment costs directly or indirectly (by higher productivity through ease of use) and/or to increase safety/trust.

2.2   Ecosystem theory with implications to m-payment services

There is a direct relation or interaction between the technical platform and an ecosystem (Iansiti & Levien, 2004). We extend definitions of ecosystems, for example that of Peltoniemi et al. (2004), by including value elements. Thus an ecosystem is a group of organizations working cooperatively and competitively in production, customer service and innovation with the purpose of creating value to customers, to the group as a whole and to each individual group member. Hardware manufacturers, service providers, end-user service providers, merchants, consumers typically act in the key roles with-

in the m-payment ecosystems (Gaur & Ondrus, 2012). Hardware manufacturers include chipset, card and hardware providers. Service providers typically offer intermediate solutions. Banks, mobile telecom operators and OTT players, like Apple and Google, as well as the providers of service schemes constitute end-user service providers. Merchants sell goods and services and receive payments for that. Consumers include also organizations that represent and lobby consumers' interests. Research on behavioral aspects with regard to merchants is limited (Van der Heijden, 2002; Teo et all, 2005; Mallat & Tuunainen, 2005, 2008; and Lai & Chuah 2010). The focus has mainly been on drivers and inhibitors to adoption. Research on behavioral aspect of consumers, based on technology acceptance models and other adoption theories, focus on traditional constructs like ease of use, usefulness, and on behavioral intention, while trust, security and privacy play a role as well. Tradeoffs between different payment systems are seldom studied (see also section 4)

States, central banks and regulators are important players that intervene in the ecosystem by setting boundaries within which the ecosystem is able to operate. In the context of (m-) payments regulation typically focuses on security and trust as well as on securing the stability of the monetary system and money flows. Such m-payment ecosystems are likely to succeed, if they are able to establish "agreements" that establish clear and natural roles for each participating organization.

2.3   Disruptive technologies with implications to m-payment services

Discussions on m-payment technologies often start with the choice of the "carrier", that is, the type of the mobile handset or the (NFC) card. NFC could be combined with RFID and/or wireless short-range communication technologies such as Bluetooth. NFC cards have extended the usage of financial applications to loyalty and to all other kinds of cards, like travel, health and social welfare, municipal services and multipurpose cards. NFC cards are sometimes built into mobile devices. In the latter option, different applications reside on the same card such as Google Wallet, which is also an example of horizontal applications. In the case of vertical applications each card application has it own function and architecture, such as branded bank-issued cards. Hybrid solutions include branded solutions within a broader wallets/service set. VISA application within the Google Wallet is an example of this. Wallets can be branded, neutral, white-label or open. Trusted service managers, such as ATOS or Gemalto, support brand neutral labels. Interoperability is an issue within open environments.

The question where the "keys" of the payment cards, also known as the Secure Element, are stored is an important m-payment concern. The secure element can be attached as a sticker containing RFID tags on the surface of a handset or stored on a Universal Integrated Circuit Card (UICC) aka the SIM (Secure Identification Module) card, which includes subscriber information. Other alternatives include an embedded chip included in the handset and an external micro security element (SE) sometimes with an embedded NFC antenna. The latter alternative is useful only if there is an extra slot for the SE in the handset. The negative consequence is that the replacement costs of handsets are high, that is, all information stored on the embedded chip on the old handset need to be transferred to a new handset. A removable, secure memory card has some advantages as it allows any stakeholder to issue secure memory cards without the requirement that service providers have to place their applications on hardware controlled by a third party. The lack of standardization and incompatibility between handsets is the downside.

Currently, an interesting disruptive alternative is to provide security via cloud solutions, bypassing the mobile network operators (MNOs), Due to cloud solutions MNOs lose their central position with their UICC based security solutions. UICC solutions enabled strict platform control by MNOs. Service providers needed to set up agreements with MNOs via a trusted service manager. Today, the cloud platform makes the UICC no longer necessary for m-payment and therefore impacts the position of MNOs in the ecosystem. OTT players including Google, PayPal, Apple and other smaller players will enable the exploitation of cloud computing possibilities for m-payment. After authentication, the cloud server

grants access to the "keys". Such a software-enabled solution applying the host Operating System (OS) can be a *pure* cloud solution, which requires an Internet connection during the entire transaction process, a tokenized or a hybrid solution. Tokenized solutions make use of tokens that are randomly generated surrogates of the primary account number. Tokens are limited in number and are usually valid for a certain time interval. Tokens have to be supported by the handset. Token specific services must also to be provided. Although tokens are vulnerable if the host OS is compromised, the advantage is that tokens don't need an Internet connection once the tokens are downloaded. Hybrid solutions overcome the limitations of both pure and tokenized solutions by making use of the SE authenticated against the cloud. Cloud SE facilitates easy expansion of capacity in comparison to the limitations of localized SE. Cloud SE is also independent of the handset features and guarantee interoperability (access from any device) without the requirement to change handset or wallet. On the other hand, cloud solutions are vulnerable for malicious attacks. Despite of the above-discussed limitations cloud solutions offer the potential of a disruptive technology to reduce the costs and to increase the security of the payment ecosystem via m-payments.

Although in-depth knowledge of platforms, ecosystems and disruptive technologies is required at the end m-payment is about money transacted as a mobile payment. This latter view is seldom taken into account in analyzes of mobile payment and why traditional structures and roles are hard to change. Therefore we will focus on this topic in the next sub-section.

2.4   Theories of money with implications to m-payment services

Providers of m-payment services need a profound and deep understanding on what the money transacted as a mobile payment is, and should arrange the service accordingly. The theory of money is one of the corner stones in both classical and modern economics. Unfortunately, however, there are several competing theories of money. Instead of trying to determine what is the best or most useful theory, the m-payment service providers needs to understand the implications of the money concept and theories for the development of m-payment services. The reason for this is that they are not just academic theories but the intellectual basis for the monetary and fiscal policies and activities of governments, central banks, financial supervisors and "banks" in general. It is not possible to change the payment ecosystem without understanding this intellectual basis and the regulatory needs emerging from it. No government, central bank or financial supervisor is willing to jeopardize the financial stability of their respective economy. The book by Smithin (2000a), as an example, provides an overview on the history of money as well as on the most important theories of money.

According to the classical and neoclassical theories of money it emerges from barter trade as a special neutral or "viral" commodity with the purpose to facilitate the exchange of goods and services (e.g. Ricardo, 1973, Schumpeter, 1994). The origin of Bitcoins can be seen in this light. It started as the medium of exchange between people who provided services to each other and needed a medium to balance time and value (=unit of account) differences of reciprocal services (=barter) without "money". The important feature of Bitcoins is that it emerged outside the traditional monetary system and was still able to capture the key role of money, which is medium of exchange, as well as the other roles of money (unit of account, means of payment, and store of value) as understood in the classical and neoclassical theories of money. These roles are described e.g. by Ingham (2000). By having these roles the Bitcoins money became even exchangeable with so-called state moneys (Wray, 2000) such as USD and Euro. The implication to an m-payment service provider is to create mobile medium of exchange (=mobile money) outside of the traditional monetary system similar to Bitcoins. As an example, mobile content and other mobile services could be exchanged (between consumers) so that the barter value difference could be cleared by issuing some kind of "mobile content exchange credit certificate" which the holder could then use to purchase mobile content or services from other (consumers). Traditional payment instruments are unpractical and complicated for this purpose. In addition to providing the medium of exchange, a platform service provider should offer services to store the value

of such money and to exchange it into state money at an exchange rate when needed. Another implicit requirement is that such mobile money must increase productive and decrease costs (Smithin 2000b).

The social theory of money (Ingham, 1996, 2000) is close to the above-described approach but builds on a sociological stance, such as the work of Simmel (1978) and Weber (1978). Money is seen a social construct, which is continually re-negotiated and which is constituted by social relations between the monetary and other economic agencies in the society (Smithin, 2000, Ingham, 2000). It is possible to describe the implications for an m-payment service without explaining this approach in details. An m-payment service (platform) provider needs to identify such merchant, consumer and public sector payment (money) needs for which traditional payment instruments (money) fit poorly, and/or which banks ignore. The replacement of physical cash is a potential candidate in addition to payments for mobile content and services. This will strengthen the negotiation power of the m-payment service provider and offer an in-road to other payment situations. Such a service could also be easily extended to electronic moneys, in line with what Apple is pursuing with the Apple Pay service and what Google did with Google Wallet. The payment service provider also needs to support the society to control the monetary and fiscal system, that is, to cooperate with governments, central banks and financial supervisors. They have the interest to promote competition between payment instruments and payment service providers in order to increase productivity as long as the monetary system remains stable and controllable. The anti-trust cases against VISA and MasterCard (Hunt, 2003) are clear examples of this.

The implications of the (neo-) chartalist or state theory of money (Wray, 1998, 2000, Smithin, 2000b) are similar to the social theory of money. This approach, which builds on the work of Knapp (1973) and Keynes (1936), sees modern money as fundamentally state money. Central banks are given and use the power of the state or several states such as the Euro states to issue money, to control money flows, and to support taxation. The state theory of money's significance becomes even more obvious if one looks money from a monetary economy rather than real economy perspective (Smithin 2000a). Most theories of money adhere to the real economy perspective, which means that money is as a viral or neutral commodity with its various roles. However, as Smithin (2000b) describes, most crises in the economy are related to money. The bankruptcy of Lehman Brothers with its consequences, and the debt crises of several EU-Euro countries are the latest examples. The implication to an m-payment service provider is to support central banks and states to control the issuance of money, money flows and taxation. One means to achieve this to secure that the unit of account for the mobile money is state money or that it is exchangeable to state money through a liquid exchange service/market.

The credit theory of money (Rochon, 1999, Parquez and Seccareccia, 2000) also known as the theory of monetary circuit (Smithin, 2000) is the last theory we opted to discuss due to its evident implications to m-payments. In this approach money is seen primarily as debt related to future payments to reimburse and repay the debt. "Banks" create debts to allow companies, public sector organizations or states to begin the production of goods and services by acquiring necessary resources. Debts are then reimbursed when the debtor is able to acquire a sufficient quantity of banks' own outstanding liabilities, for example from the sales of production output, in order to repay principal plus interest and to generate profit. Within this approach money does not have to be physical because digital money is able to perform all the roles of money with lower costs and higher productivity. It is easy to see that credit cards with their credit limits extend this type of credit to consumers. Apple's Pay is interesting from this perspective as it follows the pattern of credit cards. An m-payment (platform) service provider could adopt similar role in the payment ecosystem as credit card companies have currently. They could issue credit lines to their m-payment customers, secure compatibility with merchants' point-of-sale (POS) and other devices used to execute payments (in addition to proving the means of exchange to mobile content and services). By providing periodic clearance against banks' deposit/checking accounts the m-payment service provider could ally with merchants and banks companies especially if fees for the payment transactions could be reduced and the security element improved. Banks and merchants may consider them to be too dependent on current major credit card companies. Thus,

banks have the interest to ally, if that helps them to keep float and to refinance their balance sheet with the clearing of credit with the banks. Acceptance from central banks and states is again needed.

2.5   Concluding remarks

Based on the four perspectives presented, e.g. platform and ecosystem related views, the threatening disruptive technologies and the relevance of the theory of money, we will next show - in sections 3 and 4 where we present a systematic literature review and meta-analysis of m-payment literature - that the issues discussed have received little attention in prior m-payment research with the exception of the ecosystem issue. We propose that by considering the platform, ecosystem and disruptive nature of mobile payments and by securing that the m-payment services fulfills the various roles of money, mobile payments might also in developed economies become a reality. In our opinion m-payment service providers need to discuss more with central banks and financial supervisors to provide necessary information for them to secure that regulators are able to control the stability of the monetary system as well as money flows. By doing these m-payment service providers, including OTT players, will become new "banks". Platform providers with millions of apps have the opportunity to extend their platforms by proposing their own, easy to use, m-payment systems (e.g. Apple Pay and Google Wallet) and by doing this to establish an in-road to the traditional payment market. This is a very strong value proposition if they are at the same time able to offer cost savings and guarantee security to the payment ecosystem However, these opportunities are highly dependent on how regulators will respond to the disruptive technical innovations and the impact they may have on the payment ecosystem. Liberalization of the banking industry and providing licenses to OTT players might change the landscape in unforeseeable ways. Even mobile network operators are able to retain a strong position in the payment ecosystem if they exploit their assets, such as customer contacts and data on customer data.

3   Methodology of a systematic literature review on mobile payment research

In addition to literature as discussed in the theory section, we conducted a literature review on past mobile payments research. The purpose was to detect in hindsight whether the issues addressed have been investigated. Our proposition is that the factors addressed in the theory part may establish the missing link for the breakthrough of mobile payments in western economies.

We followed the systematic literature review definition of Petticrew and Roberts's (2008, pp. 9-10). Both journal and conference articles are included, since a systematic review should examine both (Webster and Watson, 2002). We searched articles from nine online databases; Scopus, Science Direct, Web of Knowledge, ACM Digital Library, AIS Library, IEEE Xplore, Emerald Fulltext, ProQuest, Wiley InterScience. We used the different combinations of the following key words: mobile payment, proximity payment, contactless payment, and NFC payment. A total of 142 articles were selected from the period of 2002 to 2013 July including 88 journal articles and 54 conference articles, which fulfill our review protocol. In order to ensure that the literature review is systematic and minimize researcher bias it is necessary to specify research objectives before selecting and analyzing the articles as stated by Okoli and Schabram (2010). The research objectives for the literature research were explained above but also included the following:

- Identify and consolidate the findings of previous research in general and especially to understand how mobile payment markets, platforms, ecosystems and technology develop.

- Analyze the nomological network of concepts with regard to the behavioral aspects based on a qualitative meta-analysis approach (Van de Wijngaert et al, 2014). With regard to the behavioral aspects of consumer behavior we made use of Gephi as a network tool. In summary,

what are the main issues that need to be (further) investigated if m-payments are to be widely adopted and implemented in modern western societies?

There are few existing frameworks for classifying m-payment research, except the literature review of Dahlberg et al. (2008). Rather than adopting that framework we classified the articles using a topic modeling technique known as the Latent Dirichlet Allocation. It is a probabilistic topic modeling technique. Every document is associated to each of the to be discovered topics based on a probability distribution. To obtain a final classification, a document is labeled with the topic that has the highest associated probability. We used the machine learning software MALLET (McCallum, 2002) to perform the analysis.

4   Findings of the systematic literature review

The increase in m-payment ecosystem research is the most important and only significant change in m-payment literature during the last 6 years according to our literature review. The analysis resulted in the following topics: (1) technology, legal and regulation issues, (2) behavior of merchants and consumers, (3) m-payment ecosystem, and (4) m-payment applications and cases. Compared with the framework of Dahlberg et al. (2008), m-payment ecosystem is an emerging topic, while the other topics are similar to those used by Dahlberg et al. (2008, see Figure 1). Thus, there is still a clear focus – or even over-representation of research - on the technological developments of m-payment and the adoption of m-payment services by consumers. At the same time research on topics important for merchants, financial institutions or regulators including central banks are few or non-existent. The use of mobile payments as money or in the various roles of money is not considered either.

Trust and security were detected to be important for mobile payment adoption as explained in Dahlberg el al. (2008) and also in the theoretical discussion above. Thus it is not surprising that means to mitigate or prevent security risks and privacy concerns are major issues in technology oriented m-payment articles. The other related topic in them is the discussion on how newer technologies, such as NFC, RFID and other short-range wireless technologies, can be deployed to provide more secure and/or efficient mobile payment transactions. Fairly recently first articles have been published, where the usefulness of NFC and cloud technologies are compared as future technology basis of m-payments (e.g. Yarbrough and Taylor, 2012). Yet as of July 2013, there is a lack of research on cloud-based m-payment technologies, let alone through comparisons between NFC and cloud-based solutions.

In addition to the challenges in m-payment technologies, the slow adoption rate of mobile payments can also be attributed to the lack of common standards and inconsistencies between systems. Dahlberg et al. (2008) proposed that research on the legislation and standardization of m-payments provides an informative description on the complexities and problems in the process of standardization as well as in the execution of cross-border mobile transactions. There are still very few solutions to solve these legislative and standardization issues. Despite of these challenges the number of articles on legal, regulatory, and standardization issues has not increased much in recent years. On the other hand, towards the end of the review period there were promising signs in this direction. We found a few articles, which tackled legal, regulatory and standardization issues with a holistic view and considered all stakeholders of an m-payment ecosystem. For example, Kemp (2013) describes the various organizations participating into an m-payment ecosystem and shows that it is necessary to assess carefully their roles from a regulatory perspective when the strategy and the approach to contractual discussions is determined for each organization. The article of Lawack-Davids (2012) is an example of how legislative and standardization issues are treated in a national context. The mentioned article describes the legal and regulatory framework of mobile banking in South Africa with an m-payment twist. The battles between m-payment standards have not been restricted to inter-organizational level, but have been carried out also between competing consortia, such as the Mobile Payment Forum and the Mobey Forum. Various consortia typically represent the interest of one or several industries, such as handset or

card manufacturers, telecom operators or banks and financial institutions. The study of Lim (2008) sheds light on the disputes between consortia by describing and analyzing the role of different interest groups and their influence on the development of m-payments. It is noteworthy that legislators and regulators typically approach m-payments and other payment instruments from the theory of money perspective.

Concerning the social and cultural environment, Dahlberg et al. (2008) argued that the changes of these environments can trigger alternative needs and consequently influence the supply and demand of new payment services in different ways. Variations in national or regional cultural contexts may induce different preferences or influence m-payment promoting or prohibiting factors in different ways. Consequently such differences result in variations regarding a wide range of issues relevant for the information systems development of m-payment services. These include attitudes to services, use of payment procedures, organizational relationships, flexibilities of organizational or process changes, and the balance between technical and inter-organizational issues. The lack of studies on social and cultural studies in relation to mobile payments has not changed during the recent years. One exception is the study of Zhong (2009), which compares m-payment procedures between Finland and China.

Since the purpose of the literature review is to understand why m-payment services are not broadly emerging in western economies from the lens of the theoretical discussion above, it is important to understand in addition to the above covered research topics, who are the key actors in m-payment ecosystems. M-payment solutions typically utilize inter-industry platforms that emerge from the collaboration of the participating inter-industrial organizations, such as banks and mobile telecom operators. Past research has detected, that cross-industrial collaboration (ecosystems) has promoted the deployment of a wide variety of technologies. This has also lead to emergence of several non-similar m-payment ecosystems, which have different objectives and motives (De Reuver et al, in press). Collaborations between mobile technology manufacturers, banks, telecom operators, merchants, emerging OTT players, or any combination of them have not yet resulted in an ecosystem architecture that would have been able to make the difference in the Western m-payment markets.

As mentioned we discovered that the number of articles investigating m-payment ecosystems had increased since 2008. Published articles study m-payment ecosystems from the perspectives of banks and financial institutions, mobile network operators, third party payment service providers or from the perspective of new market entrants, whereas there are fewer multi-industrial studies. The article of Gaur and Ondrus (2012) examines the role of banks in the m-payment ecosystem by using the resource-based view (RBV). Their article identifies the unique (immobile and difficult to imitate) strategic resources of banks and financial institutions and analyzes how banks combine and deploy these unique resources and capabilities within the m-payment ecosystem. Gaur and Ondrus also propose that the RBV approach could be used to analyze the resources and capabilities of other actors. The studies of Kshetri and Acharya (2012) and Balocco et al. (2008) discuss factors, which affect the growth of m-payment markets through the actions of various stakeholders. The results of the mentioned studies address the key issues and challenges in the development of m-payment services as seen from the perspectives of various stakeholders.

Some articles investigate complex and multifaceted relationships between the actors of m-payment ecosystems (Kazan and Damsgaard, 2013; Hedman and Henningsson, 2012). These studies reveal that the outcome is highly dependent on the embedded collaboration models between the participants. These studies shed light on the behavior of different actors in different m-payment ecosystems. Ondrus and Pigneur (2009) apply a multi-actor multi-criteria method to analyze the various aspects of an m-payment market. Their method makes it easier to determine the role and other preferences of m-payment ecosystem stakeholders. Au and Kauffman (2008) apply, what they call a robust framework, to analyze economic issues related to disruptive technologies. They identified several economic issues in relation to consumers, firms, business processes, markets, industries and society. They focused especially on consumers and other m-payment service users, technology providers and vendors. The

study of Au and Kaufman covers the full range of mobile payments from individual level through organizational level to market level and from technologies to legal issues. Despite of this the Holy Grail for m-payment is not found.

As a whole, research on m-payment ecosystem is fragmented. This is especially true for studies, which consider the interaction between different stakeholders. Most studies have investigated one stakeholder or one type of stakeholders. Analyses of the real life cases, both success stories (which are few) and failure stories could provide insight to define better both theoretical and practical needs. So far m-payment solutions and platforms have predominantly been combinations between the finance and telecom industries. This means that financial institutions provide their payment expertise, mobile network operators provide mobile networks, and mobile phone manufacturers supply handsets with necessary features. This is likely to change. For instance, Google and Apple as OTT service providers have already developed their payment ecosystem and entered the payment industry. In their ecosystems, mobile network operators only act as a traffic carrier channel with limited power. Such new entrants strengthen the competition but are also likely to change roles within the entire payment ecosystem, since they already reach (hundreds of) millions consumers and merchants. We found only very few articles that had investigated the impact of OTT providers, such as Amazon, Google, Apple, Pay-Pal, Sagepay or Square. The interesting questions are: will these new entrants be able to re-shape the m-payment ecosystem and the payment ecosystem in general, and if so how will states, central banks and regulators react to such changes. One may also ask, how incumbents react and try to safeguard their positions. The article of Ondrus and Lyytinen (2011) is one of the few exceptions. They analyze and estimate the potential effect of newcomers, who – such as Google and Apple - are established companies in their respective industries. Their conclusion was that incumbents (mobile network operators, banks, credit card companies) still have the assets to block the efforts of new entrants should they want to do that.

With regard to behavioral aspects Figure 2, shows constructs used in prior m-payment consumer acceptance research as published in 14 publications, and how those constructs are related. This figure once again confirms that past behavioral research has failed to identify why and how mobile payment services become widely used. No constructs related to the long-term break through of m-payments are visible. More striking even is the lack of attention to issues that merchant struggle with.
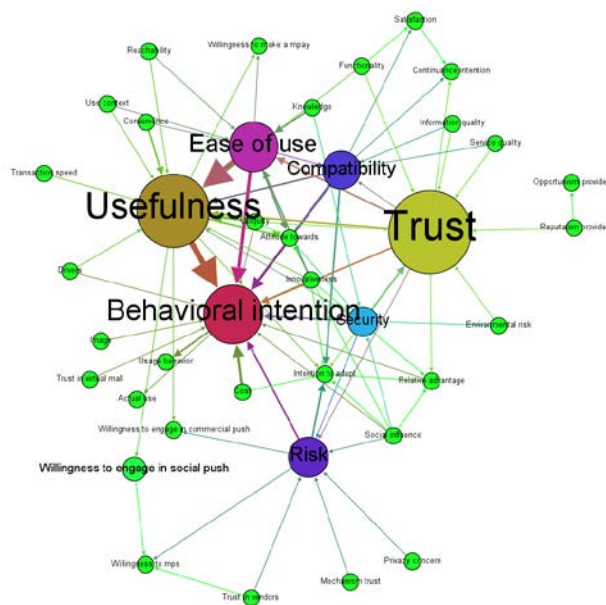

Figure 2.   Constructs of mobile payment literature with their relations.

5   Discussion

In this article we discussed the role of platforms, ecosystems, and NFC and cloud solutions (security elements) as disruptive technologies. We considered them as potential technological factors, which could make m-payment services broadly accepted in developed economies. We also reviewed several theories of money with the same motive. In addition to that we carried out a systematic literature review and a meta-analysis to find other factors that might lead to m-payment service to break through in Western economies. As the result of the literature review we discovered that m-payment ecosystem has been investigated in general but not from the perspective of how assets and resources are made available in a joint effort to implement m-payment broadly within society. Moreover the factors discussed related to platforms, the core role of Secure Elements and potential disruptive effects for the existing ecosystems, and the theory of money are largely missing from past research. The results of the meta-analysis disclosed that trust and usefulness appear as the key concept of past research on the consumer adoption of m-payments followed by behavioral intention (to use mobile payments), ease of use, risk, compatibility and security. Since these widely investigated concepts have not resulted in the breakthrough of mobile payments in developed economies they are in our view important but not decisive for adoption.

Thus, as the answer to our research question, it is, indeed, possible to detect factors that will make m-payment services broadly accepted in developed economies. We propose that this happens with widely used technological platforms, supported by large multi-sided ecosystems with cloud (security) solutions and other technology elements, which at the same time provide money and payments cheaper and with increased productivity. These issues separately and especially jointly should constitute the focus of future research. We mentioned Apple and Google, and some others, as examples of companies who have the potential to force a break through. Since m-payment could be connected to any global service or commerce site, actors from the rapidly growing Asian market, like Ali-Baba with Ali pay, might also take this role.

In this paper we also discussed other situations that promote the success of m-payment service. For instance, it is not practical or even possible to exchange mobile content by making use of current state moneys. Thus, as the answer to the other part of our research question, is it possible to detect situations that will make m-payment services viable in developed economies, and we suggest that person-to-person (P2P) m-commerce as well as m-credit might provide opportunities. We mentioned Bitcoins and credit cards as possible "role models". The positive experiences of developing economies are in line with both suggestions. For example the ability to make P2P payments with mobile phones in developing African countries brought money for the first time to these persons as a modern medium of exchange. Thus it seems possible that finding the formula for the success of mobile payments from factors mentioned in this article could result in similar breakthrough in developing economies. On a speculative level we even can consider that data can become the new money, as access and control over data becomes a new asset.

Since we have not tested empirically our propositions this article includes all the limitations of this kind of conceptual articles. Despite of our own research and experience in the field and it is possible that we have missed some important factors. On the other hand, our purpose was to offer based on practical experience and research an expert opinion to the question how to finally make mobile payment services viable in developed economies. To practitioners we offer the advice to look how cloud solutions, platforms and ecosystems can be deployed to offer better m-payment services by considering at the same time the roles of money. We also advise them to cooperate with central banks and financial supervisors in addition to their existing contacts with merchants, consumers, banks, credit card companies and technology providers.

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