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

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Abstract

In this paper, we study the development of mobile payments as an innovation in developed countries. In particular, we introduce five cooperation models that have emerged or could emerge between banks, mobile network operators, and payment systems, for the development of this new payment method. We also discuss the regulatory issues posed by the presence of mobile operators in the payments market.

Keywords: mobile payments; payment systems; mobile banking; mobile commerce.

JEL Codes: E42; G21; L96.

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1. Introduction

Since its introduction in the 1980s, mobile telephony has developed rapidly. In 2009, worldwide, about two third of the population had access to a mobile phone.¹ Besides, 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 it were in Sweden just 10 years earlier.²

Today, due to their widespread adoption, mobile phones are 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 in 2012.³ Usual arguments in favor of mobile payments are that in developed countries, mobile users are accustomed to make micro payments with their mobile phones to purchase digital content (e.g., ringtones or games⁴) or applications (e.g., for iPhones or Android mobile phones) and that in developing countries, the very poor quality of existing payment solutions creates a room for mobile payment solutions.

The economic impact of mobile payments will however 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 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 more mobile phones than payment cards. 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 competition with existing payment instruments.

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.

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).

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	China	0,5	1,3
Canada	0,7	3,4	India	0,3	0,1
United Kingdom	1,3	2,4	Thailand	0,9	0,6
France	0,9	2,3	Poland	1,2	0,8
Australia	1,1	2,5	Colombia	0,9	0,5
Sweden	1,2	0,8	Morocco	0,7	0,1 (est.)
Japan	0,9	6,0	Nigeria	0,4	0,0 ⁵

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.

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 manage to 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

⁵ 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>

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.

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 first section, Section 2, we start by defining mobile payments and by analyzing which markets could be targeted by mobile payments service providers. In Section 3, 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 consumers' incentives to adopt it. In Section 4, we introduce our five models of cooperation between banks, mobile network operators, and payment systems. Section 5 is devoted to a discussion of regulatory issues. Finally, we conclude.

2. A definition of mobile payments

In this section, we start by defining mobile payments. Then, we introduce some examples of mobile payment services. Finally, we analyze the potential markets that could be targeted by mobile payment service providers.

a. Mobile money transfers

Mobile payments are generally defined as the process of two-parties exchanging money 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 B2B, B2C, C2C, or 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 day, as we will argue latter 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 (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 Teller Machine (ATM) via contactless technologies (e.g. Bluetooth, IrDA, RFID, Near Field Communication).¹⁰ For this purpose, the mobile

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 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.

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

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 an independent payment instrument. For instance, the carrier can be the mobile phone handset, or a contactless payment card. But one could also imagine the chip to be embedded in a key ring or even in jewels. 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.

b. Examples and main players.

Mobile service providers can intervene at different stages of the payment value chain. Traditionally, the value chain of the payment industry is dominated by the financial institutions. For instance, the value chain of a card transaction comprises the cardholder's bank (the issuer), the merchant's bank (the acquirer), the payer, the payee, the payment system (which manages the authorization network), the clearing and settlement house, the transaction processors, and sometimes other service providers. For mobile payments, the value chain is more complex, as it might also involve Mobile Network Operators (MNOs), mobile handset manufacturers, and other independent service providers, that can design specific applications for money transfers.¹¹ Some mobile payment solutions require cooperation between banks and MNOs, other solutions, such as reverse billing, can be implemented by the MNOs without support from financial institutions, and finally some solutions -like contactless payment cards- can be developed without the cooperation of MNOs.

We start by giving a few examples of players that operate in the field of mobile money transfers, to help us draw a clearer picture of the current situation. In developed countries, the main examples of success of Mobile Network Operators for the provision of payment services can be found in Asia, mainly in Japan and Korea, where there has been a mass adoption of contactless technologies. In Japan, the diffusion of contactless technologies started in 2004, when NTT DoCoMo launched the FeliCa handset (a contactless RFID smartcard, which was a prepaid service). Afterwards, NTT DoCoMo evolved to buy a bank and offer a credit card contactless service through the mobile. NTT DoCoMo managed to increase the number of acceptance points, first by subsidizing

wireless connectivity technology that evolved from a combination of existing contactless and interconnection technologies.

¹¹ In the case of e-commerce, the transaction may involve several intermediaries: the carrier (who transports the service), a first intermediary who acts as a broker between carriers, service providers and financial institutions (a "broker"), and another second-tier intermediary called the aggregator (who manages the various payment options that are available on the merchant's website). Aggregators can also intervene in the case of prepaid cards, to aggregate small value transactions.

merchants to be equipped with the technology, and second by integrating vertically with a large retailer.¹²

In other developed countries, the market for mobile money transfers did not develop as fast as expected for several reasons, one of them being the lack of cooperation between banks and MNOs. Some banks have launched mobile payment services (like Caisses d'Épargne in France with the MOVO system,¹³ or Rabobank in the Netherlands, that bought a MVNO). The case of Austria builds an interesting example, as Mobilkom, the main Mobile Network Operator, created a bank named "A1" in 2003 to manage its mobile payment solution "Paybox," which was launched in 2001. In 2007, 300,000 persons had subscribed to the service in Austria, and Paybox was accepted in 40,000 POS. The bank had to manage 10 million transactions a day.¹⁴ The success of "Paybox" in Austria can be explained by a partnership, that Mobilkom managed to build with the railway society OBB for the issuing and the payment of train tickets.

Online companies like PayPal, Amazon Payments and Google Checkout, have also developed mobile payment services, which require the consumers to register with a PIN before making an operation. For instance, mobile payment solutions are part of the multiple options that are offered to PayPal account holders, who have the flexibility to pay using their account balances, their bank accounts, their payment card or their mobile phone.¹⁵ The existing payment card systems have also encouraged the development of contactless payment cards, which are another sort of contactless devices. In the United States, for instance, the major card networks (Visa and MasterCard) have invested in contactless technologies, such that some analysts estimate the number of contactless payment cards at around 27 million. Some large merchants such as McDonald's and Wal-Mart have invested in RFID infrastructure, and more than 40,000 US merchant locations accept contactless payments.¹⁶

The picture is completely different in developing countries, where a large proportion of the population is unbanked. The lack of banking infrastructure combined with a high rate of mobile phone penetration and the importance of remittances provide a fertile ground for the development of mobile money transfers. According to the World Bank, the market for remittances totaled \$420 billion in 2008, of which \$338 billion went to developing countries.¹⁷ As mobile operators have been able to offer transfer services at a lower price than several traditional transfer agencies, the use of mobile phones for international money transfers has increased over the last years. For instance, in Kenya, Safaricom, an affiliate of Vodafone, launched a service called "M-Pesa" to enable its subscribers to complete simple financial transactions (send money, deposit and withdraw cash, or transfer/receive money to/from the United Kingdom) using their mobile phone. According to the

¹² This raised the number of merchants equipped with the technology from 140 shops to 7,000.

¹³ Caisse d'Épargne stopped its Movo service in October 2009 due to low transaction volumes (see: <http://www.movo.fr/cloture.html>).

¹⁴ Presentation at the NFC Forum of Dr Christoph Koessler: "NFC evolution in SMS based ticket and payment services."

¹⁵ Source: PayPal website (2009). The PayPal service is currently available in 190 markets and 19 currencies. It has more than 78 million active accounts worldwide

¹⁶ Source: "Smart cards in the US: Contactless Payment Cards," report, Rockville, MD, May 1; Chicago Fed Letter July 2007, Number 240, "Are mobile payments the smart cards of the aughts?" by Katy Jacob.

¹⁷ Source: "Migration and Remittances Factbook," 2008, The World Bank.

manager of Safaricom, though 38% of the population is unbanked in Kenya, more than a half of the population has a mobile phone. By October 2009, Safaricom had reached a total of 7.5 million subscribers.¹⁸ Other examples of players in developing countries include Little World in India, Celpay in Zambia and DR Congo, or Wizzit in South Africa. It is interesting to note that some of these initiatives have been very successful, such as the launch of M-Pesa in Kenya, or the solutions offered by the two mobile operators of the Philippines,¹⁹ but that these experiences cannot be easily generalized. For instance, Vodafone launched the M-Pesa service in Tanzania, but it was much slower to take off.

c. Which market for mobile payment solutions?

In this paragraph, we review the potential markets that could be targeted by mobile payment service providers. First, 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.

¹⁸ Source: Safaricom, press release.

¹⁹ The SmartMoney service from Smart Communications and the GCash service from Globe Telecom offer services to an estimated 5.5 million customers. Source: CGAP.

Table 3: Some figures about the unbanked in developed and developing countries.²⁰

	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).

To understand if mobile payment service provider could 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 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. In prepaid markets of developed countries, mobile prepaid services would have to compete with the existing prepaid card solutions. For instance, in the US, payroll cards enable employees to receive deposits from their employers, convert them into cash, or pay at the point of sales. According to the Federal Reserve Bank, a substantial number of prepaid cards are private-label and their transaction volume would increase the number of card payments by 6% nationwide.²¹ 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, as we will see in the last section of this paper, regulators often decide to impose a limit on the maximum amount that can be prepaid.

²⁰ For less recent but more comprehensive data about access to financial services, see Beck et al. (2007).

²¹ Source: Federal Reserve Bulletin, volume 94, 2008.

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, this shows that it would be erroneous to assimilate too quickly 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. A survey by FSD Kenya shows that early adopters of M-Pesa were more likely to be banked, and that the existence of bank branches or agent branches is vital to the expansion of a mobile payment service.²²

Table 4: Main reasons given for not having a bank account.²³

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

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. Obopay is a payment application that enables consumers to purchase, pay and transfer money using their mobile phones. It works with any mobile phone and any carrier, and offers P2P payment services, prepaid services, quick payment solutions for online games markets and family account solutions. It has a partnership with MasterCard for P2P payments, and in March 2009, Nokia, the mobile handset manufacturer decided to take a \$35 million share of the company. Interestingly, Obopay decided to launch a subsidiary in India in March 2008, for payments and cross-border remittances. In 2007, in India, the remittances corridor from the United-States reached \$9

²² See: "What makes a successful mobile money implementation? M-Pesa in Kenya and Tanzania," FSD Kenya report (2009).

²³ Source: World Bank Research Report "Finance for All?" (2008).

million, while India was the largest receiver of remittances, with a total of \$27 million. The analysis of the existing electronic payment systems, such as payment card platforms, reveals the need to collect large transaction volumes, which are generally obtained by affiliating large retailers, to pay off their investments in infrastructure and security. The Obopay case shows that the remittances market could play this role for mobile payments, while enabling mobile service providers to target niche markets in developed countries at a lower cost.

Second, mobile payments could 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. If they do not develop mobile payments themselves, banks may view the development of mobile payments as a threat, and therefore may have an incentive to retard the adoption of this innovation.

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 payment instruments. It is for instance interesting to note that electronic wallets have not been much of a success in many countries.²⁴ This example shows that the adoption of payment innovations depends on a complex set of variables that we will try to analyze in the next section, for developed countries.

3. Mobile payment devices as an innovation in developed countries

In this section, we argue that, in developed countries, mobile payments can be viewed as an innovation in the retail payments market. We study the players' incentives to innovate and deploy mobile payment solutions, and the incentives of consumers and merchants to adopt this payment method. From now on, we restrict our analysis to the case of developed countries as the business case for mobile payments in emerging countries is very different. The issue of mobile payments in developing countries would deserve a separate study that is beyond the scope of this paper.

a. Characteristics of payment systems

The retail payments market exhibits some characteristics that must be taken into account in our analysis of the players' incentives to innovate. Usually, the economic literature stresses the two-sided nature of retail payment systems. Retail payment systems are indeed characterized by membership and usage externalities between two distinct groups of users, the consumers and the

²⁴ 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.

merchants.²⁵ 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.

Payment systems are also characterized by the presence of economies of scale and network effects, which gives strong incentives for standardization and cooperation between competitors. The example of payment cards shows that the building of a joint-venture can considerably reduce the costs of incompatibility between different standards. Also, joint-ventures take advantage of network effects when trying to affiliate consumers and merchants, which increases their probability of success.

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

b. Incentives to innovate

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.

As mobile operators are not active in payment markets, cost reduction is not a motive for developing mobile payments. The second potential motive, increasing their revenue streams, is a strong incentive for mobile operators. Indeed, mobile markets in developed countries have reached saturation levels, and operators are looking for new revenue channels. Providing their customer with innovative payment solutions might be a means for mobile operators to enhance their revenues, either by increasing customer value (with additional services) and/or taking a share of payment revenues (issuers' profits, merchant fees, etc.). The third motive proposed by Chakravorti and Kobor,

²⁵ For a review of the literature on two-sided markets applied to payment systems, see Verdier (2006). For a definition of two-sided markets, see Rochet and Tirole (2006).

customer acquisition, does not seem to be very important as mobile markets are mature. Finally, customer retention might be an important motivation for MNOs. Indeed, it is sometimes argued that banks' customers are stickier than mobile users.²⁶ Therefore, mobile operators might view mobile payment services as a means to increase their customer loyalty and to reduce churn.

From the banks' side, cost reduction might be an important motive to develop mobile payments. Indeed, mobile payments will involve lower handling costs relative to cash and checks if they substitute with cash or check. However, if mobile payments substitute mainly for payments by card, the potential for cost reductions seems limited. Second, banks might increase their revenues with the development of mobile payment services. This will depend on whether mobile payment services generate incremental benefits to consumers or merchants relative to existing payment instruments. Mobile payment services might also provide larger possibilities of differentiation to banks, which might soften competition. Third, mobile payments might help banks to attract new customers, however as we noticed previously, the unbanked consumers might be difficult to capture in particular because they have a low willingness to pay for payment services. Fourth, banks might be forced to develop mobile payment services to protect their market shares in the market for deposits, due to the entry threat of MNOs or nonbanks like PayPal or Google. The following table summarizes this analysis.

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 (see footnote 26)
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	-

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 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

²⁶ In France, the churn rate for the bank "Crédit Agricole" was estimated at 7.58% in 2006 (Source: Retail Banking Sector Inquiry, response of Crédit Agricole, 2006). The French telecommunications regulator, Arcep, considers that the churn rate in the mobile market is greater than 20%.

operators and nonbanks, there could be coordination costs. Third, there is yet some regulatory uncertainty about mobile payments, which may lead players to wait.

If banks and MNOs do not cooperate in the development of mobile payment solutions,²⁷ there is also a cost for 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 current accounts would be probably prohibitive, and therefore prepaid solutions look 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.

c. Incentives to adopt

The success of mobile money transfers depends on the users' incentives to adopt the new technologies. As regards proximity payments, the consumers must find it valuable to substitute contactless payments to the existing payment instruments such as payment cards, checks or cash, while the merchants must invest in appropriate POS readers and devices that enable them to accept contactless payments. For merchants and consumers, the added value of contactless payments at POS rests on convenience and speed of transactions. As shown by the Visa and MasterCard surveys, contactless payments enable them to save between 8 and 10 seconds for each transaction at the POS. However, consumers and merchants may have to choose between several competing technologies for contactless payments. Mobile phones potentially hold a significant advantage over contactless cards in the area of paperless two way communication, provided that the service providers implement user-friendly solutions. Card-based models do not allow for the sending, receiving and presenting of information, as mobile devices have now the ability to act as small-scale computers. A mobile payments platform can integrate payments, banking, real-time two-way data transmission, and provide recordkeeping software for budgeting purposes. The same cannot be said of cash, checks or cards.

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. As shown by a survey conducted by Capgemini Consulting in Germany, the consumers trust banks more when it comes to the provision of mobile payment services, and consumers would prefer to receive mobile payment offers from banks rather than third party processors.²⁸ Also, the price of the existing payment instruments is rather low for the consumers, which means that contactless payment service providers must at least undercut the price of the existing payment solutions, assuming that the quality of service remains constant from the consumers' perspective. 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

²⁷ See the next section for a discussion of the different cooperation scenarios.

²⁸ The results of the survey show that 62% of consumers in Germany prefer to receive mobile payment offers from financial institutions, while 27% of the consumers expected a mobile operator to offer the service.

it to be widely available.²⁹ The incentives to adopt mobile devices for remote money transfers depend on the price of the service and the existence of alternative methods that could serve as substitutes. For P2P payments, the existing electronic payment instruments do not enable consumers to exchange money, which may provide a niche for mobile money transfers in developed countries. For online markets, the inherent connectivity, ubiquity, and near real-time verification capability of mobile devices (via SMA, WAP or IVR) may provide mobile payments with a competitive edge over the existing payment instruments. If the mobile payment solution does not provide any value to the existing payment solution for consumers, 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.³⁰

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 or mobile couponing. 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. According to a study conducted by Cybersource in May 2004, cyber merchants who offer multiple payment instruments to their consumers have more visitors convert into customers than merchants who offer a single payment method (72% as against 60%).³¹ For proximity payments, the merchants have to be convinced that there can be any return on investment in upgrading POS, or enhancing their electronic payment solutions.³² 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. Large proximity stores, such as supermarkets, may find that the increase in the speed of the transactions due to contactless technologies is an opportunity to increase their sales, and to offer a better quality of service to the consumers. For small retailers, the incentives to adopt contactless technologies are less obvious, especially in the current environment, which is characterized by the battle between banks and retailers over the credit card fees. 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 and Tirole (2002)) predicts indeed that the merchants may be ready to pay for a higher fee than the benefit they obtain of accepting a payment instrument because of the strategic interactions between merchants on the retail markets.

²⁹ 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).

³⁰ 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."

³¹ See: Cybersource, "The Insider's Guide to eCommerce Payment," May 2004, http://www.cybersource.com/news_and_events/view.php?page_id=1272.

³² According to Arango and 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.

4. 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.

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 day, 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. Another example is the payment solution developed by the start up Square, which has been launched by the former CEO of Twitter. This solution is based on a plastic device that plugs into the mobile headphone jack, hence, it is completely independent of MNOs or manufacturers.³³ 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 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).³⁴ 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 acceptance of its payment solution to vending machines (like Mobilkom A1 in Austria) or to a few affiliated merchants (like Obopay, which targets mainly P2P transfers but proposes merchants to affiliate to the system at no fee).

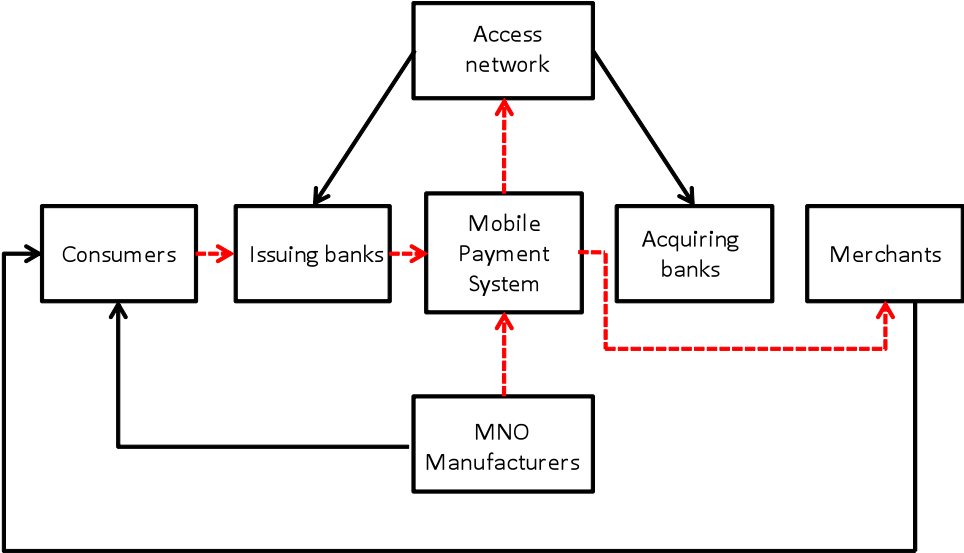
The following figure represents the economic relationships between the different players which might be involved in a mobile payment solution. The solid lines represent the existing

³³ See: Mark Milian, "Twitter Creator Wants to Give Away Square, His Credit Card Payment Gadget," *Los Angeles Times*, December 2, 2009.

³⁴ 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.

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. 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.

Table 6: Five business models for mobile payment services

	<i>Degree of dependency or cooperation with a...</i>		
	Bank	Mobile network operator or mobile phone manufacturer	Payment platform
Light model	Weak	Weak	Weak
<i>Examples</i>	<ul style="list-style-type: none"> - 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 niche market of Internet payments. - mpayy: consumers open a mpayy account and link this account to their bank account to make purchases or money transfers. This service targets the niche market of Internet and mobile commerce in the US. - The PayPal Mobile Payments service uses a link to the consumer's bank account or its debit or credit card for money transfers and online payments. It targets the niche markets of P2P payments and Internet payments. 		
Mobile-centric model	Weak	Strong	Weak
<i>Examples</i>	<ul style="list-style-type: none"> - 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.³⁵ - The Vodafone/O2 payment service in Germany³⁶ ("mpass") is a combination of the established direct debit system and of a text message confirmation system, which targets online payments. 		

³⁵ 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 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/>).

³⁶ See: http://www.vodafone.com/start/media_relations/news/local_press_releases/germany/germany_press_release/o2_and_vodafone_launch.html

Bank-centric model	Strong	Weak	Strong
<i>Examples</i>	<ul style="list-style-type: none"> - 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'Épargne in France, a payment service by SMS which has been available between 2006 and 2009. 		
Partial integration model	Strong	Strong	Weak
<i>Examples</i>	<ul style="list-style-type: none"> - The partial integration model takes place when there is a strong link between a bank and a MNO. - For example, a 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 a 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
<i>Examples</i>	<ul style="list-style-type: none"> - The full integration model corresponds to different potential or existing situations. - Vertical integration over the value chain, such that 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. 		

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 is consistent with the literature on payment systems: as noted by Chakravorti and 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). Banks have gained a great deal of experience in operating mass-market payment systems, which might be critical for a wide adoption of a mobile payment solution. They also have experience in risk and fraud management that other players, like MNOs, do not have. That is why some banks have tried to launch mobile payment services on their own, such as Caisse d'Épargne in France 2006 and 2009. In contrast, MNOs have control over the distribution of mobile phones and strong partnerships with mobile phone manufacturers which might help to develop payment-enabled mobile handsets. For instance, 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" model 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. Integration models can take several shapes: they might occur either through a strong partnership between banks and MNOs,³⁷ or through the acquisition of a bank by a MNO (A1 in Austria) or the acquisition of a MNO by a bank (Rabo Mobile in the Netherlands, launched by Rabo Bank). The low number of strong partnerships between banks and MNOs can be explained by the cost of coordination between players which have different objectives³⁸ and incentives to develop 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.

5. Regulatory issues

So far, in developed countries, regulators have often tolerated the use of mobile phones for small transactions without requiring any banking license. In several countries, monetary authorities tend to apply regulatory proportionality³⁹ by setting thresholds on the average transaction value beyond which a deposit-taking license or an approval to operate is required. Hence, the exemption of MNOs from banking licenses is justified as long as transaction volumes and transaction amounts remain sufficiently low. Furthermore, when Mobile Network Operators serve as transmission

³⁷ There are some examples of strong partnerships between banks and MNOs for experiments. However, we are not aware of any commercial partnership.

³⁸ 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 (1997).

³⁹ According to the United Kingdom's Financial Services Authority (FSA), "The restrictions we impose on the industry must be proportionate to the benefits that are expected to result from those restrictions. In making judgments in this area, we take into account the costs to firms and consumers".

networks for m-banking services, this should not require a specific regulatory regime. However, depending on their business model, MNOs do not always act as mere transmission networks for all transactions. This raises the issue of the financial regulation of these operators, which could step by step start to face the same risks as banks. For instance, in principle, small transactions which are charged to the consumers by "reverse billing" amount to short-term credit, as merchants are paid immediately, while consumers pay their bills at the end of the month. If mobile payment transactions were to reach higher volumes, mobile payment platforms should be treated as other payment systems, which are subject to the supervision of the regulatory authorities of the area in which they operate, as they may be a source of systemic risk for the economy.⁴⁰

Hence, the decision to exempt MNOs from the banking regulations could be called into question in several ways. First, if mobile payment transactions were to remain at a rather low volume, the regulators could decide to apply different rules for MNOs to ease their entry on the payments market. The threshold above which intervention should be required is not clearly defined in all countries. Let us provide a few examples of the situation that could emerge for instance in Europe. The status of "payment service provider" for nonbanks already exists in Europe, where the Payment Service Directive has been adopted, namely to favor entry on the payments market. Hence, the MNOs could decide to become "Payment Service Providers" instead of opting for a banking license or an e-money license. However, the status of "Payment Service Provider" (PSP) in Europe does not precise if the MNOs should be subject to any capital requirements. This decision is taken by the national supervisor. In France, for instance, the regulator stated precisely that MNOs must ask the national supervisor (the CECEI) the right to enter the payment markets, and it specified the minimum capital requirements needed to become a PSP. If the MNOs were to issue electronic money in Europe, they would fall into the regulations designed for Electronic Money Institutions, and meet the capital requirement of one million Euros. Other areas of the world, including Japan, and the Philippines, have also decided to establish a specific status for Electronic Money Institutions. However, in some countries, such as in Russia, there is no clear supervision of e-money providers.⁴¹ In a second situation, MNOs could decide by themselves to operate as banks, to deal with larger transaction volumes, to enhance their reputation as payment service providers, and to build an expertise in risk management, to which they may fail to have access if they do not cooperate with banks. We examine this option in the following paragraph.

If the Mobile Network Operators wish to operate as banks, they will have to comply with the various banking regulations that are designed to ensure the security and the stability of the financial system. For instance, to obtain a banking license, or to establish a banking subsidiary, the MNOs would have to prove that they are equipped with sound risk management procedures, and that they

⁴⁰ Bradford et al. (2007) identify seven sources of risks linked to the presence of nonbanks in payment systems: operational risk, settlement risk, legal risk, reputational risk, compliance risk, systemic risk, system-wide risk.

⁴¹ For an overview of the regulation of branchless banking in emerging countries, see CGAP focus note n°43, January 2008. There is no supervision of the WebMoney prepaid service in Russia (unlimited amounts can be topped-up, and customer's funds are not protected). In the Philippines, the Central Bank used its regulatory power to supervise GCash and SmartMoney, by requiring transaction caps, and a low cap on the amount that consumers may leave on their virtual account.

meet the regulatory capital requirements. As the management of risk and security is not part of their core business, the MNOs may find it costly to enter the market. The MNOs are not used to providing authentication services, to deal with fraud (operational risk), or to solve disputes between consumers and merchants (legal risk). For instance, they should be able to define who bears the share of risk if the consumer fails to pay for a transaction, whether or not they should provide a payment guarantee to the merchant. Another obstacle is their lack of experience in managing the float that exists between the payment order and the settlement of the transaction (settlement risk). In addition to that, the theory on financial intermediation shows that there are strong complementarities between the provision of payment services and the provision of credit, which is not part of the core business of Mobile Network Operators.⁴² In spite of these difficulties, the choice to operate as a bank has been made by the Austrian company Mobilkom, which runs the mobile payment platform "Paybox." Mobilkom decided to create a banking subsidiary, named A1, in order to deal with their mobile payment transactions. The creation of this banking subsidiary can be explained by the failure to reach an agreement with the incumbent banks in Austria, and by the need to be equipped with adequate risk procedures to deal with high transaction volumes. Hence, this example shows that, despite high entry costs, MNOs could decide to bypass the existing banks and create their own subsidiaries. The design of appropriate laws and regulations will crucially influence the success of mobile payment initiatives. Uncertainties on regulation could slow down the adoption process as the MNOs may decide not to run the risk of investing in a business that could end up being unprofitable (compliance risk).

Finally, the development of mobile payment solutions might generate the need to design specific guidelines for this method of payment. For instance, in the UK, such guidelines have been established and they include: disabling as soon as possible the mobile phone when it is reported lost; requiring the authentication if the transaction value exceeds some amount; etc.

6. Conclusion

In this paper, we have identified 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. We have argued that the partial- and full-integration models are more costly to implement, but that they seem necessary to target the mass market, while the proliferation of payment solutions with the light model (or with the bank-centric and mobile centric-model) 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.

⁴² See for instance Bryant (1980), Leland and Pyle (1977) or MacAndrews and Roberds (1999).

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