Cooperation for Innovation in Payment Systems: The Case of Mobile Payments

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Abstract: In this paper, we provide a definition of mobile payments and we analyze the markets that could be targeted by mobile payment service providers, both in developed and in developing countries. Focusing on the case of developed countries, we introduce five cooperation models that have emerged or could emerge between banks, mobile network operators, and payment systems, for the development of this payment method.

Key words: mobile payments; payment systems; mobile banking; mobile commerce.

Since its introduction in the 1980s, mobile telephony has developed rapidly. In 2009, worldwide, about two thirds of the population had access to a mobile phone.[1] In contrast with other technologies, the developing world is catching up fast; for instance, according to the International Telecommunications Union, in 2008, the penetration of mobile services in developing countries was at the same level as in Sweden just 10 years earlier.[2]

Today, due to their widespread adoption, a mobile phone is viewed not only as a communication device, but also as a potential payment device. For instance, a study from Arthur D. Little states that so-called "mobile payments" will represent a total transaction volume of $250 billion by 2012.[3] Usual arguments in favor of mobile payments are that in developed countries, mobile users are accustomed to making micro payments with their

[1] In 2009, worldwide, there were 67 mobile subscriptions per 100 inhabitants. See: "The World in 2009: ICT Facts and Figures," ITU, 2009.

[2] See: "The World in 2009: ICT Facts and Figures," ITU, 2009.

[3] See: "Global M-Payment Report Update – 2009," Arthur D. Little.

mobile phones to purchase digital content (e.g., ringtones or games[4]) or applications (e.g., for iPhones or Android mobile phones) and that in developing countries, the very poor quality of existing payment solutions creates room for mobile payment solutions.

The objective of this paper is to study the prospects of mobile payments in developed countries, and to analyze the potential business models that could result from the cooperation of banks and mobile network operators.

Table 1 - Possession of mobile phones and payment cards in some developed and developing countries.

Country	*Mobile phones per capita*	*Payment cards per capita*	*Country*	*Mobile phones per capita*	*Payment cards per capita*
United States	0.9	3.8	Taiwan	1.1	1.9
Canada	0.7	3.4	Russia	1.4	0.9
United Kingdom	1.3	2.4	China	0.5	1.3
France	0.9	2.3	India	0.3	0.1
Australia	1.1	2.5	Thailand	0.9	0.6
Sweden	1.2	0.8	Poland	1.2	0.8
Japan	0.9	6.0	Colombia	0.9	0.5
South Korea	0.9	3.4	Morocco	0.7	0.1 (est.)
Brazil	0.8	2.2	Nigeria	0.4	0.0 (*)

(*) Payment cards are however developed to some extent in Nigeria. At the end of 2007, there were 512,000 debit cards and 95,000 credit cards. Source: "Credit cards around the world : Nigeria," available at http://www.creditcards.com/credit-card-news/credit-cards-around-the-world-nigeria-1276.php

Sources: for the number of mobile phones per capita: ITU, 2008; for the number of cards: Euromonitor International, 2009. "Payment cards" include: credit cards, debit cards, and charge cards (ATM cards and retailer private cards are excluded); for the population: World Bank, World Development Indicators Database, 2009.

The economic impact of mobile payments will, indeed, probably strongly differ in developed and developing countries. Table 1 below compares the number of mobile phones per capita to the number of payment cards per capita, in some developed and developing countries. The table shows that in developed countries, there are generally more payment cards than mobiles phones. This suggests that mobile payment solutions would have to compete with debit and credit cards and other existing means of payment. However, in developing countries, the situation is quite different, as there are

4 For instance, in 2007, the sales of ringtones in Europe were of about $1.1 billion (see: "Ringtone market comes to the end of its crescendo," *The New York Times*, 16 December 2007).

often more mobile phones than payment cards.[5] In these countries, where a large proportion of the population is unbanked, mobile payments could represent an electronic payment solution and would not face the same degree of competition with existing payment instruments.

Though mobile payment solutions have attracted a lot of attention, they have so far developed slowly, except in a few countries. Two notable success stories are the development of contactless mobile payments in Japan by the incumbent mobile network operator NTT DoCoMo, and the development of the M-Pesa mobile payment solution in Kenya.

Different issues and problems are often cited to explain the slow development of mobile payments: low willingness to pay,[6] technical and standardization hurdles, lack of incentives from mobile operators or banks, problems of coordination, security and privacy issues,[7] etc. In this paper, we propose to study the incentives of banks and mobile operators to invest in mobile payments, and the incentives of consumers and merchants to adopt this technology.

We define five business models of cooperation between banks, MNOs, and payment systems: the light model, the mobile-centric model, the bank-centric model, the partial-integration model, and the full-integration model. Each business model is characterized by the degree of dependency or cooperation between these three key players. We argue that the partial-integration and the full-integration models are the most costly to develop, but the more efficient to target the mass market. On the other hand, the light model is the most favorable to introduce innovative payment services, but restricts firms to target niche markets.

The rest of this paper is organized as follows. In the 2nd Section, we start by defining mobile payments and by analyzing which markets could be targeted by mobile payments service providers. In the 3rd one, we argue that mobile payments should be viewed as an innovation in payment systems, and we study the suppliers' incentives to develop this innovation, and the

5 See for instance the figures about India, Colombia, Morocco and Nigeria. Note that our figures also show that in some developing countries (e.g. China, Brazil, and Taiwan) the possession of payment cards is quite common.

6 According to KPMG's third annual Global Consumers and Convergence survey (2009), 85 percent of the US respondents believe mobile banking is important, but they do not want to pay for it.

7 According to KPMG's survey (2009), 48 percent of the US respondents who had never tried banking through a mobile device cited privacy and security issues as the main reasons.

consumers' incentives to adopt it. In the 4th Section, we introduce our five models of cooperation between banks, mobile network operators, and payment systems. Finally, we conclude by summarizing our main findings.

■ Mobile payments and potential markets

A definition of mobile payments

Mobile payments are generally defined as the process of the exchange of money for goods and services between two parties using a mobile device, such as mobile phones, wireless devices, computers or PDAs, in return for goods and services.[8] For instance, consumers could use their mobile phones to pay at the Point of Sales or to purchase goods from cyber merchants. However, this definition excludes mobile money transfers which occur without any exchange of goods or services, such as Peer-to-Peer (P2P) money transfers. As P2P money transfers seem to have caused an increase in the use of mobile phones for exchanging money, in particular for remittances, we focus in this paper on "mobile money transfers," which we define as transfers of money between two parties involving a mobile device, be they Business-to-Business (B2B), Business-to-Consumer (B2C), Consumer-to-Consumer (C2C), or Consumer-to-Business (C2B). This definition includes remittances and P2P money transfers, but excludes all the banking services that can be provided through mobile devices, and that do not involve money transfers, such as account information or portfolio management services. Also, this definition does not restrict the scope of our study to the case in which mobile devices are used as a means of payment, which up to today, as we will argue later in this paper, is not necessarily the most common situation.

Mobile money transfers rely on different types of technological solutions, which differ for remote money transfers and proximity payments. In the following table, we provide some examples of the types of transfers that can be made using a mobile device.

[8] See for instance the definition of the Mobile Payment Forum (2002) cited in WARIS *et al.* (2006).

Table 2 - Examples of money transfers with a mobile device

	Remote payments	*Proximity payments*
Low value payments	Ringtones, games, low-value P2P payments.	Vending machines, parking, transit, fast food restaurants, gasoline purchases (C2B).
Medium and high value payments	Remittances (P2P). Bill payments (C2B and B2B). Cyber merchants (C2B).	Retail outlets (C2B).

Remote money transfers refer to the transactions that can be conducted independent of the user's location, and that do not require a Point of Sales terminal. Examples include remittances and P2P payments, delivery of digital services, and prepaid Top-Up services. For these types of money transfers, the first solution is to use the mobile device as an access channel to other traditional payment instruments, such as payment cards, checks or credit transfers. In this case, the payment is initiated through the mobile device, using a short message service (SMS) or the wireless application protocol technology (WAP). Sometimes, the mobile phone can be also used to authenticate transactions from payment cards (e.g. Vodafone m-pay card system in the UK enables users to charge purchases directly to payment cards they have pre-registered with the service). However, other traditional payment instruments remain needed to settle the transaction, and the mobile device cannot be defined as a means of payment. The payments initiated by the mobile device have to be "post-paid" by the consumers. To that end, Mobile Network Operators often use "reverse billing," which consists in placing payments as additional items on the customers' post-paid phone bill. For remote money transfers, another solution is to use the mobile device as an e-wallet, which operates the same way as prepaid cards. In this case, consumers store units of electronic money either in the SIM card of their mobile phones, or on the hard disk of their computers, and must reload regularly their e-wallets by other means of payment.[9] One could also imagine other remote payment solutions, in which the mobile device would become a payment instrument, enabling the consumer to transfer money from his bank account without the need of an existing payment solution.

Proximity money transfers refer to the situation in which the mobile device locally communicates with a Point of Sales (POS) or an Automatic

[9] In Europe, e-money is defined as "monetary value as represented by a claim on the issuer which is: i) stored on an electronic device, such as a chip card or computer memory; ii) issued on receipt of funds of an amount not less in value than the monetary value issued; iii) accepted as a means of payment by undertakings other than the issuer" (Directive 2000/46/EC). Strictly speaking, e-money is not a payment instrument, but a means of payment that can be substituted for cash and deposits.

Teller Machine (ATM) via contactless technologies (e.g., Bluetooth, IrDA, RFID, Near Field Communication).[10] For this purpose, the mobile device has to be equipped with a chip that stores the users' account information, while merchants require special POS readers. The chip is either separated from the SIM card of the mobile network operator or embedded in it. The payment can then be made by tapping or waving the mobile device with an embedded chip at the contactless POS reader. Notice that, with this definition, any object that is carried by the consumer, and that is equipped with the relevant technology to transfer money is a mobile device. The mobile device can be viewed as a "carrier" rather than as an independent payment instrument. The mobile phone handset may have a competitive edge over contactless cards or other potential carriers for the provision of money transfer services, as it is equipped with a small-scale screen that enables the consumers to have access to customized payment applications.

Potential markets

Which markets could be targeted by mobile payment service providers? Mobile payment service providers could offer services to consumers without payment instruments. For instance, there might be a potential for mobile payments for young people with prepaid solutions, or unbanked people, both in developed and developing countries. As shown in the table below, the market of unbanked customers is a niche in developed countries, while it is a mass market in developing countries.

To understand if mobile payment service providers are able to target the market for unbanked, we have to examine why these people do not have a bank account. There are two ways of accounting for the number of unbanked. A first explanation is related to the supply-side: banks may decide not to serve all consumers, either because of information asymmetries, such as the lack of a credit history, or because they estimate that some consumers are too risky. In this case, prepaid payment instruments can be

10 "Bluetooth wireless technology is a short-range communications system intended to replace the cables connecting portable and/or fixed electronic device." (Source: Bluetooth.com). IrDA refers to the Infrared Data Association, which set up a standard for communication between devices over short distance using infrared signals. The Radio-frequency identification (RFID) is a technology used for automatically identifying a package or an item. It is a replacement for the barcode. The Near Field Communication (NFC) is a new, short-range wireless connectivity technology that evolved from a combination of existing contactless and interconnection technologies.

used by banks or other payment service providers to serve the unbanked or the underbanked. By requiring consumers to pay early for future purchases or services, the prepaid model eliminates payment risk for the issuer of the prepaid payment instrument.[11] The total value of transactions made with prepaid devices is bound to remain limited, as consumers must reload their prepaid instrument regularly which is inconvenient for transactions of larger amounts. Also, regulators often decide to impose a limit on the maximum amount that can be prepaid.

Table 3 - Some figures about the unbanked in developed and developing countries (*)

	Proportion of unbanked	*Source*
United-States	7.7% of households have no bank account. 17.9% are underbanked.	FDIC "National Survey of unbanked and underbanked households" (2009).
France	1.6% of households have no bank account.	IFOP (2007) and Fédération Bancaire Française.
United-Kingdom	8% of households.	"Banking the unbanked," House of Commons Treasury Committee, Thirteenth Report session 2005-2006.
Western Europe	<20% of the population.	"Finance for all?" A World Bank Research Report (2008).
India	41% of the population.	Reserve Bank of India
Sub Saharan Africa	>80% of the population.	"Finance for all?" A World Bank Research Report (2008).
Latin America	High variation from 40% in Chile to 80% in Nicaragua	"Finance for all?" A World Bank Research Report (2008).

(*) For less recent but more comprehensive data about access to financial services, see Beck *et al.* (2007).

Another explanation of the number of unbanked is related to the demand characteristics. As shown in table 4, the consumers give various reasons for not holding a bank account, which differ in developed and developing countries. Some of the reasons given (such as costs or privacy) could also apply for the adoption of mobile payment solutions. Hence, it would be erroneous to equate the potential market for mobile payments to the number of unbanked, especially in developed countries. In developing countries, the comparison of the launch of the M-Pesa service in Kenya and in Tanzania reveals that financial literacy plays a role in the adoption of mobile payment services.[12]

[11] In developed countries, mobile prepaid services would have to compete with prepaid cards.

[12] See: "What makes a successful mobile money implementation? M-Pesa in Kenya and Tanzania," FSD Kenya report (2009).

Table 4 - Main reasons given for not having a bank account

Main reason	*United-States (%)*	*Mexico (%)*
Do not need account/no savings	53	7
Not comfortable with banks/don't trust banks	18	16
Want to keep records private	22	2
Fees and minimum balance too high	45	70
Inconvenience-location and hours	10	2
Lack of documentation	10	3

Source: World Bank Research Report "Finance for All?" (2008)

Another interesting aspect of the studies about the unbanked in developed countries reveals that a large proportion of this population are migrants or ethnic minorities, who resort to remittances to send their money to their country of origin. For instance, the FDIC report (2009) on the unbanked in the United-States shows that some minorities are more likely to be unbanked, such as black households (21.7% are unbanked), Hispanics (19.3%), and American Indians (15.6%). These figures suggest that the unbanked populations in developed and developing countries may be potentially interconnected, and that mobile payment service providers could seek to exploit this market opportunity. The success of the start-up Obopay in the United-States supports the view that the niche markets in developed countries and the mass markets in developing countries may be complementary.[13]

If mobile payments services are not only designed for the unbanked, they could also become a substitute for the existing electronic payment instruments, such as bank cards. So far, in most European countries, banks have provided payment instruments as a package with a bank account. Hence, the provision of mobile payment solutions by nonbanks such as mobile operators will require cooperating with banks to link the payment instrument to the banking account. As we will see later in the paper, banks' incentives to cooperate with nonbanks seem to be low.

To conclude, mobile payments will have to provide sufficient value improvement to consumers or merchants to develop in mature payment markets. This raises more generally the question of the digitization of

[13] Obopay is a payment application that enables consumers to purchase, pay and transfer money using their mobile devices. Obopay created a subsidiary in India in March 2008 for payments and cross-border remittances.

payment instruments. It is for instance interesting to note that electronic wallets have not been much of a success in many countries.[14] In the next section we will analyze how the adoption of payment innovations in developed countries depends on a complex set of interacting variables.

■ Mobile payment devices as an innovation in developed countries

Mobile payments can be viewed as an innovation in the retail payments market. In this section, we study the players' incentives to innovate and deploy mobile payment solutions, and the incentives of consumers and merchants to adopt mobile payment methods. We now restrict our analysis to the case of developed countries as the business case for mobile payments in emerging countries is very different.[15]

The retail payments market exhibits certain characteristics that must be taken into account in our analysis of players' incentives to innovate. The economic literature stresses the two-sided nature of retail payment systems. Retail payment systems are characterized by membership and usage externalities between two distinct groups of users, the consumers and the merchants.[16] The more consumers adopt mobile payments, the more merchants will be willing to upgrade their terminals, and vice versa. Hence, mobile payment service providers must find the appropriate price structure to bring both sides of the market on board, and solve the "chicken and egg" issue that arises when neither consumers nor merchants are equipped with the same payment solution.[17] Due to the presence of economies of scale and network effects, competing players in payment systems have strong incentives for standardization and cooperation. The example of payment

[14] Several schemes, such as Multibanco in Portugal, Danmønt in Denmark, and Avant in Finland, were closed down. Notable exceptions are Proton in Belgium or the Octopus card in Hong-Kong. It is beyond the scope of this paper to analyze the factors of success of e-purses. See VAN HOVE (2004) for an assessment of the success of e-purses in Europe.

[15] As explained in the previous section, this is in particular due to the fact that a significantly larger share of the population is unbanked in developing countries.

[16] See VERDIER (2006) for a review of the literature on two-sided markets applied to payment systems, and BEDRE-DEFOLIE & CALVANO (2010) for a recent contribution which takes into account membership and usage fees in payment systems. For a more general analysis of two-sided markets, see ROCHET & TIROLE (2006) and WEYL (2010).

[17] The choice of the price structure must take into account the expectations of merchants and consumers about the adoption of the new payment system.

cards shows that the building of a joint-venture can considerably reduce the costs of incompatibility between different standards.

Another striking feature of the payments industry is that it has been dominated by banks, which compete in the market for deposits. Nonbanks, such as PayPal, have been able to enter the virtual goods market, in which banks were traditionally slower to innovate, and less ready to cater to the needs of the consumers. If mobile payments were to become a widely-used solution at the POS, it remains to analyze if new payment systems could be provided by nonbanks that are neither experienced with managing deposits, nor equipped with an ATM network. As we will explain later in this paper, the mobile payment service provider would have to choose between catching-up with banks by investing in payment and withdrawal infrastructure, bear the costs of accessing the existing infrastructure, or adopt a "light model" without a large acceptance network.

As mentioned earlier, mobile payments constitute an innovation from the point of view of banks and mobile network operators. Chakravorti and Kobor (2005) identify four generic incentives to invest or innovate in payment systems: (i) cost reduction; (ii) increasing revenues by the introduction of new products or services or by differentiating customers; (iii) customer acquisition; (iv) customer retention. We apply this typology to analyze the banks' and the MNOs' incentives to develop mobile payment solutions. Our analysis is summarized in table 5 below.[18]

Table 5 - Incentives to adopt mobile payments for banks and MNOs

	Banks	*Mobile Network Operators*
Consumer retention	Mobile payments as a way to defend market shares	Important: high churn rate in mobile
Consumer acquisition	Important if unbanked market is large and unbanked consumers have sufficiently high willingness to pay	Not important: mobile markets are mature (see table 1)
Generate new revenues	If additional value of mobile payments relative to existing payment instruments	Important: MNOs are looking for new revenue streams
Reduce costs	Important if substitution with cash or checks: costs of cash and checks	Not applicable (MNOs are new entrants)
Other motivations	Developing mobile payments to deter MNOs and nonbanks from entering the payment market	-

[18] For a detailed analysis of each motive, see BOURREAU & VERDIER (2010).

There are, however, many obstacles to investment, for both banks and MNOs. First, the costs of deploying a mobile payment solution would be probably high. In particular, terminals at the point of sale would have to be upgraded or replaced. One solution would be to develop gradually merchant acceptance, for instance, by installing mobile payment systems in vending machines, or by signing agreements with large retailers, such as transport service providers (*cf*. Mobilkom in Austria). Second, if the development of mobile payment solutions involves coordination between banks, mobile network operators and nonbanks, there could be coordination costs. Third, there is still some regulatory uncertainty about mobile payments, which may lead players to wait.[19]

If banks and MNOs do not cooperate in the development of mobile payment solutions,[20] there is also a cost to each player of entering the other player's market. MNOs operate networks with large coverage and have billing relationships with their clients, however, the traditional banking functions (cash management, risk control, short term loans) are not part of their core business. The cost of setting up and servicing deposit accounts would be probably prohibitive, and therefore prepaid solutions look to be the most viable way of providing liquidity in a "bank-less" system. However, the question remains whether consumers would see enough value in such prepaid offers. As for banks, developing mobile payments without the cooperation of MNOs will require them to cooperate with mobile handset manufacturers.

The success of mobile money transfers depends on the users' incentives to adopt the new technologies. On the consumer side, the incentives to adopt contactless payments depend on the price of the service, on the security offered by the service provider, and on the convenience of the payment method. A survey conducted by the De Nederlandsche Bank on consumer criteria for selecting M-payments shows that 65.8% of the consumers expect the service to be user-friendly, while 52.2% of the consumers expect it to be widely available.[21] If the mobile payment solution does not provide any value to the existing payment solution for consumers,

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19 See Section 5 of BOURREAU & VERDIER (2010) for a more detailed discussion of regulatory uncertainty, antitrust law and consumer protection issues.

20 See the next section for a discussion of the different cooperation scenarios.

21 The survey was based on a total of 10,604 replies, and it was only addressed to experienced online shoppers, which explains probably the fact that the costs were the fourth most important criterion according to this survey (27% of the consumers selected "low cost" as a criterion for adopting M-payments).

its deployment is likely to fail, as it proves difficult to convince the users to change their habits. For instance, ONDRUS *et al*. (2009) explain the failure of the mobile payment solution developed by PostFinance in Switzerland by the lack of value added to the existing payment card solution, and the difficulties to change consumer behavior.[22] On the merchant side, the incentives to adopt contactless payments depend on the costs of upgrading the existing payment terminals, on the security of contactless transactions and on the additional benefits that can be provided by the services, such as consumer information, mobile couponing or customer acquisition/retention. The incentives to adopt mobile payments may not be the same for online merchants, large retailers or small retailers. For online merchants, the capacity to offer various payment instruments to match consumers' demand can be viewed as quality differentiation. For proximity payments, the merchants have to be convinced that they can earn a positive return on investment in upgrading POS, or enhancing their electronic payment solutions.[23] The lack of agreement over common standards may slow down the investment process as the merchants may decide not to run the risk of adopting a technology that may need to be replaced rapidly. However, once a critical mass is reached, small retailers may wish to adopt the innovation to avoid losing market share. The economic theory (See ROCHET & TIROLE, 2002) predicts indeed that the merchants may be ready to pay a higher fee than the benefit they obtain from accepting a payment instrument because of the strategic interactions between merchants on the retail markets.

■ Cooperation models for the development of mobile payment solutions

In this section, we study five cooperation models between the key players that could be involved in a mobile payment solution, and we discuss the strategic interactions within each model.[24]

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22 PostFinance was in an ideal position to implement a mobile payment solution in 2005 as it was a dominant player (60% of the daily transactions). However, according to ONDRUS *et al*. (2009), "the payment process was not simpler and faster than the use of the traditional PostCard."

23 According to ARANGO & TAYLOR (2008), the costs for merchants of accepting payment instruments for a $36.5 transaction are $0.25 for cash, $0.19 for a debit card and $0.82 for a credit card.

24 We choose to organize our description of the business models according to the forms of cooperation that can emerge between MNOs and banks, instead of analyzing mobile payments

Before describing the different cooperation models, we start by discussing how a mobile payment solution can be organized. A mobile payment solution may involve three different inputs: i) a mobile phone, ii) a bank account, and iii) a payment platform. As we consider mobile payment solutions based on mobile phones, the mobile phone is an essential input. However, the bank account and the payment platform are not essential inputs, since mobile payment solutions can be prepaid and target niche markets with few affiliated merchants. Up to now, each of these inputs has been controlled by a key player. Mobile network operators (MNOs) and mobile handset manufacturers have control over the design and distribution of mobile phones, as the former commercialize the phones at subsidized prices in their commercial agencies and own the SIM card, while the latter produce the phones. Banks have control over their consumers' accounts. And, finally, payment platforms like Visa or Mastercard have control over large acceptance networks.

The adoption of a business model for a mobile payment solution involves the choice of how much to depend on these three key players. First, a solution can be developed without the cooperation of MNOs and mobile phone manufacturers. For instance, the payment application can be resident on a separate memory card. Second, the mobile payment solution could be based on the payment card of the consumers, in which case the provider does not need a direct and strong cooperation with the banks in order to have access to the consumers' bank accounts. For instance, Obopay allows consumers to add money to their Obopay account with their debit or credit cards, and then send money to relatives or merchants with their mobile. Though Obopay proposes its service to banks, it has been developed without their direct cooperation. However, Obopay has decided to cooperate with a large acceptance network (MasterCard).[25] Third, a mobile payment service provider could develop a solution without the cooperation of existing payment platforms (like Visa or Mastercard) if it decides to target a niche market. For instance, the provider could limit the acceptation of its payment solution to vending machines (like Mobilkom A1 in Austria) or to a few

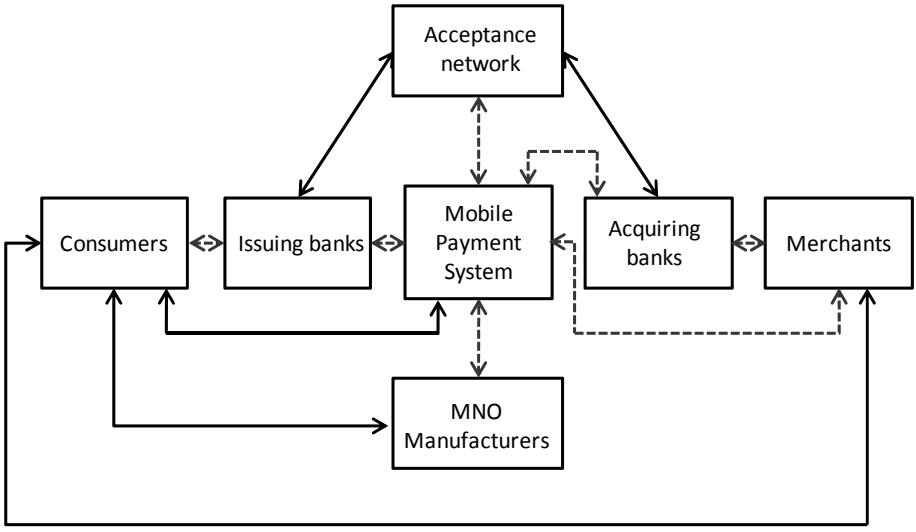
as a strategic substitute to the existing payment instruments (cash, check, debit or credit card, etc.). Whatever the form of cooperation, mobile payments can substitute with any existing payment method.

[25] Obopay does not only provide mobile phone payment services, but also card payment services, thanks to its partnership with MasterCard. As a result, the consumers can use their Obopay card to have access to the existing ATM networks in which MasterCard cards are accepted.

affiliated merchants (like Obopay, which targets mainly P2P transfers but proposes merchants to affiliate to the system at no fee).

The following figure represents the economic relationships between the different players which might be involved in a mobile payment solution. The solid lines represent the existing economic relationships, whereas the dashed lines represent economic relationships that might either exist or not. For instance, as we explained above, a mobile payment solution might be developed without the cooperation of MNOs or handset manufacturers if it is an application that is installed by the consumers on their mobile phones. Similarly, the mobile payment service provider can bypass issuing banks and the payment platform if it tries to affiliate directly consumers and merchants.

Figure 1 - Economic relationships between the players involved in a mobile payment solution



Since each of the three key players (banks; mobile network operators or mobile phone manufacturers; payment platforms) can be bypassed or not by the mobile payment service provider, we have *a priori* six different possible business models. We consider that there are different degrees of dependency or cooperation between the mobile payment service provider and the key players. Full dependency takes place when they either form a joint venture or integrate vertically, or when one of the key players is the initiator of the service. The table below gives five possible business models and provides some examples for each model.

Table 6 - Five business models for mobile payment services

	Degree of dependency or cooperation with a…		
	Bank	Mobile network operator or mobile phone manufacturer	Payment platform
Light model	Weak	Weak	Weak
Examples	- Obopay (*) in the US: consumers use their payment cards to add money on their Obopay account, and can use any mobile phone. Obopay targets the niche market of P2P payments. - Amazon Mobile Payments Service (MPS): consumers make a purchase on an affiliated merchant's website with their mobile phone using the Amazon MPS and a pre-registered debit or credit card. Amazon MPS targets the market of Internet payments. - Other examples include mpayy in the US or PayPal Mobile Payments.		
Mobile-centric model	Weak	Strong	Weak
*Example*s	- The initial mobile prepaid solution proposed by NTT DoCoMo in Japan corresponds to the mobile-centric model. - In the mobile-centric model, we also find the bill-to-carrier model, where service providers charge consumers on their mobile bill. For instance, Zong and Boku sell digital content and virtual goods in online games and charge on the mobile bill (**) - The Vodafone/O2 payment service in Germany (***)("mpass") is a combination of the established direct debit system and of a text message confirmation system, which targets online payments.		
Bank-centric model	Strong	Weak	Strong
Examples	- In the bank-centric model, banks develop a mass market mobile payment solution without the cooperation of MNOs and mobile phone manufacturers. - An example is the MOVO service of Caisse d'Epargne in France, a payment service by SMS which has been available between 2006 and 2009.		
Partial integration model	Strong	Strong	Weak
Examples	- The partial integration model takes place when there is a strong link between a bank and an MNO. - For example, an MNO can create or integrate with a bank. This corresponds to the payment solution developed by Mobilkom in Austria. The incumbent mobile operator, Mobilkom, created a bank subsidiary (A1) and restricted its mobile payment solutions to vending machines. - On the other side of the coin, a bank can create an MNO. For instance, Rabo Mobile is a service provided by a Dutch bank, Rabobank, which combines a mobile communication service and a mobile payment solution.		
Full integration model	Strong	Strong	Strong
Examples	- For instance, the full integration model corresponds to a situation of vertical integration over the value chain, where a single company provides mobile services, payment services, and has access to a large acceptance network. One example is the mobile operator NTT DoCoMo in Japan, which acquired a bank and a large retailer. - Another potential example of the full integration model is the setting up of a joint venture between banks, MNOs, and a payment system.		

(*) See footnote 13 for a presentation of Obopay.

(**) The mobile operator takes a relatively large share of the transaction, which shows that the service provider is strongly dependent of the mobile operator. For instance, in the US, carriers are said to take 50% or more of the transaction, whereas in Europe, they take around 25% (see: "A Bad Connection for Mobile Payments", http://www.mpayy.com/news/2009/12/02/a-bad-connection-for-mobile-payments/).

(***) See: http://www.vodafone.com/start/media_relations/news/local_press_releases/germany/germany_press_release/o2_and_vodafone_launch.html

The last possible business model corresponds to a situation where the mobile payment service provider owns a bank or is a bank, but bypasses the MNOs and the payment platform. We consider that this model is not relevant, as banks have strong incentives to develop a mass market solution, which would require cooperating with a payment platform, or developing one.

These different models involve different degrees and forms of cooperation. The "light model" involves the lowest degree of cooperation with other players. However, it is easier to implement as the barriers to entry are lower, and it seems the most common. The strategy adopted by mobile service providers in this model consists mainly in targeting niche markets and builds on the existing infrastructure for the payment process. This model is consistent with the literature on payment systems: as noted by CHAKRAVORTI & LUBASI (2006), "payment innovations are generally more successful when they utilize existing infrastructure and initially target profitable niche markets." However, one of the problems faced by the service providers is the affiliation of consumers and merchants. This may explain why this business model is often adopted by cyber merchants like Amazon.com or online payment services with wide coverage like PayPal. These players have indeed already access to a large acceptance network because of the scale of their activities. The "bank-centric" and "mobile-centric" models involve a strong partnership with either a bank or a mobile operator (or a handset manufacturer). For instance, some banks have tried to launch mobile payment services on their own, such as Caisse d'Epargne in France between 2006 and 2009. Also, the mobile-centric model includes the payment applications that are developed by start-ups to purchase digital content, such as Zong and Boku. However, these companies depend on a strong partnership with the MNOs as the content is charged to the consumer through reverse-billing.

Finally, the "partial-integration" and "full-integration" models involve strong relationships between different players. These relationships are costly to establish, but may generate substantial benefits for the participants, in terms of cost-sharing or synergies. The low number of strong partnerships between banks and MNOs can be explained by the cost of coordination between players which have different objectives[26] and incentives to develop

[26] The literature on research joint ventures (RJVs) indeed suggests that asymmetries between members of an RJV make the RJV less likely to succeed. See, for instance, RÖLLER *et al*. (2007).

mobile payment solutions. If they develop mobile payment services, MNOs would be new entrants in the payment industry. In contrast, banks are incumbents in the payment market, and therefore could view mobile payments as an improvement over other payment solutions that they commercialize (like payment cards). Therefore, banks could face a "replacement effect" for the development of mobile payments. Hence, their incentives to develop mobile payments might be lower than the incentives of MNOs, except that they could have high preemption incentives to protect their market share from an entry threat.

■ Conclusion

In this paper, we analyze mobile payments as an innovation in developed countries. Our main contribution is to define five cooperation models for the development of mobile payment solutions: the light model, the bank-centric model, the mobile-centric model, the partial-integration model, and the full-integration model. Though they seem necessary to target the mass market, we argue that the partial- and full-integration models are more costly to implement, in particular due to the industry cost structure, which involves high fixed costs and low marginal costs. On the other hand, the proliferation of mobile payment solutions with the light model (or with the bank-centric and mobile centric-models) might restrict mobile payments to niche markets.

The development of a mass market for mobile payments through the partial- or full-integration model might require the setting up of joint ventures between banks and MNOs. More research is needed to understand the players' incentives to cooperate, and the adequate public intervention to foster innovation in payment systems. In particular, factors pertinent to transitioning from light to integrated models deserve a separate study. Our view is that research should focus on determining the appropriate public intervention to reach the socially optimal level of innovation in payment systems. For instance, should public authorities encourage the building of RJVs by exempting some competitors from antitrust laws (e.g., by allowing interchange fees for innovative payment solutions)? Or, should mobile payment operators comply with the various banking regulations that are designed to ensure stability of payment systems?

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