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ORIGINAL ARTICLE

Proposing a comprehensive framework for analysis and engineering of mobile payment business models

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Abstract Although in the era of third generation (3G) mobile networks technical hurdles are minor, the continuing failure of mobile payments (m-payments) withstands the endorsement by customers and service providers. A major reason is the uncommonly high interdependency of technical, human and market factors which have to be regarded and orchestrated cohesively to solve the problem. In this paper, we apply Business Model Ontology in order to develop an m-payment business model framework based on the results of a precedent multi case study analysis of 27 m-payment procedures. The framework is depicted with a system of morphological boxes and the interrelations between the associated characteristics. Representing any m-payment business model along with its market setting and influencing decisions as instantiations, the resulting framework enables researchers and practitioners for comprehensive analysis of existing and future models and provides a helpful tool for m-payment business model engineering.

Keywords Mobile payment · Business model · Framework

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1 Introduction

For more than 10 years now, attempts have been made to use mobile phones for business-to-consumer payment transaction processing. However, what looks more natural and easy as many other mobile services remains far from representing an established payment instrument in most markets up to now. Although in the era of third generation (3G) mobile networks technical hurdles are minor, the continuing failure of mobile payments (m-payments) withstands the endorsement by customers and service providers. A major cause is the uncommonly high interdependency of technical, human and market factors which have to be sensitively orchestrated for a successful m-payment service offer.

For the purposes of this paper, m-payments are defined as a type of payment transaction processing in which the payer uses mobile communication techniques in conjunction with mobile devices for initiation, authorization, or completion of payment (Pousttchi 2008). M-payments can be regarded as two sides of a coin: as a payment tool for real-world scenarios on the one and as a system-inherent payment functionality for m-commerce on the other hand. First, technological development has led to the gradual installation of various electronic payment instruments worldwide. Driven by the increasing penetration of mobile phones, their specific properties, and users' behavior serious efforts have been made to use these devices for business-to-consumer payment transaction processing (Herzberg 2003). Second, as business models in the mobile economy are based on direct transaction-dependent revenues and thus need an adequate charging approach between service providers and users (Coursaris and Hassanein 2002), this type of payment transaction is an important building block of mobile commerce (Zmijewska 2005). Outside mobile commerce, m-payments become mobile services themselves to provide payment functionality in various scenarios. These scenarios include payment in stationary internet/electronic commerce, payment at vending machines [often called "unmanned point-of-sale (POS)"], payment to a person acting as a merchant or service provider ("manned POS", for example, the cashier in a department store, the pizza delivery person or the taxi driver), and money transfer between consumers (Kreyer et al. 2003).

Since the beginning of this decade m-payment has received extensive attention from both academics and practitioners (Dahlberg et al. 2006). Scholars have conceptualized success factors (Zmijewska and Lawrence 2005), analyzed empirically users' acceptance (Dahlberg et al. 2003), examined different enabling technologies (Zmijewska 2005), evaluated the disruptive potential of m-payments against other payment instruments (Ondrus and Pigneur 2005), and analyzed the emerging industry from a value-based perspective (Pousttchi 2008). Although current m-payment research denominates a sustainable business model for the m-payment service provider as one of the major problems in many markets (Pousttchi 2004), especially those with an already existing financial infrastructure, a stringent analysis of the m-payment business model is still lacking. For example, Au and Kauffman (2008) emphasize that the lack of sound business models has prevented m-payment service providers from offering services to meet consumers' expectations. Based on our longtime market observation (started in 2002) we argue that

many m-payment service providers have ignored the interrelations within their business model. As a result, a range of these market participants launched offers but did not prove to be successful. The reason was that the business models have been developed either from a technology-driven view or a purely economic view but not from a comprehensive view. Additionally, a major weakness in current business- and market-oriented m-payment research is a certain lack of rigor and comparability. This lack has been observed not only by researchers but also by practitioners and contributes considerably to the confusion in the m-payment market. From this we derive the necessity of a comprehensive framework for analysis and engineering of m-payment business models, supporting a rigorous analysis of business models while taking into account the complexity as well as the particular issues and characteristics of m-payments.

In order to achieve this, an ontological approach could be well-suited. In philosophy, an ontology is seen as a theory of what exists. Given that information systems (IS) professionals create business models that depict the real world, ontologies are obvious candidates to provide a conceptual underpinning for industry-specific business models (Gordijn et al. 2005). A prerequisite for their application is that they can be understood easily and are widely accepted by IS professionals. However, current ontologies are typically specified in formal languages requiring in-depth knowledge of these languages before they can be understood (Green and Rosemann 2004). For m-payments, the advantages of such an approach do not outweigh the disadvantages. On the one hand the formal approach inhibits practitioners' usage and on the other hand the major advantage of machine-processability cannot be exploited in the domain of m-payment business modeling. As a result, a "full" ontology does not appear adequate for the problem at hand.

In response to these requirements, this paper aims to answer the following research question: "How can m-payment business models be represented in order to build the foundation for subsequent business model analysis and engineering with regard to the high complexity and the particularities of the m-payment domain?" Underpinning this aim, the principal objective of the paper is to develop a theoretical and conceptual understanding of the different elements of an m-payment business model and the interrelationships between these. In doing so, we present a design-science research aimed at creating a rigorous business model framework that describes the business logic of an m-payment service provider. Based on a prior multi case study analysis (Pousttchi et al. 2007) we adapt the Business Model Ontology of Osterwalder (2004) and develop a framework that is depicted with a system of morphological boxes (Zwicky 1966) and discloses the interrelations between the associated characteristics. The resulting *m-payment business model framework* makes four principal contributions to theory and practice. First, it provides a comprehensive understanding of the key elements and mechanisms in the m-payment domain and the relationships between these. Second, it allows communicating and sharing the understanding of an m-payment business model among business or technology stakeholders. Third, it allows engineering future m-payment business models as instantiations of the framework. Moreover, the potential for improvement of existing m-payment business models can be identified.

Fourth, it supports the specification of valid requirements for the IS that will have to support the m-payment business model.

The article is organized as follows: in Sect. 2, we present the state of the art in business model research, particularly in the IS domain. In Sect. 3, we describe the method used in this paper. In Sect. 4, we specify the m-payment business model framework by describing the partial models and their interrelations. Moreover, we discuss the limitations of the framework and offer suggestions for future research. In Sect. 5 we summarize the results, draw conclusions and provide an outlook.

2 Business model research

For the purpose of this paper, a *business model* is understood as a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm (Osterwalder et al. 2005).

The business model concept is a common research topic in economic and IS research literature. The existing literature can be classified into four streams of research. The first category focuses on single business model classes, e.g., for deploying Web services (Baghdadi 2005). The second stream of research deals with business model classifications regarding business models in electronic and mobile commerce (Timmers 1998; Varshney and Vetter 2002; Choon et al. 2004). Whereas these both research streams refer to the way a company does business, the third stream of research emphasizes the model aspect and develops the proposition of business model meta-models in the form of ontologies. For instance, Gordijn's (2002) e^3-value ontology includes concepts, relations, and constraints as well as describes actors and alliances between them, the exchange of objects of value, the value-adding activities, and the value interface between them. Based on a synthesis of the existing business model literature, Osterwalder (2004) formalizes the elements, relationships, vocabulary, and semantics of a business model. The Business Model Ontology is structured into several decomposition layers with increasing depth and complexity. The first level of decomposition concerns the four main pillars, i.e., product, customer interface, infrastructure management, and finally, financial aspects. These concepts are then further decomposed into nine business model building blocks and associated to each other through bilateral relationships; namely, value proposition, target customer, distribution channel, relationship, value configuration, capability, partnership, cost structure, and revenue model. Finally, within the fourth stream the ontologies are being applied in management and in IS (Seppanen and Makinen 2005). Both ontologies presented above have largely parallel purposes and complement each other (Gordijn et al. 2005).

The proposed m-payment business model framework was implemented by utilizing Osterwalder's (2004) ontology because this approach shares our view of the purposes of business models. Moreover, in the area of offer- and customer-related concepts it is more elaborated (Gordijn et al. 2005). Finally, from a practical point, Osterwalder's concept allows for easier modifications.

However, the Business Model Ontology outlines some links between its top-level building blocks but does not give a complete picture on what decisions will lead to what outcomes (Seppanen and Makinen 2005) and especially does not provide help for an integrity check between different partial models or their parts as a precondition to enable business model engineering. Our framework is also meant to be used as a creativity tool for the development of new business models. Therefore we introduce a more figurative format to facilitate creative thinking (Alder 1994; McFadzean 2000). Eventually, we added the threat and financing perspectives of the business model as these show strong influence on the business model especially of m-payment start-ups. The most prominent example worldwide was Paybox Germany which had to close its operation in 2003—in spite of its (otherwise) viable business model and a customer basis of around one million subscribers.

3 Method

As stated in Sect. 1 the main goal of this research is to develop a business model framework that describes the business logic of an m-payment service provider or m-payment service enabler. In the first step of our research we used the case study approach (e.g., Eisenhardt 1989; Yin 2002) which is especially appropriate for obtaining complex details and novel understandings about a specific phenomenon under investigation.[1]

In a first step, two members of the research team independently identified and classified relevant characteristics of m-payment business models (Pousttchi et al. 2007) based on the morphological method (Zwicky 1966; Müller-Merbach 1976). After exchanging and discussing their results, the two brought both convergent and divergent ideas to a weekly project meeting. The business model elements were then discussed with the third team member who has not become immersed in details of the cases and takes the devil's advocate role (Eisenhardt 1989). The rationale behind this tactic was that the third member was able to bring a different and more objective eye to m-payment business models. In the second step, the study was supplemented by a literature review, the result of which is an analysis of existing opinions on the matter of business models found in conference papers, journals, and dissertations. In the third step, we aimed to accomplish a stronger internal validity

[1] We analyzed 27 case studies: billBOXtime (http://www.billbox.ch); Contopronto AS (http://www.luup.com); EasyPark (http://www.easypark.de); eCash (http://www.ecashdirect.net); Electronic Mobile Payment Services (http://www.nokia.com); FairCash (http://www.faircash.org); Geldhandy (http://www.geldhandy.info); Genion m-Payment (http://www.o2.com); i-mode (http://www. nttdocomo.com); Iti Achat (http://www.francetelecom.com); MicroMoney (http://www.t-pay.de); MIDRAY (http://www.midray. com); Mobileview (http://www.mobileview-ag.com); MoreCon (http://www.morecon.de/en); NCS mobile payment Bank (http://www.crandy.com); Obopay (http://www.obopay.com); ONE (http://www.one.at); Paybox Austria (http://www.paybox.at); Paybox Germany (http://www.paybox.de); PayPal (http://www.paypal.com); Paysafecard (http://www.paysafecard.com); SEMOPS (http://www.semops.com); Sonera Mobile Pay (http://www.sonera.fi/en); Street Cash (http://www.streetcash.de); Vodafone m-pay (http://www.vodafone.com); Whatever Mobile (http://www.whatevermobile.com); Mobipay (http://www.mobipay.com). Case studies are described in detail in Heinkele (2003) and Pousttchi et al. (2006). The case studies were chosen according to the m-payment standard types and theoretical categories proposed in Kreyer et al. (2003).

and higher conceptual level (Eisenhardt 1989). Therefore we restructured the framework by employing the Business Model Ontology of Osterwalder (2004). This required some modifications as well as an enhancement of the ontology, resulting in additional partial models for threat analysis and the inclusion of the financial perspective as well as in a higher degree of formalization of the partial models. The latter was achieved by the application of the morphological method and, based on this, by a more detailed determination of the interdependencies, especially on lower levels of decomposition. Moreover, the developed framework principally allows for the formulation and check of integrity constraints representing rules of compatibility between the elements in different lines of one or more morphological boxes.

4 M-payment business model framework

4.1 Overview

This section will focus on the development of the framework, containing four abstraction layers to cope with the complexity of this task. In accordance to Osterwalder (2004), top-level elements are named *pillars* and represent the basic areas product, customer interface and infrastructure management that any business model has to address. As will be outlined later, the m-payment business model framework enhances the ontology with two additional pillars, financial perspective and threat consideration. The second level of abstraction also follows Osterwalder (except for the two new pillars) and is referred to as *building block*. Below this level, the m-payment business model framework introduces morphological boxes that compartmentalize each building block into a number of characteristics representing the third abstraction layer. For example, the *revenue* building block represents the revenue model of an m-payment service provider which is decomposed into the characteristics *revenue source* and *revenue type* (Sect. 4.5.1). Finally, each characteristic is broken down into a complete set of instances representing the fourth abstraction layer. The instances represent the current state of the art in the m-payment business. The addition of further instances may be necessary in the future. However, this is facilitated by the representation. Table 1 outlines the first and the second abstraction layer of the framework.

The concurrence of pillars and building blocks is depicted in Fig. 1. In the figure the general relations on the building block level are represented by nondirectional edges. The value proposition is created by the value configuration and delivered via the distribution channel to the customers. Specific kinds of relationships promote the value proposition and are maintained with target customers. The value configuration relies on a set of capabilities. Partnership concerns the value configuration and is developed to provide a value proposition to adjust own capabilities or to maintain a distribution channel. As a result of the actual definition of the building blocks value configuration, capability, partnership, and distribution channel different kind of costs accrue. Costs and revenues influence the decisions on financing, especially the decisions of external investors. As will be shown later, not only the building blocks as a whole but also some characteristics of them are linked to each other, whereby

Table 1 Overview of the top two framework levels (adapted from Osterwalder 2004)

Pillar	Building block	Description
Product	Value proposition	A value proposition is an overall view of an m-payment service provider's bundle of offers that are of value to the customer
Customer interface	Target customer	The target customer is a segment of customers an m-payment service provider wants to offer value to
	Distribution channel	A distribution channel is a means of getting in touch with the customer
	Relationship	The relationship describes the kind of link between an m-payment service provider and the customers
Infrastructure management	Value configuration	The value configuration illustrates the activities necessary to provide the value proposition
	Capability	The capability building block outlines the assets or resources necessary to provide the m-payment procedure
	Partnership	A partnership is a voluntarily initiated cooperative agreement between the m-payment service provider and other companies in order to create value for the customer
Financial perspective[a]	Cost	The cost is the representation in money of all the means employed in the business model
	Revenue	The revenue describes the way an m-payment service provider makes money
	Financing	The financing building block addresses the capital structure of the m-payment service provider
Threat consideration[a]	Threat model	The threat model points out the potential and profound threats to the economic success of an m-payment business model

[a] Not considered by (Osterwalder 2004)

instances in one building block influence other instances in the same or one or more other building blocks. This reflects the core problem of m-payment business model engineering, the simultaneous consideration of interrelated influencing factors from different areas.

4.2 Product

The *product* pillar covers all aspects of what an m-payment service provider offers its customers (Osterwalder 2004). This comprises not only the m-payment procedure and related service but also the manner in which the procedure differentiates the service provider from its competitors. The product pillar contains the building block value proposition which can be decomposed into its elementary offerings.

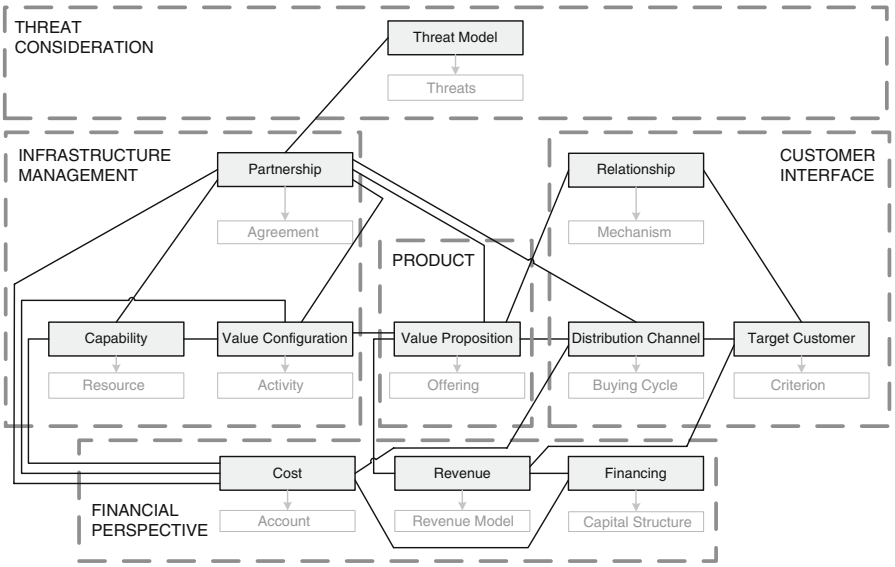

Fig. 1 M-payment business model framework (overview)

The *value proposition* building block represents an overall view of the m-payment service offer from the perspective of one or several target groups and is based on one or several capabilities. The analysis of the value proposition allows firms to clearly identify the elements of their value proposition and compare it to the one of their competitors. It consists of the offering elements use case type, geographic applicability, amount level, guarantee of payment, m-marketing integration, and finally, price level. An overview of the complete building block is represented in Table 2; the six characteristics and their instances will be closely explained in the following.

A basic set of seven exhaustive and disjoint *use case types* (Table 3) can be derived which provides a reference point for any given m-payment use case (Pousttchi 2008).

An innovative approach is use case type B because it is not implemented in practice up to now. Users pay a fixed price for their usage of a mobile service. This revenue as a whole is shared between MNO and mobile content provider according to an agreed ratio. The problem with this solution lies in the fact that "real" revenue sharing is necessary (whereas in use case type A, transmission and content were paid for separately). Hence, the ratio must include the transmission cost component of the service. This concept is called "airtime revenue sharing" and—although preferred by customers and content providers—is viewed as extremely unpleasant by the vast majority of MNOs, since they hope to compensate for declining voice revenues with data revenues and thus defend their margins strongly (Pousttchi 2008).

Geographic applicability considers the geographic coverage of the m-payment procedure. While regional transactions typically include payments for public

Table 2 Value proposition

characteristic	instances						
use case type	**A** MC premium rate	**B** MC fixed price	**C** EC digital	**D** EC/MC non-digital	**E** SMA	**F** SMP	**G** C2C
geographic applicability	international		national		regional		
amount level	macropayments			micropayments			
guarantee of payment	yes			no			
integration of m-marketing	yes			no			
price level	for free	economy		market		high-end	

Table 3 Use case types

Type	Description	Typical case study
A MC Premium rate	Purchase or use of digital goods or services in mobile commerce with the use of premium fee charging	Whatever Mobile
B MC Fixed price	Purchase or use of digital goods or services in mobile commerce with the use of fixed price charging	n/a
C EC digital	Purchase or use of digital goods or services in electronic commerce	Mobileview
D EC/MC Non-digital	Purchase of non-digital goods or services in electronic commerce or mobile commerce	Paybox Austria
E SMA	Purchase of goods or services at a physical point of sale—in the case that an automat acts as agent on the merchant side	NCS mobile payment Bank
F SMP	Purchase of goods or services at a physical point of sale—in the case that a person acts as agent on the merchant side	Mobipay
G C2C	Transfer of money between consumers	Contopronto AS

transport or parking in a certain region, national transactions are common. However, some m-payment procedures (e.g., SEMOPS) enable also international transactions.

Choosing the focus in terms of the accepted *amount level* is an important strategic issue for m-payment service providers. Amount levels are usually categorized in micropayments and macropayments (Pousttchi 2004). Micropayments represent a

payment which is up to and including €10. Due to transactions costs, their main problem is cost efficiency but they require relatively low security levels and management of claims. Moreover, micropayments are very likely within the use case types A, B, or C, reflecting the typical prices of digital goods like newspaper articles, ring tones or games. Macropayments which represent every payment above €10 require higher security levels and an effective claims management while cost-efficiency remains on a lower level of importance (Salvi and Sahai 2002; Herzberg 2003).

In view of merchants or administrations, providing a *guarantee of payment* is also an important value proposition, because of minimizing business risks like sales shortfalls or charge-back costs. For instance, online merchants would pay 1.75% of sales for receiving guaranteed payments (van Baal and Krueger 2005). Higher amount levels could have an impact on the need of a guarantee of payment for payees as large amounts of money involve a higher presumption of fraud. However, as method of settlement an e-money account typically involving an e-money license or a banking license is required to grant a legal guarantee of payment in many countries (Waris et al. 2006).

One of the most crucial issues is the pricing. Users are reluctant to pay more without having an added value service; in markets with established instruments for cashless payments, arguments like convenience and security alone are not supposed to be attractive enough. The *integration of mobile marketing* (m-marketing) into m-payments improves the value proposition for users (Wiedemann et al. 2008) as well as for merchants (Ondrus and Pigneur 2004). Examples are the use of the payment confirmation for mobile coupons or loyalty programs. For example, NCS mobile payment bank has provided mobile coupons as added value for users and, as a result, created an additional revenue source.

The characteristic *price level* compares the own value proposition's price level with the one of the competitors (Osterwalder 2004). Some m-payment service providers offer their procedure to a certain target group without asking for financial compensation, because their business model is based on other revenue sources. Referring to a certain end-customer type, the instance economy is defined as a price level which is supposed to be more attractive than of most competitors. Pricing at the market denotes little price differentiation from the rest of the market. The instance high-end represents the upper border of the price scale. Although high-end prices are usually used for luxury goods, innovative m-payment procedures showing a high added value (i.e., by integrating an attractive loyalty program or additional functionality such as convenient m-parking prolongation) may allow charging a premium.

4.3 Customer interface

The second pillar of the Business Model Ontology is the *customer interface* that covers all customer related aspects, especially the selection of the target customers, the channels through which it contacts them and the kind of relationships the company wants to establish with its customers (Osterwalder 2004).

4.3.1 Target customers

An m-payment procedure involves many different stakeholders (Au and Kauffman 2008). However, in order to develop an m-payment business model it is essential to define the *target customers* for direct business connection which accept the value proposition. The point is effective segmentation that enables a company to allocate investment resources to target customers that will be most attracted by its m-payment procedure and determines the channels to reach its customers. In order to refine a customer segmentation companies usually decompose a customer segment into a set of further characteristics Osterwalder (2004) calls "criterion". For the purpose of customer segmentation in m-payment we use the characteristics customer type, relationship between users, number of transactions per payer, number of transaction per payee, and willingness to pay. Finally, this building block includes the market segmentation strategy. An overview of the complete building block is represented in Table 4; the six characteristics and their instances will be closely explained in the following.

In general, six different *customer types* must be considered for an m-payment service provider or m-payment service enabler. A reseller serves as a selling intermediary and redistributes the procedure to its own customers, mainly users and merchants (Schwiderski-Grosche and Knospe 2002). A merchant's intention to provide m-payment is to charge services and products whereas an administration's intention is to collect taxes and charge government services. Moreover, administrations may subsidize new m-payment instruments to break down market barriers and to facilitate new industries (Karnouskos et al. 2003). An example is the project SEMOPS II which is partially funded by the Commission of the European Union. As we have seen in Sect. 4.2, m-payment and m-marketing can be integrated. For

Table 4 Target customer

characteristic	instances					
customer type	reseller	administration	merchant	mobile marketer	corporate client	consumer
relationship between users[a]	A2B	A2C	B2B	B2C	C2C	
number of transactions per payer	high			low		
number of transactions per payee	high		middle		low	
willingness to pay	high		low		nonexistent	
market segmentation strategy	concentrated		differentiated		undifferentiated	

[a] The used abbreviations—A, B, and C—represent administration, business, and consumer, resulting in combinations such as A2B for administration-to-business

this reason, the target customer building block includes also mobile marketers as customers. Most relevant are merchants, mobile parking service providers, public transport companies, and major owners of a customer base. Major owners of a customer base are companies or associations like TV broadcast companies or automobile associations that have no traditional buyer–seller relationship like merchants. With few exceptions [e.g., in customer-to-customer (C2C) or reimbursement payments] the user of an m-payment procedure and the payer are always the same entity. Users are distinguished between corporate clients and consumers. Typically, corporate clients have additional requirements such as two different accounts—one for private and one for business purchases. In this target group, m-payment competes with a traditional business credit card.

Although the characteristics *customer type* and *relationship between users* are closely related, an explicit analysis of the latter is important as this may disclose requirements and pitfalls of the business model. For instance, questions arise with the C2C relationship whether these payments are free of charge and, in that case, how merchants can be prevented from avoiding costs by pretending C2C payments (a common problem, e. g., for Paybox Germany).

After assessing the oncoming three characteristics an m-payment service provider can decide which revenue types and sources as well as price levels (Voelckner 2006) are supposed to be most suitable. For the purposes of this paper, the *number of transactions per payer* is classified as low when the average usage is equal or lower than once per workday. The instance high, thus, represents every number beyond. This issue does not only affect the revenue model but also the design of the payment procedure: on the one hand, the user will only have the chance to become familiar with a procedure that he uses very often, otherwise only very simple procedures may succeed. On the other hand, the more often he uses the procedure, the higher will be his demand for low transaction time and transaction cost—resulting, e.g., in SMS-based procedures typically being inappropriate when the numbers of transactions per payer is high (and thus causing an interrelation with the line realization technology of the value configuration partial model).

The estimated *number of transactions per payee* has an effect on merchants' or administrations' decision to integrate the procedure in their existing infrastructure. Here, we classify by comparison with other payment procedures that customers are using. The number of transactions per payee is considered as low when it is less than the number of transactions processed with the fewest used payment procedure. It is referred to as high if usage is above the most common procedure and as middle between these two extremes. Typically, this characteristic will have to be estimated over time.

Willingness to pay refers to as the maximum amount of money a certain customer type is willing to pay for a given quantity of a product (Kalish and Nelson 1991). In some markets such as Germany users' willingness to pay may be nonexistent (Pousttchi 2003), especially because of established competing payment instruments which are—or pretend to be—free of charge. In case of an existing willingness to pay, we distinguish between high and low and fix the borderline at the average cost of credit cards in the specific target market. More precisely, when analyzing users' willingness to pay we consider the annual charge and when analyzing merchants'

willingness to pay we consider the merchant service charge. The perceived usefulness of information technology increases with the number of transactions (Chau 1996) and, in addition, willingness to pay increases with a higher usefulness (Hanemann 1991). Therefore we argue that the willingness to pay is also interrelated with the number of transactions.

After the customers are defined, the remaining task in this partial model is to select one of three *market segmentation strategies*: (1) undifferentiated marketing in which the m-payment service provider attempts to go after the whole market; (2) differentiated marketing in which the m-payment service provider operates in several segments of the market with offerings and market strategies tailored to the respective segment; (3) concentrated marketing in which the business focuses on only one or a few segments with the intention of capturing a large share of these segments (Kotler 2003). The latter segmentation strategy would include also the strategy to offer the procedure only to existing customers, a common approach of retail banks acting as m-payment service providers.

4.3.2 Distribution channel

The *distribution channel* describes how the value proposition is delivered to the target customer. A channel is studied over the customer's complete buying cycle (Osterwalder 2004). In m-payments that reflects all possible contact points between an m-payment service provider and a customer in context of customer awareness, evaluation of his needs, the moment of rendition of service, and the after-sales service. However, before decisions on the channel can be made, a branding strategy must be defined. An overview of the complete building block is represented in Table 5; the seven characteristics and their instances will be closely explained in the following.

The *branding strategy* defines the brand visible to consumers (Zmijewska et al. 2004), and therefore, this characteristic depends on the customer type the m-payment service provider targets at. The instance no brand occurs when the m-payment service provider brand is not disclosed. This is typically true for system-inherent WAP billing or premium SMS. When a procedure can be issued by other companies under their own label, we define this branding strategy as white brand.

Table 5 Distribution channel

characteristic	instances				
branding strategy	own brand	co-brand	white brand	no brand	
awareness	advertising	promotion	public relation	partnership	
evaluation	web presence	sales force	reseller	online communities	test
purchase	negotiation	decision	contract	payment	fulfillment
after sales	electronic manuals	FAQs	customer service	maintenance	troubleshooting
rollout	regional	national	international		

For instance, the m-payment service provider Whatever Mobile pursues this strategy. A typical example for co-branding could be the common procedure of Visa and Royal Bank of Canada. Typical examples for establishment or extension of an own single brand for m-payment services are GXChange in the Philippines, FeliCa in Japan or Deutsche Telekom in Germany.

At the first stage of the customer buying cycle the customer identifies an m-payment service provider's value proposition that may match his needs. The customer develops the *awareness* that the company exists and that it might be able to fulfill his requests. The m-payment service provider tries to reach as many as possible potential customers of its chosen customer segment by means of advertising, promotions, public relations, or partnerships. For instance, MIDRAY was highly successful in reaching and attracting new users in Germany through a partnership with bild.t-online.de in context of charging a popular computer game. Once a customer has targeted a specific m-payment provider he intends to evaluate the organization and its offers. At this stage it is important to provide the customer with all the information necessary to assist this evaluation process. In doing so, an essential part is a web presence that includes detailed information on the organization, its references, and the value proposition. Trained sales force or resellers are able to demonstrate certain aspects of the value proposition, typically in order to address administrations, merchants, and mobile marketers. However, customers (especially users) do not necessarily rely exclusively on the information provided by the m-payment service provider and additionally inform themselves through online communities. Finally, many companies let their customer test the value proposition.

During the *purchase* phase the m-payment procedure is provided. This includes negotiation, decision, contract, payment and fulfillment. Whereas negotiation, decision and contracting are very important for the business target groups they are less significant for consumers, who typically just register for using the m-payment procedure.

The last phase, *after sales*, is probably the most promising one, as it has the potential to create loyal customers. After sales services contribute to a customer's satisfaction by helping him to profit from the value proposition and by assisting him in case of problems. It may include electronic manuals, FAQ (frequently asked questions) lists and customer service for implementation and use, maintenance, and troubleshooting.

The characteristic *rollout* reflects whether a regional, national or international rollout of the m-payment procedure is intended. A regional rollout would fulfill the need of customers in a geographically restricted area as it is typically the case for procedures evolving from regional public transport (such as Octopus in Hong Kong, Oyster in London or Rhein-Main-Verkehrsverbund in the Frankfurt region) or m-parking systems. Typical national systems are run by NTT DoCoMo in Japan, by SK Telekom in South Korea, by Cornèr Bank in Switzerland or by Vodafone which uses different m-payment procedures in several countries. Finally, a rollout over different countries is possible, e.g., Contopronto AS from Norway or NCS mobile payment bank from Germany. However, this characteristic is different from the characteristic *geographic applicability*. For instance, it may be that a particular m-payment procedure is available in two countries (i.e., international rollout), but

Table 6 Relationship

characteristic	instances					
acquiring	existing business connection		explicit merchant acquisition		acquiring service provider	
issuing	MNO	bank	credit card company	specialized intermediary	merchant	other
enabling	yes		no			

cross-boarder payments between both countries are not possible (i.e., national geographic applicability).

4.3.3 Relationship

The *relationship* describes the kind of link a company establishes between itself and the target customer (Osterwalder 2004). A relationship is used to promote a value proposition and is maintained with a target customer. For our purposes, it is decomposed into the mechanisms acquiring, issuing, and enabling. An overview of the complete building block is represented in Table 6; the three characteristics and their instances will be closely explained in the following.

Payment markets can be conceptualized as two-sided markets involving users and merchants subject to positive network effects (See-To et al. 2007). This requires an m-payment business model to consider both sides. In accordance with the respective technical terms from the credit card domain, *acquiring* refers to the acquisition of payees, normally merchants or administrations, whereas *issuing* refers to the acquisition of payers, typically consumers or corporate clients (Pousttchi et al. 2006). *Enabling* refers to the business model of an *m-payment service enabler*, i.e. it targets on enabling other companies to offer m-payment services—unlike being a regular *m-payment service provider* directly offering m-payment services to end-customers and merchants. An example for an m-payment service enabler is SEMOPS which provides an m-payment procedure to m-payment service providers such as banks and mobile network operators and enables them to resell the procedure to their own customers.

With regard to acquiring, an m-payment service provider can offer the procedure to its existing customers (e. g., a bank or a mobile operator as m-payment service provider may have relevant relations from their core business). Another strategy may be to explicitly acquire new merchants, or mandate a specialized acquiring service provider; the latter type of firms is typically already serving as an acquirer for debit and credit card payments. Issuing may be conducted by the m-payment service provider on its own or by a partner—interrelated with the branding strategy determined in the distribution channel partial model.

4.4 Infrastructure management

The *infrastructure management* pillar considers how an m-payment service provider creates value. The pillar comprises the value configuration of the firm, i.e., activities

Table 7 Value configuration

characteristic	instances							
user registration	mobile registration	internet registration	offline registration	pre-existing data	no registration			
realization technology	CLIP	IVR	SMS	USSD	WAP	NFC	Java	SIM Toolkit
initiation	by user				by merchant			
authentication	possession		knowledge		attribute			
confirmation	SMS	system inherent display	acoustic	signal	email	sales slip	none	
method of settlement	mobile phone bill	fixed line phone bill	separate bill	direct debiting	credit card	e-money account		

to create and deliver value, and the relationship between them, the in-house capabilities and those acquired through the firm's partnership network (Osterwalder 2004).

4.4.1 Value configuration

The value configuration describes the arrangement of activities that are necessary to create a value proposition for the customers. We discuss these activities according to the payment process from the view of users. Despite of the differences between the diverse m-payment procedures most follow the same general process (Krueger 2001) including registration, initiation, authentication, confirmation, and settlement. An overview of the complete building block is represented in Table 7; the six characteristics and their instances will be closely explained in the following.

Most procedures involve a *user registration* before or at least directly after first usage. This can be initialized by the mobile phone as with Contopronto AS, via Internet as with Paypal mobile, or offline as with Paybox (Zmijewska et al. 2004). A dedicated registration for an m-payment procedure may be dropped if user data are available from an existing business connection. A typical example is the procedure M-Pass, jointly offered by Vodafone and O2 Germany whose telephony customers are thus pre-registered to use M-Pass as well. However, users may be concerned that their purchases are tracked, personal information is misused, or they will receive advertisements when they register to a new payment instrument (Mallat 2007). Applying e-money account digital cash is typically withdrawn from an anonymous account; it can be spent without leaving a transaction trail. When providing e-money accounts in Europe, however, according the EU directive 2000/46/EG Art 1, an m-payment service provider must have at least an e-money license or a full banking license which includes an e-money license. For instance, Contopronto AS holds such an e-money license because of their prepaid account based business model.

Before describing the other activities, we first describe the *realization technologies* that enable m-payments and are used for initiation, authentication and

confirmation of payments. Up to now, seven technologies can be used: (1) IVR, (2) Calling Line Identification Presentation (call capture, CLIP), (3) SMS, (4) Unstructured Supplementary Service Data (USSD), (5) Wireless Application Protocol (WAP), (6) Near Field Communication (NFC), (7) Java 2 Platform Micro Edition (J2ME), and, finally, (8) Subscriber Identity Module Application Toolkit (SIM Toolkit).

IVR represents the typical first-generation m-payment procedures such as Paybox. This device-independent technology allows a telephone caller to select options from a voice menu and interact with a system through voice or keyboard entry (e.g., Turowski and Pousttchi 2004). CLIP is a Global System for Mobile Communications (GSM) supplementary service that transmits the caller's mobile telephone number (Mobile Subscriber Integrated Services Digital Network Number, MSISDN) to the called party's telephone equipment during the ringing signal or when the call is being set up but before the call is answered (ETS 300 648). In most cases CLIP is used in combination with IVR procedures for authentication purposes. However, there are also stand-alone procedures like Cashbeam: payers and payees have to call a predefined number where the last five numbers represent the price of the good. Due to concurrent call entries the m-payment service provider is able to assign the payments.

Many procedures use SMS (3GPP TS 23.040 Version 7.0.1) for confirming payments. The simplest example of a procedure based on SMS is premium SMS which is especially popular within Europe. The m-payment procedure SMS Credit (Fong and Lai 2005) uses this technology for initiating a payment. Users send an SMS with a set of parameters, i.e., merchant's code, PIN and the corresponding amount to be charged. With USSD (GSM 04.90 Version 5.0.1) users do not need to access any particular phone menu to access services; the coded commands are entered in a similar way as an MSISDN (e.g., *105*1*4556#). An example is the Spanish payment procedure Mobipay. USSD, however, would also allow for simple menus being displayed to the user. With WAP-based payments, e.g., Mobileview, users choose the desired service on a WAP portal, click on a payment button and receive the service.

NFC is based on Radio Frequency Identification (RFID) and is applied to short-distance communications (typically less than 4 cm) between all kinds of electronic devices that are not physically connected (NFC Forum 2006). In 2006 the credit card company JCB together with seven other firms from the m-payment ecosystem launched a pilot project using NFC technology to allow Nokia mobile phone users to pay at stationary merchants in Amsterdam. J2ME provides a set of runtime environments and application programming interfaces allowing for usage of the Java programming language and related tools to develop programs for mobile devices (MIDlets) (Ortiz 2004). J2ME-based procedures provide a graphical user interface, client business logic and ability to support secure dialogues with an m-payment server. Obopay in the United States is an example for a J2ME-based procedure. SIM Toolkit (GSM 11.14) is a set of commands and procedures for use during the network operation phase of GSM ensuring interoperability between a mobile devices and a SIM. For instance, this technology is used within the Belgian m-payment procedure M-banxafe.

An m-payment can be initiated in two ways. Either the user requests the m-payment service provider to execute a payment providing the necessary transaction data (initiation by user) or the merchant requests a payment from the m-payment service provider (initiation by merchant). As the aforementioned procedure Cashbeam shows a combination of both options may also be possible. Once the connection is established the user has to be authenticated. The fact that authentication and authorization are typically completed in an integrated way often inveigles practitioners into not distinguishing them properly. *Authentication* only refers to the verification of the payer's identity. Means of authentication can fall in three categories (1) possession, e.g., of a subscriber identity module (SIM); (2) knowledge, e.g., about a personal identification number (PIN) or pass word; and (3) attribute, e.g., biometric recognition (Herzberg 2003). Generally, the more means of authentication are incorporated the securer is the procedure. For instance, Contopronto and NCS mobile payment bank authenticate the payer by their MSISDN (possession) and by PIN (knowledge). The characteristics authentication and realization technology are strongly interrelated. For instance, biometric recognition entails the need of an interface and a matching algorithm that compares the trait of the payer with a database (Dass and Jain 2007). Using fingerprint as a trait requires an application on the mobile device based on J2ME or proprietary software (Jain et al. 1999).

After completion of a payment transaction it is important that the user is aware of the status, typically by means of a confirmation. An m-payment procedure may refrain from providing the user with any explicit confirmation when status information is already integral part of the process, e.g., when services or products are delivered immediately. Typically, this setting is given with digital goods or services (use case types A, B, or C) or at vending machines (use case type E). Nonetheless, as a recent study showed (Linck et al. 2006), users attach importance to receiving a confirmation. At the point of sale in use case type F (and possibly also in use case type E), traditional sales slips can be used. An email as confirmation is especially suitable for purchases on the Internet (use case types C or D). An acoustic signal is often conceivable for procedures based on IVR, CLIP, Java or NFC technology for use case types E and F; this may also be the case for use case type G if payer and payee are situated in the same place. A system inherent display refers to visual confirmations that are displayed on the mobile phone screen and generated by USSD-, Java-, NFC-, or WAP-based procedures, but excludes SMS. The considerations regarding the confirmation in a given use case and for a certain realization technology are important since certain mechanisms considerably increase the cost of operation—especially when using SMS.

Merchants usually receive the funds into their bank accounts. For the users, the payments can be settled via various *method of settlement* (Kreyer et al. 2003; Khodawandi et al. 2003) such as mobile or fixed line phone bills (e.g., Whatever Mobile, Mobileview, MoreCon, ONE, Deutsche Telekom), separate bill (e.g., EasyPark), direct debiting (e.g., Paybox, NCS mobile payment bank), credit cards (e.g., Cornèr Bank), or deduction from a pre-paid e-money account (e.g., Contopronto AS).

Table 8 Capability

characteristic	instances				
tangible resources	payment infrastructure	office equipment	others		
intangible resources	patents	reputation	brands	full banking license	e-money license
human resources	sales force	product design	software development	others	

4.4.2 Capability

A capability is the ability to execute a repeatable pattern of actions that is necessary in order to create value for the customer. These capabilities depend on the assets or resources of the firm (Bagchi and Tulskie 2000) which are differentiated between tangible and intangible assets and people-based skills (Grant 1991). An overview of the complete building block is represented in Table 8; the three characteristics and their instances will be closely explained in the following.

For the purpose of m-payment *tangible resources* may include existing payment infrastructure, office equipment and other assets that traditionally appear on the company's balance sheet. A major difference occurs between the business models of a company that has these resources already available from other business (e.g., a bank or a mobile operator) and a company that has to set up the capacities especially for its m-payment operation (e.g., a specialized m-payment intermediary); this major difference is to be considered for the two upcoming characteristics alike.

Intangible resources include patents, reputation, brands, full banking license, or e-money license. Traditionally, regulation of payment procedures, and thus also m-payments, has been a part of banking regulation and/or monetary policy (Krueger 2002). Thus, in case of charging products and services of third parties a banking license, at least a restricted banking license, is required. In the European Union, the e-Money Directive (2000/46/EG) aims to establish a level playing field between issuers of electronic money (e-money) and regulates the provision of the e-money license. For instance, the m-payment service providers Contopronto AS and NCS mobile payment bank hold this license.

Human resources are the people a firm needs in order to create value with tangible and intangible resources. Examples include sales force, product design, and software development (Bagchi and Tulskie 2000).

4.4.3 Partnership

The lack of cooperation between the key players is a significant barrier to m-payments success (Zmijewska and Lawrence 2006). As all key players have their strengths and weaknesses, the most successful business models could be those based on strong partnership (Pousttchi 2004; Zmijewska and Lawrence 2006). According to Osterwalder (2004), a *partnership* is referred to as a voluntarily initiated cooperative agreement formed between two or more independent companies in

order to carry out a project or specific activity jointly by coordinating the necessary capabilities, resources and activities. For the purpose of this paper, a partnership is considered according to the resource-based view of the firm, emphasizing the contribution of partnering for acquiring resources that the m-payment service provider does not hold. Thus a partnership typically entails an improvement of the cost structure. An overview of the complete building block is represented in Table 9; the six characteristics and their instances will be closely explained in the following.

Partnerships are typically based on commonly negotiated terms and conditions. This is the reason why Osterwalder (2004) introduced the *agreement* sub-element that explains the motivation of an arrangement between business partners. For the purpose of m-payments we distinguish between customer relationship, psychological, legal and technological aspects, and finally, expertise (Zmijewska and Lawrence 2006).

There are various key players and thus possible *partners* of an m-payment service provider in the m-payment ecosystem. Banks' and credit card companies' strengths are strong customer trust, high brand awareness, experience in handling financial risks, banking license, and existing billing and charging infrastructure. Mobile operators may be key players because of a large customer base, existing mobile billing and charging infrastructure and because they control the mobile network, the SIM card and the handset configuration. A specialized intermediary runs an m-payment procedure as his core competency and may be able to provide a bank- and MNO-independent solution. But as we will see in Sect. 4.5 its business model is extremely difficult. Also Internet Service Providers (ISP), fixed network operators, merchants, and other major owners of a customer base may access large customer bases. Moreover, an ISP as a partner is reasonable when offering m-payments in e-commerce (use case type C and D). A partnership with technology providers may be

Table 9 Partnership

characteristic	instances										
customer relationship aspects	large user base					large merchant base					
psychological aspects	trust			brand			reputation				
legal aspects	patents			full banking license			e-money license				
technological aspects	access to SIM cards			access to mobile network			existing billing and charging infrastructure				
expertise	research and development			billing and payment			risk management			cross-border transactions	
partner	bank	credit card company	MNO	spec. intermediary	ISP	fixed network operator	technology provider	merchant	major owner of a customer base	administration	none

useful for companies balancing lack of technical competence. Equipment and handset vendors also fall in this category and are currently gaining importance (e.g., Nokia and Apple already extended their value chain).

4.5 Financial aspects

The *financial aspects* pillar is transversal as all other pillars influence it (and vice versa). The pillar consists of the m-payment service provider's revenue model, its cost structure (Osterwalder 2004), and financing model. The former both determine the company's profit- or loss-making logic.

4.5.1 Revenue

A major success factor for an m-payment system is to identify the right revenue model in order to convince both users and merchants to adopt the service. The building block revenue describes the incoming money streams from the value offered by the m-payment service provider and bases on the revenue model, which, in turn, is composed of revenue source and revenue type. An overview of the complete building block is represented in Table 10; the two characteristics and their instances will be explained in the following.

Revenue sources can be classified in three categories. The first category refers to users who could be charged for membership and for use of the system when they pay for purchases or transfer money to other users. However, as outlined in Sect. 4.3.1, m-payment service providers must survey the user's willingness to pay in order to decide on this instance. Merchants fall in the second category, which proved to be the most commonly used revenue source in our case study analysis. The third category includes third parties, i.e., entities not involved in the payment process directly. These may be resellers, mobile marketers and furthermore administrations when subsidizing the m-payment service providers due to economic-political motives.

Moreover, we distinguish between transaction-dependent and transaction-independent *revenue types* (Turowski and Pousttchi 2004). The former type includes revenues generated with each transaction, e.g., for the payment itself or the provision of m-marketing integration. The latter type includes customers' nonrecurring cost and/or period cost independent from the volume of payment transactions. Examples are basic fees, royalties, proceeds of hardware sale, installation, integration, and support, as well as account-keeping and account set-up/one-time registration fees (e.g., Henkel 2002; Salvi and Sahai 2002). The characteristic is strongly interconnected with the characteristics number of transactions per payer, respectively per

Table 10 Revenue

characteristic	instances		
revenue source	user	merchant	third party
revenue type	transaction-independent	transaction-dependent	

payee (Pousttchi et al. 2002). Typically, customers with a high number of transactions prefer contracts with transaction-independent fees. In opposite, for customers with a low number of transactions the reverse is true.

4.5.2 Cost structure

The *cost structure* measures all the costs the m-payment service provider incurs in order to create, market, and deliver the procedure to its customers. An account defines a specific type of expenditures. For the purpose of m-payment, we have to differentiate between set-up, infrastructure, operation as well as advertising and promotion (Salvi and Sahai 2002). This building block consists of just one characteristic which is shown in Table 11.

While banks, credit card companies and MNO can use an existing infrastructure and (typically) customer base with an existing billing relationship, specialized intermediaries run an m-payment procedure as their core business and have to build up both from scratch. Thus, their situation regarding cost (and revenues) is rather difficult (Pousttchi 2004). Set-up costs, e.g., costs of foundation or royalties for the payment procedure, carry particular weight when a banking license is needed. In the European Union for instance, according to the e-Money Directive (2000/46/EG), a minimum capital of €1 million is required to establish an e-money institute. Furthermore, m-payment service providers have to consider costs for infrastructure setup cost or upgrade of their existing infrastructure; costs of operation include for instance salaries, servicing expenses, authentication fees, transport fees, and losses (e.g., bad debt and fraud losses); finally, advertising and promotion expenses accrue that can be reduced by the use of public relations or viral marketing. Therefore, depending on the existing capabilities and the strategic partners as well as the design of the value configuration and distribution channel costs vary in a concrete m-payment business model.

4.5.3 Financing

All businesses need financing to cover operating expenses and to invest in assets or resources of the firm. Therefore, [in opposite to (Osterwalder 2004)] the m-payment business model framework includes financing aspects as the aim was to propose a comprehensive approach to m-payment business models including also implementation problems. Regarding *financing,* shown in Table 12, an m-payment service provider faces the same issues regarding their *capital structure* as other companies do. The firm must find the optimal ratio of borrowed capital and equity capital, considering different costs of capital, leverage effects and tradeoffs between tax

Table 11 Cost structure

characteristic	instances				
accounts	set-up	infrastructure	operation	advertising and promotion	other

Table 12 Financing

characteristic	instances	
financing	borrowed capital	equity capital

benefit and the associated bankruptcy, and agency costs (Modigliani and Miller 1958; Leary and Roberts 2005; Miao 2005; Bradley et al. 1984; Gilson 1998; Leland 1998). This building block also consists of just one characteristic which mirrors, however, the amount of money invested in the m-payment procedure depends on the necessary tangible, intangible and human resources.

Although this partial model makes a tiny impression it is essential and also should be regarded as a reminder value for all related issues that can not be included explicitly as they would go beyond the scope of the model. The case of Paybox Germany shows the concern of these issues especially on specialized intermediaries.

4.6 Threat consideration

The *threat consideration*, as last pillar, describes potential and profound threats to the economic success of an m-payment business model. Due to the peculiarities of m-commerce, the occurrence of unforeseen threats is much more likely. Interdependencies are intransparent and need special attention. In contrast to fixed line Internet business it is typical here that stakeholders appear at different links in the value chain (Turowski and Pousttchi 2004), often acting with hidden agendas and using the market power they possess in or from other markets; their actions often compromise the success of other players. A further issue is regulation. While regulation in general shows already difficult and sometimes unpredictable effects, besides, m-payment is affected by two different regulatory environments, telecommunications and financial services. Finally, technology plays a particular role, characterized by the relatively low level of standardization in handsets, networks and software. Following experiences from practice, the explicit inclusion of a threat model aims at making these considerations an integral part of construction and assessment of m-payment business models, with special regard to the interrelations to other parts of the business model. An overview of the complete building block is represented in Table 13; the four characteristics and their instances will be explained in the following.

Table 13 Threat model

characteristic	instances					
legal issues	unsteady legislation	regulation	consumer protection	other		
technology issues	evolution of standard	unreliable technology	mobile device evolution	scalability	other	
objective security	integrity	authorization	authentication	confidentiality	non-repudiation	availability
competition	lawful threats		dubious threats		threats from other markets	

The characteristic *legal issues* considers among others unsteady legislation, regulation, and consumer protection. Changes in legislation may occur with a raise of a compulsory minimum reserve for payment institutes or changing tax assignments. Moreover, markets with network externalities tend to have monopoly structures (Toshimitsu 2007). Hence antimonopoly laws play a larger role. Furthermore, in emerging markets the likeliness and the impact of changes in law are very high (IFLR 2006). Regulatory issues may appear within procedures settling payments with an e-money account, since e-money is typically created. Several authors stated that a raise of e-money has an impact on monetary and fiscal policy and payment supervision (Owen and Fogelstrom 2005; Berentsen 1999; Grigg 1996; Dowd 1990). Moreover, to date, it is unclear whether e-money issued by MNO in circumstances where prepaid consumers use some of their prepaid credit to buy services from third parties falls within the ambit of the e-Money Directive (EU Commission 2004). Consumer protection activity can cause major changes and thus endanger the success of a payment procedure. For instance, in countries like Germany there are powerful consumer organizations whose declarations against different products or companies have a severe impact on public opinion and legislation. Regardless of the justness of an according decision—risk assessment in this area must be an integral part of any m-payment business model.

Also *technology issues* like the evolution of a standard, unreliable technology, mobile device evolution, and insufficient scalability may endanger an m-payment business model. As the market for m-payments is still in an experimental period and compatibility is critical for success in network economies (Shapiro and Varian 1999), betting on an outdated standard may be a severe competitive disadvantage. Furthermore, the m-payment procedure has to be tested against attacks on the payment infrastructure to detect unreliable technology issues. Also an assessment of the mobile device evolution is important. Varying implementations of standard environments and multiple proprietary environments on mobile devices have led to platform fragmentation—even the implementation of J2ME is not consistent from device to device. Furthermore, care should be taken that scalability (Bondi 2000) of the procedure is given as far as the prospect exists that the transaction volume increases strongly in the future. In this context, scalability should be regarded not only with a technical focus on transactions and backend systems. An example for a different scalability issue could be if an MNO-driven m-payment business model relies on the revenue made out of the SMS customers must send to initiate a payment, e.g. Mobilkom Austria. The argument that customers do not notice these costs is only true for occasional use—as soon as they want to use it on a daily basis, the cost of 30–100 SMS per month arises.

Several studies revealed that security is one critical success factor of m-payments (Dahlberg et al. 2006). Whereas subjective security, i.e., the degree to which a person believes that using a particular procedure would be secure (Linck et al. 2006), is largely influenced by factors from the distribution channel and partnership partial models, objective security is an issue to be covered in the threat model. *Objective security* (Linck et al. 2006) is a concrete technical characteristic, given, when a certain technological solution responds to all of five security objectives such as integrity, authorization, authentication, confidentiality, and non-repudiation. In

recent years also the availability of a system is frequently called which provides functionality to ensure that the service is accessible and usable (Spinellis et al. 1999). It is clear that a flaw in objective security that is revealed after its establishment could immediately turn into a vital threat to the whole business model.

Finally, m-payment service providers have to anticipate other players' actions. These could be conducted by lawful means (e.g., when an m-payment procedures is based on CLIP for non-answered calls and an MNO objects to that) or by dubious means (e.g., an MNO delays the delivery of initiation or confirmation SMS). Mobile markets as well as traditional payment markets show indications for both types of behavior. Finally, threats from other markets are possible, e.g., when an m-payment service provider competes against key players with high market power that result from their traditional business, e.g., against a strong MNO who already exhibits a large customer base.

The threat model completes the m-payment business model framework described in Sects. 4.2–4.6. The resulting model consists of five pillars with their eleven building blocks and the according layer 3 relations. Following the blueprint given in Sect. 4.1 the complete model including all four abstraction layers is assembled in Fig. 2.

4.7 Application of the framework

Although the complexity of Fig. 2 may seem deterrent at first glance it is highly recommended to use this one as preferred working base. The experience of the authors with the employment of earlier versions for workshops with (prospective) m-payment service providers or other interested parties—such as venture capitalists in the due diligence process or merchants evaluating the acceptance of one or more m-payment procedures—showed quick familiarization and high acceptance of this exposure by practitioners when examining or developing an m-payment business model, thus instantiating the framework.

Examination of an existing or pre-planned model as a purely descriptive task should start with the easiest building blocks and then step-by-step go ahead versus the more complex and difficult ones. Usually the order of pillars as shown in Sects. 4.2–4.6 represents a good approach for a workshop sequence.

Contrariwise, m-payment business model engineering requires a completely different approach which highly depends on the respective starting point of the task. This is often either a defined service provider (e.g. a bank which intends to enter the business), a given technology decision (e.g. SMS), a given application area (e.g. payment for Internet shopping) or even a combination of these. In the following, the pre-defined instances and subsequently the direct and indirect restrictions have to be identified and indicated in the model. Indirect restrictions result from the starting point or the direct restrictions by checking the characteristics possessing relations to these for integrity. In some cases the indirect restrictions could again result in further indirect restrictions. Subsequently, the remaining characteristics are determined one building block after the other, beginning with the easiest decisions and typically ending with the threat model.

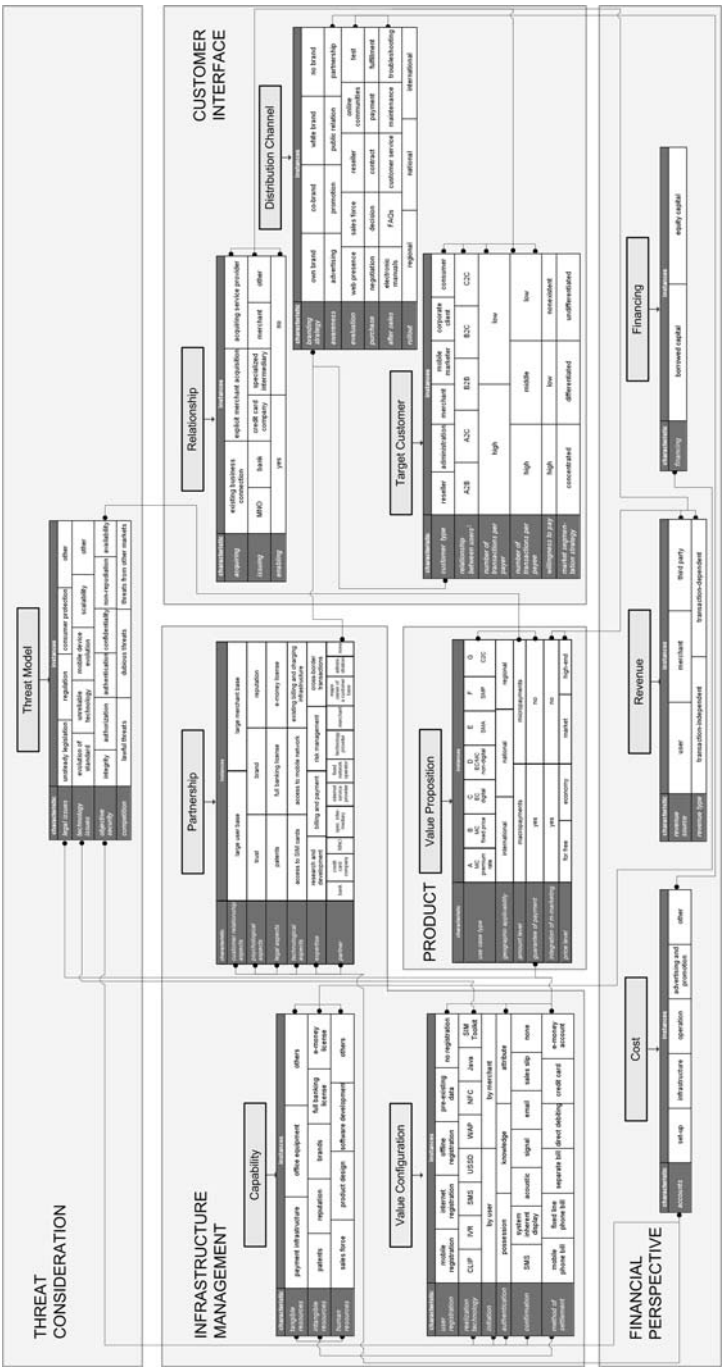

Fig. 2 M-payment business model framework (complete)

4.8 Limitations and future research

A number of limitations to the m-payment business model framework should be noted. First, when constructing a future m-payment business model, the framework could limit practitioners' creativity. Although the framework is depicted with morphological boxes that can also be used as creativity technique, it allows only combining ideas which already exist. This issue in mind, practitioners should additionally include other creativity techniques such as brainstorming, synectics, or lateral thinking. Second, more work is necessary to test the artifact. During this research we demonstrated the soundness of the framework by using it in workshops with (prospective as well as active) m-payment service providers, venture capitalists, and merchants. Additionally, the full framework was instantiated while analyzing three existing German m-payment business models. However, measures and evaluation metrics are crucial components of design-science research (Hevner et al. 2004). Therefore, to test the artifact within an appropriate context the next step in our research will be to develop such measures and evaluation metrics. Third, the model is not specified in a formal language. As outlined in Sect. 1, we deliberately decided against a full ontological approach with a formal specification as the outcome. However, the semi-formal methodology applied in our research principally allows the transformation of a resulting m-payment business model specification in description languages such as XML (Extensible Markup Language). This could allow for an implementation of the M-Payment Business Model Framework into a computer-based tool that aims at automated designing, simulating and comparing m-payment business models. Our future research will begin to tackle these challenges. We hope that these issues will also be given attention by other researchers in this area.

5 Conclusion

This research was motivated by the lack of an integrated view on m-payment business models. With regard to the fact that numerous failures and virtually no successful market entries can be observed in European and North American markets, we aimed at reflecting the complexity of the m-payment task and the high interdependency of technical, human and market factors in order to serve researchers and practitioners alike.

In response to these requirements we chose an ontological approach and proposed a framework as a conceptual tool for comprehensive analysis and engineering of m-payment business models. Based on prior theoretical work and multi case study analysis we adapted the Business Model Ontology of Osterwalder (2004), enhancing it with additional partial models and two detailed abstraction levels depicted with a system of morphological boxes. Starting with a sketch of the top two abstraction levels we developed the eleven partial models of the framework and the interrelations between the associated characteristics in detail. Finally, the partial models were assembled and the application illustrated.

Besides the obvious task of description and textured comparison of existing m-payment procedures and their business models, the framework is suited for further applications. Most relevant is *m-payment business model engineering*, starting with a well-structured identification of the existing direct and derivation of indirect restrictions with the help of integrity checks. Thus the existing degrees of freedom can be determined and used in a defined and more formal way. This allows making a step from—currently predominant—intuitive development of m-payment business models to a more engineer-like approach, systematically considering all relevant factors and their interrelations.

This formalization should not be overrated: above all, business model development remains a creative task for experienced industry executives. However, methodical support of the process could help to overcome the m-payment paradox. Given the fact that a widespread m-payment represents a key enabling factor for the success of other mobile business-to-consumer services, this help could be beneficial not only for m-payment service providers but for the mobile industry as a whole, enabling independent application developers to offer services and generate direct transaction-based revenues—an opportunity that has remained very limited up to now.

References

Alder H (1994) The technology of creativity. Manage Decis 32(4):23–30

Au YA, Kauffman RJ (2008) The economics of mobile payments: understanding stakeholder issues for an emerging financial technology application. Electron Commer Res Appl 7(2):141–164

Bagchi S, Tulskie B (2000) e-Business models: integrating learning from strategy development experiences and empirical research. In: 20th Annual international conference of the strategic management society. Vancouver

Baghdadi Y (2005) A business model for deploying Web services: a data-centric approach based on factual dependencies. Inf Syst e-Business Manage 3(2):151–173

Berentsen A (1999) Monetary policy implications of digital money. Kyklos 52(2):263–264

Bondi AB (2000) Characteristics of scalability and their impact on performance. In: Proceedings of the 2nd international workshop on software and performance, Ontario, pp 195–203

Bradley M, Jarrell G, Kim EH (1984) On the existence of an optimal capital structure: theory and evidence. J Finance 39(3):857–880

Chau PYK (1996) An empirical assessment of a modified technology acceptance model. J Manage Inf Syst 13(2):185–204

Choon SL, Hyung SS, Dae SK (2004) A classification of mobile business models and its applications. Ind Manage Data Syst 104(1):78–87

Coursaris C, Hassanein K (2002) Understanding m-commerce—a consumer centric model. Q J Electron Commer 3(2):247–271

Dahlberg T, Mallat N, Öörni A (2003) Consumer acceptance of m-payment solutions—ease of use, usefulness and trust. The second international conference on mobile business 2003. Vienna

Dahlberg T, Mallat N, Ondrus J, Zmijewska A (2006) M-payment market and research—past, present and future. Helsinki mobility roundtable, Helsinki

Dass SC, Jain AK (2007) Fingerprint-based recognition. Technometrics 49(3):262–276

Dowd K (1990) The state and the monetary system. Philip Allen, London

Eisenhardt K (1989) Building theories from case study research. Acad Manage Rev 14(4):532–550

EU Commission (2004) Application of the e-money directive to mobile operators—guidance note from the commission services. http://ec.europa.eu/internal_market/bank/docs/e-money/guidance_en.pdf. Accessed 17 July 2008

Fong S, Lai E (2005) Mobile mini-payment scheme using sms-credit. In: Proceedings of the international conference on computational science and its applications. Singapore, pp 1106–1114
Gilson SC (1998) Transactions costs and capital structure choice: evidence from financially distressed firms. J Finance 52(1):161–202
Gordijn J (2002) Value-based requirements engineering—exploring innovative e-commerce ideas. Doctoral Dissertation. Vrije, Amsterdam
Gordijn J, Osterwalder A, Pigneur Y (2005) Comparing two Business Model Ontologies for designing ebusiness models and value constellations. In: 18th BLED conference (eIntegration in action), CDrom
Grant RM (1991) The resource-based theory of competitive advantage: implications for strategy formulation. California Manage Rev 33(3):114–135
Green P, Rosemann M (2004) Applying ontologies to business and systems modelling techniques and perspectives: lessons learned. J Database Manage 15(2):105–117
Grigg I (1996) The effect of Internet value transfer systems on monetary policy. Working paper 001, London Business School, London
Hanemann WM (1991) Willingness to pay and willingness to accept: how much can they differ? Am Econ Rev 81(3):635–647
Heinkele C (2003) Überblick und Einordnung ausgewählter M-Payment-Verfahren. Report, Chair of Business Informatics and Systems Engineering, University of Augsburg, Augsburg
Henkel J (2002) M-payment. In: Silberer G, Wohlfahrt J,Wilhelm T (eds) Mobile commerce—basics, business models and success factors. Gabler, Wiesbaden
Herzberg A (2003) Payments and banking with mobile personal devices. Commun ACM 46(5):53–58
Hevner AR, March ST, Park J, Ram S (2004) Design science in information systems research. MIS Q 28(1):75–100
Jain AK, Bolle R, Pankanti S (1999) Biometrics: personal identification in networked society. Kluwer, Boston
Kalish S, Nelson P (1991) A comparison of ranking, rating and reservation price measurement in conjoint analysis. Mark Lett 2(4):327–335
Karnouskos S, Vilmos A, Hoepner P, Ramfos A, Venetakis N (2003) Secure m-payment—architecture and business model of SEMOPS. In: Proceedings of the EURESCOM summit. Heidelberg
Khodawandi D, Pousttchi K, Wiedemann DG (2003) Akzeptanz mobiler Bezahlverfahren in Deutschland. In: Proceedings of the 3rd workshop on mobile commerce. Augsburg, pp 42–57
Kotler P (2003) Marketing management, Pearson Education. Upper Saddle River, New York
Kreyer N, Pousttchi K, Turowski K (2003) Mobile payment procedures: scope and characteristics. eService J 2(3):7–22
Krueger M (2001) The future of m-payments—business options and policy issues. Background paper no. 2; Electronic Payment Systems Observatory (ePSO), Sevilla. http://epso.intrasoft.lu/papers/Backgrnd-2.pdf. Accessed 10 August 2007
Krueger M (2002) M-payments: a challenge for banks and regulators. IPTS report 63:5–11
Leary MT, Roberts MR (2005) Do firms rebalance their capital structures? J Finance 60(6):2575–2619
Leland HE (1998) Agency costs, risk management, and capital structure. J Finance 53(4):1213–1243
Linck K, Pousttchi K, Wiedemann DG (2006) Security Issues in M-payment from the customer viewpoint. In: Proceedings of the 14th European conference on information systems. Gothenburg, Sweden
Mallat N (2007) Exploring consumer adoption of mobile payments—a qualitative study. J Strateg Inf Syst 16(4):413–432
McFadzean E (2000) Techniques to enhance creative thinking. Team Perform Manage 6(3/4):62
Miao J (2005) Optimal capital structure and industry dynamics. J Finance 60(6):2621–2659
Modigliani F, Miller MH (1958) The cost of capital, corporation finance and the theory of investment. Am Econ Rev 48(3):261–297
Müller-Merbach H (1976) The use of morphological techniques for or-approaches to problems. Operations research '75. North-Holland, Amsterdam, pp 127–139
NFC Forum (2007) Near Field Communication and the NFC Forum: The Keys to Truly Interoperable Communications. http://www.nfc-forum.org/resources/white_papers/nfc_forum_marketing_white_paper.pdf. Accessed 25 August 2007
Ondrus J, Pigneur Y (2004) Coupling mobile payments and CRM in the retail industry. Accepted IADIS international e-Commerce 2004 conference

Ondrus J, Pigneur Y (2005) A disruption analysis in the mobile payment market. In: Proceedings of the IADIS 38th Hawaii international conference on system sciences, Hawaii, January 3–6
Ortiz E (2004) A survey of J2ME today. Available via http://developers.sun.com/mobility/getstart/articles/survey. Accessed 5 August 2007
Osterwalder A (2004) The business model ontology—a proposition in a design science approach. Dissertation, University of Lausanne, Switzerland
Osterwalder A, Pigneur Y, Tucci CL (2005) Clarifying business models: origins, present, and future of the concept. Commun AIS 15:751–755
Owen AL, Fogelstrom C (2005) Monetary policy implications of electronic currency: an empirical analysis. Appl Econ Lett 12(7):419–423
Pousttchi K (2003) Conditions for acceptance and usage of m-payment procedures. In: Proceedings of the 2nd international conference on mobile business. Vienna, pp 201–210
Pousttchi K (2004) An analysis of the m-payment problem in Europe. In: Proceedings of the Multikonferenz Wirtschaftsinformatik Essen, pp 260–268
Pousttchi K (2008) A modeling approach and reference models for the analysis of mobile payment use cases. Electron Commer Res Appl 7(2):182–201
Pousttchi K, Selk B, Turowski K (2002) Akzeptanzkriterien für mobile Bezahlverfahren. Mobile and Collaborative Business 2002. In: Proceedings zur Teilkonferenz der Multikonferenz Wirtschaftsinformatik. Lecture notes in informatics (LNI), pp 51–68
Pousttchi K, Wiedemann DG, Schaub J (2006) Aktueller Vergleich mobiler Bezahlverfahren im deutschsprachigen Raum. Studienpapiere der Arbeitsgruppe Mobile Commerce. Augsburg, pp 50–96
Pousttchi K, Schiessler M, Wiedemann DG (2007) Analyzing the elements of the business model for mobile payment service provision. In: Proceedings of the 6th international conference on mobile business (ICMB 2007). IEEE Computer Society Press, Toronto
Salvi AB, Sahai S (2002) Dial M for money. In: Proceedings of the 2nd ACM international workshop on mobile commerce, Atlanta, USA, pp 95–99
Schwiderski-Grosche S, Knospe H (2002) Secure mobile commerce. In: Mitchell C (ed) Spec issue IEEE Electron Commun Eng J Secur Mobil 14(5):228–238
See-To EWK, Jaisingh J, Tam KY (2007) Analysis of electronic micro-payment market. J Electron Commer Res 8(1):63–83
Seppanen M, Makinen S (2005) Business model concepts: a review with case illustration. In: Proceedings of the Engineering Management Conference. IEEE International, pp 376–380
Shapiro C, Varian HR (1999) Information rules: a strategic guide to the network economy. Harvard Business School Press, Boston
Spinellis D, Kokolakis S, Gritzalis S (1999) Security requirements, risks and recommendations for small enterprise and home-office environments. Inf Manage Comput Secur 7(3):121–128
Timmers P (1998) Business models for electronic markets. Electron Mark 8:3–8
Toshimitsu T (2007) A note on quality choice, monopoly, and network externality. J Ind Compet Trade 7(2):131–142
Turowski K, Pousttchi K (2004) Mobile Commerce. Grundlagen und Techniken, Springer, Heidelberg
van Baal S, Krueger M (2005) Internet-Zahlungssysteme aus Sicht der Händler (IZH3), IWW, Universität Karlsruhe
Varshney U, Vetter R (2002) Mobile commerce: framework, applications and networking support. Mobile Netw Appl 7(3):185–198
Voelckner F (2006) An empirical comparison of methods for measuring consumers' willingness to pay. Mark Lett 17(2):137–149
Waris FS, Mubarik FM, Pau LF (2006) Mobile payments in the Netherlands: adoption bottlenecks and opportunities, or throw out your wallets. In: ERIM report series reference no. ERS-2006-012-LIS. Available at SSRN: http://ssrn.com/abstract=898921
Wiedemann DG, Goeke L, Pousttchi K (2008) Ausgestaltung mobiler Bezahlverfahren—Ergebnisse der Studie MP3. In: Breitner MH, Breunig M, Fleisch E, Pousttchi K, Turowski K (eds) Mobile und Ubiquitäre Informationssysteme—Technologien, Prozesse, Marktfähigkeit. In: Proceedings of the 3rd conference on mobile and ubiquitous information systems (MMS 2008). Lecture notes in informatics (LNI), Bd. P–123, Gesellschaft für Informatik, Bonn, pp 94–107
Yin RK (2002) Case study research—design and methods. Sage, Thousand Oaks
Zmijewska A (2005) Evaluating wireless technologies in mobile payments: a customer centric approach. In: Proceedings of the international conference on mobile business (ICMB'05), pp 354–362

Zmijewska A, Lawrence E (2005) Reshaping the framework for analysing success of mobile payment solutions. Paper presented at the IADIS international conference on e-Commerce, Porto
Zmijewska A, Lawrence E (2006) Implementation models in m-payments. In: Proceedings of the IASTED international conference advances in computer science and technology, Puerto Vallarta, Mexico, pp 19–25
Zmijewska A, Lawrence E, Steele R (2004) Classifying m-payments—a user-centric model. In: Proceedings of the third international conference on mobile business (ICMB'04). New York
Zwicky F (1966) Entdecken, Erfinden. Forschen im Morphologischen Weltbild. Knaur-Droemer Verlag, Munich