Jie Guo

To Pay or Not to Pay: The Dilemmas of an Emerging Business Ecosystem – The Case of Mobile Payments

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Jie Guo

Information Systems

Faculty of Social Sciences, Business and Economics

Åbo Akademi University

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Supervisor

Professor Dr. Harry Bouwman
Institute for Advanced Management Systems Research
Faculty of Social Sciences, Business and Economics
Åbo Akademi University
Turku, Finland

Faculty of Technology, Policy and Management
Delft University of Technology
Delft, The Netherlands

Reviewers

Professor Dr. Jonas Hedman
Department of IT Management
Copenhagen Business School
Copenhagen, Denmark

Professor Dr. Hannu Salmela
Information systems
Turku School of Economics
University of Turku
Turku, Finland

Opponent

Professor Dr. J. Felix Hampe
Faculty of Informatics
Institute for Information Systems Research
University Koblenz
Koblenz, Germany

Abstract

In the modern digital age, with mobile technology at the heart of new and vibrant digital ecosystems, mobile payments draw extensive attention from researchers and practitioners. A mobile payment ecosystem can be described through the three general characteristics of a business ecosystem (symbiosis, platform, and co-evolution), together with a mobile payment technology platform, and all the actors coevolving reciprocally with each other. Due to the complex issues of a mobile payment ecosystem, a narrow view focusing only on a few components of mobile payment is unlikely to provide a sufficient understanding. To that end, a more comprehensive analysis from multiple perspectives is required to gain insights that can form the basis for building viable mobile payment ecosystems.

The main research objective of this thesis is to describe and explain the core and the extended network of the mobile payment ecosystem and to offer guidelines to actors in a mobile payment ecosystem in order to strengthen their positions in the mobile payment ecosystem. In order to do so, first, a literature review is carried out, followed by the studies discussing the core actors (different mobile payment providers and merchants), combing qualitative and quantitative methods. On one hand, mobile payment providers are investigated from business models and resources perspective, by considering dynamic changes in the ecosystem. On the other hand, merchants are examined from a business ecosystem perspective to study their adoption behaviour.

The main theoretical contribution lies in obtaining a new perspective on existing theories (i.e., business ecosystem theory, platform theory, resource based view, resource dependency theory, contingency theory, configuration theory and business modelling) in light of what we can achieve by integrating them into a general framework. More specifically, first, the StReS model offers a novel general approach for integrating different theories to understand organizational behaviour in a business ecosystem. Second, the analytical framework modelling merchants' acceptance is a novel framework integrating different theories to explain an organization's adoption of a technology. Third, the approach to link business models to an actor's position in a business ecosystem provides a novel method to identify the critical design issues of business models that can help to strengthen the core actors in the mobile payment ecosystem.

The main practical contribution lies in offering guidelines to actors, especially mobile payment platform providers, to strengthen their positions in the mobile payment ecosystem.

Sammanfattning

I dagens digitala samhälle finns det bland forskare och näringsliv ett utbrett intresse för mobila betalningar. Mobilteknologi ligger i centrum för de nya levande digitala ekosystem. Ett mobilt betalningsekosystem kan beskrivas genom tre allmänna egenskaper för affärsekosystem (symbios, plattformar och samevolution), tillsammans med en teknologisk mobil betalningsplattform, samt att alla aktörer utvecklas i växelverkan med varandra. Mobila betalningsekosystem medför komplexa frågor som inte kan besvaras genom att enbart fokusera på begränsade delar av ekosystemet. För att kunna bygga livskraftiga mobila betalningsekosystem, behöver man insikter som bygger på en mera omfattande analys och insikter från flera synvinklar.

Avhandlingens huvudsakliga mål är att beskriva och förklara kärnan och nätverket av mobila betalningsekosystem, samt att erbjuda riktlinjer för olika aktörer så att dessa kan stärka sina positioner i ekosystemet. För att uppnå dessa mål, bygger forskningen på en litteraturstudie, åtföljd av studier om de centrala aktörerna. Studierna genomförs med en kombination av kvalitativa och kvantitativa metoder. De tjänsteleverantörer som erbjuder mobila betalningstjänster granskas med fokus på affärsmodeller, resurser och dynamiska ändringar i ekosystemet, medan återförsäljare undersöks i huvudsak gällande deras adoptionsbeteende.

Avhandlingen bidrar till teorin genom att ge nya perspektiv på existerande teorier med syftet att undersöka vad som kan uppnås genom att integrera dem till ett generellt ramverk. Mera specifikt är det första bidraget StReS-modellen som integrerar olika teorier och erbjuder ett innovativt angreppssätt för att kunna förstå organisationsbeteende i ett affärsekosystem. För det andra presenteras ett nytt ramverk för att förklara hur organisationer adopterar teknologi. Det tredje bidraget är en ny metod för att identifiera kritiska designfrågor gällande affärsmodeller som kan stärka aktörerna i mobila betalningsekosystem.

Det huvudsakliga praktiska bidraget ligger i nya riktlinjer för att speciellt de aktörer som erbjuder plattformar för mobila betalningar skall kunna stärka sina positioner inom det mobila betalningsekosystemet.

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List of original publications

1. Dahlberg, T., Bouwman, H., Cerpa, N., & Guo, J. (2015). M-Payment-How Disruptive Technologies Could Change the Payment Ecosystem. In proceedings of European Conference on Information Systems, paper 35, Munster, Germany.

2. Dahlberg, T., Guo, J., & Ondrus, J. (2015). A Critical Review of Mobile Payment Research. Electronic Commerce Research and Applications, 14(5), 265-284.

3. Guo, J., & Bouwman, H. (2016). An Analytical Framework for an M-payment Ecosystem: A Merchants′ Perspective. Telecommunications Policy, 40(2), 147-167.

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6. Guo, J., & Bouwman, H. (2016). An Ecosystem View on Third Party Mobile Payment Providers: A Case Study of Alipay Wallet. Info, 18(5), 56-78.

The contribution of the author to the original publications

1. Joint author. Responsible for literature review and analysis of literature review. Wrote most of sections 3 and 4.

2. Joint author. Responsible for collecting literature review and statistical analysis. Wrote most of sections 2, 3.3 and 4.4.

3. Main author. Designed the interview with the co-author. Responsible for collecting data, analysis and wrote most of the paper.

4. Main author. Designed the questionnaire with co-authors. Responsible for collecting data, analysis and wrote most of the paper.

5. Main author. Designed the interview and questionnaire with co-authors. Responsible for collecting data, analysis and wrote most of the paper.

6. Main author. Designed the interview with the co-author. Responsible for collecting data, analysis and wrote most of the paper.

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1. Introduction

1.1. Background and motivation

The dynamics of economic, technological, social, cultural, and political changes have shaped the ways in which organizations conduct their operations from individual actions to the formation of interconnected business networks, with the main goal of maintaining the sustainability of their business. For this reason, the concept of business ecosystem has attracted the attention of many researchers, especially in the last decade. By advancing an ecosystem perspective, academic research on organizational and business innovations can evolve and result in a better understanding of and broader view on the continuous interaction between interdependent organizations (Basole, 2009a; Ghisi & Martinelli, 2006; Lusch et al., 2010). Formally, a business ecosystem is defined as a set of interconnected and interdependent organizations collectively producing a holistic, integrated technological system that creates value for customers (Bahrami & Evans, 1995; Teece, 2007; Ågerfalk & Fitzgerald, 2008). The organizations in a business ecosystem work cooperatively and competitively together in a dynamic structure that evolves over time (Peltoniemi, 2006; Moore, 1993, 1996; Iansiti & Levien, 2004a, 2004b). Understanding the dynamics of changes taking place in an ecosystem regarding technology, economic and social environment, and recognizing the factors driving ecosystem evolution, can provide important information for organizations to improve their strategies. According to Li (2009), business ecosystems have three major describing characteristics: symbiosis, platform, and co-evolution. In the modern digital age, mobile technology is at the heart of new and vibrant digital ecosystems. Reflecting the same three discussed characteristics of a business ecosystem (symbiosis, platform, and co-evolution), a mobile payment ecosystem, the object of our study, loosely connects multiple actors with a mobile payment technology platform, and all actors coevolve reciprocally with each other.

Firstly, symbiosis refers to the phenomenon of business ecosystem actors being loosely connected but at the same time reinforcing each other. Based on the business ecosystem definition of Moore (1993, 1996) and Iansiti and Levien (2004a, 2004b), a business ecosystem includes actors on (at least) three levels: (i) entities

contributing directly (such as direct suppliers, direct customers, and distribution channels); (ii) entities contributing indirectly (such as competitors and suppliers' suppliers); (iii) entities having less immediate but powerful influence on the other actors' business (such as regulatory institutions and labour union).

Secondly, a service/product or technology platform is present in the ecosystem, and this platform can be utilized by members other than the platform provider(s) (Moore, 1993). Therefore, providers of the platform play a crucial role in what way an ecosystem fosters the growth and productivity of other organizations. Platform providers in different contexts are termed keystone players (Iansiti and Levien, 2004a), platform leaders (Cusumano and Gawer, 2002) or ecosystem leaders (Moore, 1993), who can utilize the platform to influence other organizations with associated products or services. Because of this, the value generated in a business ecosystem needs to be measured on a network level, rather than on an individual level (Hearn & Pace, 2006).

Lastly, business ecosystem co-evolution refers to the organizations evolving reciprocally with each other (Basole, 2009a; Teece, 2007; Moore, 1993). The process of co-evolution involves different layers of (positive, negative or neutral) interactions among organizations, resulting in the exchange of information and resources (Bahrami and Evans, 1995; McCarthy et al., 2000; Tsatsou et aI., 2010; Vidgen and Wang, 2006). In addition, the relationship between firms can take on various forms of cooperation as well as competition, resulting in co-opetition among ecosystem actors (Basole, 2009a; Isckia, 2009). The participation of organizations in ecosystems makes it possible for the organizations to create value that they could not create individually. Co-evolution is more readily observed in ecosystems where complementary products or services of organizations produce distinct technological sub-systems, and there is a clear platform architecture that connects all sub-systems in a stable fashion (Li, 2009). A business ecosystem entails a broad community of firms that add value to a technology standard by supplying complementary assets to the core product (Moore, 1993).

Mobile payments are arising, as a consequence of the following recent developments: (i) the exponential increase in the penetration of smartphones, with 2.6 billion smartphone subscriptions globally in 2014, and this number is estimated to reach 6.1 billion by 2020 (Ericsson, 2015), and (ii) the continuous developments

in mobile internet technology, with 3G or 4G coverage set to reach 86% of the population by 2020, with ongoing research on 5G since 2012 (GSMA, 2015). As a source of designing new services in the digital world and generating value for companies and customers, mobile technologies drive the development and innovation potential of various mobile commerce services. As an important type of mobile commerce services, mobile payment in this thesis is defined as *"a payment system to initiate, authorize and confirm a financial value exchange for goods and/or services using mobile devices by taking advantage of wireless and/or other communication technologies while excluding: (i) any type of electronic or mobile money, (ii) access to electronic payment services with mobile devices, and (iii) electronic banking"* (Guo & Bouwman, 2016b). Mobile payment is on the way to fundamentally change how customers pay for services and products and, in general, how they interact with merchants, service providers, etc. (Dahlberg et al., 2015a). By studying different actors that can potentially play a role in realizing mobile payments, the network of these actors offers itself as an important case to analyse and understand business ecosystems.

A mobile payment ecosystem can be considered as an increasingly complex phenomenon, because the mobile payment market is very dynamic, particularly due to constantly developing technological advances (Au & Kauffman, 2008). With the introduction of 3G and 4G, different payment providers are all involved in fierce competition and collaboration with the aim of creating sustainable and profitable mobile payment platforms (Guo et al., 2015). In the past, mobile payment has been understood as an intermediate platform between finance and mobile communications, meaning that financial firms provide their payment expertise, mobile network operators provide mobile networks, and mobile phone manufacturers supply handsets with supporting features (Ondrus & Pigneur, 2005). The evolving development of a mobile payment ecosystem allows actors to join from different industries (in addition to financial and telecommunications industry) with different incentives and prerequisites, which may cause misalignments among the stakeholders, further increasing the complexity of a mobile payment ecosystem. In addition, the great opportunities and potential of mobile payment have led to entry of newcomers. As a result, incumbents have to re-position themselves in the mobile payment market, and because of these developments, different mobile payment platforms can co-exist in mobile payment markets. These include platforms

provided by financial institutions or banks, platforms provided by MNOs, platforms provided based on collaboration between financial institutions and MNOs, platforms provided by third party payment providers, platforms provided by over-the-top (OTT) providers and platforms provided by merchants (Ondrus & Pigneur, 2005; Dahlberg et al., 2015a; Guo & Bouwman, 2015). In other words, mobile payment platforms can be provided by different actors or different combinations of actors. The existence of different providers can be explained by different actors competing for the control over core assets in a mobile payment ecosystem (Au and Kaufman, 2008; Dahlberg et al., 2008b; Guo et al., 2015). For instance, the location of a secure element (SE), which is one of the key assets, is essential to user identification and authentication, and encryption of payment transactions (Dahlberg et al., 2015). Different countries have adopted different technologies and business models based on their own realities.

In this thesis, the focus is on the Chinese mobile payment market, which will be discussed in more detail in Chapter 3.2. In China, with the country having the world's largest mobile subscriber base, all the important potential key actors are present in mobile payment ecosystems. These actors include MNOs (i.e. China Mobile, ranked No.1 in the world), financial institutions/banks (China Unionpay as the second-largest payment network by value of transactions processed, (Wu, 2012)), and third party payment providers (such as Alipay supported by Alibaba, one of the world's biggest retail networks) (Guo et al., 2015). In this research, we are aware of the additional factors or entities having less immediate but powerful influence on the other actors' business (such as regulatory institutions and labour union). As all the actors are under the same regulations and standardizations in China, one can assume that the economic, social and regulatory environment is the same for all core actors as discussed in this thesis. Naturally, the economic and cultural environment can be different in regions of China, but we do not consider these potential differences in the thesis. That is to say, the focus of this thesis is on the entities contributing directly (different mobile payment providers and merchants) to the mobile payment ecosystem. In this thesis, business ecosystem is used as the unit of analysis. Developments in mobile technology cannot be viewed in isolation: one has to consider the system and the infrastructure these technologies are part of (Adomavicius et al. 2007; Au & Kaufman, 2008, Dahlberg et al., 2008b; Dahlberg et al., 2015b). Following the same line of thoughts, Basole and Karla

(2011) propose that the set of organizations present in the mobile technology industries, such as the mobile payment industry, is more appropriately conceived as an ecosystem. This holistic perspective allows us to focus specifically on the different levels of interactions among the core actors at ecosystem level and to describe and explain their actions based on this understanding.

1.2. Problem statement

When we look at academic research focusing on mobile payment (ecosystems), the starting point can be identified as the introduction of SMS based payments in Coca Cola vending machines in Finland, which can be seen as the first example of transforming mobile commerce taking place already in 1997. By looking at the history of payment methods, one can observe that every change resulted in a payment solution that was faster, cheaper, more secure, more efficient and more integrated into customers' daily life than its predecessor (Dahlberg et al., 2015a). This evolution can mainly be attributed to various business and technological innovations (Leinonen, 2008). The necessary technological developments and the adoption of smartphones capable of performing mobile payments seem to offer a favourable basis for widespread use. However, within the last two decades, one can find only very few successful cases and numerous failures from trials in most countries and regions (Bouwman et al., 2008; Gannamaneni et al., 2015; De Reuver et al., 2015). Since the first trials, thousands of practitioners and researchers have continuously attempted to identify and understand the issues that (i) prevent and (ii) could support mobile payment adoption (Au and Kaufman, 2008; Van der Heijden, 2002; Kazan & Damsgaard, 2013). According to Dahlberg et al. (2015a), there are four main issues to be considered in order to understand the reasons behind the lack of breakthrough for mobile payment in most of the countries and regions: (i) consumer and merchant behaviour, (ii) the large number of competing technologies, (iii) the complexity of mobile payment ecosystems (the presence of multiple actors from different industries with different incentives and prerequisites, providers competing for control over the core assets in mobile payment systems and the entire ecosystem, Dahlberg et al., 2015b), and (iv) the lack of clear regulations.

The steps of the evolution of payment methods include bartering, cash, account-based paper instruments, credit cards, electronic account transfers, and presently mobile payment. Each step forward in this development has required the users to

trust the new tools/devices and/or new institutions offering the new payment solutions (Leinonen, 2008). Customers are in general slow to change their payment habits and need several distinct incentives, such as lower cost, improved service and higher convenience compared to the old means of paying, in order to accept a new payment solution (Leinonen, 2008). In order to capture a significant share of the market, a new payment method has to find its way into the customers' payment habits (Leinonen, 2008; Dahlberg, et al., 2015a).

In most of the mobile payment cases, the actors involved in offering mobile payment solutions were established in different industries before they made the decision to cooperate and compete with each other while providing mobile payment services (i.e., MNOs operating originally in telecommunications industry but expanding to provide mobile payment services, or over-the-top providers such as Google or Apple also expanding to the mobile payment market). The key actors in a mobile payment ecosystem can be classified into three main segments: (i) the providers of the mobile payment platforms, such as banks/financial institutions, mobile network operators, payment service providers, mobile device manufacturers and any other mobile payment platform providers (e.g. over-the-top (OTT)) or directly product-related participants; (ii) the users adopting the mobile payments, such as consumers and merchants; and (iii) regulators governing the development, including policy makers, regulatory agencies and other public sector entities.

Several previous studies (Dahlberg et al., 2008a; Dahlberg et al., 2015b; Dennehy & Sammon, 2015) have observed that the academic literature on mobile payment between 1998 and 2014 is dominated by two main topics: technology developments and consumer adoption. So far, this focus of mobile payments has not offered sufficient contributions to the understanding of the reasons that hindered the developments of mobile payments over the years.

As the main premise of this thesis, it is assumed that a narrow view focusing only on a few components of the complex phenomenon of mobile payment is unlikely to provide a sufficient understanding. A more comprehensive analysis from multiple perspectives is required to provide an understanding that can form the basis for building viable mobile payment ecosystems.

1.2.1. Mobile payment ecosystem and platforms

As a starting point to describe and discuss mobile payment ecosystems, the widely used approach of Moore (1993; 1996) and Iansiti and Levien (2004a; 2004b) is used in this thesis. According to this approach, the main actors of a business ecosystem can be identified as: (i) entities contributing directly (such as direct suppliers, direct customers and distribution channels); (ii) entities contributing indirectly (such as competitors and suppliers' suppliers); (iii) entities having less immediate but powerful influence on the other actors' business (such as regulatory institutions and labour union). In addition to the ecosystem perspective, mobile payments also build on the characteristics of a multi-side platform, i.e. a technology that creates value primarily by enabling direct interactions between two (or more) parties (Hagiu & Wright, 2011).

Platforms can be analysed from different viewpoints. From a technological perspective, a platform is "a set of elements and interfaces that are common to a family of products" (Meyer and Lehnard, 1997). From an 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 a strategic perspective, platforms are defined as "building blocks (they can be products, 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 the information systems literature, there are several notions focusing on a platform perspective and capturing various aspects of the phenomenon, such as 'digital infrastructures' (Tilson et al., 2010), 'software platforms' (Taudes et al., 2000) or 'digital platforms' (used as alternative for software platform) (Eaton et al, 2015). Digital infrastructures can be defined as "the basic information technologies and organizational structures, along with the related services and facilities necessary for an enterprise or industry to function" (Tilson et al., 2010, p. 748).

In addition to the main functionality, a platform can include several modules (building blocks) that are interoperable with it through interfaces (Tiwana el al., 2010). Such building blocks can be reused to support a wider range of functionalities and they support development, deployment and delivery of new products or services

on top of the core functions. Consequently, platforms make it possible to meet diverse user requirements and fulfil user needs. Platforms enable two or multisided markets (Basole, 2009b; Evans et al, 2006; Rochet & Tirole, 2003). A typical example of multisided markets can be a platform that provides access to two or more customer groups and/or induces a positive network effect. In the specific case of mobile payment, the payment platform mediates among banks, consumers, merchants, application developers, and advertisers. The platform creates costs and collects revenues while serving multiple sides. In order to succeed, a platform needs to: (i) create value for each side, for example through transaction cost reduction, and (ii) collect revenues from each side. Regarding the second point, in some cases one or even two sides could be subsidized to increase the total value creation through the platform.

In order to foster the growth of a platform, the "start-up" problem of multi-sided platforms (the well-known chicken-and-egg problem) states that one side of a platform receives value only if participants on the other side of the platform receive value at the same time (Gawer, 2009). Mobile payment platforms are crucial for the interactions between merchants and end-users (consumers) (Leinonen, 2008). In other words, it is critical to achieve acceptance of both sides in order to ensure the success of a mobile payment service (Guo & Bouwman, 2016a). In general, merchants are hesitant to invest in mobile payment solutions without the assurance of consumer adoption, while consumers do not adopt without the assurance of merchants' adoption.

Looking at some widely adopted mobile payment initiatives in different countries, mobile network operators (MNOs) in particular play a leading role in the mobile payment ecosystem in both Japan (NTT DoCoMo) and Kenya (Safaricom) (Guo et al., 2015), while MNOs and financial institutions together are the dominant actors, with government support, in the development of a mobile payment ecosystem in South Korea. Moreover, over-the-top (OTT) providers are also interested in offering mobile payment services. A typical example is Google with the mobile payment service Google Wallet, which is only available in the United States at the time of writing this thesis. Financial institutions can also provide mobile payment services, for example Visa with Visa payWave. Besides platform providers, there are different sets of actors involved in different mobile payment

ecosystems with different individual focuses and strategies. In most of the cases, all the involved actors have established a good reputation in their original industry. Thus, , organizations from different industries can establish different modes of mobile payments (referring to different actor(s) acting as mobile payment provider(s)) when entering the mobile payment market: (i) the operator-centric mode (MNOs acting as the mobile payment platform providers), (ii) the bank-centric mode (banks or other financial institutions acting as the mobile payment platform providers), (iii) the independent service provider mode (i.e., third-party payment providers acting as mobile payment platform providers), and (iv) the collaborative mode (e.g., financial institutions and MNOs acting as joint providers) (Smart Card Alliance, 2008).

As the basis of any relevant analysis, it is an important precondition to identify the structure of the business ecosystem and the roles of different actors involved in it. The structure of the ecosystem is frequently reshaped by the battles for platform leadership and the control of critical resources among different actors (Au & Kaufman, 2008, Dahlberg et al., 2015a, De Reuver et al., 2015). These mobile payment platform providers are in most cases giants in their own industry and they want to extend their leadership to mobile payment. They are continuously struggling to maintain bargaining power by controlling key value elements when joining the mobile payment ecosystem. These value elements can include, for instance, the secure element (SE), functions that are used for user identification and authentication, and encryption of payment transactions (De Reuver et al., 2015). In the following, the most important actors and their initial resources acquired in their respective industry before entering the mobile payment ecosystem are introduced.

Conventionally, financial institutions are composed of organizations such as banks, insurance companies and investment dealers. Financial institutions have been in control of traditional financial transactions in the payment industry for a long time gaining the loyalty and trust of end-users. This core strength differentiates them from other actors and can help them to secure a dominant role in the mobile payment market. In addition, as a result of decades' long experience with risk management, banks can offer mature management in terms of data security, brand equity and reliability. These factors can ensure the vital role of financial institutions/banks in mobile payment ecosystems. On the other hand, banks are threatened by over-the-

top (OTT) providers entering the payment industry (i.e., Apple, Google, Facebook, Alibaba etc.). For instance, Apple Pay allows customers to make payments by waving their iPhone over a terminal. In addition, many Fintech (financial technology) start-ups are emerging to try to disrupt the banks' business models. For instance, TransferWise, as a currency-exchange unicorn with peer-to-peer technology, charges significantly less than banks (Feldman, 2015). Facing such competition and challenges, banks need to take defensive actions to keep their positions in the payment industry.

Mobile Network Operators (MNOs), as SIM card issuers, control network infrastructures and the mobile phone, which makes them the most important carrier in the mobile internet era. In addition, MNOs have been in the telecommunication industry for a long time gaining the loyalty and trust of end-users. As current mobile phones can function not only as information, communication and entertainment tools but also as "wallets", the operators, by acting as a bridge between the customers and merchants, can benefit from their network infrastructure. They can share this essential resource with financial institutions, merchants and third parties, potentially ensuring the dominant position in the mobile payment ecosystem. On the other hand, MNOs are threatened by over-the-top (OTT) providers; for instance, various OTT companies, like Skype, and What's app have eroded the telecom industry. MNOs therefore need to find ways to be prepared for the threat in the early stages of mobile payment development.

Third-party payment providers (in some cases also labelled as OTT providers) as newcomers, have more innovative ideas to bring to the mobile payment market. For instance, Google launched Google Wallet in 2011, in cooperation with different stakeholders, such as Citibank as the issuing bank, MasterCard as the initial payment network, and Sprint as the first mobile carrier. Both Apple and Samsung launched their mobile payment alternatives in 2015. Paypal and Alipay, as dominant online payment providers, have also entered the mobile payment market. About 15 percent of the purchases in Starbucks' U.S. stores were paid through its proprietary mobile application in 2014.

From a technology perspective, mobile payment evolved from early SMS based and WAP based payment methods to NFC (Near Field Communication) technology (Global, 2013). In 1999, the first major mobile commerce platforms were launched

in Japan (iMode) and in the Philippines (Smart Money). In 2002, the European Telecom Standards Institute developed official industry standards for mobile commerce (Global, 2013). In 2005, Nokia launched the world's first NFC enabled phone, which opened the gate for contactless payments (Global, 2013). Reflecting on the numerous competing technologies and standards for mobile payments, Kadhiwal and Zulfiquar (2007) argue that the slow adoption rate of mobile payment can mainly be attributed to the lack of common standards and the inconsistency of the underlying systems. In the last decade, various groups have been formed to define standardized solutions for mobile payments, but the presence of different mobile payment ecosystem actors with heterogeneous interests have led to cumbersome situations in the standards setting processes (Lim, 2008). In addition, Lim (2008) claims that different industries have their particular standards; for example, the regulations in the financial industry are different from the regulations in the telecommunications industry, which can hinder the growth of mobile payment. Therefore, it is crucial to find common approaches on national and international levels for the standard-setting process of emerging technology development (Lim, 2008). It is generally agreed that compatible mobile payment standards should be developed and implemented by the actors involved (Au & Kauffman, 2008).

In addition, previous regulations have been developed in order to stimulate MNOs to open their networks to service providers and to stimulate the development of the mobile service market. However, MNOs' innovation capabilities have been seriously harmed as a consequence of these changes in the regulations. As a result, 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 enter mobile payment ecosystems. At the same time, and in contrast to the situation of MNOs, the position of banks and other established financial institutions has for a long time been protected by sector specific financial regulations. As the growth of mobile payment has been steady but slower than expected (Au & Kauffman, 2008), most regulatory organizations are cautious and hesitant to introduce new regulations that might discourage organizations from the development of new innovations or favour one type of industry stakeholders or a specific business model at the expense of others (Gibney et al., 2015). Gibney et al. (2015) state that regulators have adopted a two-pronged approach: (i) industry

working groups have been formed to reach agreements on best practices, public commitments, and voluntary compliance guidelines; and (ii) new directives, legislation, and regulations have been drafted and passed to address specific concerns about mobile payments.

In summary, from an organizational perspective, the actors (such as banks/financial institutions, MNOs, third-party payment providers, and OTT providers) are seeking to gain a position at the table of mobile payment by taking either a defensive or an offensive expanding strategy, or both. From an ecosystem and platform perspective, to begin with, all core actors in a mobile payment ecosystem need to collectively work together to develop a mobile payment solution in order to achieve the common goal: return on investment. Then, the mobile payment providers should consider the start-up problem of a platform to get both merchants and end-users on board in order to ignite mobile payments and generate positive network effects. In addition, the battles for control of critical resources among all the key actors dynamically reshape the ecosystem structure, resulting in all the key actors struggling to manage the interdependent relationship all the time and trying to strengthen their positions in the ecosystem. As for the technology perspective, the unified standards and compatibility are key elements for the network effects of the mobile payment platform and the mobile payment ecosystem (Au & Kauffman, 2008). Shapiro and Varian (1998) propose that standards enhance compatibility, also known as interoperability, which increases the network effect by essentially combining existing networks.

As a summary, the following main conclusions can be drawn as the motivation for the research presented in this thesis, as discussed in more detail in later chapters:

- there is a lack of studies on mobile payments from an ecosystem perspective based on a multi-theory approach;

- there are few studies of the role of core actors in mobile payment ecosystems under the same regulatory conditions and in the same social-cultural context;

- there is a lack of studies on mobile payments from the perspective of merchants;

- there is a limited set of studies describing collaboration between multiple stakeholders;

- there is a lack of studies documenting viable and sustainable mobile payment cases.

1.3. Research objective and research questions

Due to the complex issues of establishing a mobile payment ecosystem as discussed above, the main research objective of this thesis is *to describe and explain the core and the extended network of the mobile payment ecosystem and to offer guidelines to actors in a mobile payment ecosystem in order to strengthen their positions in the mobile payment ecosystem.* In order to do so, in the thesis, first, we address the core actors' business model design, with the main goal to identify the elements of design that could help the organizations to decide where to focus in order to establish and strengthen their positions in the mobile payment ecosystem. Second, from a resource-based and a resource dependency perspective, by considering dynamic changes in the ecosystem, we analyse actions that actors are taking to reduce uncertainty on interdependent resources in order to strengthen their positions in the mobile payment ecosystem. Third, we study merchants who act as providers for consumers and are adopters from the perspective of mobile payment platform providers, and consider the start-up issues of mobile payment platforms. We study what factors in a dynamic ecosystem will influence merchants' decision processes leading to the adoption/rejection of mobile payment platforms.

In the thesis, the main focus and the context of the study is on various organizations, including the companies that are present in the Chinese market as mobile payment providers: (i) banks that are the original central actors in the payment industry; (ii) MNOs that are originally central actors in the mobile communication industry; and (iii) third party payment providers that dominate the on-line payment market, and (iv) merchants that are adopters of mobile payment platforms. Regarding end-users, we make use of the already existing literature, and although the thesis does not include a consumers' perspective directly, the interaction among consumers and other stakeholders is worked out and discussed.

Based on the above discussion, the research objective can be addressed through several research questions that have been answered in the original research publications. To begin with, analysing one single aspect, no matter how systematically, it is unlikely to find a sufficient explanation to the complexities related to mobile payments. Therefore, the state of the art on mobile payment research is focused on the ecosystem perspective, which leads to the question:

RQ1. What is the state of the art on mobile payment, specifically when the ecosystem perspective is considered?

It might be assumed, based on an initial impression of ex ante literature, that there is a lack of studies on mobile payment from a merchants' perspective. Merchants act not only as users who adopt a mobile payment platform offered by different providers but also as providers of mobile payment services to consumers. These two different roles require merchants to consider the factors related to technology push as well as consumer demand. To balance the (possibly) conflicting requirements of these two roles, the dynamic interplay of organizational level factors (i.e. power and control, competitive strength and strategic orientations) with environmental level factors (i.e. the mobile payment ecosystem factors) should be considered.

RQ2: What are the factors in a mobile payment ecosystem that influence merchants' acceptance of mobile payment platforms; how do these factors affect their adoption-decision process?

In addition, the studies found in the literature are mainly focused on western economies. More specifically, there is no prior study systematically investigating the core actors, such as mobile payment providers, in a mobile payment ecosystem that operate under the same regulations and context (i.e. China). Therefore, in this thesis we focus on different mobile payment providers in China. Within the mobile payment ecosystem, all the core actors are struggling for a better position, which leads to the following research question.

RQ3: How can different mobile payment providers establish/strengthen their positions in a mobile payment ecosystem?

In order to answer these research questions, the structure of the thesis is presented as follows.

1.4. Overview of the thesis and contributions

This thesis summarizes findings from six original publications, addresses the three research questions and aims to attain the initially formulated research objective. Figure 1.1 shows an outline of the research.
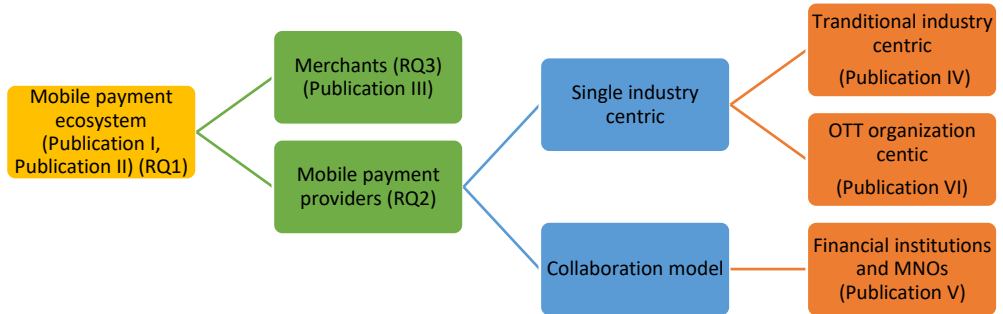
Figure 1.1 Overview of the thesis and publications

Chapter 1 of the thesis explains the relevance of the research, including the background, motivations, research objectives, and research questions.

Chapter 2 summarizes the state-of-art of mobile payment literature focusing on the ecosystem perspective, with the discussion based on Publication I and Publication II. Publication I, "*Mobile payment - How Disruptive Technologies Could Change the Payment Ecosystem*", discusses possible theories that can be used in mobile payment research, while Publication II, "*A critical review of mobile payment research*", offers a literature review on mobile payment and identifies research gaps and future research directions in the domain.

Chapter 3 presents the theoretical foundations and research frameworks of the thesis, namely, business ecosystem theory, contingency and configuration theories, resource based view and resource dependency theories. In addition, the general structure of a mobile payment ecosystem is presented and the context in which a large part of the research is conducted, namely the Chinese mobile payment market, is discussed.

Chapter 4 of the thesis summarizes the methodological basis for the research and introduces the main qualitative and quantitative approaches utilized in the research.

Chapter 5 offers a deeper analysis of a mobile payment ecosystem from the perspective of different actors, in which four more publications are included forming the main results of the research as discussed in the following.

Publication III, with a focus on merchants in a mobile payment ecosystem, "*An analytical framework for an m-payment ecosystem: A merchants' perspective*", analyses the dynamic relationships among merchants, end-users (consumers), mobile payment platform, platform providers and regulatory institutions. The aim of this paper is to understand: (i) what factors influence merchants, as crucial actors in the mobile payment ecosystem, to adopt mobile payment platforms; (ii) how those factors are related to each other; and (iii) how the decision processes of merchants are evolving as they lead to the adoption or rejection of mobile payment. Building on insights from business ecosystem concepts, a multi-perspective analytical framework is developed to identify factors influencing merchants' acceptance of mobile payment platforms. The data is collected by in-depth interviews with experts and managers carefully selected among merchants in China.

The contributions of Publication III can be summarized as follows. First, unlike many prior studies that attempted to extend a conventional technology, organization, and environment (TOE) framework (Oliveira and Martins, 2011) or the diffusion of innovation (DOI) model (Rogers 1995) to examine organizational adoption of new information and communication technologies, we contribute to mobile payment adoption research from a configuration perspective by investigating the non-linear interactions among different elements in the mobile payment ecosystem. Second, we develop an analytical multi-level framework that helps to analyse the interdependent factors within the model, which can be extended to other actors in the business ecosystem. Third, the study combines ecosystem and platform theory, bridging the gap between resource configurations and strategy orientations with technology, demand and environment factors. Fourth, from a practical point of view, the article offers advice to mobile payment platform providers as well as regulatory bodies on how to facilitate merchants to adopt mobile payments. The practical implications of our study indicate that mobile payment providers should pay close attention to multi-level issues.

The results show five identified categories that have an impact on merchants' adoption in the mobile payment ecosystem: (1) organizational factors; (2)

technology factors; (3) demand factors; (4) inter-organizational factors; (5) environmental factors. In addition, whether merchants adopt a mobile payment platform or not depends on the configurations of the identified interdependent factors clustered together. The decision process of the adoption originates from the core business level, and then moves to the extended network level and finally to the business ecosystem level.

Following an extensive analysis on the role and adoption behaviour of merchants, mobile payment providers in the mobile payment ecosystem are analysed in three publications:

Publication IV, "*Analyzing the Business Model for Mobile Payment from Banks' Perspective: An Empirical Study*", offers a holistic view of the business model for mobile payment from a bank perspective by making use of the STOF (service, technology, organization and finance) (Bouwman et al., 2008) model as the research framework and the Analytic Hierarchy Process (AHP) as the research approach, to analyse which domain of the STOF model (service, technology, organization and finance) is more important, and to highlight the most important components within each domain. The data is collected - using a questionnaire - from a number of bank employees working on mobile payment solutions in China.

Publication IV contributes new insights from a business model perspective, on how to establish and strengthen the banks' position in a mobile payment ecosystem through the design of a business model.

Based on the results, we suggest that banks should improve their business models from two angles. Firstly, in order to enlarge their customer base and stay competitive in the market, banks should provide more attractive and appealing services to the customers. Secondly, banks as one of the most important actors in the mobile payment ecosystems should make more efforts to improve the customer/merchants relationships, and pay careful attention to choose the right partners.

Publication V, with a focus on mobile network operators' (MNOs) perspective, "*Business Model for Mobile Payment in China*", applies a mixed-method approach combining quantitative and qualitative methodology to provide insights into the design of a viable business model of a mobile payment platform that is jointly operated by an MNO and a financial institution. The cooperation of China Mobile

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and China Unionpay to build a Trusted Service Manager (TSM) platform to provide mobile payment is selected as a representative of two powerful organizations' collaboration. Firstly, to identify design issues for viable mobile payment business models and for better positions in mobile payment ecosystems, the Analytic Hierarchy Process (AHP) is utilized to analyse questionnaire data collected from three MNOs in China. Then, by comparing the gained insights from semi-structured interviews with experts and the results of the AHP analysis, the results show how business models can be improved.

Publication V contributes an approach that can also be applied to other services to identify critical design issues of business models. This study contributes new insight on two powerful organizations' collaboration, with a focus on how business models can help organizations to establish and strengthen their positions in a mobile payment ecosystem. Moreover, this study sheds light on how government policy and regulations can reinforce a more viable business model. From a practical perspective, the results provide guidelines for what design issues should be addressed to make a viable mobile payment business model.

The results show that components such as building customer trust on payment services, innovative payment experience, extending the market to new segments, guaranteed security and privacy issues, user profile management, and hardware problems involving existing infrastructure, customer/merchant relationships, platform interoperability, and cost savings on fraud detection need to be improved to enhance the potential of mobile payment. Moreover, we found that policy and regulation support play a critical role in the development of mobile payments. A unified standardisation, clear government policy and regulations encourage service providers to actively promote mobile payment, which in turn enhances the performance of the entire mobile payment ecosystem.

Publication VI, "*An Ecosystem view on Third Party Mobile Payment Providers: A Case Study of Alipay Wallet*", investigates how a relatively successful mobile payment provider is established and sustained through the dynamic changes of an ecosystem from a resource perspective. We analyse the case of Alipay wallet, the mobile payment service provider with the largest market share in China, and focus on understanding the motivations and subsequent actions of the organizations cooperating in the Alipay wallet core ecosystem.

Publication VI contributes to platform theory and ecosystem theory, and bridges the gap between the resource based view (RBV) (Wernerfelt, 1984; Barney, 2001), resource dependence theory (RDT) (Pfeffer & Salancik, 1978) and ecosystem perspectives on mobile payments. The StReS (Structure-Resources-Strategy) framework is introduced to analyse a business ecosystem and to investigate (i) the motivations of the organizations cooperating in the core ecosystem, and (ii) the actions they have taken to reduce dependency and uncertainty.

The results show that actors with heterogeneous and complementary resources can forge sustainable collaborations. Within the ecosystem, although always constrained by resources and capabilities, the power imbalances are dynamically changing, depending on the actions that the core actors have taken in order to reduce uncertainty.

Chapter 6 offers the answers to the research questions, and presents theoretical contributions, recommendations to practice, the main limitations and possible future research directions.

2. Literature review

This chapter presents a summary of the literature published on mobile payment from 1998 to March 2016. By applying both quantitative and qualitative analysis, research gaps are identified and as a result, an answer to RQ1 is offered. The complete literature review is presented and discussed in more detail in Publication I and Publication II. Publication I discusses possible theories and concepts that can be used in mobile payment research, and presents a systematic literature review from 1998 to 2013. Publication II conducts a systematic literature review from 2007 to 2015 to identify research gaps and future research directions in the domain. In this section, we combine the literature reviews of Publication I and II, and extend the discussion with the mobile payment literature from 2015 until 2016, based on the framework used in Publication I and II. In the following, the way we executed the systematic literature review is presented in Section 2.1. Section 2.2 discusses the literature review framework (Figure 2.1), which includes both the five forces approach (Porter, 1980) and the generic contingent theory factors. Based on the selected literature, our definition of mobile payment, as already provided in Chapter 1, is discussed in more detail in Section 2.3. Section 2.4 presents the overall results of the literature review using descriptive statistics. Section 2.5 focuses on analysing the articles most relevant to our research, specifically mobile payment ecosystem contributions, using a qualitative analysis. Finally, the identified research gaps are addressed in Section 2.6.

2.1. Systematic literature review approach

In this study, the following definition of systematic literature review by Petticrew and Roberts (2008) is applied: "Systematic reviews are literature reviews that adhere closely to a set of scientific methods that explicitly aim to limit systematic error (bias), mainly by attempting to identify, appraise and synthesize all relevant studies (of whatever design) in order to answer a particular question (or set of questions) " (p. 9-10). The analysis includes both journal articles and conference papers, as a systematic review should examine journal articles as well as selected conference proceedings in order to be topical (Webster & Watson, 2002). Publication forms excluded from the analysis consist of unpublished working papers, master and doctoral dissertations, editorials, news reports, book reviews and book chapters.

First, the published articles were selected from 1998 to March, 2016. The reason for choosing 1998 as the starting point is that mobile commerce can be traced back to the Global Mobile Commerce Forum in London on the 10th of November, 1997, that attracted more than one hundred organizations participating with their mobile commerce teams. The literature search started with a wide systematic search of various online databases to identify mobile payment literature published in English. Table 2.1 lists the databases that were considered in the literature review. The initial search was based on the keywords: ''mobile payment(s)'', ''mobile payment(s)'', ''proximity payment(s)'', ''contactless payment(s)'', and ''NFC payment(s)''. The titles and abstracts of the articles in the databases were screened for the above expressions. Afterwards, articles in which mobile payments constitute only a minor section were excluded; for example, articles specifically focusing on mobile commerce or electronic payments were not included in further analysis. In addition, the articles that are highly technical, addressing mostly engineering and computer science issues were also excluded. Moreover, based on the identified articles, the review process continued by examining other works of the same authors as well as citations in the articles (Webster and Watson, 2002). Articles from conferences in the fields of IS with a focus on electronic commerce and mobile business were included. Table 2.1 lists the conferences included in the literature review.

Second, the selected articles are classified into nine categories, namely, technological, consumers, merchants, mobile payment ecosystem, new e-payments, social & cultural, traditional payments, commercial and legal, regulatory, standards, according to the review framework (as shown in Figure 2.1).

Table 2.1 *Sources used to search literature*

Online database	Selected conferences proceedings
ScienceDirect	International Conference on Information Systems, ICIS
EBSCO	Hawaii International Conference on System Sciences, HICSS
Scopus	Americas Conference on Information Systems, AMCIS
Web of Knowledge	European Conference on Information Systems, ECIS
Emerald Fulltext	Pacific Asia Conference on Information Systems, PACIS
ProQuest Direct	Australasian Conference on Information Systems, ACIS
IEEE Xplore	Bled Electronic Commerce Conference, BLED
ACM Digital Library	International Conference on Electronic Commerce, ICEC
AIS eLibrary	International Conference on Electronic Business, ICEB
Wiley InterScience	IADIS E\Commerce
Google Scholar	IADIS WWW/Internet
	Mobility Roundtable
	International Conference on Mobile Business, ICMB

The classification proceeded as follows: the whole article (i.e., the title, abstract, methodology, results, and discussion/conclusions) was reviewed and based on this the article's main category was determined as well as the methodology used (empirical or conceptual). There is a class 'multiple categories', as some articles focused on several factors.

2.2. Literature review framework

The framework shown in Figure 2.1 has been proposed by Dahlberg et al. (2008a), and extended by Dahlberg et al. (2015b) as a possible basis for conducting a literature review on mobile payment. The framework is used to classify and analyse literature, and to propose future research directions. The framework is guided by two theories: (i) the five forces model developed by Porter (Porter, 1980), and (ii) the generic contingency theory, which has emerged from the work of Lawrence and Lorsch (1967), Perrow (1967) and Thompson (1967).

In this framework, the actors present in the mobile payment ecosystem include service providers, merchants, consumers, and policy makers as well as other technologies, and social and cultural context as mentioned in the introduction of this thesis. The graphical representation of the framework is presented in Figure 2.1.
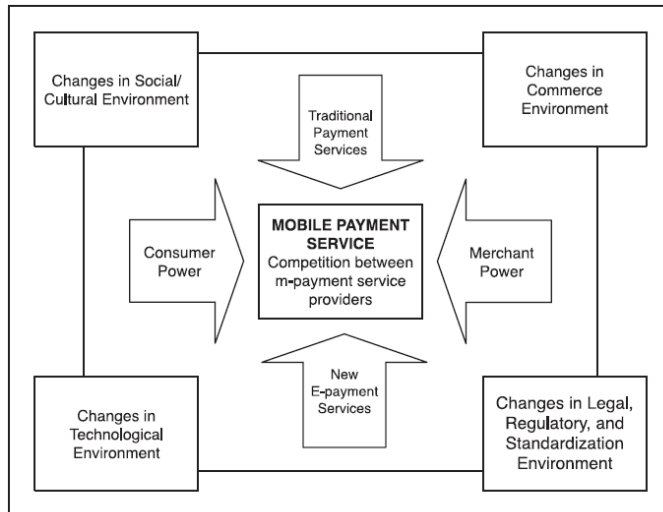
The key actors in a mobile payment ecosystem can be classified into three main segments: (i) the providers of the mobile payment platforms, such as banks/financial institutions, mobile network operators, payment service providers, mobile device manufacturers and any other mobile payment platform providers (e.g. over-the-top (OTT)) or directly product-related participants; (ii) the users adopting the mobile payments, such as consumers and merchants; and (iii) regulators governing the development, including policy makers, regulatory agencies and other public sector entities. According to Dahlberg et al. (2015a), there are four main issues to be considered in order to understand the reasons behind the lack of breakthrough for mobile payment in most of the countries and regions: (i) consumer and merchant behaviour, (ii) the large number of competing technologies, (iii) the complexity of mobile payment ecosystems (the presence of multiple actors from different industries with different incentives and prerequisites, providers competing for control over the core assets in mobile payment systems and the entire ecosystem, Dahlberg et al., 2015b), and (iv) the lack of clear regulations.

Porter's the five forces model (Porter, 1980) describes the key roles of consumers, merchants, mobile payment providers, and other market factors such as competing technologies and the complexity of mobile payment up- and downstream supply chain. Porter's model offers a framework that can be utilized in order to analyse the structure and attractiveness of an industry, to gain insights on the

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profitability, to understand the consequences of important decisions about whether to leave or enter industries or sectors and to develop strategic alternatives to improve relative performance and position in the industry. This approach can be particularly helpful for a relatively new service such as mobile payments (Scholes & Johnson, 2002; Pearce & Robinson, 2005). Porter's model has been applied by numerous practitioners and academicians (Karagiannopoulos et al., 2005), and it has been selected as one of the most influential management tools for strategic industry analysis (Breedveld et al., 2006).

The core part of the framework describes the competitive forces of the mobile payment services market with the concepts derived from Porter's Five-Forces model. Porter's model (Porter, 1980) claims that organizational performance is mainly determined by industry structure. The model is based on establishing the connection between profitability of the participants in an industry and the competitive forces that play within the industry (Karagiannopoulos et al., 2005). The Five-Forces model can be utilized to analyse the competitive environment on the level of business units, based on the insights originally identified in industrial economics (Breedveld et al., 2006).

In addition to the competitive forces within the mobile payments markets, other factors have to be considered as they impact the markets as well, for example, technology and standards, regulatory activities and legislation, established purchase and payment habits (consumer and merchant behaviour), or national economy infrastructures. In terms of the mobile payment ecosystem as the unit of analysis, these other factors can be seen as contingency factors, which influence the performance of the ecosystem but beyond the influence and control of that unit, as defined in contingency theory (Dahlberg et al., 2008a). Therefore, contingency theory is well suited to classify mobile payments research and to capture the environmental factors that are characteristic of the mobile payment markets (Dahlberg et al., 2008a).

The outer part of the framework represents contingency factors impacting the market, with concepts derived from contingency theory. Contingency theory postulates that (i) the impacts of environmental factors are systematic, rather than entirely situational; (ii) environment affects the structure of the organization (through the "environment – strategy – performance'' link).

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As a summary, the framework includes the five main competitive forces of mobile payment services markets in the inner part, which are the market factors. In addition, within a mobile payment ecosystem, the contingency factors, that include technological, social/cultural, commercial, and government/legal factors, can potentially impact the performance of the whole ecosystem. The presented framework is used (i) to classify past research contributions identified in the search described above, (ii) to analyse research findings of the identified studies, and (iii) to establish gaps in literature.

2.3. Mobile payment definitions

After an overview of mobile payment related studies was obtained by classifying the identified articles into the categories of the framework described above, the first important observation is that a large number of papers (more than 80 papers out of 183) do not provide a definition for the term mobile payment. This can be attributed to three main reasons: (i) the lack of a unified definition of mobile payment; (ii) the authors base their work on previous research that provides the background and definition; (iii) the main focus of the papers is on mobile payment technologies or a specific mobile payment application. For example, Mallat et al. (2008) do not present any definition of mobile payment; however, the authors refer back to the work of Dahlberg et al. (2003) who provide a definition: mobile payment is defined as the use of mobile devices, such as mobile phone, to commit payment transactions. However, it is important to offer an all-encompassing definition of mobile payment in order to understand what is actually discussed in literature. Without this step, one would obtain a confusing picture as the way mobile payment is presented in various contributions is not consistent across the articles. For instance, some articles do not make a clear distinction between mobile banking and mobile payment, or do not clarify whether online payment performed with a mobile device can be considered a mobile payment (Donner & Tellez, 2008; Hu et al., 2008; Zhou, 2011). This raises the problem of understanding what specific attributes characterize mobile payments and differentiate them from other payment types.

Based on the literature review, a small set of definitions can be identified that can be considered as the most common definitions, as most of the articles in the mobile payment literature either employ directly one of these definitions or only modify them to a small extent. The definitions specified in various articles can be

clustered into the following four groups corresponding to the original source of the definition:

- Pousttchi (2003) provides a definition of mobile payment for the first time in the identified literature: "I define mobile payment (MP) as that type of payment transaction processing in the course of which - within an electronic procedure - (at least) the payer employs mobile communication techniques in conjunction with mobile devices for initiation, authorization or realization of payment." (p. 201)

- Karnouskos (2004) refers to a mobile payment as: "Any payment where a mobile device is used in order to initiate, activate, and/or confirm this payment can be considered a mobile payment" (p. 44). Au and Kauffman (2008) extends this definition into the following form: "mobile payment is any payment where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return for goods and services" (p. 24).

- Ondrus and Pigneur (2005) define mobile payments as "wireless transactions of a monetary value from one party to another using a mobile device whose physical form can vary from a mobile phone to any wireless enabled device (e.g. PDA, laptop, key ring, watch) which are capable of securely processing a financial transaction over a wireless network" (p. 84).

- Dahlberg et al. (2008a) define mobile payments as "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" (p. 165).

Additionally, considering the papers that provide a definition, there are a few of them (11 articles) that provide mobile payment definitions without adopting the four mainstream definitions. Looking into those definitions in detail, putting aside two definitions of mobile wallet, some (Konidala et al., 2012; Weber & Darbellay, 2010; Mjølsnes & Rong, 2003) state that mobile phone is the device to realize transactions, while the others also focus on various other mobile devices (such as tablet, PDA

etc.). Some of the definitions (Timalsina & Moh, 2012; Gaur & Ondrus, 2012; Dai et al., 2011) consider payments between merchants and consumers or buyers and sellers. Based on these definitions, a value exchange between other parties, such as between consumer and consumer, would not be classified as mobile payment. The rest of the selected articles (Kadhiwal & Zulfiquar, 2007; Ghezzi et al., 2010; Kshetri & Acharya, 2012) usually offer a very brief definition without clarifying the words payment and mobile.

Several similarities and differences can be found among the four existing definitions of mobile payment listed above. Two things are common among all the definitions: (i) the devices to realize the payment (mobile devices), and (ii) the function of payments (a transfer of monetary value, payments for goods, services, and bills, payment transaction processing, transactions of a monetary value). The main differences lie in: (i) the level of emphasis put on the technology to realize mobile payment, and (ii) the payment process. Pousttchi (2003), Ondrus and Pigneur (2005) and Dahlberg et al. (2008a) point out that a mobile payment takes advantage of wireless and other communication technologies, while Karnouskos (2004) only mentions the concept mobile device. Pousttchi (2003) and Karnouskos (2004) present initiation, authorization or realization and confirmation of the payment process, while Dahlberg et al. (2008a) focus on transaction fulfilment of the payment but Ondrus and Pigneur (2005) do not include the phases of the payment process in their definitions.

Taking all the similarities and differences into consideration, four main elements can be identified in the existing definitions:

- Mobile devices;
- Financial value exchange;
- Taking advantage of wireless and/or other communication technologies;
- Initiation, authorization or realization and confirmation of a payment process.

Based on this discussion, the definition of mobile payment used in this thesis can be formulated as follows. Mobile payments can be defined as *a payment system to initiate, authorize and confirm a financial value exchange for goods and/or services using mobile devices by taking advantage of wireless and/or other communication technologies while excluding: (i) any type of electronic or mobile money, (ii) access*

to electronic payment services with mobile devices, and (iii) electronic banking. We are aware that a mobile payment application may include banking transfer services and access to electronic payment services with a mobile phone, as for instance is the case with Alipay wallet. However, when we discuss mobile payments on a theoretical level, we only discuss the mobile payment service without considering other added services.

2.4. Descriptive analysis of the literature

The systematic literature search identified 284 papers (188 from 2007-2015, 73 from 1998-2006, 23 from 2015-2016 March) from 1998 to March 2016, of which 183 (87, 73, 23) were published in conference proceedings or in journals with an impact factor. The title, abstract and discussion or conclusions sections of each article were reviewed and based on this the articles were classified to one of the ten categories as discussed in section 2.1.

Among the ten categories, two categories dominate mobile payment research: consumer studies (65) and technology studies (57), which is consistent with the findings of Dahlberg et al. (2008a) and Dahlberg et al. (2015b). The trends for the number of articles in each category in every year are shown in Figure 2.2. Since 2007, mobile payment ecosystem studies are growing slowly, over the years becoming the third most studied category (34 articles).
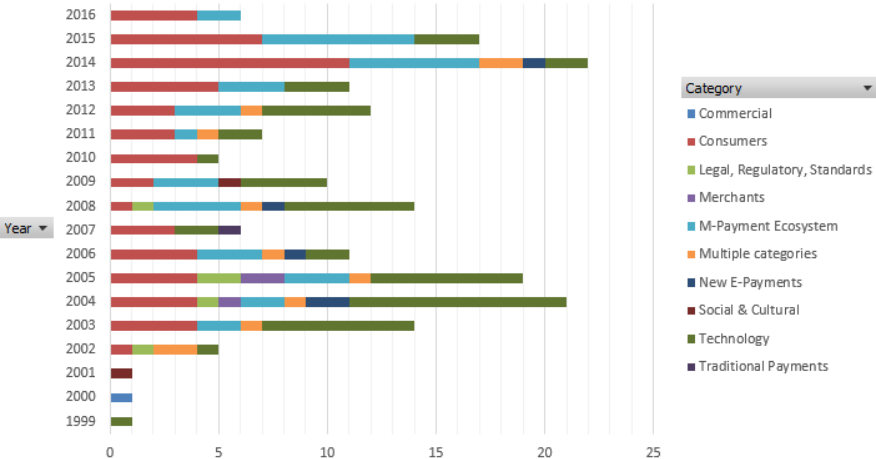
Figure 2.2 Distribution of articles and categories by year

Considering the methodology followed in the articles, 103 of them can be classified as empirical and 80 as conceptual (see Figure 2.3). As might be expected. the cumulative number of empirical studies grows faster and by-passed conceptual studies after 2014, while conceptual articles dominated the early years of mobile payment research. The trends in Figure 2.4 show that the number of journal articles is growing.
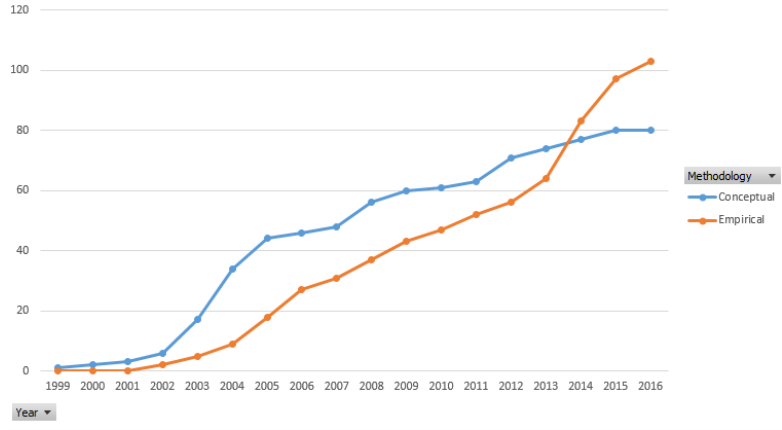
Figure 2.3 Empirical and conceptual articles from 1998 to 2016 March
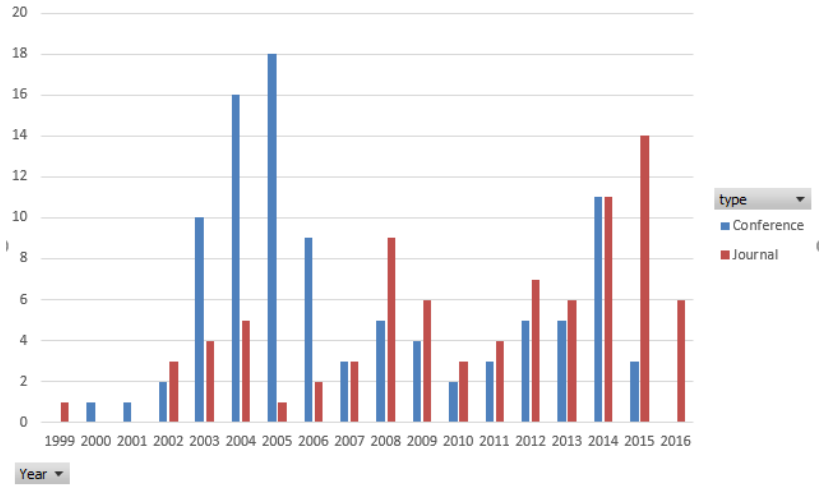
Figure 2.4 Conference and journal articles from 1998 to 2016 March

Consumer adoption studies and technology studies have traditionally drawn a lot of attention in academia (Dahlberg et al., 2008a; Dahlberg et al., 2015b). However, mobile payment ecosystem performance is largely determined by the competitive

forces and the contingent factors (Figure 2.1). In general, mobile payment ecosystems have turned out to be complex, which can be explained by the following reasons: (i) the dynamic changes due to constantly developing technological advances, (ii) actors from different industries with different incentives and prerequisites, (iii) different regulations in different industries. Therefore, the studies focusing on the consumer adoption or technology aspects without considering the other interrelated factors and interactions in the mobile payment ecosystem may not offer sufficient explanations of the causes hindering or boosting the development of mobile payment. Since the end of 2014, the emergence of multi-perspective and multi-level research on mobile payment platforms at the ecosystem level has started to contribute analysis of the interdependent factors in the mobile payment ecosystem from different perspectives (see next section). These types of studies have now started to offer explanations of the complex phenomenon of mobile payments. Therefore, in the next subsections, papers that were identified as belonging to the market/ecosystem category are discussed in more detail.

2.5. Analysis of mobile payment ecosystem literature

The articles in the literature review reflect three increasing trends in recent years: (i) multi-perspective frameworks, (ii) mobile payment business models, and (iii) platform theories and strategies.

According to the first trend, some articles aim to build a multi-perspective framework for understanding mobile payment ecosystems, introducing (and recommending other mobile payment studies to include) theories from other fields, such as economics, marketing, or employing general business ecosystem theories. The articles belonging to this group include Ondrus et al. (2005), Zmijewska and Lawrence (2005), Dahlberg et al. (2008a), Au and Kauffman (2008) and Pousttchi et al. (2009). Several studies build theoretical frameworks and apply these in practical cases, offering empirical insights, i.e., Ondrus et al. (2009), Kazan and Damsgaard (2013), Liu et al. (2015), and Guo and Bouwman (2016b). All these papers emphasize that only different perspectives together can offer useful insights to analyse and understand mobile payments. The number of ecosystem-related articles on mobile payment has slowly grown since 2008, and there are several typical patterns appearing throughout the years. Dahlberg et al. (2008a) propose a theoretical framework to understand the failure of a dominant design in the Finnish

market, by building on theories adapted from standardization and emerging market research. Au and Kauffman (2008) proposed a framework for the analysis of economic issues of disruptive technologies, to identify consumer, firm, business process, market, and industrial issues. Liu et al. (2015) retrospectively analysed the evolution of mobile payment innovations in the past two decades with respect to technological changes relative to market competition and cooperation, and government regulation. Their main goal was to find the major forces that drive the evolution of technology-based innovations, such as mobile payments, in financial services, and to identify the roles played by market competition, cooperation, and regulation in shaping the observed paths of evolution and the changing pace of technological transitions.

Secondly, some articles aim to utilize an integrated view on mobile payment business models, i.e., Faber and Bouwman (2003), Ondrus and Lyytinen (2011), and Miao and Jayakar (2016). The early study of Faber and Bouwman (2003) explore the connections between service offering and organizational arrangements (ecosystem design), by analysing the business models and value network of three mobile payment initiatives. Ondrus and Lyytinen (2011) provide an early assessment of the arrival of new actors such as Apple and Google, discussing whether the newcomers will face the same challenges as the incumbents (MNOs and financial institutions), and anticipating how disruptive the new insurgents could be in the mobile payment markets. Miao and Jayakar (2016) examine the possible evolutionary paths of operational models (the strategies of mobile operators, financial institutions and third-party platforms) for mobile payments in China, comparing them to the previously established and more advanced models in Japan and South Korea, from the perspectives of differences in industry, economics, society and regulation polices.

Thirdly, some studies focus on platform theories and strategies, i.e., Staykova and Damsgaard (2015), De Reuver et al. (2015), and Kazan and Damsgaard (2014). Staykova and Damsgaard (2015) propose a framework to study how market entry and expansion strategies determine the success of a mobile payment platform based on various digital payment solutions that were launched in the Danish market in a time span of just eight months. De Reuver et al. (2015) combine collective action theory and platform theory to study the issues of collaboration and competition

between banks and operators. They conclude that differing strategic objectives and interests, conflicts, lack of dependencies and governance issues led to the dissolution of the analysed mobile payment platform. Kazan and Damsgaard (2014) propose a framework to study mobile payments and conducte a comparative case study of mobile payment platforms considering banks, mobile network operators, merchants, and start-ups to look into their platform design and strategic issues.

2.6. Summary and research gaps

In summary, analysing one single aspect, no matter how systematically, is unlikely to provide an explanation to the complex phenomenon of mobile payments. Mobile payment research desires studies from different perspectives of the mobile payment market, as well as considering the interdependent factors and interaction among the core actors in mobile payment ecosystems, by applying a variety of theories (i.e., platform and ecosystem theory). Mobile payment ecosystem studies are still in the early stage, but a variety of theories have started to emerge taking different actors' perspective into account in an attempt to build a concrete foundation for understanding success or failure of mobile payment development. More specifically, studies of core actors in mobile payment ecosystems under the same regulation and context are few.

In addition, in mobile payment literature, there is a lack of studies on the merchants' perspective considering that, on one hand, merchants are users who adopt mobile payment platforms offered by different providers and, on the other hand, they are providers who offer mobile payment services to consumers. These two roles require merchants to take into consideration both a technology-push and a consumer demand perspective and to balance the requirements these two put on their business. To achieve this, the dynamic interplay on an organizational level (i.e. power and control, competitive strength and strategic orientations) with the environmental level (i.e. the mobile payment ecosystem factors) should be considered.

Furthermore, considering studies following an ecosystem perspective, one can see that the articles are mainly looking at cases from Western markets. Moreover, a number of recent studies have identified several possible reasons for the failures of mobile payment platforms: a lack of collaboration between multiple stakeholders, difficulties in finding win–win business models and a lack of standardization

(Apanasevic 2013, De Reuver et al. 2015, Gannamaneni et al. 2015, Liu et al. 2015, Ozcan & Santos 2014). Moreover, due to the rapidly changing technological environment and the lack of successful mobile payment ecosystems, there is still no mobile payment ecosystem study that focuses on a case that can be labelled as successful. All the discussed cases presented in academic literature can be seen as descriptions of mobile payment failures.

Therefore, motivated and guided by the identified gaps, we integrate these aspects into a comprehensive mobile payment ecosystem research logic. Firstly, we study the core actors (mobile payment providers and merchants) in the mobile payment market from an ecosystem perspective under the same regulations, i.e. in China. Secondly, we analyse the factors in a mobile payment ecosystem that influence the merchants' acceptance of mobile payment platforms, and how these factors affect their adoption-decision process. Thirdly, we study how different mobile payment providers established/strengthened their positions in a mobile payment ecosystem by employing a variety of theories and concepts, including business models, business ecosystems, platform theory, resource-based view (RBV) (Wernerfelt, 1984; Barney, 1991) and the resource dependence theory (RDT) (Pfeffer & Salancik, 1978; 2003). Fourthly, we choose the Alipay wallet (having the largest market share in China in the mobile payment market) as a successful case to investigate how Alipay was able to strengthen their position in the mobile payment ecosystem.

3. Theoretical foundations and research frameworks

This chapter presents the theoretical foundations and the research frameworks of this research. Section 3.1 presents general business ecosystem concepts (Publications I, II, III and VI). In Section 3.2, a model specifying the general structure of a mobile payment ecosystem is built with detailed discussion focusing on three tiers of a mobile payment ecosystem (Publication III). In Section 3.3, contingency and configuration theory are presented, as a theoretical foundation for the study on merchants' adoption to answer RQ2 (Publication III). In Section 3.4, resource based view and resource dependency theory are presented, as theoretical foundations for studies on both merchants and third party payment providers (Publications III and VI). In Section 3.5, the STOF model (Bouwman et al., 2008) is presented as a business model framework to identify design issues in mobile payment providers' (i.e. banks and MNOs) business models, as the research foundations for RQ3 (Publications IV and V). In Section 3.6, the StReS (structure-resources-strategy) model is presented as a research framework to analyse how Alipay (third party payment provider) strengthened their position in the mobile payment ecosystem, which provides a research foundation to answer RQ3 (Publication VI).

3.1. Business ecosystem theory

Since Moore (Moore, 1993; Moore, 1996) introduced the concept of business ecosystem, it has attracted extensive attention by many researchers. The concept of ecosystem has been used in many domains, including industrial ecosystems (Frosch & Gallopoulos, 1989), economical ecosystems (Rothschild, 1990), social ecosystems (Mitleton-Kelly, 2003), and business ecosystems (Moore, 1996). Following the concept of business ecosystem, several other uses of the ecosystem terminology have emerged, such as digital ecosystems (De Tommasi et al., 2005), entrepreneurial ecosystems (Cohen, 2006), technology ecosystems (Messerschmitt & Szyperski, 2005) and, specifically in our context, payment ecosystems (May et al., 2008).

The term ecosystem is taken as a metaphor from biology as proposed by Tansley (1935). In the most widely used definition, Moore (1996) defines a business ecosystem as

"an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies" (p. 26).

Similarly, to natural ecosystems, the evolution of business ecosystems consists of four distinct stages: birth, expansion, leadership, and self-renewal or death. Iansiti and Levien (2004a) delineate business ecosystem as an analogy between business networks and biological ecosystems, which comprises of companies performing outsourced business functions, institutions providing financial services, companies providing technology, manufacturers with complementary products, regulatory agencies, media outlets, competitors and customers. Moreover, Iansiti and Levien (2004a) state that the companies create platforms (services, tools, or technologies) in order to enhance their own interests; while a platform can also benefit other members of the ecosystem by improving their performance, this in turn can promote the overall health of the ecosystem.

In summary, a business ecosystem has three characterizing basic components, namely, multiple loosely connected actors, as also described and analysed in value network, a service or technology platform, and a co-evolution process.

3.2. Mobile payment ecosystem specification

Based on the definition presented above, a mobile payment ecosystem can be defined as a set of interconnected actors in a dynamic environment cooperating and competing with each other through a core mobile payment technology platform. According to the characteristics of a general business ecosystem, mobile payment ecosystem can be described through the following three components:

- **Multiple actors**

    The key actors in a mobile payment ecosystem can be classified into three main segments: (i) the providers of the mobile payment solution consisting of actors such as banks/financial institutions, mobile network operators, payment service providers, mobile device manufacturers and other service

or product related participants; (ii) the users adopting these solutions such as consumers and merchants; and (iii) the regulators governing these solutions including governmental bodies, regulatory agencies and other public sector entities.

- **Mobile payment platform**

  Mobile payment providers in the mobile payment ecosystem provide the services through a core (technology) platform that members other than the platform provider(s) can utilize. This platform connects providers, merchants and users, under the governance of regulators.

- **Co-evolution process**

  The actors in a mobile payment ecosystem evolve reciprocally with each other as does the technology and the network of actors. The actors interact with each other in terms of cooperation, competition and co-evolution in a dynamically changing environment (Choi et al., 2001), while, depending on technology changes, the ecosystem changes as well.

The mobile payment ecosystem is brought into existence through the convergence of the payment and mobile telecommunication ecosystems with some additional actors (i.e., over the top (OTT) actors or third party payment (TPP) actors) entering the ecosystems at various stages of the development. The multiple actors are originally from different industries (MNOs from telecommunication industry, banks/financial institutions from financial industry and OTT or TPP from other industries) with different firm sizes, having the common goal of serving and creating markets that are beyond the capacity of any single firm or any traditional industry. The sustainability of the overall ecosystem's health depends on their collective ability to learn, adapt, and, as the most crucial activity, innovate together.

Government and other
regulatory/standard bodies

M-payment providers

Tier-1
Merchants
M-payment platfrom
Endusers

Tier-3

Tier-2

Competing organizations

Trade associations, labour union,
consumer organizations

Business ecosystem

Extended network

Core business
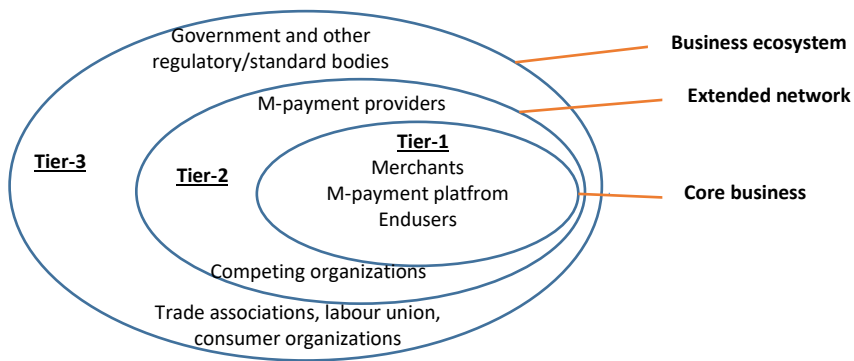
Figure 3.1 The mobile payment ecosystem actors (based on Guo & Bouwman, 2016a)

Based on the general concept of a business ecosystem (Moore, 1996), the mobile payment ecosystem with some minor modifications is shown in Figure 3.1. Within the ecosystem, three tiers (groups of actors in the ecosystem) are defined. The circle of "core business" (Tier-1) includes the merchants as the providers who interact with end-users (consumers) via the mobile payment platform. The circle of "extended network" includes "core business" and Tier-2 (mobile payment platform providers and competing organizations). The focus when analysing Tier-2 is to study the mobile payment platform providers (MNOs, banks/financial institutions, and TPP provider), while considering the other interrelated factors in the ecosystem. In general, as also discussed in Chapter 1, there are four mobile payment modes in the market: the operator-centric mode, the bank-centric mode, the independent service provider mode and collaborative mode (e.g., financial institutions and MNOs as joint providers) (Smart Card Alliance, 2008). Normally, two main types of organizations can be identified based on the four modes acting as platform providers: (i) organizations originally operating in an industry traditionally related to mobile payment, such as MNO's or financial institutions/banks, and (ii) third-party organizations acting as payment providers coming from various industries. According to these characteristics, three different cases are considered in the empirical analysis: (i) a single organization (i.e. bank-centric) as the mobile payment provider, (ii) joint providers (i.e. MNOs and financial institutions) as the mobile payment provider, and (iii) a third-party payment provider.

The circle of "business ecosystem" includes the "extended network" and additionally Tier-3 (trade associations, labour unions, consumer organizations, government agencies and other regulatory/standard bodies). We note here that Tier-

3 is not the main focus of our study, but the factors in Tier-3 are included in the discussion. Regarding Tier-3, the Chinese context will be illustrated in more details as the empirical studies of the thesis were conducted in this specific environment. China has the world's largest mobile subscriber base: the number of mobile subscribers in China reached 1.3 billion as of August 2015 (Kemp, 2015.). The number of 4G users reached over 250 million, and this number grows to 695 million if also 3G users are included (Technode, 2015). Considering these developments closely relate to mobile payment development, seeing the large number of mobile subscribers and mobile internet users, it is evident that there is a huge market and growth potential. All the key actors in an mobile payment ecosystem can be found in China, including MNOs (i.e. China Mobile, ranked No.1 in the world), handset manufacturers (such as HuaWei), financial institutions/banks (China Unionpay as the second-largest payment network by value of transactions processed (The People's Bank of China, 2010), TPP providers (such as Alipay, supported by Alibaba, one of the world's biggest Internet retail networks, etc) as well as international OTTs, like Apple and Google trying to enter the Chinese markets with their mobile wallets. However, it is important to observe that a large-scale nationwide mobile payment scheme has not been implemented yet. Regulatory authorities and key actors are currently in the process of finalizing standards and regulations for the future rollouts of mobile payment. As there are not many studies systematically investigating the Chinese mobile payment market, with those favorable conditions in place, it is worth to study this context.

Mobile payment was introduced in the Chinese market more than a decade ago when China Mobile rolled out a micro-payment service in 2002 based on carrier bills. Users could purchase products or services with a mobile subscription bill by sending SMS (short message service) with a mobile phone. Presently, the main mobile payment providers in China include financial intuitions (China Unionpay), banks, MNOs, and TPP companies. While financial institutions, banks and MNOs are in general state-owned enterprises (SOEs), TPP providers are non-state-owned (private) enterprises. In China, four different principle in mobile payment models can be identified: (i) MNO centric; (ii) financial institution centric; (iii) TPP provider centric or merchants' own platforms; and (iv) collaboration between financial institutions and MNOs.

The overall revenue of the Chinese mobile payment market is expected to reach 1,358.34 billion Yuan in 2016 (iResearch, 2013a). According to iResearch (2013a), the top three providers in the Chinese mobile payment market in the first quarter of 2013 are the following: TPP provider Alipay (Mobile App) is ranked first with a market share of 67.6%, followed by China Unionpay (Mobile App) with 8.3%, and TPP provider Tenpay (Mobile App) third with 7.3%. Although TPP providers dominate the online mobile payment market, offline payment is dominated by POS (point-of-sale) payment, which is provided by financial institutions. Presently, China Unionpay is putting effort into modifying the POS machines in order to accept NFC mobile payment, which is planned to be their dominant service to compete with TPP's. Since 2012, China Mobile cooperates with China Unionpay to offer a mobile payment service by integrating bank, bus, membership and any type of cards with a Near Field Communication (NFC) enabled mobile phone to make a secure contactless payment by simply tapping the phone at a NFC enabled payment terminal. This service can be used anywhere when POS machines are available.

Regarding the regulations and policy of e-commerce in China, the industry is supervised by five governmental departments in the development of policies, standards and industry specifications: (i) the Ministry of Commerce (MOFCOM), (ii) the Ministry of Industry and Information Technology (MIIT), (iii) the People's Bank of China (PBC), (iv) the State Administration of Industry & Commerce (SAIC), and (v) the State Administration of Taxation (SAT). Each department focuses on its own area to promote the growth of e-commerce (Shim & Shin, 2016). Typically, MNOs only process micro-payments, while banks can handle the macro-payments, which have been the result of continuous changes since 2010, (The People's Bank of China, 2010) when the "Administrative Measures for the Payment Services Provided by Non-Financial Institutions" was announced in September. Since then, the regulations permit non-financial organizations, such as MNOs, to be involved in financial areas. In addition, there are already 27 companies since 2010, including Alipay, that have successfully applied to obtain TPP licenses to provide online payment services. This new regulation legitimized online payment services and placed them under the government's regulatory regime. As this evolution of regulations illustrates, the providers' capabilities and roles change as a result of the dramatic changes in the Chinese mobile payment market, which in turn implies that

banks or financial instuitions will no longer be the only providers of payment services.

The regulations and standards that are published in recent years in China and concern mobile payment development are listed in Table 3.1. Although some policies and regulations exist, there are no clearly set market access rules and the technical standards are not harmonized yet.

Table 3.1 Improvement in the regulatory system on mobile payment in China (adapted from iResearch, 2013b)

Date	Regulations
June 2010	Regulation on Payment Service of Non-financial-institution payment Companies
September 2010	Detailed Rules for the Implementation of Regulation on Payment Service of Non-financial-institution payment Companies
May 2011 to September 2012	Regulations on Prepaid Card[1] Service of Payment Organizations
January 2012	Regulation on Online Payment Service of Payment Organizations
December 2012	Technical Specifications of Mobile Payment of Financial Products
March 2014	Third-party Payment Draft Regulations

3.3. Contingency and configuration theories

In developing the analytical framework further, two theoretical foundations are employed: contingency and configuration theory. Contingency theory (Lawrence & Lorsch, 1967; Thompson, 1967) states that there is not a single best way to design an organization, as the optimal course of action depends upon the internal and external situation (context). With mobile payment as an information and communication technology (ICT) innovation, and actors as the unit of analysis (organizational level), contingency theory can be applied to understand inter-organizational relationships in the mobile payment ecosystem. In contrast to contingency theories that only represent traditional bivariate relationships involving unidirectional causations, configuration theory works out non-linear synergistic effects and higher-order interactions among constructs; this representation comes closer to the reality of practitioners (Meyer et al., 1993). As shown in Figure 3.1, actors in each tier can be identified as elements that form constellations relevant to

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[1] Prepaid cards shall mean the cards issued for profit in forms such as cards and passwords by adopting technologies such as magnetic stripes or chips, with a prepaid value used for purchasing commodities or services outside the issuing agency (The People's Bank of China, 2010).

any actors in the mobile payment ecosystem. In the following, the factors within the three circles will be addressed; more details can be found in Publication III.

A platform, serving as a service or technology platform, is present in the ecosystem that members other than the platform provider(s) can also utilize (Moore, 1993). The "start-up" problem of multi-sided platforms often must contend with the well-known chicken-and-egg problem, which states that one side of a platform receives value only if it is also true for the participants on the other side of the platform (Gawer, 2009). In other words, an mobile payment platform depends on the interaction and synchronization of the adoption by the supply (merchants) and demand (customers) sides. Therefore, in order to initiate a mobile payment platform, the first step would require having both sides on board. Moreover, an organization's strategic positioning in the economic marketplace should be considered in understanding its mobile payment adoption decisions. Within an mobile payment ecosystem, merchants acquire knowledge about their partners, including their resources, needs, capabilities, strategies, and other relationships by exchanging information within the network. Accordingly, critical internal and external resources are both necessary for an organization to position itself in the market place as well as in the business ecosystem.

Merchants are not only users, but also providers of the mobile payment platform to end-users through direct interaction with them. There are only a few studies that consider end-users and merchants at the same time, focusing on network effects (Au & Kauffman, 2008, Kazan & Damsgaard, 2013). Same-side network effects arise when a user's benefits from using a technology increase with the number of other users employing the same technology (Katz & Shapiro, 1992; Shapiro & Varian, 1998). For instance, when joining an mobile payment platform, end-users take into account the number of other end-users adopting mobile payments. Cross-side network effects influence the adoption behaviour of the two distinct groups. For instance, when joining an mobile payment platform, end-users take into account the number of merchants providing that mobile payment platform. A basic observation regarding cross-side network effects is that the value of the platform is zero to either side if the other side stays out. According to this, it is important for the merchants to be sure that mobile payments have a large customer base and vice versa. Allen (1988) refers to this "chicken-and-egg" problem as a critical mass effect: merchants

will not adopt the system unless they have the impression that there are enough end-users using it. Similarly, end-users will not adopt the system unless they have the impression that merchant adopt. Therefore, reaching a wide enough initial adopter base or at least suggested that there is such a use base of both consumers and merchants is a critical success factor for mobile payments.

3.4. Resource based view and resource dependency theories

In the following, we identify the factors having an impact on merchants' acceptance of mobile payment within the ecosystem in each Tier (Figure 3.1), with more details to be found in Publication III. In Tier-1, the factors from the perspectives of merchants, end-users and mobile payment platform technology characteristics are included. As for merchants, the factors are the following: (i) internal organizational factors (strategy, resources, and capabilities) of merchants based on a resource based view (RBV) (Wernerfelt, 1984; Barney, 2001), (ii) the external resources based on the resource dependence theory (RDT) (Pfeffer & Salancik, 1978), (iii) merchants' strategic operations based on the Value-Discipline Model (Treacy & Wiersema, 1993), and (iv) managerial issues in organizational adoption (Damanpour & Schneider, 2006). As for end-users, the factors that are considered include: (i) the same-side network effects and the cross-side network effects (Katz & Shapiro, 1992; Shapiro & Varian, 1998), and (ii) consumer readiness toward mobile payment (Meuter et al., 2005). As for mobile payment platform technology characteristics, ease of use, security, privacy issues, and technology compatibility (Bouwman et al, 2008) are considered. In Tier-2, the factors regarding mobile payment platform providers and suppliers of merchants are included. As for mobile payment platform providers, the considered factors are: (i) the strategies to solve the chicken and egg problem (Eisenmann et al., 2006), (ii) marketing strategies of mobile payment platform providers (Frambach and Schillewaert, 2002), and (iii) platform openness (Gawer, 2009). As for the suppliers of merchants, partner readiness (Iacovou et al., 1995) is considered. In Tier-3, technology standardizations (Kadhiwal & Zulfiquar, 2007) and institutional pressure (Dimaggio & Powell, 1983) are considered to be relevant conditional factors.

In summary, the factors are identified from Tier-1 to Tier-3 that influence merchants as crucial actors within the mobile payment ecosystem to adopt mobile payment platforms (RQ2). Based on the research foundations, we will analyse how

the decision process of merchants leading to the adoption or rejection of mobile payment is evolving (RQ2).

3.5. Business models perspective

The development of mobile payments is mainly determined by the interaction and competition among the core actors in the ecosystem. However, the lack of agreement on the business models of all stakeholders in the mobile payment market is hindering the uptake of mobile payment services (Smart Card Alliance, 2008). The STOF model, as one of the business model frameworks, is applied to analyse how mobile payment providers (single organization (i.e. bank-centric) and joint providers (i.e. MNOs and financial institutions)) establish and strengthen their position in the mobile payment ecosystem (RQ3). Business models have been used in the literature to show how companies create and capture value from technological innovations (Chesbrough & Rosenbloom, 2002). Focusing on e-business, Timmers (1998, p.4) defined a business model as *"an architecture for the product, service and information flows, including a description of the various business actors and their roles, a description of the potential benefits for the various business actors, and a description of the sources of revenues"*.

There are multiple business model approaches, e.g. CANVAS (Osterwalder & Pigneur, 2010), STOF (Bouwman et al., 2008), C-SOFT (Heikkilä et al., 2010), VISOR (El Sawy & Pereira, 2013) and many other approaches (see Bouwman et al., 2012 for an overview) with several common features as well as distinct differences. The common for all the business models is the focus on strategy implementation, creating and capturing customer value, customer segmentation (target groups), relations and channels, by organizing resources, capabilities and assets together with partners, looking into costs and revenues. The differences mainly lie in the core focus of the models. While in the CANVAS approach individual companies are the unit of analysis, the STOF model focuses on networked enterprises as the unit of analysis. While C-SOFT starts from customer segments and focuses on marketing strategy in relation to business processes and enterprise systems, STOF has a technology and design focus and looks into mobile and IT (information technology) system innovation as a driver and enabler. VISOR focuses on digital business models considering customer and human computer interaction (HCI) interfaces, platforms and ecosystems.

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In light of the commonalities and differences, both VISOR and STOF are most likely choices for our cases. We use the STOF model, mainly because STOF provides a more detailed and elaborate way of dealing with the design issues and success factors with regard to business models, and specifies stages of quick scan and validation steps (Bouwman, et al., 2008; Faber and de Vos, 2008). STOF uses a systematic approach to identify critical issues related to services provided by networked organizations through four domains, i.e. service (including customer-related issues), technology (platforms and architectures), organization (networked sharing of assets, resources and capabilities) and finance (costs, revenues, pricing and risks). In the model, these four domains are closely related to each other, meaning that it is specifically acknowledged and modelled that a trade-off in one domain has a direct relation to a trade-off in another domain, for instance, by relating value network (O) to technology, e.g. platform (T) and analysing how they interact and co-evolve. Therefore, this thesis employs the STOF as a business model framework to identify critical issues for the mobile payment providers (MNOs and banks).

In order to design 'balanced' business models, designers need to understand the design issues and their interdependencies. De Reuver and Haaker (2009) defined a design issue as *"a design variable that is perceived to be (by a practitioner and/or researcher) of eminent importance to the viability and sustainability of the business model under investigation"* (p. 242). The generic design issues within the four domains of the STOF model for the mobile payment ecosystems, from the perspectives of banks and MNOs, are explained in detail in Publication IV and Publication V, offering the research foundation for answers to RQ3.

3.6. StReS model

Following the definition of business ecosystems (Moore, 1993) are based on insights gained during the research process, the StReS model is proposed to analyse the business ecosystem on three levels: (i) structure, (ii) resources and (iii) strategy. This model is proposed to analyse the complex relationships among multiple actors, and to understand how value is generated through their interactions and how these interactions are triggered by different strategies (actions). The StReS model will support a study of how mobile payment providers strengthen their positions in the mobile payment ecosystem, which is part of RQ3.

Structure: Firstly, we construct the structure of the mobile payment ecosystem by analysing the articles in existing literature classified as the mobile payment ecosystem category in Dahlberg et al. (2015b), by utilizing network visualization. Following a starting point for examining the network of organizations based on an ecosystem view, we need to discuss the resources and capabilities of the core actors, in order to completely understand how organizations' behaviour evolves on coopetition (cooperation and competition) in the mobile payment ecosystem.

Resource: Secondly, based on the information obtained in the network analysis involving the centrality of the actors, we decide which actors to focus on. Then, we apply resource-based view (RBV) (Wernerfelt, 1984; Barney, 1991) and resource dependency theory (RDT) (Pfeffer and Salancik, 1978; 2003), to identify the resources controlled by the core actors of the ecosystem, and the dependency on resources among core actors. Then, we integrate RDT with the RBV of the firm, as this combination can be more productive than applying the two frameworks individually (Hillman et al., 2009). According to business ecosystem theory and RDT, the relationships among actors within an ecosystem depend on managing resource dependencies, which change dynamically all the time.

Strategies: Lastly, by focusing on the links in the network, we look into the "strategies", which here refer to the actions that the organizations have undertaken to redefine their dependency relationships and reduce uncertainty. As the roles in a mobile payment ecosystem can be varied and dynamically changing, power and dependence are terms that reflect an asymmetric relationship between companies: B is dependent on A to the extent that A has power over B. Moreover, power does not add up to zero, as A and B can each have power over each other, making them interdependent. Organizations continuously try to reduce their dependency on others based on RDT theory; however, what an organization should do and what it actually can do to absorb its constraints often differ dramatically (Casciaro & Piskorski, 2005). To differentiate various levels of this power imbalance, we classify a dependency relationship using the (essential/complementary) resources involved. The term 'essential' refers to the resources actors must have or the service cannot work, while 'complementary' refers to the resources that are important to a specific service, but that do not stop the service from being operational.

In summary, we propose a five-step approach to identify and analyse the complex set of relationship among actors in a business ecosystem, and to provide the research foundations for answers to RQ3, with more details to be found in Publication VI.

1. Visualize the network by utilizing network theory based on the literature.
2. Draw the core network based on interview results and compare with the network visualized in 1.
3. Explain why the core actors work together to build the network, by applying resource based reviews (general resources of each actors).
4. Explain how the actors work together by applying the resource dependency theory (dependency resources dividing into essential and complementary resources).
5. Examine the "strategies" the actors have adopted to reduce uncertainty.

The StReS model can be seen as the core results of this research project.

As it can be seen in Table 3.2, Publication III, focusing on merchants' perspective in mobile payment ecosystems, has applied business ecosystem theory, resource based view (RBV), resource dependency theory (RDT), and contingency and configuration theories providing an answer to RQ2. Publication IV, focusing on the perspective of traditional industry single platform providers (banks), has utilized business ecosystem theory and business models perspective to contribute to answering RQ3. Publication V, focusing on the perspective of traditional industry collaboration (financial institutions and MNOs), has utilized business ecosystem theory and business models perspective to address RQ3. Publication VI, focusing on third-party payment provider, has utilized business ecosystem theory, resource based view (RBV), resource dependency theory (RDT), and has proposed StReS model to answer RQ3.

Table 3.2 Summary of theories in each publication

Research questions	Publications	Actors in Mobile payment ecosystems	Theories	Concepts
RQ2	Publication III	Merchants	• Business ecosystem theory • RBV • RDT • Contingency and configuration theory	• Mobile payment • Multi-sided platform • Business ecosystem • Resources and capabilities
RQ3	Publication IV	Traditional industry single organization (banks)	• Business ecosystem theory • Business models perspective	• Mobile payment • Business ecosystem • STOF model concepts

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	Publication V	Traditional industry collaboration (financial institutions and MNOs)	• Business ecosystem theory • Business models perspective	• Mobile payment • Business ecosystem • STOF model concepts
	Publication VI	Third-party payment provider	• Business ecosystem theory • RBV • RDT • StReS model	• Mobile payment • Multi-sided platform • Business ecosystem • Resources and capabilities

4. Methodology

This chapter describes and discusses the methodological approach of the thesis. After the philosophical underpinning of the thesis presented in Section 4.1, Section 4.2 and 4.3 discusses qualitative and quantitative methodology as used in this dissertation, respectively. Section 4.4 presents the overall research process.

4.1. Philosophical Perspectives

Broadly speaking, there are essentially three main approaches or methods applied when conducting scientific research: qualitative methods, quantitative methods and mixed methods (Creswell, 2003; Creswell & Clark, 2007; Tashakkori & Teddlie, 1998, 2010). The various methodologies are rooted in different philosophical underpinnings. Conducting research utilizing quantitative methodologies relies on the ideas of positivism. According to this approach, the appropriate way to conduct scientific research is by collecting empirical evidence. In other words, positivism holds that any phenomena can be "reduced" to a set of empirically observable objects or events that capture the "truth". From an ontological perspective, it assumes the existence of an objective reality that is independent of human perception. Based on this assumption, it is possible for a researcher to study a subject without influencing it or being influenced by it, as was pointed out by Guba and Lincoln (1994, p. 110): "inquiry takes place as through a one way mirror". The main goal when using quantitative research is to discover and understand causal relationships underlying a real life phenomenon, usually utilizing empirical observations and various statistical methods.

In contrast, qualitative research is based on the ideas of interpretivism (Altheide & Johnson, 1994; Kuzel & Like, 1991; Secker et al., 1995) and constructivism (Guba & Lincoln, 1994). From an ontological perspective, this approach holds that reality depends on the individuals' interpretation and reconstruction of it, resulting in multiple truths existing at the same time. In other words, reality is socially constructed (Berger & Luckmann, 1966) and it changes continuously. On an epistemological level, accessing reality can never offer an objective, independent observation and there is no objective "truth" to be measured (Smith, 1983). Performing qualitative research usually emphasizes the need to understand the processes underlying the analysed phenomenon. Accordingly, the most widely used

data collection techniques used in qualitative research include in-depth interviews, focus group discussions and participant observations. In these studies, a sample is not necessarily chosen to represent a larger population, but because specific cases in a sample can offer important insights of a specific phenomenon.

The inherent differences in the assumptions of quantitative and qualitative research are rarely discussed or acknowledged when using mixed-method designs. This can mainly be attributed to the positivist paradigm becoming the predominant frame of reference in most of the sciences (Sale et al., 2002). Caracelli and Greene (1993) refer to mixed-method designs as those where "neither type of method is inherently linked to a particular inquiry paradigm or philosophy" (p. 195).

There are several reasons why qualitative and quantitative methods can be combined. Firstly, because scientific enquiries share the goal of understanding a complex setting (Haase & Myers, 1988) and both qualitative and quantitative methods share a unified logic with the same rules of inference (King et al., 1994), either inductive or deductive.

Second, another common feature is a commitment to understanding and improving the human condition, and conducting research in a rigorous and critical manner (Reichardt & Rallis, 1994). Casebeer and Verhoef (1997) argue that "it is possible and more instructive to see qualitative and quantitative methods as part of a continuum of research techniques, all of which are appropriate depending on the research objective" (p. 132).

Third, the combination of research methods can help in discovering insights in complex phenomena requiring studies from different perspectives, as this study seeks to investigate interrelated actors' behaviour in mobile payment ecosystems, to understand possible causes of successful mobile payment, and to offer normative advice to actors in a mobile payment ecosystem. In order to achieve these objectives, qualitative and quantitative methods need to be combined. Due to the rapidly changing technological and economic environment in information systems (IS), IS research is in the situation in which existing theories and findings do not sufficiently explain or offer significant insights into a phenomenon of interest (Venkatesh et al., 2013). Combining qualitative and quantitative research design strategies can help to address complex and dynamically evolving phenomena to offer novel contributions to theory and practice (Venkatesh et al., 2013). As for mobile payment, due to the

complex, changing infrastructure and dynamics, this thesis applies a mixed-method approach that combines quantitative and qualitative research in a way that provides insights that the application of individual methods cannot provide (Venkatesh et al., 2013). In this thesis, qualitative methods are employed to answer RQ2, and to identify the possible causes and factors that influence the merchants' acceptance of a mobile payment platform, and why and how those factors impact their decision process. In general, qualitative methods are more appropriate to answer "why" and "how" questions, which motivates this methodological choice. In addition, qualitative methods are used to answer part of RQ3 on how Alipay strengthens its position in the mobile payment ecosystem, by using the dynamic changes among all the core actors in the ecosystem, and the interplay among them. On the other hand, quantitative methods are employed to answer RQ3 to understand how banks and MNOs can establish and strengthen their positions in the mobile payment ecosystem through business model design. Three publications included in the thesis applied qualitative methods, one applied quantitative methods, and one applied a combination of both (cf. Table 4.4 in Section 4.4). A concurrent research design that combines both qualitative and quantitative approaches is employed in this study. Since there is no clear input-output relation between qualitative and quantitative results we are hesitant to label our approach as mixed method.

In the following, we will look at the main mentioned research approaches in more detail.

4.2. Qualitative methodology

As was mentioned above, qualitative research is primarily grounded in the ideas of interpretivism (Altheide & Johnson, 1994; Secker et al., 1995) and constructivism (Guba & Lincoln, 1994). Qualitative researchers design their studies with the goal of exploring and/or explaining a social phenomenon by observing or interacting with the participants of the study.

> *"Qualitative research involves the studied use and collection of a variety of empirical materials-case study; personal experience; introspection; life story; interview; artifacts; cultural texts and productions; observational, historical, interactional and visual texts-that describe routine and problematic moments and meanings in individuals' lives"* (Norman & Yvonna, 2005, p. 73).

In order to achieve specific research objectives using qualitative techniques, the type of problems for which Curry et al. (2009) recommend considering using qualitative research can be specified as follows (see Table 4.1):

- to investigate complex phenomena that are difficult to measure quantitatively;
- to generate data necessary for a comprehensive understanding of a problem;
- to gain insights into potential causal mechanisms;
- to develop sound quantitative measurement processes or instruments;
- to study special populations.

Table 4.1 When to consider using qualitative methods (cited from Curry et al., 2009)

Research Aim	Examples of Contributions of Qualitative Methods
Investigate complex phenomena that are difficult to measure quantitatively	Characterize organizational processes, dynamics, and change over time; describe social interactions; elicit individual attitudes and preferences
Generate data necessary for a comprehensive understanding of a problem	Provide detailed descriptions of individual perceptions and experiences; enhance quantitative measures of phenomena
Gain insights into potential causal mechanisms	Generate hypotheses about why a given intervention has a specific impact, how the impact occurs, and in what organizational context it occurs
Develop sound quantitative measurement processes or instruments	Identify patient-centred measures of health-related constructs; assess cross-cultural equivalency of existing tools
Study special populations (those traditionally underrepresented in research, those with low literacy)	Improve methods for recruitment, retention, and measurement

In case of very complex phenomena, the underlying processes usually evolve by time and are difficult to measure using quantitative techniques (Patton, 1990). In the case of mobile payment ecosystems, it can be difficult to investigate how the resources of various interdependent actors dynamically change over time, as well as how the organizational processes within the mobile payment ecosystem change. Therefore, qualitative methods are employed in this thesis to help to identify and characterize the multifaceted organizational dynamics in the mobile payment ecosystem (Sofaer, 1999). In addition, Publication III provides additional insight into potential causal mechanisms of the merchants' decision processes for mobile payment adoption using qualitative techniques.

The most important qualitative data collection methods are summarized in Table 4.2.

Table 4.2 Qualitative data collection methods (cited from Curry et al., 2009)

Approach	Application/Purpose
In-depth interview	Explore individual experiences and perceptions in rich detail
Focus group	Generate unique insights into shared experiences and social norms
Observation	Learn about behaviours and interactions in natural settings; examine situations or processes typically hidden from the public; study cultural aspects of a setting or phenomenon
Document review	Identify patterns of communication; analyse traits of individuals; describe characteristics of organizations or processes; make inferences about antecedents and effects of communication

4.3. Quantitative methodology

Quantitative research is defined as "entailing the collection of numerical data described as exhibiting a view of the relationship between theory and research as deductive, a predilection for a natural science approach (and of positivism in particular), and as having an objectivist conception of social reality" (Bryman & Bell, p. 154).

Typically, quantitative research requires two basic properties in order to be considered as valid, namely reliability and validity of measures. A measure is considered reliable if it yields the same result over and over again. Different types of reliability measures and guidelines on assessing reliability are discussed by Straub et al. (2004).

Quantitative research is based on collecting numerical data that is analysed using various mathematical and statistical methods. The results of quantitative research can potentially be generalized to a "larger" population as it relies on offering statistically significant results. Therefore, we apply Analytic Hierarchy Process (AHP) as a quantitative method to understand the design of viable business models for actors in the mobile payment ecosystem.

AHP (Saaty, 1980) is a multi-criteria decision-making methodology based on the decomposition of decision-making problems; AHP has gained the attention of information systems researchers especially in recent years (Ho et al., 2013). AHP starts with building a hierarchical structure of the criteria relevant to the underlying decision problem, with the main goal at the top of the hierarchy. On the second level,

the main goal is decomposed into a number of criteria that are comparable to each other. In the next step, every criterion from the second level is considered as a sub-problem of the decision-making process and decomposed into the third level of the hierarchy. The number of levels in the hierarchy depends on the complexity of the main goal of the decision-making problem. After the hierarchy has been created, criteria belonging to the same level are evaluated by means of pairwise comparison. The respondents are asked to perform the pairwise comparisons in terms of importance for all the combinations of elements within a sub-problem with respect to the parent criteria. The pairwise comparison values are collected into a matrix for each sub-problem and the eigenvectors of these matrices are calculated. The outcome of AHP is a set of weights representing the importance of the associated attributes of the problem. The weights are calculated based on the pairwise comparison matrices, using the eigenvector corresponding to the maximum eigenvalue of the matrix as the estimation for the preferences. One crucial assumption concerning the rational decision-making process is consistency: for example, if attribute *a* is preferred over *b* by 4 times and attribute *b* is preferred over *c* by 2 times, then *a* is preferred over *c* by 4*2=8 times. The reliability (consistency) of the respondents can be measured using the Consistency Index: perfectly consistent judgments result in the value 0. High values of the index indicate a lack of consistency in the evaluation. In this case, the eigenvector of the matrix does not provide an appropriate estimation for the weights of different attributes. In general, after the calculation of the consistency index, evaluations that cannot be classified as consistent (the consistency value is over a given threshold) are removed from further analysis. In the analysis of evaluations of multiple respondents, the derived individual priorities need to be aggregated to obtain an overall evaluation. We employed the geometric mean to aggregate individual preferences, as it is consistent with the underlying philosophy of AHP (Forman & Peniwati, 1998). Microsoft Excel is used to perform the calculations.

4.4. Mobile payment ecosystem in China

In China, the country having the world's largest mobile subscriber base, all the important potential key actors are present in mobile payment ecosystems. The overall revenue of the Chinese mobile payment market is expected to reach 1,358.34 billion Yuan in 2016 (iResearch, 2013a). According to iResearch (2013a), the top

three providers in the Chinese mobile payment market in the first quarter of 2013 are the following: TPP provider Alipay (Mobile App) is ranked first with a market share of 67.6%, followed by China Unionpay (Mobile App) with 8.3%, and TPP provider Tenpay (Mobile App) third with 7.3%. Although TPP providers dominate the online mobile payment market, offline payment is dominated by POS (point-of-sale) payment, which is provided by financial institutions. Presently, China Unionpay is putting effort into modifying the POS machines in order to accept NFC mobile payment, which is planned to be their dominant service to compete with TPP's. Since 2012, China Mobile cooperates with China Unionpay to offer a mobile payment service by integrating bank, bus, membership and any type of cards with a Near Field Communication (NFC) enabled mobile phone to make a secure contactless payment by simply tapping the phone at a NFC enabled payment terminal. This service can be used anywhere when POS machines are available.

China has the world's largest mobile subscriber base: the number of mobile subscribers in China reached 1.3 billion as of August 2015 (Kemp, 2015.). The number of 4G users reached over 250 million, and this number grows to 695 million if also 3G users are included (Technode, 2015). Considering these developments closely relate to mobile payments development, seeing the large number of mobile subscribers and mobile internet users, it is evident that there is a huge market and growth potential. All the key actors in an mobile payment ecosystem can be found in China, including MNOs (i.e. China Mobile, ranked No.1 in the world), handset manufacturers (such as HuaWei), financial institutions/banks (China Unionpay as the second-largest payment network by value of transactions processed (The People's Bank of China, 2010)), TPP providers (such as Alipay, supported by Alibaba, one of the world's biggest Internet retail networks, etc.) as well as international OTTs, like Apple and Google trying to enter the Chinese markets with their mobile wallets. Regulatory authorities and key actors are currently in the process of finalizing standards and regulations for the future rollouts of mobile payment.

As all the actors are under the same regulations and standardizations in China, one can assume that the economic, social and regulatory environment is the same for all core actors as discussed in this thesis. However, with those favourable conditions in place, a large-scale nationwide mobile payment scheme has not been

implemented yet. As there are not many studies systematically investigating the Chinese mobile payment market, with those favourable conditions in place, it is worth to study this context.

Mobile payment was introduced in the Chinese market more than a decade ago when China Mobile rolled out a micro-payment service in 2002 based on carrier bills. Users could purchase products or services with a mobile subscription bill by sending SMS (short message service) with a mobile phone. Presently, the main mobile payment providers in China include financial intuitions (China Unionpay), banks, MNOs, and TPP companies. While financial institutions, banks and MNOs are in general state-owned enterprises (SOEs), TPP providers are non-state-owned (private) enterprises. In China, four different principles in mobile payment models can be identified: (i) MNO centric; (ii) financial institution centric; (iii) TPP provider centric or merchants' own platforms; and (iv) collaboration between financial institutions and MNOs.

In summary, in this thesis, we re-classified the four models into three categories: (i) traditional industry single organization (Publication IV focusing on banks), (ii) traditional industry collaboration (Publication V focusing on collaboration between financial institutions and MNOs) and (iii) TPP provider centric (Publication V focusing on Alipay wallet).

4.5. Research process and data collection

The research process started in March 2013. The complete research process is described in Table 4.3. For each phase, the objectives and publications are listed. In this thesis, in order to gain a deep understanding and a wide angle perspective of the emerging topic (Venkatesh et al., 2013), all three discussed methodologies have been utilized in order to attain the research objective (Table 4.3).

Table 4.3 Research process phases

Research questions	Time	Objectives	Methods	Publications
RQ 1	2013 Spring – 2016 Spring	Mobile payment academic and industrial state-of-the-art	Qualitative	Publication I, II
RQ 3	2013 Spring – 2014 Spring	Investigating Chinese mobile payment market, study how banks/financial institutions and MNOs can establish and strengthen their positions	Quantitative, Combination of qualitative and quantitative	Publication IV Publication V

| RQ 2 | 2014 Spring – 2015 Spring | Investigating the role of merchants in the mobile payment ecosystem. | Qualitative | Publication III |
| RQ 3 | 2015 Spring – 2016 Spring | Investigating how TPP providers can strengthen their positions in the mobile payment ecosystem. Summarizing all the studies. | Qualitative | Publication VI |

Publications I, III, and VI are qualitative studies, while Publication IV is a quantitative study, and Publication V combines qualitative and quantitative research. In these publications the specific designs as well as methodological decisions are discussed in detail. Here we discuss the research approach on a high level. As a starting point, Publication I provides the possible theories and concepts that can contribute to explaining why mobile payments have not taken-off yet in a majority of countries, by applying qualitative methods in order to investigate complex phenomena that are difficult to measure quantitatively to answer this question. Publication III provides answers regarding "why" merchants accept or reject a mobile payment platform, and conceptualizes the decision-process of acceptance and rejection, as the research aim is gain insights into potential causal mechanisms. Publication VI investigates the dynamic interaction among the core actors in the Alipay wallet ecosystem over time, and seeks the answer "how" Alipay strengthens its position in the ecosystem. A qualitative method is chosen in Publication V in order to scrutinize and characterize organizational processes, dynamics, and change over time, as well as to describe interactions among all key actors in the mobile payment ecosystem. In summary, qualitative methods are employed in this dissertation to answer the "why" and "how" questions. On the other hand, Publication IV offers a way to determine "what" the most important design issues are for a viable business model to establish and strengthen the actors' position by applying a quantitative method to assess the decision-making processes. Concurrent procedures are employed in Publication V, in which quantitative and qualitative data is converged in order to provide a comprehensive analysis of the research problem. Qualitative methodology is employed in Publication V in order to enhance quantitative measures of phenomena by providing detailed descriptions of experts' perceptions and experiences. In this design, both forms of data are collected at the same time during the study, and observations have been integrated in the interpretation of the overall results.

Table 4.4 Mapping the methods applied in the publications

Publications	Approaches		Methods			Data				Data analysis			
	Conceptual	Empirical	Qualitative	Quantitative	Combination of qualitative and quantitative	Case study	Interview	Survey	Document	AHP	Network analysis	QSR Nvivo	Qualitative coding
Publication I	✓		✓						✓				
Publication II	Systematic literature review												
Publication III		✓	✓				✓		✓			✓	
Publication IV		✓		✓				✓	✓	✓			
Publication V		✓	✓			✓	✓	✓	✓	✓			✓
Publication VI		✓			✓	✓	✓		✓		✓	✓	

As can be seen in Table 4.4, quantitative data is collected through questionnaires, while qualitative data is collected in interviews, as well as in the form of documents used as secondary data. The data collection followed the suggestions by Rubin and Rubin (2011), Seale et al. (2004) and Yin (2013).

Data was collected from 2013 to 2015. The quantitative data was collected first in February 2013 with 39 complete responses to questionnaires of employees in banks working on mobile payment solutions (Publication IV). In May and June of 2013, the quantitative data from questionnaires (30 complete responses) and qualitative data from interviews were collected (8 managers responsible for mobile payment solutions in MNOs) and presented in Publication V. In Publication IV and Publication V, the quantitative data analysis is based on the Analytic Hierarchy Process (AHP) (Saaty 1980). The qualitative data was analysed through qualitative coding, which can be defined as a procedure for the categorisation of verbal or behavioural data, for purposes of classification, summarisation and tabulation (Hsieh & Shannon, 2005). Regarding the process of analysing data and interpreting the interview findings, all the responses of the interviews were summarized, interpreted and tabulated from the transcripts according to the research question topics. If any information remained unclear and/or more data was needed, respondents were contacted at a later date for additional questions. In January and February of 2014, the qualitative data related to merchants was collected from six state-owned enterprises (SOE) and six non state-owned enterprises, being in

different stages of mobile payment adoption (adopt, intention to, no intention), having different size (small, medium and big), and coming from different industries (service and retail). The data is utilized in Publication III. All the interviews were transcribed, and a software package for qualitative data analysis, QSR NVivo, was employed. In May 2015, qualitative data was collected in 13 interviews, and the data was analysed with the software package QSR NVivo as well.

5. Analysis and results

This chapter summarizes the key results of the research work that was carried out for this thesis. The full results are discussed in more detail in the original papers that are part of the thesis. The sections of this chapter are organized according to the research questions listed in Chapter 1 and the research framework described in Chapter 3. Section 5.1 visualizes the structure of a mobile payment ecosystem, which offers a starting point for selecting and investigating actors in the network. The details on which Section 5.1 is based are mainly presented in Publication VI. Based on the ecosystem structure described in 5.1, and considering the actual mobile payment market in the Chinese context, the cases and actors are carefully chosen for this study. Section 5.2, with a focus on the merchants in the mobile payment ecosystem, addresses the factors in a mobile payment ecosystem that influence merchants' acceptance of mobile payment platforms, and how these factors affect their adoption-decision process. The detailed results on which Section 5.2 is based are mainly presented in Publication III. Section 5.3, with a focus on the mobile payment providers of the mobile payment ecosystem, presents the results on how the core mobile payment providers can establish/strengthen their positions in the mobile payment ecosystem in China. The detailed results for Section 5.3 are mainly reported in Publication IV, Publication V, and Publication VI.

5.1. The structure of the mobile payment ecosystem

Based on the analysis of the literature in Dahlberg et al. (2015b), the network of mobile payment actors is shown in Figure 5.1. The network is constructed based on the frequency by which various actors are found in the analysis of articles selected for the literature review. According to this, every node represents one actor in the ecosystem with the node size representing the number of articles mentioning the specific actor, i.e. the larger the node, the more important the actor is according to the literature. The connections in the network are specified based on the number of articles in which two actors are included together. The network was created using the open-source network visualization and exploration software Gephi[2]. Based on the created network, the core actors include various platform providers, merchants, end-users, suppliers for platform providers, policy-makers (governmental

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[2] https://gephi.org/

organizations) and regulatory agencies, and newcomers, such as over-the-top companies entering the mobile payment market.
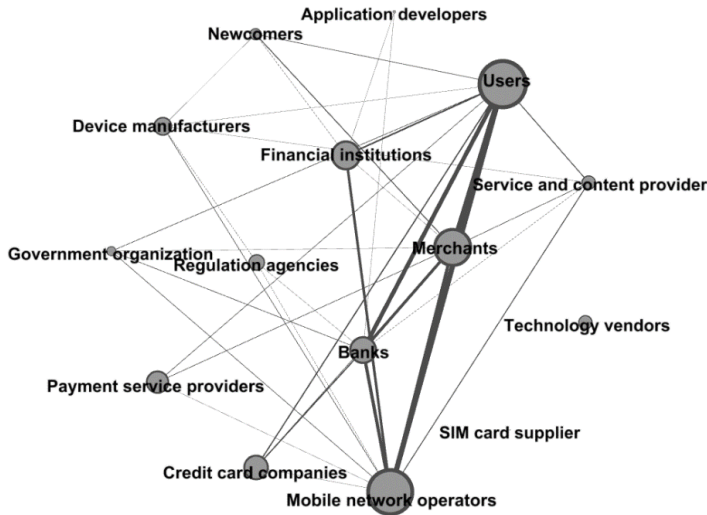
Figure 5.1 The structure of mobile payment ecosystem based on the literature (Guo & Bouwman, 2016b)

The structure of the mobile payment ecosystem offers an important basis for understanding the actions of various actors in the network. It can be seen that MNOs, banks, financial institutions, merchants and end-users are in the core of the network. Combining this information with the recent mobile payment situation in China (from 2013 to the end of 2015, during the time of doing the research and collecting data), the main actors can be identified as banks/financial institutions, MNOs, third-party providers, merchants and end-users. We note here that end-users are not the focus of this study, although the interactions between end-users and other actors are considered. In order to study the listed actors in the mobile payment ecosystem, we further discuss the results in the following sections.

5.2. Merchants' in the mobile payment ecosystem

We consider how the factors (from tier-1, tier-2, and tier-3 in Figure 3.1) in the mobile payment ecosystem affect merchants' adoption decision (Publication III) as summarized in Table 5.1. In the core business (tier-1), the merchants act both as users adopting the mobile payment platform and as providers offering the mobile payment platform to consumers. In addition, the mobile payment platform plays the role of the core asset connecting mobile payment providers with the other actors,

merchants and end-users in the mobile payment ecosystem. Therefore, on one hand, there is direct interaction between mobile payment providers and merchants through the mobile payment platform; besides that, there is direct interaction between merchants and end-users through the mobile payment platform. As a result, considering all the interactions, the interdependent factors in the mobile payment ecosystem from the merchants' perspective are identified and classified into five categories: (i) organizational factors (resource configurations, strategy orientations, managerial issues), (ii) technology factors (compatibility, perceived security, trust), (iii) demand factors (consumer readiness, critical mass), (iv) interorganizational factors (marketing strategies, platform openness, partner readiness), and (v) environmental factors (intuitional pressure, market opportunity). Thirteen elements have been identified that play an important role in merchants' adoption of mobile payment (see Table 5.1). Although each element is crucial for the decision of merchants' adoption of mobile payment, the analysis shows that the configurations of these interdependent elements clustered together contribute to the adoption decision.

Table 5.1 Summary of themes and cases of factors affecting merchants' acceptance (Guo & Bouwman, 2016a)

Themes		adopted and continue using mobile payment	adopted and abandoned mobile payment	have intention to adopt	with no intention to use
Organizational factors	Resource configurations	Sufficient internal and external resources	Internal resource and sufficient support from external resources	Some internal resources but not sufficient	No basic resources from both internal and external resources
	Strategy orientations	Focus on customer intimacy or product leadership	Not so important as the provider invest the costs	Customer intimacy	Some are not fit into their strategies, while the others hindered mainly by SOEs specific culture and structure issue
	Management support	Full support from management	Full support	Working on it	No support from management level
Technology factors	Technological characteristics	High level of compatibility with existing system, high level of perceived security and trust	High level of perceived security and trust	Perceived compatibility is not high, but can be improved. High level of perceived security and trust.	Low level of compatibility with existing system, low level of perceived security
Demand	Critical mass	High level of perceived critical mass as mobile	Low level of perceived critical mass as mobile	Perceived critical mass will grow in a	

		payment fit into the merchants' customers' need	payment only suitable for a minority of group	long run, but not at present	
	Customer readiness	The merchants' customers fit into the mobile payment customer segments	A minority group of the merchant's customer segment is ready	The merchants' customer readiness is limited in a small group which takes time to cultivate the behaviour	Low level of customer readiness
Interorganizational factors	Pricing strategy	Mobile payment providers provide subsidization strategy on either end-users or merchants	Mobile payment providers provide subsidization strategy on both merchants and end-users		
	Marketing strategy	Mobile payment providers help to reduce risks and advertisement	Mobile payment providers full support on reducing risks and advertising		
	Platform openness	Higher degree of mobile payment platform openness	Limited mobile payment platform openness		
	Partner readiness	Not important	Powerful partner (the power leads this merchant to adopted and abandoned it)	Not important	Not important
Environmental factors	Standardiza-tion	Lack of standard-izations	Lack of standard-izations	Lack of stand-ardizations	Lack of standard-izations
	Market opportunity	High level of perceived market opportunity	High level of perceived market opportunity	High level of perceived market opportunity	Low level of perceived market opportunity
	Institutional pressure	Low level of instituti-onal pressure	Low level of institutional pressure	Low level of institutional pressure	Low level of instit-utional pressure

In addition to this, all five identified categories have an influence on merchants' adoption decision for the mobile payment platform. The applied configuration approach explains how a mobile payment ecosystem could work as a result of the non-linear interaction of the thirteen constituent elements listed (see Figure 5.2). These different elements are interrelated and cluster systematically as can be seen in Figures 5.2, 5.3, and 5.4. As a result, the resource configurations and strategy orientations can be bridged by the factors from tier-1 (demand factors), tier-2 (technology factors) and tier-3 (environmental factors). As a mobile payment platform is a typical multi-sided platform, platform openness and network effects play important roles in the mobile payment ecosystem. Organizational factors from the merchants' side and demand factors from the end-users' side can reinforce each other as a result of cross-side network effects through the mobile payment platform.

On the other hand, the strategies (pricing and marketing) of platform providers can facilitate mobile payment adoption. The interplay between different actors is crucial in order for merchants to turn innovation into value.
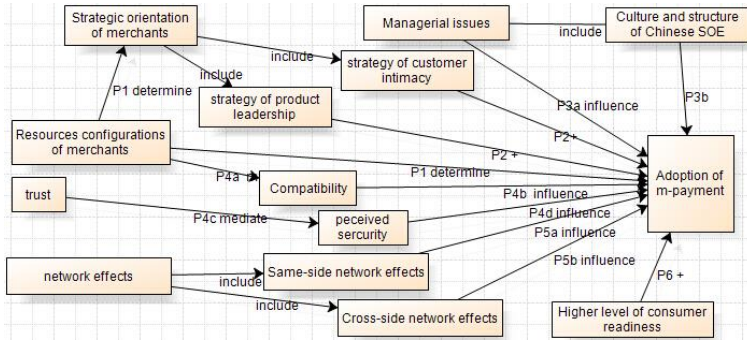
Figure 5.2 Summary of factor relations in Tier-1 of the business ecosystem (Guo & Bouwman, 2016a)
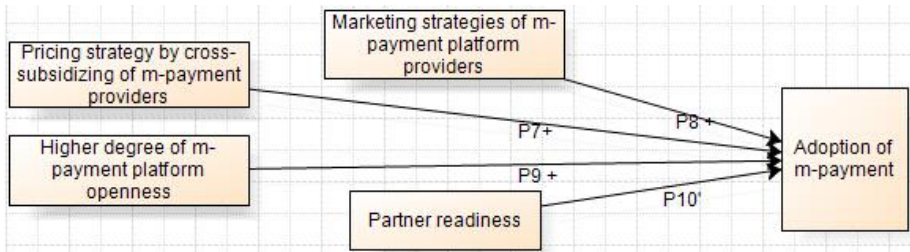
Figure 5.3 Summary of factor relations in Tier-2 (Guo & Bouwman, 2016a)

Figure 5.4 Summary of factor relations in Tier-3 (Guo & Bouwman, 2016a)

As shown in Figure 5.5, concerning the decision process of merchants' adoption of a mobile payment platform, it originates from core business level, and then moves to the extended network level and finally to the business ecosystem level. Furthermore, the factors at the core business level (Figure 5.2) are the most significant factors in order to decide whether to adopt a mobile payment platform. For instance, if the merchants decide to adopt a mobile payment platform, first, the factors at the core business level need to be satisfied (Figure 5.2); second, when facing imperfect conditions in the outside circle of the business ecosystem (Figure

5.4), the merchants see more opportunities. If the merchants decide not to adopt a mobile payment platform, the essential impediments lie at the core business level. If the merchants have intention to adopt but only in the future, the barriers probably lie outside the core business level, i.e., in extended network level (Figure 5.3) and/or business ecosystem level (Figure 5.4).
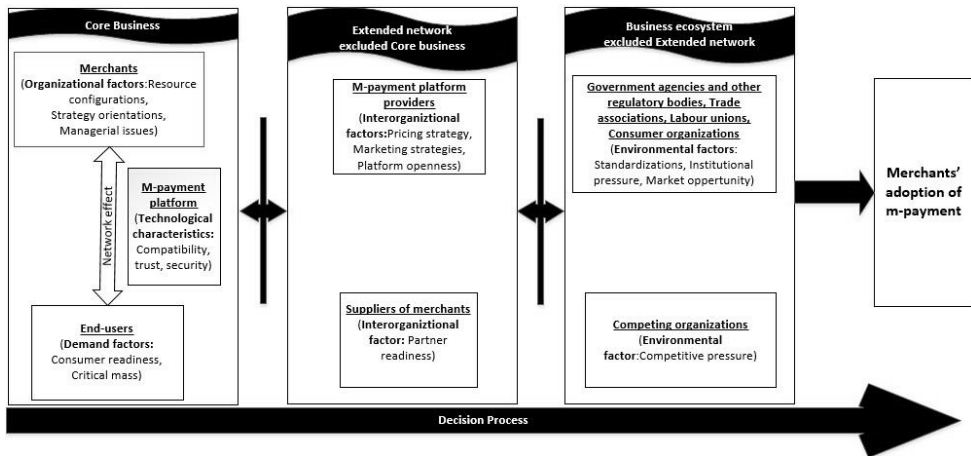
Figure 5.5 Merchants' acceptance of mobile payment decision process

Finally, the findings that most of the merchants have already adopted or intend to use TPP platforms is consistent with the findings by iResearch (2015) stating that TPP platforms occupied more than 60% market share in China. Private TPP providers that develop mobile payment platforms are increasingly present and have managed to gain a competitive edge over SOEs (banks/financial institutions and MNOs). The reasons can be explained as follows. First, the majority of Chinese financial institutions, and all MNOs are SOEs, which have monopolies in their own market. They intend to extend their leading status in the mobile payment industry, which makes them overconfident of their bargaining power in the mobile payment market. Second, both MNO centric and financial institution centric models offer limited mobile payment scenarios with non-interoperable mobile payment solutions. For instance, the MNOs focus on micropayments for their own customers. As a consequence, a China Mobile customer cannot use the mobile payment platform to pay for services or products provided by China Unicom or China Telecom, and vice versa. Financial institutions are mainly interested in major financial transactions, although they also provide micro-payment solutions. However, different banks may have different standards and system interfaces, which hinder cross-bank mobile

payment service operations. In contrast, TTP providers offer both micro- and macro-payments with a more interoperable platform by supporting a wide range of mobile networks and bank accounts. Third, the largest TPP providers have rich experience in online payments which results in a huge customer base that is familiar with the look and feel of the mobile payment platform. TPP providers are discussed in more details in 5.3.3.

5.3. Mobile payment providers

In the Chinese market, there are three types of mobile payment providers as we discussed previously: (i) traditional industry single organization (i.e., bank-centric), (ii) joint provider (i.e., MNOs and financial institutions), (iii) third-party payment providers. In this section, banks as the representative case of traditional industry single organization providers, are studied from a business model perspective (see 5.3.1) to answer the RQ3 regarding how banks can establish and strengthen their position in the mobile payment ecosystem (details in Publication IV). The collaboration between China Mobile (MNO) and China Unionpay (a financial institution) (see 5.3.2) is chosen to represent the case of joint providers. This study compares an "ideal" business model and the actual business model to provide answer the RQ3 on how MNOs can establish and strengthen their position in the mobile payment ecosystem (details in Publication V). Alipay Wallet is chosen to represent third-party payment providers (see 5.3.3). This study is formulated using both resource-based view (RBV) (Wernerfelt, 1984; Barney, 1991) and resource dependency theory (RDT) (Pfeffer & Salancik, 1978; 2003) perspectives to answer RQ3 on how TPP providers can establish and strengthen their position in the mobile payment ecosystem (details in Publication V).

5.3.1. Traditional industry single organization business model

Banks, as core actors in the traditional payment industry, are confronted with major challenges due to the rapid developments in technological and web-based applications. The emergence of mobile payment is a strategic opportunity that can convert cash into electronic transactions, as well as build a defensive competence against new entrants. In order to realize these potential advantages, banks need to design a viable business model for serving the major actors involved in the mobile payment ecosystem; the business model should offer the basis for managing profitable mobile payment services through collective action and collaboration, in

order to establish and strengthen the banks' position in the mobile payment ecosystem (Publication IV). As can be seen in Figure 5.6, the criteria for the banks' decision problem are structured in a hierarchy, with mobile payment as the main goal at the top of the hierarchy. On the second level, mobile payment is decomposed into the four domains of the STOF model as discussed in the early chapter.
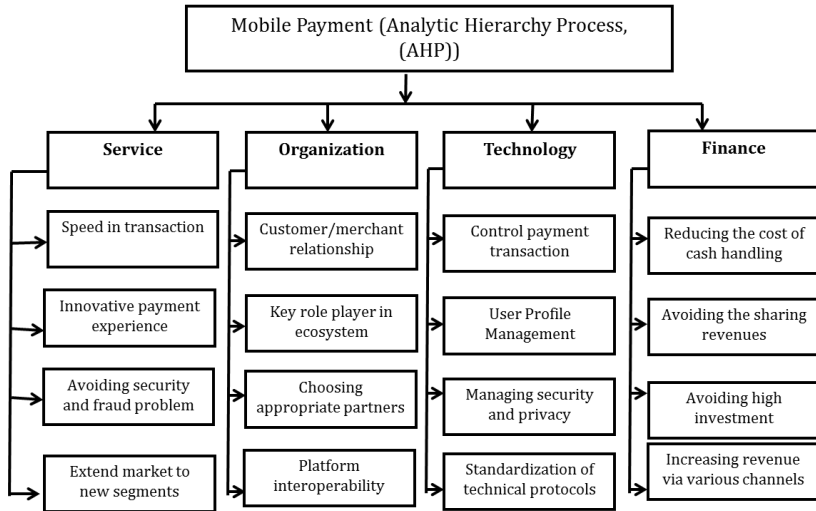
Figure 5.6 A hierarchical model of the determinants of the mobile payment business model for banks

According to the STOF model, the most important design issues of mobile payment from the bank's perspective are identified in relation to the four main components. In the empirical analysis, the service domain has the highest weight, followed by the technology, organization and finance domains (Table 5.2).

Table 5.2 Priority ranking and weight of the main factors of banks' STOF model (Guo et al., 2013)

Priority Ranking	STOF	Weight
1	Service	0,33
2	Technology	0,26
3	Organization	0,22
4	Finance	0,19

As for the overall ranking of the components (Table 5.3), two security related factors account for almost 25% of the overall weights (*avoiding security and fraud problem* from the service domain *and managing security and privacy* from the technology domain). The results illustrate that security is a main factor when designing a business model for mobile payment (Table 5.3). Banks have extensive experience in data security, fraud prevention and risk management through which

they have gained customer's trust. Using their reputation, they can assure customers of the security and privacy of traditional banking services.

Table 5.3 Priority ranking and weight of the components in banks' STOF model (Guo et al., 2013)

Priority ranking	Attribute level	Relative weight	STOF
1	Avoiding security and fraud problem	0,138	Service
2	Managing security and privacy	0,089	Technology
3	Speed in transaction	0,080	Service
4	Innovative payment experience	0,062	Service
5	Platform interoperability	0,061	Organization
6	User Profile Management	0,058	Technology
7	Standardization of protocols	0,058	Technology
8	Control payment transaction	0,058	Technology
9	Increasing revenue	0,056	Finance
10	Key role player in ecosystem	0,053	Organization
11	Choosing partners	0,053	Organization
12	Customer/merchant relationship	0,051	Organization
13	Extend market to new segments	0,051	Service
14	Control investment	0,046	Finance
15	Reducing the cost of cash	0,046	Finance
16	Avoiding the sharing of revenues	0,037	Finance

Technology is key to realizing mobile payment service offerings, and it consists of security, quality of service, system integration, accessibility for customers, and management of user profiles. The results demonstrate that all the components in the technology domain are important to design a viable business model. Security is ranked in the 2nd place, while the others (*User profile management, Standardization of protocols,* and *Control payment transaction*) are relatively equally important and ranked at the top half of the list as can be seen in Table 5.3.

In the mobile payment ecosystem, the difficulties lie in the organization domain, as all the partners have to make agreements on identifying their roles in the ecosystem and determining viable and profitable business models that satisfy, to some extent, the interests of all the actors. As can be seen in Table 5.3, *Platform interoperability* is ranked in the 5th place, while the other factors related to the organization domain (*Key role player in ecosystem, Choosing partners,* and *Customer/merchant relationship*) are ranked from 10th to 12th. This lack of assigned importance can help to trace the three reasons why banks do not succeed

in offering profitable mobile payment services yet. Firstly, banks have not paid enough attention to the possibility to play a key role in the mobile payment ecosystem, even though they have the capabilities and resources. Secondly, if banks do not choose the proper partners, this will result in serious conflicts of interest among actors in the ecosystem. Thirdly, banks in China have not made significant efforts to improve the customer/merchant relationships.

In the finance domain, *increasing revenue* through mobile payment services is ranked as the most important component. Surprisingly, the other three components (*Control investment, Reducing the cost of cash,* and *Avoiding the sharing of revenues*) are ranked as the least important priorities (Table 5.3). Sharing revenues is ranked in the last place, which implies that banks keep an open mind to cooperating with the others, but clearly it is not their priority.

5.3.2. Traditional industry collaboration business models

The collaboration between China Mobile and Unionpay (discussed in more detail in Publication V) is analysed by combining quantitative and qualitative research. In the first step, performed with AHP similarly to the previous analysis of the banks' business models in 5.2.1 (Figure 5.7), the criteria are structured in a hierarchy, with the mobile payment business model as the main goal at the top of the hierarchy. On the second level, the business model is decomposed into a number of criteria/attributes that are comparable to each other (in our case the four domains of the STOF model).
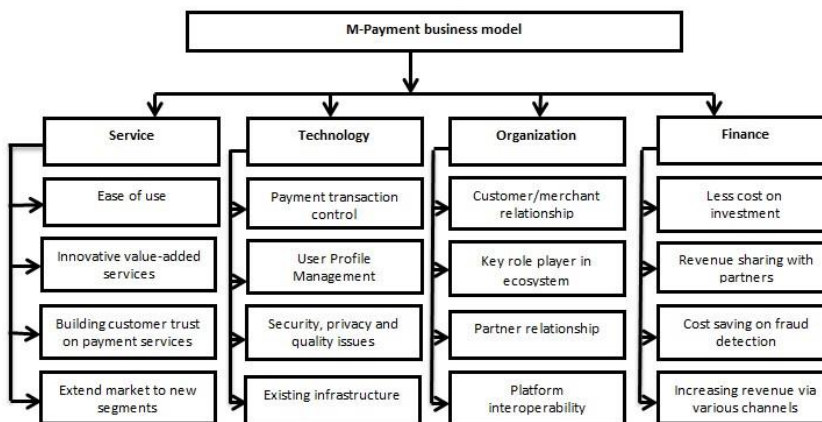
*Figure 5.7 A hierarchical model to determine the mobile payment business model for MNOs*

According to the STOF model, the important design issues of mobile payment from the MNOs' perspective are identified in relation to the four main components. In the empirical analysis, we found that the service domain has received 37% of the total weight in the priority ranking, followed by the technology domain (27%), the organization domain (19%) and the finance domain (17%). This result shows that the respondents consider service and technology as the most important domains when providing mobile payment services and solutions (see Table 5.4). Interestingly enough, comparing Table 5.2 and Table 5.4, the respondents from the banks and the MNOs both perceive service and technology as the most important domains of the business model, followed by organization and finance.

Table 5.4 Priority ranking and weight of the main factors of MNOs' STOF model (Guo et al., 2015)

Priority Ranking	STOF	Weight
1	Service	0,37
2	Technology	0,27
3	Organization	0,19
4	Finance	0,17

Moreover, on the second level of the hierarchy, *ease of use* (0.14) and *building customer trust* (0.12) are the two most important components of the STOF model, as they have received the highest priority ranking and weight values by MNOs (see Table 5.5). These findings are consistent with the results of the first order attributes (i.e., level one of the hierarchy tree), as they are the components of the service domain. *Customer and merchant relationship* (0.08) from the organization domain and *guaranteed security and privacy issues* (0.068) from the technology domain are the third and fourth most important components according to the respondents. It can be assumed that the employees of the MNOs are aware that maintaining sustainable relationships with the customers and the merchants play a crucial role in the adoption of mobile payment services.

Platform interoperability (0.066) and *key role player in ecosystem* (0.064) are both considered to be very important attributes from the organization domain.

*Table 5.5 Priority ranking and weight of the components in MNOs' STOF model (*Guo et al., 2015)

Priority ranking	Attribute level	Relative weight	STOF
1	Ease of use	0,143	Service

2	Building customer trust on payment services	0,123	Service
3	Customer/merchant relationship	0,08	Organization
4	Guarantee security and privacy issues	0,068	Technology
5	Platform interoperability	0,066	Organization
6	Key role player in ecosystem	0,064	Organization
7	Partner relationship	0,057	Organization
8	Increasing revenue via various channels	0,057	Finance
9	Revenue sharing with partners	0,052	Finance
10	Innovative payment experience	0,051	Service
11	Extend market to new segments	0,051	Service
12	Payment transaction control	0,051	Technology
13	User Profile Management	0,043	Technology
14	Cost saving on fraud detection	0,034	Finance
15	Less cost on investment	0,033	Finance
16	Existing infrastructure	0,027	Technology

Increasing revenue via various channels (0.057) is the most important attribute in the finance domain. As different actors enter the market, while mobile MNOs have traditionally been the dominant actors, MNOs should either strive for focusing on operational excellence in their core businesses and integrating their operating systems with their business systems, or strive to focus on creating new incremental innovative services and new business models. Mobile payment services may help MNOs to stay competitive in their dynamic market. The existing infrastructure is the least important component of the STOF business model according to the respondents.

In order to gain a deeper insight into how mobile payment business models can be further developed, in-depth interviews were carried out with experts and managers working in MNOs to learn about their actual mobile payment business models and the performance of their companies related to mobile payment s. Then, the actual business model was compared to the identified "optimal" business model (from the AHP results), to determine in which domains they may need to improve on any insufficient factors (see Table 5.6).

By comparing the results of the interviews with managers from Chinese MNOs and the results of AHP analysis (see Table 5.6), we can see that many components

need to be improved in each domain as addressed by the STOF model in order for the business model to be able to satisfy customer needs and to balance providers' benefits. Regarding service domain, while the present mobile payment service achieves ease of use, which makes the payment simple and fast, and can store all existing plastic cards and coupon details, the weaknesses in this domain primarily relate to building customer trust, to innovate payment experience and to extend market to new segments. In the technology domain, guaranteed security and privacy issues, user profile management and existing infrastructure would require more time and effort to cultivate the technology and environment, while payment transaction control is already under proper control.

Table 5.6 Integration of AHP results and interview results of MNOs (Guo et al., 2015)

STOF Domain	AHP Ranking	Interview Results	Improvement Required
Service	1-Ease of Use	• Simple and fast payment • All existing plastic cards and coupon details are stored in mobile payment	
	2-Building customer trust on payment services	• China Unionpay and China Mobile have a good reputation in the Chinese market • The TSM platform can provide trust from a technology perspective	Requires a long-term effort to see the performance of the TSM platform
	3-Innovative payment experience	Collect loyalty points, redeem coupons, and enjoy promotional offers by simply waving a NFC-enhanced phone by a POS terminal	• POS terminal and NFC-enabled phone shortage • Mobile payment knowledge • Redefine the whole purchase process experience
	4-Extend market to new segments	Considerable opportunities to roll out mobile marketing campaigns through mobile phones	Redefine the whole purchase process experience
Technology	1-Guarantee security and privacy issues	SE in SIM (SWP SIM solution)	Popularize the knowledge of the security of mobile payment services
	2-Payment transaction control	• Delivers account information to secure element • Load payment request and authorization from TSM platform	
	3-User profile management	Guide future strategies with personal data, interest, and context	Consumers' resistance to share personal information
	4-Existing infrastructure	• Operator network • Basic infrastructure	Hardware problem

Organization	1-Customer/merchant relationship	Promoting the service to customers	Not strong connection with merchants as China Unionpay promotes the service to merchants
	2-Platform interoperability	• Collaborating with China Unionpay to build TSM platform to enhance platform interoperability	Competing with other integrated mobile payment platform
	3-Key role player in ecosystem	Collaborating with China Unionpay and Banks to guarantee the security	
	4-Partner relationship	• Collaborating with China Unionpay and Banks to guarantee security • TSM platform provider	
Finance	1-Increasing revenue via various channels	• Business function fee • Application functions fee • Communication costs • The rental fee	• No revenues gene-rated directly from mobile payment services • A strategic imperative
	2-Revenue sharing with partners	• Rental fee • Operators pay for ordering specific NFC phone	
	3-Cost saving on fraud detection	Aware of fraud detection	Less concerned with fraud detection than banks are
	4-Less cost on investment	• Existing infrastructure is mature • Less cost on technology	

In the organization domain, while two of the components (*key role player in ecosystem and partner relationship*) have already been established in practice, platform interoperability and customer/merchant relationships need to be improved. In the finance domain, the developments in two components (*revenue sharing with partners* and *less cost on investment*) are satisfactory, while the other two (*increasing revenue via various channels* and *cost saving on fraud detection*) require a greater effort, and the interviewed managers and experts are aware of this.

5.3.3. Third-party payment provider

Alipay is chosen as a successful case, as it owns the largest mobile payment market share in China. In the Alipay case (more detail in Publication VI), the core business ecosystem includes Alipay, banks, merchants and end-users. Alipay makes use of the mobile network provided by MNOs, which is regulated by the end-users' contract with MNOs. As a consequence of this, the role of MNOs as providers of payment solutions is not considered further in this analysis. MNOs as merchants refer to the role of MNOs as providers of "phone recharging service" on the Alipay wallet platform. In addition to this, fund corporations, as a type of financial

institutions, provide fund services that consumers can use to buy products through the Alipay wallet platform. For instance, Tianhong Fund Corporation provides money-market savings accounts known as Yu'E Bao or leftover Treasure.

Based on the second step of the StrReS model (Structure-Resources-Strategy), the resources of the core actors in the Alipay wallet ecosystem are summarized in Table 5.7. Alipay Wallet has a large customer base, a compatible and secure technology platform, and technical support as important resources. Alipay wallet, as a subsidiary of Alibaba Group Holding Ltd, is the only payment solution on Taobao (consumer-to-consumer) and Tmall (business-to-consumer) platforms, which are China's largest retail platforms for consumers and businesses. As the Alibaba ecosystem contains a large number of business entities, all actors work together smoothly to get benefits and to contribute to the survival of the whole ecosystem. In addition, different interconnected marketplaces belong to Alibaba, so many buyers and sellers from one marketplace also participate in the activities in other marketplaces, i.e. from Taobao to Tmall, from online payment to mobile payment, which generates network effects that further enhance the ecosystem. In other words, the Alipay wallet ecosystem both benefits from Alibaba's network effects and contributes to them.

Merchants are essential for providing payment scenarios on the Alipay wallet platform to attract consumers. The aim of Alipay is to enrich the payment scenarios and to increase the lock-in effect for end-users. As a result, Alipay selects merchants who provide must-use services (i.e., public service payment), convenient and fast services (i.e., Kuaidi taxi-hailing), and value-added services (i.e.,Yu'E Bao). In order to provide more payment scenarios by inviting more merchants, Alipay not only attracts a diverse and large number of merchants, which in turn attract more users to generate more network effects and to increase loyalty of both end-users and merchants.

Banks are essential in the ecosystem to provide a payment channel. Interviewees from Alipay (details in Publication VI) claimed that banking systems and banking licenses are the key resources and capabilities of the banks, allowing banks to act as important actors in the Alipay wallet ecosystem.

Table 5.7 Resources and capabilities of core actors in Alipay wallet ecosystem (Guo et al., 2016b)

Actors	Resources	Role
Alipay wallet	- secure authentication & authorization - secure element - risk management - cost-efficient independent payment infrastructure - transaction management - system integration - IT infrastructure - customer base	Platform providers
Merchants	- system integration - cost-efficient independent payment infrastructure - customer base	Critical payment scenarios
Banks	- secure authentication & authorization - risk management - transaction management - banking system - customer base - banking license	Payment channel

In line with the resource dependence theory, we identify and classify the interdependences among the core actors in the Alipay wallet ecosystem in Table 5.8. There are two essential resources in the case of Alipay wallet: (i) Alipay depends on the banks' licenses and the banking system, if they would not connect to Alipay wallet, the Alipay wallet mobile payment platform would not work; (ii) merchants depend on Alipay, as very few of them can develop mobile payment services by themselves. There are two complementary resources: (i) Alipay wallet depends on merchants in various payment scenarios; (ii) banks depend on Alipay wallet to deal with micro-payments which allows the banks to focus on their core business.

Table 5.8 Dependency resources of core actors in Alipay wallet ecosystem (Guo et al., 2016b)

Actors	Dependency resources	Type
Alipay wallet on merchants	- more functionality services - customer base	Complementary
Merchants on Alipay	- Low commission fee and fast money arrival - customer base - Marketing guidance - Payment technical support - secure authentication & authorization - secure element - risk management	Essential

	- cost-efficient independent payment infrastructure - transaction management - system integration - IT infrastructure	
Alipay wallet on banks	- secure authentication & authorization - risk management - transaction management - banking system - banking license	Essential
Banks on Alipay wallet	-Handling micro-payment -customer base -Enhancing the loyalty of existing customers	Complementary

In the next step, making use of the StReS framework, we explore what the actors have done to manage the external interdependencies and the outcome of their actions (strategies). To reduce uncertainty, there are two prominent ways that can be followed by organizations: (i) reducing dependency on the others, and/or (ii) increasing the dependency of others (lock-in).

Alipay has taken actions that both increase the banks' dependency on Alipay and reduce Alipay's dependency on banks. Alipay wallet did not choose the strategy of acquiring a bank to obtain a banking license. Therefore, banks are willing to join the Alipay wallet platform as the platform facilitates the exchange of goods for money, and Alipay compete with banks directly.

Alipay has also taken actions to increase its power balance in the Alipay wallet ecosystem, even if Alipay built its own positions in mobile payment services as a platform provider. The position is mainly a consequence of Alipay being the leading online payment provider in the Chinese market: (i) the company has experience in e-payment, (ii) a large market share, (iii) a large customer base (merchants and end-users), and (iv) a solid reputation. All these pre-conditions helped Alipay to move smoothly from online payment to mobile payment. With regard to the power balance between Alipay and the banks, Alipay depends on the banks' essential resources while banks depend on Alipay's complementary resources as the four points mentioned before illustate. Even though Alipay could not survive without banks, more and more banks are joining Alipay's platform for economics of scale reasons, with a majority of the Chinese banks already on board. This development is the consequence of Alipay´s keystone strategy and its actions designed to: (i) create

value within the ecosystem, and (ii) share this value with other participants in the ecosystem. Alipay has managed to realize its strategy by (i) creating the Alipay wallet platform, with various services, tools and technologies that offer solutions to other participants, and (ii) sharing data (but keeping customers' privacy), such as guidance on consumers' habits based on the results of big data analysis, which is communicated to merchants and banks according to the contracts. As a consequence of these actions, the power of Alipay within the ecosystem has increased compared to the initial stages, when some of the banks were reluctant to join. In other words, although actors with essential resources have advantages in the ecosystem, the position and power balances are dynamically changing according to the strategies (actions) the actors have followed, as the resources and dependency configurations are changing as well.

As for the Alipay wallet platform, the main goal is to increase the range and reach to enable interactions among the participants (merchants and end-users) affiliated with the platform, and thus to create and capture value which can ensure long-term success. To achieve this, Alipay wallet cooperates with various merchants and attracts them mainly with its large consumer base. Moreover, Alipay wallet triggered platform network effects including both same-side effects and cross-side effects in order for the Alipay wallet platform to reach critical mass. The network effects of the Alipay mobile payment platform, with growing numbers of connected end-users, merchants and banks, drive value creation and scale effects to all parties, which make them even more dependent on Alipay.

6. Summary and Conclusions

This chapter summarizes the main outcomes of the research work and offers a number of conclusions. The concise answers to the research questions are provided in Section 6.1. The theoretical contributions and managerial implications are introduced in Section 6.2. Finally, limitations and future research directions are summarized in Section 6.3.

6.1. Answers to the research questions

Throughout this work, our main goal is to analyse and understand mobile payment ecosystems and for this purpose, we consider them as a set of interconnected actors in a dynamic environment where they cooperate and compete together through a core mobile payment technology platform. By applying an ecosystem perspective, this study focuses on the core actors (mobile payment providers and merchants) in China. In Chapter 1, a number of complex issues were identified and discussed that need to be considered in a business ecosystem. We formulated the overall research objective of the thesis as *"to describe and explain the core and the extended network of the mobile payment ecosystem and to offer guidelines to actors in a mobile payment ecosystem in order to strengthen their positions in the mobile payment ecosystem"* (see Chapter 1). In the following, we discuss how the answers to the individual research questions helped to achieve this objective.

RQ1. What is the state of the art on mobile payment, specifically when the ecosystem perspective is considered?

This research question is discussed in Chapter 2 of the thesis and answered in more detail in Publication I and Publication II. In order to identify and summarize the state of the art, firstly, possible theories and concepts, i.e. ecosystem and platform theory, business models, technology characteristics etc. that could offer a basis for novel contributions to mobile payment research, are studied in Publication I. Furthermore, a systematic literature review has been carried out to find possible research gaps with a focus on ecosystem perspective as well as to work out recommendations for future research; the review is presented in more detail in Publication II.

As we concluded in the previous chapters, in order to work out some systematic explanations for the complexities of mobile payments, several issues need to be addressed. First, the research requires studies from different perspectives on the mobile payments market, as well as taking into account the interactions among the core actors in the mobile payment market. Second, mobile payment research requires studies using a variety of theories that can offer new perspectives on the domain (i.e., platform and ecosystem theory). Keeping these observations in mind, we found that an ecosystem perspective is suitable for this research. In addition, in mobile payment literature, there is a lack of studies from the merchants' perspective. Understanding the behaviour and actions of merchants is a challenging problem as they are both (i) adopters of a mobile payment platform and (ii) providers of mobile payment services to consumers. These two important, many times conflicting, roles of merchants can be understood by considering the interactions of the interdependent factors in the mobile payment ecosystem (RQ2). As we found in the literature review, there is a lack of studies in the field of mobile payment from a providers' perspective in general. Furthermore, the studies of mobile payment cases are mainly from Western markets, especially when we consider the studies following an ecosystem perspective. Moreover, due to the rapidly changing technological environment and the lack of successful mobile payment ecosystems, there is hardly any study reporting successful mobile payment cases. Therefore, motivated and guided by the identified gaps, in the thesis we analysed the mobile payment ecosystems from the perspectives of different mobile payment providers (MNOs, financial institution/banks and TPP providers) and with special attention paid to merchants. We employed a variety of theories and concepts tailored to each specific sub-problem in the research process, including business ecosystem, platform theory, resource-based view (RBV) and the resource dependency theory (RDT), as well as business model thinking. The obtained results provide answers to RQ 2 and RQ3.

RQ2: What are the factors in a mobile payment ecosystem that influence merchants' acceptance of mobile payment platforms; how do these factors affect their adoption-decision process?

This question is answered in Section 5.2 and Publication III. The two different roles specified previously require merchants to find a balance between technology-

push and consumer demand. To resolve the (possibly) conflicting requirements of these two roles, the dynamic interplays on the organizational level (i.e. power and control, competitive strength and strategic orientations) with the environmental level (i.e. the factors present in the mobile payment ecosystem) are considered in this thesis. The thesis proposes an analytical multi-level framework that can help to analyse and understand the dynamics by investigating the non-linear interactions of the elements of the mobile payment ecosystem.

The ecosystem factors are classified into five categories: (i) organizational factors (resource configurations, strategy orientations and management support); (ii) technology factors (technological characteristics); (iii) demand factors (critical mass and customer readiness); (iv) interorganizational factors (pricing strategy, marketing strategy, platform openness, and partner readiness); and (v) environmental factors (standardization, market opportunity and institutional pressure). While each factor is important individually in the decision of merchants' adoption of a mobile payment platform, the results show that merchants' adoption decision is determined by the configurations of these interdependent elements clustered together (Table 5.1). In addition, the resource configurations and strategy orientations can be linked by tier-1 factors (Figure 5.2), tier-2 factors (Figure 5.3) and tier-3 factors (Figure 5.4). The decision process resulting in (lack of) adoption of a mobile payment platform originates from the tier-1 core business level, and then moves to tier-2, the extended network level, and finally to tier-3, the business ecosystem level. The most important factors to make a decision regarding the adoption of a mobile payment platform are located at the core business level. More specifically, the merchants will adopt a mobile payment platform only if the core business level factors are satisfied. If a merchant decides not to adopt a mobile payment platform, the main obstacles lie at the core business level. If a merchant has intention to adopt a mobile payment platform in the future, the obstacles in most of the cases lie outside the core business level. Based on our findings, as the effect of a factor can be largely affected by its interactions with other factors and the configurations of the clustered interdependent elements, we do not recommend classifying factors simply as drivers or barriers for merchants' adoption.

RQ3: How can different mobile payment providers establish/strengthen their positions in a mobile payment ecosystem?

This question is answered in Section 5.3 and in Publication IV, Publication V, and Publication VI. The question is answered from two perspectives: business models and resources as made available in the ecosystem; in addition to this, the analysis is worked out for three cases analysing different mobile payment providers.

In the thesis, we classified Chinese mobile payment providers into three groups: (i) a traditional industry single organization as mobile payment provider (Publication IV), (ii) traditional industry joint providers (Publication V), and (iii) third-party payment providers (Publication VI). Banks are chosen to represent the case of organizations acting as single providers. The reason for choosing banks is their prominent role in the traditional payment industry and the important problem of how they establish and strengthen their positions in the mobile payment ecosystem, when facing the potentially disruptive technology and the new entrants to the payment industry. In other words, the strategy followed by banks is not only a defensive competence against new entrants, but also a growth prospect for their existing business if they adopt the new technology.

Financial institutions and MNOs as joint providers are chosen to represent the case of traditional industry joint providers. The mobile payment ecosystem was brought into existence through the convergence of the payment and mobile telecommunications ecosystems with some additional actors emerging in the process. The aim in this second case is to study how two giants in their own industry cooperate collectively to provide a mobile payment platform. While in the first case we considered the banks' perspective, in this second case, we additionally include an MNO's perspective, to study how MNOs can establish and strengthen their positions in the mobile payment ecosystem relying mainly on their resources acquired in the telecommunications industry.

The case of Alipay Wallet is chosen to represent third-party payment providers. The reasons to choose Alipay Wallet can be explained as follows. First, private third party payment platforms gained a competitive edge over state-owned enterprises, although mobile payment evolved from the convergence of the financial and the telecommunications industries, which are traditionally dominated by state-owned enterprises in China. Second, Alipay Wallet is the most successful third-party payment provider with the largest market share in China, consequently the present work offers one of the first analyses of a success case in mobile payment literature.

This analysis can help to understand how third-party payment providers (from industries other than traditional financial or telecommunication industries) can successfully strengthen their positions in the mobile payment ecosystem.

Publication IV and Publication V are formulated from a business models' point of view to analyse how banks and MNOs can establish and strengthen their positions in the mobile payment ecosystem. Publication IV uses the STOF business model framework to identify the critical design issues of the banks' business models and analyses which domains of the STOF model (service, technology, organization and finance) are the most important. The analysis is carried out with the Analytic Hierarchy Process (AHP) methodology. Publication V combines qualitative and quantitative research to identify design issues that should be addressed to design a viable business model in order to improve the providers' positions in a mobile payment ecosystem. In this case, we consider a Chinese mobile payment platform which provided by a collaboration between MNOs and financial institutions. In the first step of the analysis, the Analytic Hierarchy Process (AHP) is employed as a research approach and the STOF business model as a research framework, to identify design issues for mobile payment services from the MNOs' perspectives. Furthermore, insights from semi-structured interviews with experts (an "ideal" business model) are compared to the AHP results (the actual business model), to find out how MNOs could improve their actual business model design. In Publication V, we find that policy and regulation support plays a critical role in the development of mobile payment. Unified standardization, government policies and regulations encourage service providers to actively promote mobile payment, which in turn enhances the performance of the entire mobile payment ecosystem. This is consistent with the findings of Publication III.

Publication VI studies how Alipay as a third party payment provider successfully strengthened its position in the mobile payment ecosystem. The study follows a resource-based perspective and offers recommendations for other mobile payment providers. Publication VI proposes the StReS (Structure-Resource-Strategy) framework as a general approach to systematically analyse business ecosystems. In the StReS framework, first the structure of a business ecosystem is represented as a network, followed by the identification of the motivations of the organizations cooperating in the core ecosystem. This analysis relies on the understanding of the

considered actors' relationships and resources, and then studies the actions the core actors have taken to reduce dependency and uncertainty in the ecosystem. Building on insights from business ecosystem concepts, the StReS framework in this thesis is utilized in combination with the resource-based view (RBV) and the resource dependency theory (RDT) in a qualitative research approach, using in-depth interviews with experts and managers from a number of organizations to analyse the case of the Alipay Wallet ecosystem. The results show that actors with heterogeneous and potentially complementary resources can create a sustainable but dynamic collaboration. We find that the cooperation of core actors in an ecosystem is motivated by their need for each other's resources to gain competitive advantages. In the presented case, the resources and capabilities as well as the dependency resources of the core actors in the Alipay Wallet ecosystem are identified. Moreover, the dependency resources are found to change dynamically, as all the actors are taking actions all the time to reduce dependency and uncertainty, which results in unstable power balances. In the Alipay case, the dynamic collaboration worked out in favour of Alipay that was able to increase its power in the ecosystem. The lessons learnt from this case can offer insights and advice to other platform providers.

The guidelines for actors to strengthen their positions in the mobile payment ecosystem (cf. RQ3) are worked out as practical implications in the following section.

6.2. Implications

This thesis offers a number of theoretical and practical contributions to the field through our analysis of the core actors in mobile payment ecosystems. The detailed contributions are discussed in the following.

Theoretical contributions

The first contribution lies in identifying the theories that could be used in mobile payment research, including platform theory, business ecosystem theory, resource based view, resource dependency theory, contingency theory, configuration theory and business modelling. These theories are identified based on the lessons learnt from a systematic literature review of mobile payments since the first contributions in 1998 until March 2016, summarizing the research status, and identifying the research gaps in Chapter 2 (details in Publication I and Publication II). Following

the discovery of research gaps in the literature, the thesis studies the core actors in mobile payment ecosystems, including banks/financial institutions, MNOs, third-party payment providers and merchants, by taking interactions among all actors in a mobile payment ecosystem into account with the help of an integration of the theories mentioned above.

The second contribution is the developed analytical framework integrating business ecosystem and platform theory, resource based view, resource dependency theory, contingency theory, and configuration theory in a novel way to explain organizational adoption of a technology (Publication III). To begin with, business ecosystem concepts help to understand the relationships among the mobile payment ecosystem actors, and to define the scope of the study. In addition, based on the premise of contingency theory (Lawrence & Lorsch, 1967; Thompson, 1967) stating that there is no single best way to design an organization, as the optimal course of action depends upon the internal and external situation (context), contingency theory is employed to identify contingent factors at core business network level (tier-1), extended network level (tier-2) and business ecosystem level (tier-3). Contingency theory helps to posit that a merchant's acceptance of a mobile payment platform is dependent upon the fit among a merchant's organizational structure, characteristics of a mobile payment platform, and mobile payment environment. However, contingency theory only represents traditional bivariate relationships involving unidirectional causations, which fails to capture the full picture of organizational change and adoption (Galunic & Eisenhardt, 1994). In other words, in a mobile payment ecosystem, the contingency variables increase as a result of changes in organizations, technology, environment, and the dynamic interplays among actors in the mobile payment ecosystem over time. Therefore, configuration theory is employed to help explaining how a merchants' adoption behaviour is the result of the interaction of its constituent elements, representing it using non-linear synergistic effects and higher-order interactions among multiple factors. Moreover, when considering the organizational structure, resource based view (RBV) helps to identify internal organizational factors (strategy, resources, and capabilities) of merchants having an effect on the decisions of adopting innovations. Additionally, resource dependency theory (RDT) assists us to understand the network aspects and the fact that merchants acquire and sustain resources from their external environment and attempt to change their dependency relationships by minimizing

their own dependence or by increasing the dependence of other organizations on them. RBV and RDT help to identify and classify the internal and external resource configurations. Furthermore, as mobile payments reflect the characteristics of a multi-side platform, platform theory is applied to illustrate the "start-up" problem of multi-sided platforms (the well-known chicken-and-egg problem), by considering the interactions between consumers and merchants, mobile payment platform technology characteristics, as well as cross-side and same-side network effect.

This framework contributes to mobile payment adoption research in the following way. First, unlike many prior studies that have attempted to extend the conventional technology, organization, and environment (TOE) framework (Oliveira and Martins, 2011), or the diffusion of innovation (DOI) (Rogers 1995) models to examine organizational adoption of new information and communication technologies, in this work *a business ecosystem framework* (Figure 3.1) is developed based on the general concept proposed by Moore (1996). With this regard, our main contribution to the literature is to extend the traditional view on business ecosystems with a configuration perspective by investigating the non-linear interactions among different elements in the special case of mobile payment ecosystems. This offers a more structured and systematic approach to identify the factors influencing merchants' adoption choices and behaviour. Our findings further extend the discussion on business ecosystems by considering them as the outcome of the interactions of interdependent factors (i.e. demand, organizational, technology, interorganizational and environment factors) and interrelated actors (merchants, mobile payment platform, consumers, mobile payment platform providers and standard bodies). The non-linear interactions show that the identified elements (Table 5.1) result in constellations when they cluster systematically to reveal a holistic picture of a mobile payment ecosystem, offering a contribution to literature on organizational technology adoption. Second, the identified interrelationships provide insights that contribute to adoption theory by explaining why (instead of how) a merchant would/would not adopt a mobile payment platform. As we found, the traditional view of classifying adoption factors simply as drivers or barriers can be misleading, as the effect of a factor heavily depends on the resource configurations resulting from its interactions with other factors. Based on our findings, a factor should be positioned as either a driver or a barrier only for a fixed

configuration and not in general. Third, the results contribute to mobile payment adoption research as we study the merchants' adoption-decision processes, where many prior studies work only with the related factors in isolation of each other without looking at the problem from a holistic perspective. Fourth, this thesis synchronizes platform theory, business ecosystem theory, the resource based view, the resource dependency theory, contingency theory, and configuration theory together into a novel analytical framework.

The third contribution is that the thesis sheds light on how to identify the critical design issues of business models that can help to strengthen the core actors (banks and MNOs) in the mobile payment ecosystem (Publications IV and V). The business model perspective helps to specify service and technology as the most important domains of the business model, followed by organization and finance in both cases. Publication IV employs AHP to identify how banks should improve their business models in order to establish and strengthen their position in the mobile payment ecosystem. Publication V combines a qualitative and quantitative approach to integrate interview results with quantitative analysis results, which gives us a comprehensive way to examine business models. These results first contribute to business model and business ecosystem research in ways that link one organization's business model to its position in the business ecosystem. Second, the novel way of integrating a quantitative multi-criteria decision-making approach (Analytic Hierarchy Process) and qualitative approaches simultaneously into business model design can be applied to other studies, to identify the critical design issues of an organization's business model in order to establish/strengthen the position in a business ecosystem.

The last contribution is the StReS model as a novel general model, by integrating resource based view, resource dependency theory, business ecosystem theory and network analysis, can be used to understand organizational behaviour in a business ecosystem. In the last presented case, the thesis studies how third-party payment providers can strengthen their positions in the mobile payment ecosystem from a resource perspective (Publication VI). In developing this model, network analysis is applied to help in analysing and visualizing the structure of mobile payment ecosystems based on the literature in Dahlberg et al. (2015b). Then, the resource based view helps to identify the organization's key resources and capabilities that

serve as a source of sustained competitive advantage. In addition, resource dependency theory aids in understanding the ecosystem aspect and the fact that it is not necessary to own resources but to depend on the others' resources or even to acquire and control the resources from the other actors in a business ecosystem. The control of critical resources leads to gaining more power in a business ecosystem. On one hand, organizations are willing to acquire more power and to improve their performance, by reducing the dependency on the other actors in a business ecosystem; on the other hand, organizations are willing to increase other actors' dependency on them. In order to achieve this, organizations take different strategies (actions) to reduce uncertainty. In this model, first, this study synchronizes business ecosystem concepts, resource based view and resource dependency theory together into a novel model. This novel approach, combining the representation and visualization of the mobile payment ecosystem as a network with resource based analysis of the actions taken by the actors, offers a tool that can be applied in other business ecosystem studies in the future. Second, the study contributes to linking organizational resources to organizations' positions in a business ecosystem, by showing that the dependency relationships among the actors determined by their resource configurations are dynamically changing within the ecosystem. Third, StReS offers a tool to bridge actors in a business ecosystem, to identify dependency resources among the actors and to outline strategies of the actors resulting in unstable power balances that are determined by the actions taken by the actors.

In summary, the thesis works out a systematical way to carry out mobile payment ecosystem research, as well as the possible theories that can be applied and how to integrate these theories. This study focusses on mobile payment ecosystem research in China. This choice is motivated by the opportunity to systematically analyse all the key actors under the same regulations and social-cultural context, in addition to the facts that conditions are favourable in China, which was the main reason is to study mobile payment ecosystems in China. The same approach can be extended to other mobile, financial, or business ecosystems outside China and to business ecosystem in general. First, the structure of a business ecosystem can be identified and visualized based on the literature. Then, one can utilize the analytical acceptance framework by following a four-step process: (i) draw the network of business ecosystem actors from the studied actor's perspective, (ii) identify and classify the interdependent factors of interrelated actors in a business ecosystem, (iii) analyse

how those factors are related to each other, and (iv) study the decision process of the actors leading to the adoption/rejection of a platform. Regarding the organizations' position in a business ecosystem, one can apply the STOF model and the StReS model (Structure-Resources-Strategy). The STOF model can be applied by following a two-step process: (i) to identify the hierarchy built into a business model needed to perform Analytic Hierarchy Process, (ii) to assess actual business models based on the design issues identified in the first step, and to discover the factors that influence the performance of mobile payment. The StReS model can be applied by following a three-step process: (i) constructing the structure of a business ecosystem, (ii) determining the motivations of the organizations that cooperate in the core ecosystem, and (iii) identifying the strategies (actions) they have taken to reduce dependency and uncertainty.

Practical implications:

The thesis studies the core actors in mobile payment ecosystems, and offers some recommendations to the actors, especially to mobile payment providers, which attains our research objective: *offering guidelines to actors to strengthen their positions in the mobile payment ecosystem*.

Publication III, from the merchants' perspective, outlines how mobile payment platform providers could and how they should facilitate merchants to adopt mobile payment. The reasons for the large market share of TPP providers in China can serve as a reference for other mobile payment providers. First, the TPP platform requires low investments on implementation and maintenance, and does not require significant infrastructure development on the merchants' side. Second, the large customer base of the TPP providers' platform can satisfy the demands of different types of merchants that focus on different customer segments. Third, the interoperable interfaces of TPP mobile payment platforms are considered an important advantage as they provide technology solutions that can accept every major bankcard from different card systems and mobile phones from different MNOs.

Publication IV and Publication V, from the providers' business model perspective, offer guidelines for mobile payment providers on design issues that should be addressed to create viable mobile payment business models that can help to establish and strengthen their positions in mobile payment ecosystems. For

instance, banks can improve their business models from two angles. First, in order to gain more customers and stay competitive in the market, banks should provide more attractive and appealing mobile payment services to the customers. Second, in order to retain the customers, banks should make more efforts to improve customer/merchant relationships, and pay careful attention to choosing their partners. As for MNOs, in order to extend their market to new segments, MNOs should build customer trust on mobile payment services and improve customer/merchant relationships. In addition, MNOs should put efforts on platform interoperability, which is consistent with the findings from Publication III. On the other hand, in order to build competitive market positions, MNOs should increase revenue through various channels and save costs with improved fraud detection.

Publication V presents a case that may serve as an example for other providers to follow, taking similar actions to increase the dependency of others on them and to reduce their own dependency on others, which can result in gaining more power in the ecosystem. The lesson learned in this case is to take a keystone strategy to create value within the ecosystem, and share this value with other participants. Moreover, Alipay not only manages value creation within the ecosystem, but also shares that value with the other participants. Finally, although it is difficult to define the boundaries of actors in the ecosystem, the core business of every actor is the key competitive or survival condition. This notion should be observed by actors whose actions affect the business of their ecosystem partners. In other words, the scope and the boundaries of the actors should be clearly identified, so that the core business is not threatened.

6.3. Limitations and future research

This thesis has a few limitations that could be addressed in future studies. First, the present research is entirely based on the Chinese mobile payment market, which has specific features that may not apply to other cases. Hence, this should be considered when generalizing the findings to other markets. In addition, we do not apply the same methods to study all actors. For instance, the business model framework does not fit all mobile payment providers with the same set of specific design issues. Similarly, the described specific use of the resource based view, and the resource dependency theory may not be applicable to other mobile payment providers.

Accordingly, in future research the same analytical tools will be applied to all actors to obtain a more comprehensive picture. For instance, we will apply the StReS model to other mobile payment providers to gain a more in-depth view on the mobile payment ecosystem. Moreover, the frameworks should be validated based on other cases from other countries and for other platforms in well-being, Internet of Things or for instance Smart Living. We have also found that attention should be paid to the dynamics within a given ecosystem, first of all by using more specific quantitative network analysis tools (e.g. various centrality measures) over time, in order to represent and understand the structure of the core business ecosystem (or other sub-systems). Next, based on the results of the network analysis, different perspectives of ecosystems can be analysed, using methods suitable to the research objective in question, either qualitative, quantitative or combinations of both. When discussing organizational (strategic) behaviour to reduce uncertainty and strengthen the actors' positions in the ecosystem, platform theory, transaction cost theory and control mechanisms may play a role in the analysis.

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Appendices

I.   Publication III interview protocol

Part 1 Some background information: Education, position in the company, how long have been worked in this company

Part 2 Two big groups with four semi-groups:

1. Unexperienced	1.1 Unaware/uninterested
	1.2 Aware/interested
2. Experienced	2.1 Trialled/abandoned
	2.2 Continuing /successful

Technology-push, Demand-pull, Organizational factors, environmental factors (keep this in mind, if needed give some examples to make to interviewee open to talk)

Group 1. Unexperienced

1. Do you have m-payment in your organization?
2. Have you ever heard about it?

1.1 Unaware/uninterested
3. Why do you think your company are not interested in m-payment solutions?
4. From your point of view, why do you think m-payments failed or are not going to roll out in the market?

1.2 Aware/interested
5. Why do you think your company are interested in m-payment solutions?
6. Do you have any specific plan when or how are you going to implement m-payments? Which kind of platform are you going to choose? Why?
7. How do you expect mobile payment to be?
8. Who is your target group to use m-payments?
9. From your point of view, what solutions for mobile payments are going to catch on in the market?

Group 2. Experienced

1. How many m-payment solutions have been utilized in your company? Please name it.
2. Which one or which providers do or did your store adopt and why?
3. What was the motivation to use m-payment solutions at your store?

2.1 Trialled/abandoned
4. When did you implement and stop it?
5. Why did the m-payment solutions fail?
6. What are the disadvantages/ challenges of m-payments?
7. Is there any benefits that m-payment has brought?
8. What are the differences between m-payment and other payment methods (credit card, cash)?

9. How much was the costs for m-payments, including investment for POS terminal, transaction cost, and interchange fee, etc.)?
10. What's the customer's feedback about m-payment as far as your concern?
11. What were the main groups to use m-payments? (e.g., young and fashion people)
12. From your point of view, what solutions for mobile payments are going to catch on in the market?

2.2 Continuing /successful

13. When did you implement and use it?
14. What is the current situation of m-payment usage, such as frequency of use?
15. What are, from a merchant's point of view, the advantages of m-payments?
16. What are, from a merchant's point of view, the challenges of m-payments?
17. What are the benefits to your business since you have started using it?
18. What are the differences between m-payment and other payment methods (credit card, cash)?
19. How much was the costs for m-payments, including investment for POS terminal, transaction cost, and interchange fee, etc.)?
20. Which feature of m-payments do you like the best and why?
21. What's the customer's feedback about m-payment as far as your concern?
22. What are the main groups to use m-payments?
23. Why is having m-payment important to your business?
24. From your point of view, what solutions for mobile payments are going to catch on in the market?

II.   Publication IV questionnaire

Instruction: In this questionnaire we ask you to compare different statements with regard to m-payment. Before we do so we would like to give you a short instruction on how to fill out the questionnaire. PLEASE read the following instructions carefully.

Imagine you are in the context of "Selecting the Best Car". What are your preferences? Here is how you could rank them, considering that there are three criteria which affect the car selection, Price, Speed and Fuel Consumption. You can rank them as follows.

Price is 4 times more important than Speed, so you choose No. 4 which is closer to price.

Price	⑤❹③②①②③④⑤	Speed

Price has equal importance as Fuel Consumption, so you choose No. 1.

Price	⑤④③②❶②③④⑤	Fuel Consumption

Fuel Consumption is 4 times more important than Speed for you, so you choose No. 4 which is closer to fuel consumption.

Speed	⑤④③②①②③❹⑤	Fuel Consumption

In this questionnaire we would like to ask you to make similar assessment for m-payment. We want you to compare the relevance of service (value proposition), technology, organizational (eco system) and financial aspects.

The following table describes the main interconnected traits or attributes for developing m-payment business models.

Mobile Payment	
Service	A provider intends to deliver a certain value proposition and customers or end-users expect to perceive a certain value proposition
Organization	The eco system that is needed to realize the particular service offering
Technology	The technologies that have to be implemented and be used in order to be able to provide the services and the organizations involved in supplying these technologies
Finance	The financial arrangements between various actors in the eco system

1- Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Mobile Payment		
Service	⑤④③②①②③④⑤	Organization
Service	⑤④③②①②③④⑤	Technology
Service	⑤④③②①②③④⑤	Finance
Organization	⑤④③②①②③④⑤	Technology
Organization	⑤④③②①②③④⑤	Finance
Technology	⑤④③②①②③④⑤	Finance

The following table provides detailed description of the main components within the service aspect.

Service	
Speed in transaction	The presumed value proposition at point of sale (POS) rests on the convenience and speed of contactless payments enabled by mobile phones with embedded NFC chips and other similar technologies
Innovative payment experience	The new added value services enhance the loyalty of existing customers
Avoiding security and fraud problem	Banks should be concerned of fraud, security and risk management
Extend market to new segments	Potential for banks to acquire new customers such as under-banked

2. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Service		
Speed in transaction	⑤④③②①②③④⑤	Innovative payment experience
Speed in transaction	⑤④③②①②③④⑤	Avoiding security and fraud problem
Speed in transaction	⑤④③②①②③④⑤	Extend market to new segments
Innovative payment experience	⑤④③②①②③④⑤	Avoiding security and fraud problem
Innovative payment experience	⑤④③②①②③④⑤	Extend market to new segments
Avoiding security and fraud problem	⑤④③②①②③④⑤	Extend market to new segments

The following table provides detailed description of the main components within the technology aspect.

Technology	
Control payment transaction	Banks get more involved in payment transaction to control the whole process
User Profile Management	Banks can guide future strategies with personal data, interest, and context and provide the generic business functions as authentication, billing, location-based services
Managing security and privacy	Banks should pay attention to privacy, security and risk management issues and problem
Standardization of technical protocols	Banks try to unify the technical standardization of important protocols

3. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Technology		
Control payment transaction	⑤④③②①②③④⑤	User Profile Management
Control payment transaction	⑤④③②①②③④⑤	Managing security and privacy
Control payment transaction	⑤④③②①②③④⑤	Standardization of technical protocols
User Profile Management	⑤④③②①②③④⑤	Managing security and privacy
User Profile Management	⑤④③②①②③④⑤	Standardization of technical protocols
Managing security and privacy	⑤④③②①②③④⑤	Standardization of technical protocols

The following table provides detailed description of the main components within the organization aspect.

Organization	
Customer/merchant relationship	Banks have a direct relationship with customers and merchants.
Key role player in eco system	Banks play a key role in determining the intended customer value and creating the business model
Choosing partners	Banks should carefully choose the most appropriate partners in the ecosystem that make profit maximization
Platform interoperability	Banks need to support customers from a lot of competing platforms to be profitable.

4. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Organization		
Customer/merchant relationship	⑤④③②①②③④⑤	Key role player in eco system
Customer/merchant relationship	⑤④③②①②③④⑤	Choosing partners
Customer/merchant relationship	⑤④③②①②③④⑤	Platform interoperability
Key role player in eco system	⑤④③②①②③④⑤	Choosing partners
Key role player in eco system	⑤④③②①②③④⑤	Platform interoperability
Choosing partners	⑤④③②①②③④⑤	Platform interoperability

The following table provides detailed description of the main components within the finance aspect.

Finance	
Reducing the cost of cash handling	With the use of mobile payment, the cost of cash and check handling can be reduced
Avoiding the sharing revenues	Banks should manage how to control revenue sharing with mobile operators, as the intermediaries take an increasing proportion of profits
Control investment	Banks should control the initial technical investment, maintenance of mobile applications and ect.
Increasing revenue via various channels	The revenue is increased via micro-payments, processing fees and value added advertising to retailers for a fee

5. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Finance		
Reducing the cost of cash handling	⑤④③②①②③④⑤	Avoiding the sharing revenues
Reducing the cost of cash handling	⑤④③②①②③④⑤	Control investment
Reducing the cost of cash handling	⑤④③②①②③④⑤	Increasing revenue via various channels
Avoiding the sharing revenues	⑤④③②①②③④⑤	Control investment
Avoiding the sharing revenues	⑤④③②①②③④⑤	Increasing revenue via various channels
Control investment	⑤④③②①②③④⑤	Increasing revenue via various channels

At last, we would like to ask you some additional questions.

6. Which year were you born? …………………….

7. What is your gender?　　○ Female　　○ Male

8. What is the category of your bank?　　○ International　　○ National

9. How many years have you worked in this bank?

10. What is your main role in the bank?

11. How many employees are in your Bank?

…. Number of employees

12. Does your bank provide m-payment service? (Skip logic question)

○ Yes ○ No (to question 15)

13. Since when does you bank provide m-payment services

Since 20…   Please fill out the year of start m-payment services

14- How many people work on the m-payment service?

….   Number of employees working in the field of m-payment

15- When do you think that your bank is going to provide m-payment service?

 In …. year(s). Please fill in the number of years that you expect your bank will to provide m-payment services

III.   Publication V Questionnaire

Instruction: In this questionnaire we ask you to compare different statements with regard to m-payment. Before we do so we would like to give you a short instruction on how to fill out the questionnaire. PLEASE read the following instructions carefully.

Imagine you are in the context of "Selecting the Best Car". What are your preferences? Here is how you could rank them, considering that there are three criteria which affect the car selection, Price, Speed and Fuel Consumption. You can rank them as follows.

Price is 4 times more important than Speed, so you choose No 4 which is closer to price.

Price	⑤❹③②①②③④⑤	Speed

Price has equal importance as Fuel Consumption, so you choose No 1.

Price	⑤④③②❶②③④⑤	Fuel Consumption

Fuel Consumption is 4 times more important than Speed for you, so you choose No 4.

Speed	⑤④③②①②③❹⑤	Fuel Consumption

In this questionnaire we would like to ask you to make similar assessment for m-payment. We want you to compare the relevance of service (value proposition), technology, organizational (ecosystem) and financial aspects.

The following table describes the main interconnected traits or attributes for developing m-payment business models.

Mobile Payment	
Service	A Mobile Network Operator intends to deliver a certain value proposition and end-users expect to perceive a certain value-added proposition
Organization	The ecosystem that is needed to realize the particular service offering
Technology	The technologies that have to be implemented and be used in order to be able to provide the innovative services and the organizations involved in supplying these technologies
Finance	The financial agreements between the various actors in the ecosystem

1- Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Mobile Payment		
Service	⑤④③②①②③④⑤	Organization
Service	⑤④③②①②③④⑤	Technology
Service	⑤④③②①②③④⑤	Finance
Organization	⑤④③②①②③④⑤	Technology
Organization	⑤④③②①②③④⑤	Finance
Technology	⑤④③②①②③④⑤	Finance

The following table provides detailed description of the main components within the service aspect.

Service	
Ease of use	Provide m-payment platform to make customers and merchants more convenient and easy
Offering innovative value-added services	Enable telecom operators to provide innovative payment services by real-time communications with the cardholder through their mobile device
Building customer trust on payment services	Mobile Network Operators should build customers trust in mobile payment services
Extend market to new segments	Potential of m-payment for MNOs to acquire new customers such as under-banked

2. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Service		
Ease of use	⑤④③②①②③④⑤	Offering innovative value-added services
Ease of use	⑤④③②①②③④⑤	Building customer trust on payment services
Ease of use	⑤④③②①②③④⑤	Extend market to new segments
Offering innovative value-added services	⑤④③②①②③④⑤	Building customer trust on payment services
Offering innovative value-added services	⑤④③②①②③④⑤	Extend market to new segments
Building customer trust on payment services	⑤④③②①②③④⑤	Extend market to new segments

The following table provides detailed description of the main components within the technology aspect.

Organization	
Customer/merchant relationship	MNOs have a direct relationship with end-users and merchants, as well as m-payment providers
Key role player in ecosystem	MNOs play a key role in determining the intended value required from end-user and creating the business model
Partner relationship	MNOs should have the ability to choose the suitable m-payment partners
Platform interoperability	MNOs need to support end-users from competing m-payment platforms to be profitable.

3. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Organization		
Customer/merchant relationship	⑤④③②①②③④⑤	Key role player in eco system
Customer/merchant relationship	⑤④③②①②③④⑤	Partner relationship
Customer/merchant relationship	⑤④③②①②③④⑤	Platform interoperability
Key role player in eco system	⑤④③②①②③④⑤	Partner relationship
Key role player in eco system	⑤④③②①②③④⑤	Platform interoperability
Partner relationship	⑤④③②①②③④⑤	Platform interoperability

The following table provides detailed description of the main components within the organization aspect.

Technology	
Payment transaction control	MNOs control the entire process of m-payment transaction
User Profile Management	MNOs control the relationships with the end-user and provide the generic business functions as authentication, authorization and accounting
Guarantee security and privacy issues	MNOs should guarantee privacy, security and manage risk
Existing infrastructure	MNOs already own critical resources/infrastructures of mobile network

4. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Technology		
Payment transaction control	⑤④③②①②③④⑤	User Profile Management
Payment transaction control	⑤④③②①②③④⑤	Guarantee security and privacy issues
Payment transaction control	⑤④③②①②③④⑤	Existing infrastructure
User Profile Management	⑤④③②①②③④⑤	Guarantee security and privacy issues
User Profile Management	⑤④③②①②③④⑤	Existing infrastructure
Guarantee security and privacy issues	⑤④③②①②③④⑤	Existing infrastructure

The following table provides detailed description of the main components within the finance aspect.

Finance	
Less cost on investment	MNOs have the network infrastructure therefore less investment on the technologies is needed
Revenue sharing with partners	MNOs should build and share high-value common assets with partners such as m-payment information of infrastructure, clients, merchants etc.

Cost saving on fraud detection	Make use of MNOs' infrastructure so that banks can invest less on security and privacy related issues
Increasing revenue via various channels	The revenue is increased via micro-payments, processing fees and value added advertising to retailers

5. Next, we would like to ask you to compare the following items regarding to your preference for developing m-payment business models?

Finance		
Less cost on investment	⑤④③②①②③④⑤	Revenue sharing with partners
Less cost on investment	⑤④③②①②③④⑤	Cost saving on fraud detection
Less cost on investment	⑤④③②①②③④⑤	Increasing revenue via various channels
Revenue sharing with partners	⑤④③②①②③④⑤	Cost saving on fraud detection
Revenue sharing with partners	⑤④③②①②③④⑤	Increasing revenue via various channels
Cost saving on fraud detection	⑤④③②①②③④⑤	Increasing revenue via various channels

At last, we would like to ask you some additional questions.

6. Which year were you born? …………………….

7. What is your gender?   ◯ Female   ◯ Male

8. What is the category of your telecommunication company? ◯ International
        ◯ National

9. How many years have you worked in this company? ……………………………..

10. What is your main role in the company? …………………………..

11. How many employees are in your company?

 …. Number of employees

12. Does your company provide m-payment service? (Skip logic question)

◯ Yes◯ No (go to question 15)

13. Since when does you company started to provide m-payment services? Since
20……………………………………………………14- How many people work on the m-payment service? ………………………

….   Number of employees working in the field of m-payment

15- When do you think that your company is going to provide m-payment service? In
….year time

IV.   Publication V interview questions

1. Service domain

What type of mobile payment services your company is going to/has been providing to customers and merchants?

2. Technology domain

What kind of platform/technology architecture your company is going to use/utilized to provide mobile payment services? (2G, 3G?)

3. Organization domain

What kind of criteria or policy do your company use to select partners for providing mobile payment services?

How many partners are currently involved in mobile payment platform?

4. Finance domain

How do your company share revenue and investment with your key partners?

V.   Publication VI interview protocol

Interview checklist

Sampling strategy: who, what, where, when to be consulted

The following interviewees (defined by tier role) should be approached

- Project owner: person who initiated the project or is the outward spokesperson/face of the project
- Project manager: person currently project
- Technical architect
- Marketing representative
- External expert with know-how on the project as a validation

Service, technology, and marketing persons who are responsible for Alipay wallet.

Case study/ interview questions

Interview topics

The interview topics might be used as a checklist during the interview. Be aware that there might be a number of issues that might be answered by all interviewees while other are more relate d to specific functions of interviewees, for instance the question on technology might not be answered by marketing people.

Service and value related issues

- How does the service look like: short description
- What are the target groups?
- What is the added value for the target group? In which context, situation?
- What is the added value for the merchant?
- What is paid for exchange of what service or products to whom?
- Are there competing platforms? Are there network effects? (Also based on analyses of interview data) Same side or cross side network effects?

Technology

- What is the functionality of the platform? How is the platform secured? How does AAA (Authentication, Authorization et cetera) take place?
- How does the layer in architecture look like: telecom/data exchange level; payment transaction level, end user interface? 3-tier architecture?

- How is the Secure Element managed? On card/device (SIM), core in network, cloud?
- Is the platform based on open standards? Proprietary?
- Who controls the data that is collected on transactions via the platform?
- Who owns the customer relation? Where are the core databases situated? Core in the network, distributed?
- How is billing arranged for: is there a billing process for the use of platform? Who controls this?

Organization

- Who is the dominant actor in the ecosystem?
- What are the role within the ecosystem fulfilled by whom? What resources and capabilities are provided by the different roles (actors)?
- How does the Tier-1 network looks like? Tier-1 network is the network that contains all the core actors without whom the platform and m-payment service cannot be delivered.
- How does the core actor control the processes?
    o Input control: by selecting actors based on the preference of the core actor
    o Output control: focus is on meeting targets by actors in eco-systems and on delivery the required quality and quantity of output
    o Behavioural control: processes are closely monitored by core actors

PM Be aware that there are dynamics, so the control mechanisms can mitigate during the process from ideation, implementation and exploitation.

- How is governance arranged: based on trust, market mechanisms: actors can be replaced based on availability on a market with many providers, or is there a clear network in which actors understand their mutually dependencies.
-

Can a network of the ecosystem be drawn?

- Based on a drawing of a network:
- Can **value streams** be drawn: what tangible or intangible benefits are shared? How do money flows look like?
- How is i**nformation** about payment shared? Which data is controlled by whom in the networked? Is data aggregated and shared by whom? Are there also knowledge sharing processes?

- How does the process of money transfer between which actors look like?

Financial

- How does the network make money? Who is the main investor?
-

Questions with regard to the background of the interviewee:

- function, experience, centrality in project.