Going Cashless at the Point of Sale: Hits and Misses in Developed Countries

Storing value electronically ... sending value electronically ... many people living in developed countries take these things for granted because making electronic transactions are part of everyday routines for them. After all, who would think twice about making a payment or getting cash from a debit or credit card?

Debit cards are indeed becoming a standard payment instrument for people with a savings account. Debit cards have achieved critical mass adoption in most developed countries. Their further spread is mostly limited at this point by three factors:

- The penetration of bank accounts among the population.
- The weak business case for deploying a sufficiently dense network of acceptance terminals (automated teller machines [ATMs] or point-of-sale [POS] devices) in environments with low economic activity or population density.
- The cost of communications underpinning the real-time authorization of payments, in markets with limited communications infrastructure or for very low-value transactions (for which the communications cost as a percentage of the transaction cost may be too high).

These are important limitations in many developing countries, where the spread of banking services and infrastructure is often restricted by socioeconomic stratum and geography. Even in developed countries, these limitations may create niche opportunities for alternative electronic payment (e-payment) schemes to exploit the gap between the informality of cash and the heavier communications infrastructure required for debit cards.

Yet, many initiatives that have sought to push the frontier of electronic money (e-money) and payment devices to drive out cash beyond debit cards have failed, because customers often are not convinced of the need or practicality of these systems. Europe tested the market for these services early on—and collected some high-profile failures in the process, from cash-substituting smartcards in the second half of the 1990s (Mondex, Proton) to interoperable mobile payment platforms in the early 2000s (Simpay, Mobipay).

The more developed markets in Asia—Japan, Hong Kong, Korea, Singapore, and Taiwan—have taken the lead in devising new schemes and are, in fact, meeting with some success. So against overwhelming failures in Europe, we can point tounderwhelming successes in Asia.

Although these developed country experiences may not directly translate into lessons that can be used in developing countries, this paper better informs us about what may or may not be possible and may or may not be different in the developing world context.

There may be factors specific to Asia at play in explaining the more positive experience in Asia—customers’ fascination with new technology, the importance of conveying innovation in the branding strategy of mobile operators, the low penetration of credit cards. Some of the Asian formulas are now finding their way back to Europe. Hong Kong’s success with transit cards (Octopus) is also proving its mettle in London (Oyster). Japanese and Korean operators (NTT DoCoMo [DCM] and SK Telecom, respectively) are slowly proving the benefits of mobile phones with very short-range communications technologies for use with in-person mobile payments, and many European operators are now anxiously awaiting the spread in Europe of phones with embedded NFC capabilities.

---

1 We use the term “very short-range communications” to include infrared, radio frequency identification (RFID) or near-field communications (NFC) technologies.
This paper reviews some of the bigger failures and some of the more promising experiences in the use of smartcards and mobile phones as payment platforms in developed countries. We selected just a few examples—from dozens of possibilities—and did not delve into much detail on any given scheme. Beyond telling the stories of these ventures, our objective is to extract some lessons behind the failures and the successes. Although these developed country experiences may not directly translate into lessons that can be used in developing countries, this paper better informs us about what may or may not be possible and may or may not be different in the developing world context.

**A Look at Three Broad Approaches**

We discuss three broad approaches, and in each case we look at two providers who met different degrees of acceptance in the marketplace. Although our primary interest is with payment through mobile phones, we start with two cases that use smartcards, because these share many of the same characteristics and issues as payments through mobile phones.

**Smartcard-based electronic-cash providers**

Mondex was a stored-value smartcard that allowed users to make low-value, in-person payments. It could be loaded from regular bank accounts at specially equipped terminals, and value was stored on the card itself without back-up in a server, which made much faster, offline payments possible. Taking on cash in its home front—at the shop—proved too much. Customers failed to appreciate strong advantages over paying in cash and remained concerned about the security and reliability of the new system. Mondex debuted with much fanfare in several countries, and then languished.

Octopus is also a stored-value smartcard, but it was launched with a much narrower ambition: as a public transport ticketing system. It excelled at this niche application, in no small part helped by very favorable ticket pricing schemes. Now Octopus is growing out of the subways and ferry stations where it developed and is becoming an accepted form of payment at many retail establishments. This model is being replicated by mass transit consortia in many countries.

**Mobile operators facilitating existing payment instruments**

Mobipay was an attempt by mobile operators in Spain to establish the mobile phone as a virtual wallet—the single interface through which people could access any of their usual payment mechanisms. By integrating the wallet into the phone, the latter would emerge as an ever more personal and personalized expression of the mobile operators’ service. Unlike Mondex and Octopus, Mobipay did not require customers to accept a new form of payment (although it did add the option of operator billing). It simply sought to change how users accessed their existing payment options. But even this proved difficult: Mobipay failed to spur sufficient interest, and only a small share of customers saw enough benefit to actually try the system (beyond using it as a mechanism for electronic airtime top ups).

SK Telecom in Korea followed a similar approach, but simplified the procedure for customers: it focused on enabling credit card payments only. It used contactless capabilities so that phones could communicate directly with merchant terminals.

---

2 In Europe, the other more substantial e-wallet schemes are Belgium’s Proton, the Dutch Chipknip, Austria’s Quick, Germany’s GeldKarte, and Sweden’s CashCard. In Asia, other noteworthy initiatives include CashCard in Singapore, Touch ‘n Go in Malaysia, and Chunghwa Telecom’s emome in Taiwan.
simply by waving them over the terminal, thereby reducing the need for cumbersome data entry by users at POS. It also permitted offline transactions by storing credit card details directly in a special chip on the mobile phone. This functionality came at a price: it took a long time before it was interoperable with other POS terminals, and it required special phones, which slowed take-up. But more fundamentally, the value to customers of not carrying a card in addition to a mobile phone remains unproven.

Mobile operator-centric payment schemes

The leading mobile operators in Europe sought to go beyond channeling customers’ payment instructions. They devised a scheme called Simpay to put their own billing platforms at the heart of a new small-value payments system. Goods purchased through a mobile phone or a personal computer (PC) would be billed to the customer’s mobile operator account (prepay or postpay). By bypassing traditional bank and credit card payment instruments, participating operators sought to lower the cost of such small payments, while at the same time strengthening their direct customer billing relationships.

Learning from the Mondex experience, they initially targeted online payments where cash is not an option. Its use as a cash substitute would then emerge naturally over time as customer familiarity with Simpay grew. Simpay never had the opportunity to test its proposition with customers. It failed to navigate through the increasingly diverging strategic interests of its own backers, and the multioperator, pan-European nature of the service proved more technically complex than the market opportunity justified.

In Japan, the leading mobile operator, DCM, also sought to create an operator-centric transactional and payments ecosystem, but it exerted a much tighter degree of control over the platform, focusing not on interoperability with other operators but on domestic payments. It also sought to increase the customer’s payment options. The service, Osaifu-Keitai, allows customers to charge goods and services to their mobile bill, against DCM-backed e-money, or to DCM- (and third-party) issued credit cards. DCM understood the importance of driving acceptance of the service with both customers and merchants, and it developed a sophisticated ecosystem-building strategy. Nevertheless, customer take-up and especially use remains relatively low.

Back to debit and credit cards

Is the track record of introducing new retail e-payment instruments and devices in developed countries really so bland, if not bleak? Not at all. Consider the inexorable rise of credit cards in the United States in the 1980s and the catch-up with debit cards in Europe in the 1990s. These payment cards have largely replaced checks. They are fast becoming the real competitors with cash today in physical (in-store) payments, and they dominate in remote payments (using the phone or Internet).

Bolt and Humphrey (2007) report that store-value cards accounted for just over 1 billion euros in payments across 11 European countries in 2004 (by which time their novelty had largely gone). Yet in that year the value of debit card transactions was estimated to be over 1 trillion euros. Debit cards have indeed morphed into what Mondex hoped to be, and customers now use them for even very small transactions (less than 5 euros).

---

3 Although there is no strict definition for what constitutes small-value payments, they are generally held to be below 10 euros (US$14). Jones (2008) reports that as many as one-third of transactions in Europe are in fact under 5 euros.
Yet the topic of alternative e-payments devices and instruments will keep coming back. We are far from a payments end-game, for two main reasons:

- Debit, and especially credit, cards are still costly instruments. Detailed costing studies of alternative payments instruments in Belgium and the Netherlands reveal that cash is still more economical than debit cards for purchases below 10–12 euros; the cut-off would be higher still for credit cards. Much of the technical literature laments that people do not have adequate incentives to use the most economically appropriate payment mechanism for each type of transaction, which perpetuates the use of cash and pushes more costly alternatives, such as credit cards, instead of promoting the emergence of new very low-cost payment options.

- E-payments are now firmly based on bank systems—credit cards, debit cards, Internet banking. There is a need for electronic instruments that target the unbanked.

So there may be room for a nonbank-based payment instrument that has all the advantages of debit cards at a much lower unit transaction cost. Or perhaps banks will continue to fill the void, finding ways to lower the cost of card transaction processing and launching their own alternative prepaid products. Or, to paraphrase Jones (2008), we will continue to lose the war on cash. Whatever the eventual outcome, we will continue to see no shortage of new technologies and new business models being thrown at the “cash problem.”

Summary: A classification of the payments systems considered

Our six cases (seven, if we include debit cards) are very diverse in their scope, approach, intended applications, and nature of backers. Figure 1 offers a framework to visually represent the major differences along three key dimensions: whether they work from existing bank accounts or new forms of payment (e-money, operator billing), the payment instrument used (card or mobile phone), and whether they are led by individual companies or based on interoperable industry consortia. The position of each scheme within the matrix represents the primary application of the scheme.

---

4 These calculations take into account (i) social costs (i.e., net costs to all parties involved, including customer, bank, and merchant) of the various instruments and (ii) variables costs (i.e., not including the cost of payment terminals and nonscalable back-office infrastructure). See Reits and Winder (2005) and National Bank of Belgium (2006).
Debit cards are just a method for accessing liquidity in your normal bank account. Mondex is a new form of liquidity (e-money) intermediated (i.e., sold to users) by banks and linked to bank accounts. Octopus is a self-standing reloadable store-of-value system operated by a single company; it may be topped up through a variety of mechanisms, including through cash machines.

On the mobile phone side, Moneta is primarily a mechanism for mobile-enabling credit card payments (Moneta Chip), although it originally also included an e-money option. At the other extreme, Simpay is a system designed primarily to support operator billing (charging to prepay or postpay mobile accounts) for low-value payments. It constitutes an alternative settlement platform for customer transactions. Mobipay is a mobile wallet service enabling a range of bank payment instruments (debit, credit), as well as operator billing to a limited extent. And Osaifu-Keitai is the broadest in terms of the range of instruments it supports: credit cards, e-money, and operator billing.

A cash substitute: Mondex in the United Kingdom

What is Mondex

Mondex is electronic cash on a card. It was designed to mimic cash, particularly small notes and coins (e.g., micropayments), so transactions with Mondex had to be extremely fast and had to incur no transactions cost. Accordingly, Mondex was conceived as an offline transactional method that does not require clearing systems to support individual transactions. Mondex-type systems are generally called “e-purses.” Many such systems emerged across Europe in the late 1990s: the Proton system backed by Visa in Belgium and the Danmont system in Denmark were other early projects.5

The concept was invented in 1990 in the United Kingdom. Mondex UK was officially incorporated in 1992 by two U.K. banks (NatWest and Midland), and the umbrella company, Mondex International, was established in 1996. MasterCard acquired a 51 percent ownership of this company later in the same year.

How it works

Under the Mondex system, customers are issued a smartcard, which is a plastic card with an integrated circuit or chip from which data can be read and updated by card-reading devices. The chip stores the money value, but this is not linked to any bank account, and the information is not backed up on a server. Thus, the money value is irretrievably lost if the card itself is lost, and the card provides a much higher level of anonymity for users.

Consumers load Mondex value by transferring money from their (separate) bank account using an ATM or a Mondex-enabled telephone, which has a card reader and is connected to the Mondex system. The float is kept by the Mondex issuer (a private company set up by Mondex International in each country), from whom participating banks would “buy” Mondex value to meet their customers’ requirements for Mondex value.

Value can be transferred between two cards by inserting them into the same card-reading device. Most commonly this would be a POS terminal at a store (for transactions between consumers and retailers). It could also be a pocket-sized, dual card-slot consumer device (called a wallet) that enables person-to-person (P2P) transactions. While Mondex was conceived primarily for in-person transactions, with the two cards coming together in a single device, Mondex value could also be

5 This section is based on Clarke (2006), Stalder (1998), and Stalder (2002).
transferred between remote wallets through Mondex telephones. Subsequently, Mondex developed a card-reading device that could be attached to PCs to enable Mondex value transfers via the Internet.

Because the monetary value is stored directly in the card, the card-reading device does not need any communications capability: transactions between cards are final and are not authorized or validated by a third party. There is no password authentication of the card owner. Thus transactions can take place very fast, and no communication cost is incurred. And because the system does not operate from bank accounts, transactions between wallets do not create a need for clearing and settlement systems between banks, and hence there is no back-office cost. Because the value is stored in individual cards, there is no central accounting system. Mondex’s security architecture ensures that value is added to one card at the same time that value is reduced from the other card. The value is stored in hardware (the card’s chip) rather than in software on a server, which offers a higher level of intrinsic security.

The market verdict and lessons learned

Extensive field tests were conducted in Swindon, in the United Kingdom, during 1995–97 and in Guelph, Canada, in 1997–98. Both involved a very strong marketing push to get a critical mass of merchants to take up the card-reading devices. In the Swindon trial, 14,000 cards had been issued by the time the trials were discontinued after 3 years, compared with the uptake of 25,000 cards that had been anticipated for the first year alone (Van Hove 2005). Use of the cards turned out to be much more disappointing. Although this service still lingers in a few countries, it never met much market success.

Customers will adopt a new payment service or technology when (i) it provides clear benefits relative to current alternatives and (ii) they can trust it based on a clear understanding of the risks involved. Mondex failed to convince the public on both grounds.

Utility

Customers are culturally accustomed to using cash, and hence a cash-substitute product does not need to be simply "as good as cash," it needs to be better to justify the switch. The utility of the new payment mechanism can be evaluated on two core fronts: convenience and ubiquity.

- **Convenience.** Users did not find using Mondex faster than using cash. The consensus now is that Mondex went head-to-head against cash in the hardest market—small in-store transactions—without having a clear advantage. It did not offer a very practical solution for the P2P payments market, because it required customers to buy a specialized wallet device. Mondex was subsequently refocused toward online (e-commerce) rather than in-store payments, but in the end it was overtaken by simpler schemes, such as PayPal.

- **Ubiquity.** The usefulness of the card depends on the adoption of card-reading devices by merchants. The customer proposition for merchants is in principle much more tangible than for customers, insofar as it reduces cash handling costs and permits automated accounting of transactions. However, the store will realize these benefits only if a significant proportion of customers adopt the new payment mechanism. Mondex was never able to create enough critical mass of card holders wanting to pay for goods at stores using their Mondex card, with the result that merchants did not push for this form of payment—even if it was in their collective longer term interest.
Risks
Through the trials, customers remained unsure about several aspects of the service. Using Mondex seemed to incorporate substantial risks that people did not have to worry about when using cash.

- **Loss of value.** Although both cash and Mondex value stand to be lost irretrievably, Mondex is electronic and hence more vulnerable to physical damage (notes and coins can survive being run over by a car, for instance) or malfunction. Because the value is not backed up on servers, Mondex could not guarantee restitution of value in the case of a faulty chip, which left customers wondering about the reliability of the system. Mondex was less safe than cash, and even less so than other electronic forms of payment whereby if you lose your card you don’t also lose the balance in your account.

- **Security.** Because Mondex transactions happen offline, are not recorded in central accounting repositories, and do not leave (much of) an audit trail, it is very hard to detect cards that have been successfully tampered with. Thus, the security of the system needs to rely on the chips on the cards being tamper-resistant, without there being much of a possibility of using “fall back” intrusion detection methods. However, no hardware can be made absolutely tamperproof, so security breaches, though unlikely in practice, could have very serious repercussions if they occurred. Thus, despite the high security standards embodied in the Mondex system, it continued to be dogged by questions about whether the security could be ensured long-term.

- **Privacy.** Although it was initially marketed as a completely anonymous transactional system, some transaction details are captured by the card-reading devices. There were concerns by public privacy advocacy groups about the use of such data by merchants (who own the card-reading devices) and by Mondex itself. Mondex was unwilling to disclose exactly what data were being captured, to protect the confidentiality of its security system. Whether justified or not, Mondex was never fully able to shake the public’s perception that information was being captured.

- **Sustainability of Mondex value.** Just what were users who loaded their Mondex card acquiring? Because it is not bank-based, Mondex value, which is issued by Mondex itself, was not guaranteed by participating banks nor did it fall under government deposit insurance schemes. What protection would users get against a potential collapse of Mondex? The answers to these questions were never fully articulated, and customers were kept guessing on the implications to them of a failure of the system. The public distrusted the new form of money, which was only reinforced by the security concerns.

A transit card: Octopus in Hong Kong

**What is Octopus**

In 1979, Hong Kong’s Mass Transit Railway (MTR) launched a prepaid card with a magnetic strip as a ticketing system for use with its rail services. In 1994, Creative Star (renamed Octopus Cards Ltd. in 2002) was formed as a joint venture between MTR and four other public transport operators in Hong Kong to make it an intermodal ticketing system (i.e., including buses, ferries, subway, etc.). The Octopus card, a contactless smartcard based on Sony’s FeliCa chip, was introduced in 1997, replacing the old magnetic strip cards. The card does not need to be physically inserted into a device to be read, which makes payment very
convenient for users in a hurry: all they have to do to pay the exact fare is to swing their purse or handbag near the card reader.

The value is stored securely in the card itself. The card can be personalized for an extra charge with a photo, and personal data can be kept on record. If a personalized card is lost or stolen, the customer can reclaim the remaining value of the card, and the original card will be blacklisted to prevent its use.

Value can be reloaded at transport stations, over the counter, or by feeding banknotes into value-adding machines. More recently, cards also can be reloaded online or at 7-Eleven stores and electronically at ATMs. There is also a convenient automatic top-up option directly from an account (the card is automatically reloaded against a credit card account with HK$250 or HK$500 as soon as the card value falls below zero). There is a maximum value storable on the card (around US$130). The float is held by Octopus Card Limited, and the full value is deposited in banks.

At the time of launch, acquiring an Octopus card required a deposit of HK$50, which created widespread resentment with the new payment mechanism. However, adoption was driven by (i) very rapid conversion of all turnstiles to the new system; (ii) a short phase-out period for the old ticketing system of only 2–3 months; and (iii) a pricing scheme of the only remaining ticketing alternative—a single trip ticket—at a much higher price. This amounted to a compulsory conversion by all transport users, such that within 3 months, three million cards—a number equal to half the residents of Hong Kong—were sold (Siu 2002). Adoption of the card was also helped by a coin shortage in 1997, at the time of the transfer of Hong Kong to China, that resulted from the belief that the older Queen’s Head coins in Hong Kong would appreciate, causing people to hoard the coins.

Although the Octopus card was originally designed as a single-purpose card, Octopus moved to retail payments and launched the Octopus Retail card. In 2000, Octopus obtained a special purpose deposit-taking company authorization from the Hong Kong Monetary Authority to allow it to develop different applications. The use of the Octopus card was subsequently extended first to transport-related areas (e.g., parking, shops at transport terminals) and then, from 2000, to vending machines and unrelated retail outlets. In November 2004, all parking meters in Hong Kong were converted to work on the Octopus card system. Interestingly, taxis do not accept Octopus cards, because Octopus does not have an automatic account updating system, so drivers would have to return to the office every day for accounting purposes. Merchants pay a fee to Octopus for each transaction customers make with their Octopus card.

The Octopus card has also been used for multipurpose ticketing (e.g., combining station car parking, the train ticket, and the ticket to an event into a single fare). The Octopus Rewards scheme, added in November 2005, provided benefits at participating retailers. And in July 2008, Citibank launched a combined contactless Octopus travel and credit card.

The Octopus card is evolving into a multiapplication platform. Personalized cards can be used as a key card for access to residential and office buildings or in a university environment to record student attendance and manage a student’s library loan account. Octopus has also extended the range of physical formats in which it is embodied: Octopus
sells watches and mobile phone covers that function as an Octopus card.

**In the wake of Octopus**

Transit operators around the world are following in Octopus’s tracks. Transactions that could be conducted by the Oyster card, issued by Transport for London, was extended to include low-value purchases at retail stores in January 2006. Transit cards have the potential to go cardless: Oyster payments proved to be the most popular application in trials conducted by Nokia and U.K. mobile operator O2 in early 2008 using new mobile handsets enabled with NFC, with 89 percent of trial participants saying they would like to keep the functionality on their handsets after the trial (Week in Wireless 2008).

Many cities are now adopting smartcards for mass transport ticketing, such as SmarTrip in Washington, D.C.; T-Money in Seoul, Korea; Snapper in Wellington, New Zealand; Suica in several metropolitan areas in Japan; and Easycard in Taipei.

In a similar vein, many e-money cards have emerged out of road-pricing schemes. Singapore’s CashCard was the mandated instrument for road pricing in the island and then expanded to other low-value applications.\(^6\) In the United States (EZPass) and in Australia (e-TAG), drivers rely on smartcards to zip through tollbooths, but that success hasn’t traveled far beyond the highway.

Smartcards with a short-range connection have also been tried in unattended POS environments beyond mass transport systems. Exxon in the United States introduced this capability as a simple key fob (a small device that can be attached to a key chain) with which customers could pay at gasoline stations by simply waving the fob key over the payment terminal.

Convinced of its own success, Octopus created a wholly-owned subsidiary called Octopus Knowledge Limited, to provide international automatic fare collection consultancy services.

**The market verdict and lessons learned**

The Octopus system is now a widely used electronic cash system. By mid-2008, there were over 17 million Octopus cards in circulation (which is more than twice the population of Hong Kong), with more than 10 million transactions, worth HK$85 million, processed daily (Citi 2008). The cards are used by 95 percent of the population of Hong Kong aged 16 to 65; the average user stores around HK$63–65 on the card. It is evolving from a transit card to a retail or “city card.” By late 2006, the card was accepted by 3800 shops operated by 379 companies. According to De Jong (2006), only 76 percent of transactions were for transport services. “In the company’s lifetime, its focus has shifted from delivering a not-for-profit, cost-reducing technology to being a marketing organization today” (De Jong 2006).

Papadopoulos (2007) presents a much more skeptical view: the “head start” from its forceful introduction as a transit payment card “did not materialize in higher use or quicker development for Octopus Retail than other e-money projects elsewhere.” This “provides a note of caution […:] it may be easy to expand as a single payment medium in a protected environment, where the issuer is also creating and controlling the demand of its product and is a completely different challenge to compete in unequal terms against the established use of cash in retail.”

---

\(^6\) Based on the success of the CashCard, the Government of Singapore developed a plan called Singapore Electronic Legal Tender to grant legal tender status to some form of e-money and to drive out the use of cash entirely. There is not much information on the status of the initiative, which seems to have been relegated in importance and time.
Van Hove (2005) notes that Mondex failed to take root in Hong Kong, whereas Octopus has taken root. Octopus had four distinct advantages over Mondex:

- Having signed up all the main public transport companies in the territory, Octopus had a de-facto monopoly with a large user base—mass transit users. It was able to attain substantial customer adoption in a remarkably short time by installing the new card readers at all locations under its direct control and using relative pricing of the various access methods (Octopus vs. single-journey tickets). In effect, users were left with no alternative. Once the Octopus card had attained mass use, it was then able to extend its use outside of its captive market in normal retail outlets. In contrast, Mondex had to prove that it was better than other payment alternatives on the basis of its own merits and did not have the option of manipulating pricing at retail stores to provide incentives for its use relative to other means of payment.
- Octopus focused on replacing cash in unattended POS—ticketing machines. The ability to present exact fares at all times through a smartcard at unattended machines offered a big convenience factor for users. In contrast, at least initially, Mondex attempted to replace cash in stores, where not having the exact change is much less of a bother for customers.
- Octopus’s contactless features made it extremely convenient for users—indeed, faster than using cash. The cards do not have to be inserted and, in fact, generally do not even have to be withdrawn from wallets and handbags, to be read by the card readers.
- The card’s personalization feature means that value can be retrieved by users who lose their card or have a faulty card.

**Interoperable mobile wallet supporting multiple payment instruments: Mobipay in Spain**

**What is Mobipay**

Mobipay is a mobile payment mechanism that allows customers to pay for goods through their mobile phone using a range of payment instruments: credit cards, debit cards, or the operator’s account. It supports both in-person and remote payments. The platform is open to any mobile operator or payment instrument issuer in Spain.

The system is based on a cooperative model between mobile operators and financial institutions. Mobipay España S.A., which operates the system, was formed in July 2001. It is co-owned by the three major mobile operators in Spain (jointly owning 40 percent), as well as by over 30 financial institutions (jointly owning 48 percent), and the three national card payment processing companies (jointly owning 12 percent). At its inception, system development received financial support from the Spanish Ministry of Industry. Mobipay España S.A. was actually formed as the merger of two competing projects: Movilpago (backed by a major bank, BBVA, and the incumbent mobile operator Telefónica Móviles) and Pagomóvil (backed by another leading bank, BSCH, and the two other mobile networks).

A separate company, Mobipay Internacional S.A., was created to promote this payment solution in foreign markets, especially Latin America. However, unlike the Spanish entity, the international one is controlled by just one telecommunications company (telecom)—Telefonica Moviles—and one bank (BBVA), which should give it a stronger strategic coherence. It has launched in Mexico through FINPE, an organization created in 2004.
by a consortium of banks and credit card operators with the sole purpose of promoting the use of e-payments in Mexico.

How it works

Each Mobipay customer gets a virtual wallet, which can contain up to nine different payment instruments. Each time the customer wants to make a payment, the system will ask which of the available payment instruments the user wishes to pay with. Customers can register a new bank payment instrument in their mobile wallet by requesting it from its issuer (through their branch, ATM, Internet banking, or telephone banking channels) or by sending a message via short messaging service (SMS) with the keyword ALTA (subscribe) followed by the card number. Mobile operators automatically register the mobile account as a payment method (whether the customer is on a prepay or postpay plan) when their customers use Mobipay for the first time.

The mobile phone acts merely as a payment initiator, because transaction processing is the responsibility of the selected payment issuer. The main Mobipay user interface is through the Unstructured Supplementary Services Data (USSD) mobile communications channel, which works on most phones without requiring phone configuration. The USSD session can be triggered directly by dialing a USSD number or, more commonly, by sending an SMS. This establishes an interactive, real-time session between the mobile phone and Mobipay’s server. The user experience is a sequence of questions and answers. Mobipay has also developed interfaces using interactive voice recognition (IVR), SMS (based on a system of keywords) or WAP.7

There are three main ways of initiating a payment. For smaller, in-person transactions, customers can give their phone number to the merchant, who will then issue the payment request. Larger retailers can use a special barcode reader that can acquire the customer’s mobile phone number directly by reading a tag on the customer’s phone, which reduces the possibility of error. For purchases from machines or for remote purchases, the customer can enter a transaction code that identifies the product to be purchased (e.g., a parking meter might display the code *145*980*122#). In this case, the customer initiates the payment request.

In any of these cases, the customer will receive a message with the details of the transaction (description of the goods and the payment amount), which the customer will need to authorize by entering the personal identification number (PIN) for the underlying bank payment instrument (i.e., if using a debit card, it will be the same PIN as the one used at the ATM) or by hitting OK if the transaction is charged to the operator bill (i.e., in this case there is no PIN). Buyer and seller will then receive messages confirming the transaction.

Customers do not incur a charge using Mobipay. Merchants pay the normal discount fees associated with the payment instrument used by the client (e.g., a credit card), but there is no additional merchant fee payable to Mobipay if the payment occurs through its infrastructure. Mobipay pays the customer’s operator a fixed amount per transaction (0.08 euro if billing against a card or bank instrument and 0.15 euro if operator-billed), for use of its communications channel. Mobipay charges a fixed amount to its shareholders to cover its costs.

---

7 For a description and comparison of the USSD, IVR, SMS, and WAP mobile communication methods, see Mas and Kumar (2008), Box 1.
Use originally focused on mobile content (e.g., ringtones); small on-the-road transactions, such as taxis (in the two major cities of Madrid and Barcelona); public transport (buses in Málaga) and parking ticketing (though not very widespread); and Internet purchases. In recent years, Mobipay has targeted the use of the platform for prepay top ups. Customers need only send an SMS to a shortcode with the keyword recarga (load) and the amount of the top up.

The Mobipay payment method is marketed by operators and financial institutions and not by Mobipay itself. Customers are presented with the Mobipay logo to inform them of the availability of this payment method. While many retailers have embraced payments through Mobipay, the largest department store chain (El Corte Inglés) and the national airline (Iberia) have not. Mobipay has remained fundamentally a tool for mobile-enabling bank cards: these represent 90 percent of transactions, against only 10 percent being operator-billed.

Mobipay has recently been running a sequence of trials to try to broaden its market, including the use of NFC-enabled phones to pay for public transport in Málaga, a parking ticketing application in Madrid, a vending machine payment application in Telefonica’s corporate campus, and a betting payment application with a private company called Bet And Win. Mobipay sees opportunities particularly in the transport area, with the support of NFC-enabled devices—the space Octopus has demonstrated.

The market verdict and lessons learned

Mobipay was trialed in mid-2002 in a small town and launched nationally in late 2002. In less than a year, it acquired 17,000 customers and 4,500 merchants (2,800 online and 1,700 bricks and mortar). Six years later, there are only 400,000 registered—not necessarily active—users, amounting to less than 1 percent of the population. And less than 2,000 transactions are processed daily.

This dismal performance can be explained by two main factors. First, Spain is highly penetrated with banking services and infrastructure, so Mobipay struggled to open up a niche in the retail payments market. Second, Mobipay did not have a marketing budget to promote its own service; it had to rely instead on promotion by its shareholders (who were also its customers). These shareholders, in turn, did not see much benefit in promoting the Mobipay brand, because they felt that their competitors (whether the telecoms or the banks) would benefit equally from their marketing expenditures. As a result, Mobipay has languished in the absence of effective marketing or a “killer application” that can raise public awareness of the service.

Mobipay’s marketing morass is symptomatic of a larger misalignment of interests and experiences among Mobipay’s diverse set of promoters, which has hampered its development. The telecoms always saw their involvement as a concession to the banks, which in fact were their major shareholders—a sort of shareholder tax.8 The telecoms’ relatively tepid engagement is in part because they were accustomed to margins of over 50 percent in their prior content billing services (e.g., ringtones/logos purchased using premium SMS), whereas the banks were happy to operate at much lower margins. Telecoms also saw the banks as overly conservative. The technical teams from banks and telecoms had very different mindsets, used different terminology, and worried about different technical issues. And the fact that all major telecoms and all major banks but one where part of the Mobipay consortium meant that they faced no real competition—there was no sense of urgency at developing the market.

---

8 This is why all three major Spanish telecoms jumped at the opportunity of joining the Simpay consortium when it was conceived. That was going to be “their thing.”
Mobile payments through credit cards: Moneta in Korea

What is Moneta

SK Telecom (SKT) belongs to the third largest chaebol (conglomerate) in Korea. SKT controls around half the market for mobile telephony, with 20 million customers. It has developed a comprehensive framework for mobile payments (Moneta), mobile banking (Mbank), and mobile commerce. Moneta was launched in November 2002 as a mobile wallet application that allowed customers to make proximity (in-store) payments through several mechanisms. Moneta initially supported a mobile cash payment product (Moneta Cash) and evolved toward a platform to support credit card payments through mobiles.

Moneta developed in the face of stiff competition from other market players, especially from the BankOn platform promoted by the powerful Kookmin Bank and supported by SKT’s two mobile competitors (LG Telecom and KTF).

The origins: Moneta Cash

SKT pioneered mobile payments in Korea with a mobile cash (m-cash) product, NeMo (Network + Money), which was launched alongside nine major Korean banks in 2001 and was subsequently rebranded Moneta Cash. Customers subscribing to Moneta Cash got a virtual money account, with their phone number acting as their account number. M-cash account balances were maintained in an SKT server (i.e., not on the card), with SKT keeping the float. Moneta Cash customers could use their mobile phones to top up their m-cash account from linked bank accounts at participating banks. Both the m-cash account and the bank account were associated with the customer’s phone number, and both accounts shared the same PIN. Once the Moneta Cash account was loaded, customers were able to use their mobile phones to transfer money to other Moneta Cash accounts, including at POS to effect payments for goods. Transactions were capped at KRW 500,000 (US $500 approximately), but there were no limits on total value stored in the card. The user proposition was based on the convenience of being able to make payments from the mobile phone, without having to disclose bank or credit card account details to payees. All Moneta Cash payments were confirmed by SMS, and customers got daily transaction records.

Moneta Cash attained three million registered customers by 2004. Over time, tension arose with participating banks that increasingly saw SKT’s m-cash accounts as an “invasion of an outsider into their business domain” (Oh et al. 2006). In 2004 sensitive customer data became accessible through the Internet and was used illicitly. Although SKT claims it was not a technical problem but rather inadequate care by certain customers in protecting their security information, Moneta Cash was discontinued following this incident.

The sweet spot: Mobile-enabling credit card payments

Unlike Mobile Cash, which gave customers a new type of account, Moneta itself was not a payment instrument but rather a mobile wallet application that allowed customers to pay using their credit card over mobile terminals. It worked with a new type of chip-embedded Moneta Card (a credit card in a smartcard format). Moneta cards were launched in September 2001 and were initially co-branded by Visa and issued by five major domestic credit card companies and banks. While SKT had made plans to buy a credit card company to internalize this aspect of the service, this never occurred.

In its original form, customers had to use specially designed mobile phones with a full-size smartcard reader into which they would insert their Moneta
Card when they wanted to make a payment against their credit card account. In March 2003, these phones were replaced with others that could house a subscriber identity module- (SIM) sized credit card smart chip (Moneta Chip) inside the phone, so there was no longer a need to separately carry and insert a Moneta Card to make a payment, and the phones could be smaller. Still, users needed to have special-purpose phones, and customers wanting to pay with different credit cards would have to switch the smart chip inside the phone.

Customers can use their cell phones incorporating the Moneta Chip in affiliated stores equipped with enhanced POS terminals. Merchants need to attach a dongle to their existing POS terminal; this enables the terminal to read the Moneta Chip at close range using infrared or RFID technology. Waving the phone over the dongle triggers the payment. Additional PIN-based authentication through the carrier’s SMS is required for higher value transactions. Moneta supports payments in both online and offline mode. In stores not equipped with dongles, customers could continue to use a separate Moneta Card linked to the same credit card account.

Since 2006, Visa and MasterCard have introduced SIM-sized credit cards that work on their VisaWave and PayPass, respectively, proximity payment platforms. As a result, merchant dongles became interoperable across alternative wireless service providers for the first time.

In 2007, SKT partnered with Visa International and created a platform whereby subscribers could download multiple credit card data and applications over the air to the standard SIM card in their phones. This had three benefits for the customer. First, customers could make payments with any of their Visa credit cards without having to change the chip inside their phone. Second, Moneta customers were no longer restricted to a narrow range of Moneta-enabled phones; they could use any standard third-generation phones. Third, this platform provided the ability to download other mobile banking and public transportation applications onto the same chip over the air, rather than having to be preinstalled in each chip (Bradford and Hayashi 2007). Thus, the Moneta platform became the cornerstone in a broader set of m-banking and m-commerce applications.

**Evolution beyond in-store payments**

Over time, SKT has expanded its Moneta payments services from the merchant proximity payment service (Moneta Card) to online payment services (August 2003) and mass transit payments (Moneta Pass) in Seoul. In addition, it has used the payment platform to offer m-shopping, m-banking (Moneta Bank or MBank), and m-stock trading (Moneta Stock Trading) services.

MBank, launched in March 2004, is the result of a partnership of SKT with several smaller banks. It was joined in September 2004 by the larger Kookmin Bank, which had earlier developed its own m-banking platform. MBank uses multiapplication chip technology to share the use of the Moneta smart chip in the phone with the banks, so that half of the chip is controlled by SKT to deliver its Moneta Card payments services, and the other half is controlled by the bank to store relevant bank account information.

**The market verdict and lessons learned**

By the end of 2003, SKT had placed some 400,000 dongles with merchants. Moneta still had only 40,000 users, despite the 400,000 Moneta-compatible handsets available (Wallage 2003).

---

9 SKT’s network uses the CDMA rather than GSM communications standard, and CDMA phones do not normally have SIM cards in them. Hence, use of the Moneta Chip required the user to have a special CDMA phone with a SIM card slot.

10 These are contactless smartcards that are fully compatible with the global EMV smartcard standard and can be read through insertion in traditional readers or wirelessly at close range (a few centimeters) using RFID. They give consumers a fast and convenient way to make payments, because no signature is required and there is no need to hand the card to the cashier.

11 SKT adopted WCDMA (which is part of the standard GSM technology evolution) as its third-generation network standard. The Universal SIM is a standards-based smart chip that is embedded in all WCDMA-enabled phones.
Moreover, only 21 percent of registered users had made any purchase using their handsets. The greatest number of users came from the 30–39 age group (29 percent). By August 2005, SKT had sold 4.9 million Moneta-enabled handsets, a penetration of 20 percent of its customer base (Beerfiles 2005). As of February 2007, there were 1.5 million registered users of Moneta services in Korea (Payment News 2007), and 80 percent of new third-generation-capable phones had the credit card functionality enabled. But according to uncorroborated sources, use is very low, and the future of Moneta is uncertain.

Moneta is fundamentally a new technology for paying from credit card accounts. With Moneta, SKT sought to simply mobile-enable the preexisting payment ecosystem. By not introducing a new payment instrument, SKT did not need to convince users about the safety and soundness of a new type of money (unlike Mondex or Octopus, which positioned a new prepaid account). Also, by keeping the payment instrument with bank issuers rather than taking the issuance role itself, SKT did not need to itself assume any collection duties (unlike Simpay, which favored operator billing).

Yet despite this apparent “simplification” of the mobile money innovation, Moneta has experienced relatively low levels of use in a population that is among the most tech-savvy in the world. Driving adoption of a new way of presenting and exchanging credit card information has proven difficult for three main reasons.

Utility. From the customer point of view, it is not apparent what problem Moneta is addressing relative to standard credit card payment arrangements. At its most basic, Moneta simply physically combines the mobile phone with the credit card. How much of an advantage is that really? In a world where people still carry cash and hence wallets, what is the compelling customer benefit from transferring the credit card from inside the wallet to inside the mobile phone? The lack of a clear customer benefit was compounded by usability issues, because the user interface design required customers to go through many screens to make a simple payment (Bradford and Hayashi 2007).

Technology lock-in. In the absence of industry standards, market participants may chose to delay adopting new technologies until clear winners emerge. Many players were positioning themselves with their own technologies to enable credit card payments over mobile phones: the two leading telecoms, SK Telecom and KTF, were promoting their own standards; Harex InfoTech, a start-up, offered its own infrared-based m-payment service called ZOOP in parts of Seoul; and some established credit card companies wanted to develop their own card-based m-payment solutions.

- The solution required installing proprietary merchant POS readers, which for many years were not interoperable among rival systems. Retailers faced the need to have to deploy multiple card-accepting devices, which would add cost and complexity to their operations and ultimately eliminate the efficiency benefits from adopting e-payments. Retailers resisted investing in the new equipment (dongles) necessary to process Moneta transactions before demand for such services was well proven.
- Similarly, handset vendors were slow to respond in developing the special-purpose Moneta capabilities (with the contactless dual chip) until they saw the market as fully developed (Wallage 2003). Korean handset manufacturers have always been keen to showcase new technology. However in recent years they have become more
successful in global handset supply and thus the ability to have a product that is globally more applicable is influencing their engagement in local initiatives.

**Distrust from financial institutions.** The development of m-payments was hampered by very public bickering between leading banks and telecoms and the consortia they formed.

- There was little alignment in the business models. The banking and credit card industries were not supportive because the mobile carriers demanded a large share of the transaction revenue (Bradford and Hayashi 2007). At the same time, it is reported that SKT wanted credit card fees reduced to 1 percent (from the normal 2–3 percent) on credit card transactions taking place through its network to stimulate use (Wireless Week 2002).
- The typical bank–telecom disputes over customer ownership flared up. The single Moneta Chip houses SKT subscriber data and the customer’s credit card and possibly bank account information. Banks remained concerned that SKT’s control over the Moneta Chip would allow SKT to control what services were proposed to their customers. It took until 2004 for SKT and Kookmin Bank (the leader of a rival scheme) to determine how to collaborate.12

**A multioperator platform for mobile operator billing: Simpay in Europe**

**What is Simpay**

Simpay (initially called the Mobile Payments Services Association) was launched in February 2003 by a consortium of the four leading European mobile operators: Orange, Vodafone, T-Mobile, and Telefónica Moviles. Two smaller national operators, Amena and Proximus, joined the project in early 2005. Its mission was to develop and operate a pan-European payments system for mobile phones, focused on micropayments (less than 10 euros). Despite the company’s tagline—“pay for stuff with your mobile”—the system was also designed to allow purchases from PCs connected to the Internet.

Before Simpay, mobile commerce was largely driven by purchases of low-value digital content—ringtones, obtaining sports results—from operators’ proprietary portals (“walled gardens”), and customer billing was through premium-rate SMS text messages between the customer and the merchant. With the advent of new third-generation networks, operators saw much larger mobile commerce opportunities, such as music downloads, Java games, video streaming, and TV over mobile, from data services.

Through Simpay, operators sought to make it easier for their customers to buy digital content from any source, whether on- or off-portal, using any connected device (mobile phone or PC), from any country covered by the operator consortium. Retailers would be drawn by the fact that on joining Simpay and interfacing once into its systems, they could then gain access to all the customers of Simpay’s member operators, which amounted to 280 million at the time. Customers would be able to conveniently purchase digital content directly from a broader range of retailers, who would advertise the availability of the Simpay payment method as a trusted payment brand.

Simpay is a mobile operator-centric model, based on operator billing mechanisms. To the extent that it targeted small transactions, it could be seen as complementary to credit and debit cards and could

---

12 Interestingly, Oh et al. (2006) write: “Although Kookmin Bank joined [rival SKT’s] MBank, Kookmin was considered as the winner because it successfully prevented SK Telecom from the rights to control customer information.”
operate within the requirements of the European Union’s eMoney directive.

However, it represented a potential longer term threat to credit cards if it came to replace credit card use among some customers. On the other hand, Simpay considered the possibility in the longer term to offer customer “wallet” functionality, which would enable the customer to choose among payment methods (e.g., on the operator bill, on credit card, or on a stored-value account).

Subsequently, the platform would also support payment for larger purchases undertaken on the mobile or PC (e.g., theater tickets), as well as physical (in-store) transactions. Some operators saw Simpay as ultimately becoming a cash alternative.

**How it works**

Under the Simpay scheme, mobile purchases are debited from the mobile user’s account—whether prepaid or postpaid—with his operator. The operator thus authenticates, provides the mobile transacting channel to, and bills the user. Transactions with merchants (retailers and content providers) are aggregated through merchant acquirers—essentially intermediaries who would drive adoption of the technical platform by individual merchants and who would channel payments between Simpay and individual merchants. Simpay stands between the various mobile operators and the various merchant acquirers, providing payment authorization, clearing, and settlement services between them. Operators can also act as merchant acquirers—as when the user purchases content from the operator’s own content portal (or walled garden)—but they also allow users to purchase content from third-party merchant acquirers.

Thus, the Simpay initiative sought to create a de facto standard controlled entirely by mobile operators. It envisioned a standardized set of technical interfaces across the billing platforms of all member networks and promised to reduce the number of contractual relationships needed between operators and merchant third parties. A merchant could plug in through a merchant acquirer and sell its products to the customer of any participating network. And the Simpay logo would be deployed widely to inform customers about the availability of the mobile payment channel.

Cross-border transactions (e.g., where the user is purchasing content from a provider in a different country) were supposed to be firm at time of transaction. Simpay would negotiate exchange rates ahead of time with the settlement bank and apply it to all transactions within a particular day. This offered more pricing certainty to customers than they typically get when they pay with credit cards, because in this case the customer does not know the cost in his home currency at the time of transaction.

Simpay was also intended to enable operators to profile customers for marketing and service purposes. By incorporating customer payment data into their customer relationship management systems, mobile operators saw an opportunity to develop a more effective customer marketing channel and create more customer “stickiness.”

**The demise of Simpay**

Simpay selected four major vendors to develop, test, and run the system: Valista, Encorus, Privnet, and Qpass. The initial plan was to offer the service in 20 countries by 2004, but many delays ensued. Simpay was hampered by strategic and operational difficulties. Despite the common vision at the
beginning, the sponsors were unable to agree on what types of mobile payments Simpay would offer. T-Mobile wanted to incorporate contactless payment chips within the mobile phone casings to take on proximity payments, whereas Vodafone wanted to concentrate on purchases of digital content.

These misalignments stemmed in part from the fact that Simpay’s business model was squeezed by two operator concerns. First, they did not want to lose the high margins (60 percent or so) on existing premium SMS sales, mainly for ringtones and logos. Second, many of the participants in Simpay had previously established their own mobile Internet payment services, which in fact remain in place today, such as Mobipay for the Spanish operators and Vodafone UK’s M-pay.13 The common goal was to open up new mobile commerce streams, but it was unclear what such streams actually were. Although there was a genuine interest by the operators in the consortium to harmonize their platforms, some member operators were pursuing their own related research and development activities in parallel, as if they were hedging their bets.

It appears that the complexity of the task had been considerably underestimated. The solution was deemed by many to be out of proportion for the very low volumes of paid mobile services at the time, beyond ringtones and logos. Some people questioned whether it was really so important to create a pan-European payment roaming network, at least in the first instance, which inevitably forced a solution that was not optimized to “fit” the specific needs of any given market.

Over time, as strategic divergences became more marked, the operator working groups creating the specifications lost momentum. Many were there to ensure that their competitors didn’t get ahead rather than to pursue a common objective. At the working level, there was even more tension between the operators on one side and Simpay staff on the other. Simpay had recruited a significant number of staff with a banking or payments background, which clashed with operators’ mindset.

The market (non)verdict and lessons learned

Divergences among the founding members led T-Mobile to withdraw from Simpay in June 2005, and Simpay’s activities were discontinued shortly thereafter. Simpay was never launched.

Unlike Mondex, Simpay was, at least at its conception, not in the business of replacing cash. And like Octopus, it tried to concentrate on small payments where cash was impractical and in a vending environment it could tightly control. Indeed, by focusing on remote payments for digital content, Simpay would offer a valuable new payment mechanism to its customers while playing to the strengths of its member operators. And by basing payments on the billing platforms of its member operators, it also avoided the bank–telecom partnership tensions that sapped Mobipay and restricted the potential of Moneta. Thus, Simpay was charting a new path that in many ways incorporates the lessons from the experiences that we have reviewed so far in this paper.

However, as development work proceeded, member operators started diverging on their overall product vision. Moreover, Simpay’s task was complicated by the multicountry, multioperator nature of the platform it needed to build. Ultimately it was not able to maintain strategic alignment among its member operators for several reasons:

- From a product marketing point of view, it was never clear what key benefits were being pursued. Many questioned whether international interoperability was the right focus, because

13 M-pay has evolved to support the U.K.-wide “payforit” service, which provides billing to mobile accounts for any service designated on the Web as being “payforit-enabled.” This service is now available across all licensed U.K. mobile operators.
much content is of a local nature. And if retailers were to be nationally aligned with operators, it was not clear what advantage the platform would have over existing operator-specific premium SMS-based billing methods. It is always a challenge to build harmonized products that do not lose sight of customer wants and needs.

- From a business model point of view, many operators were loath to relinquish the high margins on existing ringtone/logo sales through premium SMS and, hence, relegated Simpay to be the payment mechanism for future, though as yet unavailable, mobile Internet content sales. The fear of cannibalizing existing revenues undermined Simpay’s business case.

- From a governance point of view, a consortium of such major industry players is very difficult to maintain, even within the apparent homogeneity of an operator club. Despite initial alignment, the true motivation and strength of interest of the partners changed as the project unfolded. Some operators had more interest in checking the interests of their competitors than in pursuing the common good.

Without clear product marketing vision coming from the member operators, Simpay ended up developing technical plans that were unrealistic. Each operator had special technical interface requirements, which led to an overly complex technical architecture.

An operator-centric transactional ecosystem: Osaifu-Keitai in Japan

What is Osaifu-Keitai

DCM is Japan’s leading mobile communications operator, with 53 million subscribers as of March 2008, representing over half of Japan’s cellular market. It launched a mobile wallet service, Osaifu-Keitai (meaning wallet-mobile phone) in July 2004. Osaifu-Keitai is based on a FeliCa card embedded in mobile phones (the same that was used by Octopus in Hong Kong). The FeliCa card was developed by Sony, and the chipsets are commercialized by FeliCa Networks, which is controlled by Sony with a minority stake (38 percent) by DCM. The FeliCa card includes an integrated nonvolatile memory that makes it possible for mobile devices to contain multiple forms of data, including personal identification as well as up to 10 service-specific applications. The FeliCa card also includes a wireless communication chip, enabling data exchange when it is held adjacent to compatible readers/writers via RFID. This allows consumers to use their phones as a substitute for cash and cards at vending machines and merchants’ POS; in addition it facilitates remote payments.

Osaifu-Keitai is a device-based mobile payments solution, supporting both proximity payments in shops that have a FeliCa chip reader and remote (online) payments. Although the FeliCa-based wallet platform was developed by DCM, since 2005 it has been supported by the two other major mobile phone operators in Japan, making it the de facto standard mobile payment platform in Japan. As a result, FeliCa readers (though not the payment services themselves) work across mobile operators.

Osaifu-Keitai is based on a wallet application on the FeliCa chip, which supports multiple payments instruments (Williams 2008):

- **Credit cards.** DCM developed a proprietary platform, iD, for storing e-credit cards on FeliCa-enabled handsets (analogous in its functionality to the Moneta Chip system described previously). It is open to the cards of other issuers, in addition to DCM’s own DCMX credit cards. Payments against DCMX cards are billed together with the user’s monthly DCM phone charges.

---

14 In Japan, credit card issuers need not be banks. DCM purchased a 33 percent stake in Sumitomo Mitsui Card.
• **Operator billing.** Small expenditures can be charged directly to the phone bill. This is called DCMX mini, and it has a 10,000-yen (US$94) credit limit. Big spenders can apply for more credit and use it just like a regular credit card.

• **Prepaid e-money.** DCM entered a joint venture called bitWallet with Sony and some financial institutions. bitWallet offers a prepaid e-money service called Edy. Customers can fund their Edy accounts with cash or credit cards or from Internet/mobile banking accounts. The Edy wallet is limited to small-value settlements (up to 3000 yen) and can hold up to 50,000 yen in stored value. As of February 2008, it is accepted in more than 71,000 convenience stores, bookshops, and coffee chains and at vending machines. The Edy network handles close to a million transactions per day.

• **Transport ticketing.** East Japan Railways (the third partner with a 5 percent stake in FeliCa Networks) developed Mobile Suica, which allows customers to buy railway fares from a prepaid account. Like Edy, this can be funded from cash, credit cards, or Internet/mobile accounts.

• **Postpay services.** Beginning in 2005, JCB and AEON Credit Services have released QuicPay, a postpay service.

DCM’s core belief—one that it developed based on the success of the i-mode content platform in Japan—is that use of payment services will be pulled by the presentation of a range of services to the customer. Therefore, DCM has developed a very structured approach to enticing partners onto its content and payment platforms and to promote further service innovation. The service platform now supports a variety of uses beyond e-money, including airplane tickets, membership cards, and house entry keys. Users can download multiple applications over the air onto the FeliCa card to support each of these services. DCM also recognized the challenge of convincing retail chains to accept their mobile money scheme. They were deliberate in stressing to these agents the ways in which Osaifu-Keitai would increase both customer convenience and value for their businesses through (1) process speed, (2) versatility, and (3) security (Jenkins 2008).

However, DCM appears to have retained a tight degree of control over the payment options underpinning Osaifu-Keitai. The credit card payment system iD was proprietary to DCM, requiring merchants to install iD-compatible readers. It has stated that it will seek to collaborate more closely with banks and card companies to further expand Japan’s mobile payments market (Market Platform Dynamics 2006). In 2007, DCM, East Japan Railways, JCB, and bitWallet agreed to make their readers interoperable (Bradford and Hayashi 2007).

**The market verdict and lessons learned**

As of January 2006, there were over 10 million subscribers of Osaifu-Keitai with compatible handsets. As of 2008, there are more than 29 million subscribers (NTT DoCoMo 2008). The mobile wallet application is accepted at more than 640,000 stores (Contactless News 2008).

Osaifu-Keitai has achieved good recognition in the marketplace, but usage is lagging. A survey of 1,093 mobile users in Japan in June 2007 showed that while only 40 percent had Osaifu-Keitai-enabled phones, twice as many knew about the service. Of those with the capability to use Osaifu-Keitai, only 30 percent used it “sometimes” or “often.”

Though Osaifu-Keitai is by no means a proven success, it does show significant promise. What sets it apart from all the other initiatives we have...
reviewed is the sheer level of dominance DCM exerts over the mobile market (with an impressive 80 million customers) and the ecosystem around it. DCM is able to heavily influence mobile handset design because of its close relationship with manufacturers, through which it can streamline the customer experience; it purchased a bank and transaction processing company to drive economies of scope; it provided substantial funds as an incentive to merchants to purchase the necessary POS terminals; and through its base of developers and development partners it was able to foster substantial innovation around new platforms, such as Osaifu-Keitai. The sheer muscle that DCM brings is unparalleled. This approach would not be replicable in Europe, where markets are more fragmented on both the telecom and banking sides.

**Learning from these experiences**

The above experiences show very limited success with electronic or mobile money schemes beyond debit cards. The lack of a compelling user experience and lingering security concerns remain barriers to customer adoption. Transport applications are driving most of the usage today and appear to be the main focus of new business development. Nontransport-related service introductions appear to be primarily aimed at showcasing the technology in key markets, such as Japan and Korea, but with as yet limited commercial rationale. Although customer data are very hard to come by, penetration rates are reasonably high in some schemes but usage is very low across the board.\(^\text{17}\) Box 1 provides an (admittedly crude) indication of just how much in the news these schemes now are.

The partial successes and many failures of these initiatives in developed countries are mainly because these markets are already so “banked.” There is no need to pay with my mobile phone, when I have a debit or credit card in my wallet. There is no need to totally eliminate cash when there are ATMs on every corner. So we can view these unsettling experiences in a different light: a quiet technology battle has occurred for e-payments, and the debit card has won. It is not a case of repeated failures to make payments electronic, but rather it’s a case of a singular success: the debit card. From the developing world perspective, however, many of these services are so out of reach for people that mobile phones and smartcards may have a role to play. It is therefore important to understand the stark economics these schemes must defeat to succeed.

**The problem with new payment devices**

The experience has amply demonstrated that new forms of e-payments beyond debit cards cannot be simply swept in by the spread of digital technologies, such as smartcards and mobile devices. They need to deliver economic advantages to both buyers and sellers, and they need to be in every way at least as reliable and convenient to use as the forms of payment they are displacing. There is still no money scheme that leverages the data entry, storage, processing, and communications capabilities of mobile phones (or, their more limited counterparts, smartcards) in a way that can be expected to be universally adopted and replicable.

Why is it so difficult? Why is there so much market inertia supporting old ways of doing things, in the face of significant technical innovation? There are three broad categories of reasons:

- Those relating to the strict comparison, from the customer’s point of view, of the use features

\(^{17}\) Van Hove (2005) shows data on eight e-money schemes in Europe, including number of cards issued, number of acceptance points (terminals), frequency of use, and float.
among cash, debit cards, and the new forms of e-money and payment systems. Users will hold the burden of proof on the new payment devices to demonstrate superiority in at least some applications.  
- Those relating to the difficulty for the public to assess the security and establish trust with the new system.  
- Those relating to the difficulty of supplanting established payment mechanisms and standards due to the microeconomic characteristics of payments markets. Even if a new payment device is intrinsically clearly superior, that by itself will not guarantee its success in the market.

For all the problems associated with the physical embodiment of cash, it has some unique characteristics that make it very useful: it is familiar to everyone through centuries of use, easy to value (counting), quick to exchange (at least for low values), guaranteed to be anonymous (no traceability), sturdy (withstands harsh handling), universally accepted (no basis for exclusion, de jure as well as de facto), divisible (you don’t need to take all of it with you), and incurs no marginal transaction cost (at least once you have the cash in hand). Van Hove (2007) stresses that people value the underlying product purchased and not the payment service itself, and so these attributes

### Box 1: How Current Are They?

We wanted to get an indication of how “hot” the various e-money schemes are today—are they still much discussed and analyzed, or are they yesterday’s news? To get a simple indication of that, we conducted Google searches on each of the schemes reviewed in this paper (the exact key words are shown in the first column of the table below and were chosen to be as broad as possible without creating ambiguity with other possible uses of the terms). For each scheme, we picked out the first (and, presumably, most relevant and popular) 10 search results with meaningful commentary or analysis on each scheme. We ignored search results relating to the company’s own Web site or press releases. We then dated the documents behind these top 10 search results by year of publication. The results are shown in the table below.

Osaifu-Keitai ranks as the most talked about, followed by Octopus, and then Moneta. Mobipay is failing to generate much excitement. And predictably, the moribund Mondex and the defunct Simpay schemes have not received any attention in recent years. While a Google search may seem like a crude way of measuring the relative success or failure of e-money schemes, this proxy does confirm the story we’ve told about the rise and fall of various e-money schemes.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>96</th>
<th>97</th>
<th>98</th>
<th>99</th>
<th>00</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mondex Smart Card</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Octopus Card</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mobipay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moneta Korea</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simpay</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osaifu-Keitai</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total By Year</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>5</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

Note: Searches conducted on google.com during 27–28 August 2008.
of cash need to be viewed individually and collectively as hygiene factors rather than merely as desirable features that can be traded off against each other.

The e-money schemes that have been tried may be superior to cash and debit cards in many ways, but each is inferior in at least one way that has proven to be important to customers:

- Card-based e-money products require some familiarity and comfort with technology. They need to be expressly loaded. Their value cannot be readily observed by customers. They are less sturdy than cash and expose the user to malfunction, in which case the user stands to lose the stored value. Making payments depends on finding a card-reading device, which greatly limits the ability to make direct P2P payments.

- Network-based e-money products working online are safer (because the value is not stored in the card itself), but financial intermediaries holding the accounts of payer and payee need to be involved. As a result, they are slower to transact than cash (because of the need for PIN-based security and real-time transaction authorization with the issuing institution), incur a marginal communications cost, and may be traceable. But then they work analogously to a debit card, and it is not clear why customers would choose to fragment their liquidity between bank account and network-based e-money.

These problems are magnified by the fact that the costs and benefits of cash and alternative payment schemes are not distributed evenly across all players. From the merchant side, it is common for smaller merchants to prefer cash despite the theft and fraud concerns, and it is only the larger merchants who want to improve efficiency by adopting e-payments (Jones 2008). From the consumer’s point of view, there is a premise underpinning many of the schemes we have reviewed, whether they were based on new forms of e-money or on enabling debit or credit card transactions, that people benefit from consolidating the contents of their pocket—carrying a card instead of a full wallet and a mobile phone instead of a card. That may not be the case, and in fact it is possible that people want money to be embodied in distinct tokens (coins, bills, cards) rather than merging into fuller service devices, such as mobile phones.

There is a particular challenge in overcoming public concerns on the security and reliability of new money schemes. People respond better to known risks (probability of being robbed on the street or of a stash of cash being found) than to unknown ones (e-security breaches). They are also more ready to accept loss of value when it happens because of their own actions or inaction (e.g., distraction leading to loss of cash) than because of circumstances beyond their control (e.g., smartcard malfunction). As a result, it is very difficult to reassure customers about new payment devices when they lack a track record and require higher levels of technical sophistication. These concerns get in the way of people even trying to learn about and experiment with new schemes. A recent poll across many developed countries suggested that 60 percent of people continue to “not trust their mobile device to provide a secure transaction,” and only 10 percent “are likely to do m-commerce.”

Even if there were a new payments device that was decidedly superior from a user’s point of view, there are several characteristics of the e-payments market—common to many network-based markets—that militate against rapid adoption and favor incumbent solutions (such as cash or debit cards):

---

18 Telecom Asia (2008), quoting a study by Unisys.
• **Network economies**: the value of the payments network grows with the number of economic agents using it. Getting early adopters is difficult when there are few other users to transact with, and more established schemes become unassailable.

• **Economies of scale**: e-payments are characterized by large fixed costs (merchant terminals, value loading machines, servers) and very small marginal costs. This creates significant barriers to entry and delays the point at which newer solutions can be justified on a business case basis.

• **Two-sided market**: electronic forms of payment need to deal with penetrating two sides of the market—customers and merchants—and both need to be cracked at the same time, which creates a familiar chicken-and-egg problem. The problem is particularly acute when the two types of users need to incur specific costs (e.g., for payment terminals) to participate in the market.

This triple whammy means most new payment schemes will need a significant amount of time to establish themselves and grow, even if they offer distinct customer benefits. But while they do not supplant the old schemes, their value will be undermined: why adopt e-money if I will still need to carry cash around for some purchases? Hence, both store customers and merchants may have limited incentive to use the new payment method while it is being rolled out in the market, even though using it is in their long-term interest.

**But if you must try it...**

Our review of different experiences has highlighted specific lessons:

• Schemes that have developed within captive, niche markets where they can exploit some unique advantage over cash have met more (though still limited) success than general e-payment schemes. Clear opportunities exist to address purchases at unattended POS (such as the fixed denomination, small-value transactions at ticketing, parking, or vending machines enabled by Octopus or Suica (powered by Osaifu-Keitai) and remote purchases over the Internet or mobile phones (such as mobile content downloads enabled by Mobipay or Osaifu-Keitai).

• **Interoperability and industry consortia** are a double-edged sword. Schemes based on interoperability, such as Simpay, can be subjected to large coordination problems among the various players. They also risk being pulled into multiple strategic directions, with adverse impacts on technical complexity, service cost, and quality of the customer experience. Yet proprietary schemes, such as SKT’s, are much harder to get adopted in the marketplace, because they require specific investments in their own handsets and merchant terminals. They also can lead to market paralysis as market participants defer investment decisions until a clear winner emerges in the marketplace.

• **Customer convenience** and in particular speed of transaction is essential. The more successful schemes—Octopus, Osaifu-Keitai, Moneta—are all based on devices with short-range communications (RFID or NFC) that work with contactless card readers and minimize the data entry requirement on users.

• **Payment enablement needs to be conceived as a platform or ecosystem, not as a service. Providers have to not so much sell as orchestrate the creation of a new market. Driving adoption requires complex multi-party gaming strategies, and at the very least takes time. As DCM has shown, these ecosystems need to develop in a fairly open, collaborative fashion, but at the
same time they need to be forcefully led. Few players can be expected to have the power and the skill to bring this about.

Many observers believe that the most promising area for e-payments in developed countries at least in the near future is ticketing. The above list of lessons and the Octopus case study shows why. Octopus exploits a niche where cash is not so convenient: at unmanned ticket machines. The backer of Octopus was able to drive fast take-up by customers by adjusting ticket pricing to favor the new pricing scheme. At the same time, the backer of Octopus controlled a very sizable network of acceptance terminals, which it was able to convert to the new payment scheme overnight. This double approach, “easing pain” by adopting smartcards and removing the need to deal with ticket machines and “applying pain” on cash purchases through higher prices, provided powerful incentives that drove very rapid adoption. Once people become aware of Octopus and are comfortable using it, its usage broadens naturally beyond the original purposes.

In developing countries mobile payments and e-money may have a bigger role to play given the paucity of banking infrastructure and alternative payment channels for people without access to bank accounts. The market opportunity may be larger, but schemes in developing countries will face similar challenges in establishing critical mass.

References


NTT DoCoMo. www.nttDocomo.com


Ignacio Mas is a senior adviser and Sarah Rotman is an associate microfinance analyst, both in CGAP’s Technology Program. The authors wish to thank David Bridge and David del Ser for providing very useful insights and information and Sangwoo Yu, Hyesoon Kim, and Jaesic Jeon of SK Telecom for providing facts and comments on Moneta.

CGAP publications are frequently cited in other works. The suggested citation for this paper is as follows: