

Electronic Cash in Hong Kong

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Introduction

Asian business has long had a fondness for cash. While the West gravitated toward purchases on credit – through cards or installments – Asia maintained its passion for the tangible. Four-fifths of all transactions in Hong Kong are handled with cash. It is into this environment that Mondex International, the London based purveyor of electronic *smart cards*, and Visa International, the credit card giant, are currently competing for banks, consumers and merchants, each supporting their own proprietary flavor of electronic commerce. Visa International claims the largest number of operating pilot programs, thirteen worldwide, while Mondex lags with two sites and three more being planned. By the year 2000, the industry predicts that Asia will account for one-third of the smart cards in global circulation (Banking Bill).

While the *Prime Visa Cash* card appears to have the edge over Mondex in terms of penetration at the moment, the two systems offer substantially different services. This ultimately may be more important in determining the winning e-cash format. *Smart cards* are credit-card-sized plastic cards containing an embedded microcomputer that has been programmed to function as an electronic purse. The Mondex card sports a built-in calculator, can be locked using a cryptographic key, and can be plugged into a computer terminal to be read by Java compatible Internet browsers. Mondex cards can be reloaded (with cash) through automated teller machines (ATM) or Mondex-enabled telephones. A balance reader can be used to check the value remaining. Transfer between cards is enabled by an electronic wallet; transfer from a bank account to the card-chip by an ATM machine or by a specially equipped telephone. *Prime Visa Cash* is less flexible, and works currently through stored value – the consumer pays a bank

teller cash for a card and uses it until that value is exhausted. Visa plans to offer a reloadable card later.

History

Mondex was the brainchild of two NatWest bankers – Tim Jones and Graham Higgins. They began technology development in 1990 with electronics manufacturers in the UK, USA and Japan. Subsequent market research with 47 consumer focus groups in the US, France, Germany, Japan, Hong Kong and the UK refined the practical design of Mondex card systems. The most notable feature of this design was the abil-

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ity of users to lock their cards. Early in 1992, NatWest began a trial of Mondex in an office complex in London with a 'canteen card' known as *Byte*. The *Byte* trial is still continuing with more than 5,000 people using the card in two office restaurants and six shops. By December of 1993, the Mondex card was introduced on a large scale. Sourcing for Mondex system components involves more than 450 manufacturers in over 40 countries. In October of 1994, franchise rights were sold to the Hong Kong and Shanghai Banking Corporation Limited to cover the Asian region including Hong Kong, China, India, Indonesia, Macau, Philippines, Singapore and Thailand. 1996 saw HongkongBank initiate its launch at two sites, one in Tai Koo Shing on Hong Kong Island and the other in Shatin in the New Territories. Mondex built technical alliances with CyberCash, VeriFone and Sun Microsystems, while Hitachi developed a specialized version of the H8/310 series microprocessor to provide an advanced "attack-resistant" technical platform for the widespread introduction of Mondex. Ownership of Mondex International was transferred to a consortium of 17 banking companies in Europe, North America and Asia. The Hang Seng Bank franchised Mondex in 13 markets in the Asia Pacific. In October of 1996, Mondex was launched in Hong Kong by HongkongBank and Hang Seng Bank with 400 retailers accepting Mondex in the Citiplaza shopping center in Taikoo Shing and in the New Town Plaza in Shatin in the New Territories. In November 1996, MasterCard International and Mondex International announced that they had signed a letter of intent for MasterCard to acquire 51% of Mondex International, and for MasterCard to adopt Mondex International's technology as its future choice of a strategic chip platform.

Hong Kong Mondex is the first localized rollout of Mondex in the Asia-Pacific region, initially signing up 500 retailers – about 75% of the merchant community at the two Mondex sites in Shatin Town Centre and Tai Koo Shing Cityplaza malls. Mondex issued more than 40,000 smart

cards in Hong Kong by March 1997. Since the program is still in pilot testing, Mondex has limited the maximum stored value on a card to 3000 Hong Kong Dollars (1 US\$ = HKD 7.73). The average transaction has been around HKD 60 (Banking World Hong Kong) but the potential is huge, considering the HKD 370 billion that Hong Kong people spend annually on retail (Brevetti, 1997). Hong Kong residents use cash for 80% of all transactions, accounting for almost 70% of the money actually spent (this results in persistent queues at ATM machines, which are located at regular intervals in malls and train stations). Hong Kong offers an ideal location for Mondex's Asian rollout, with its flourishing retail community and consumer-oriented, cash based society.

Standard Chartered and the Bank of China launched Mondex's competitor *Prime Visa Cash* on August 1, 1996. By November they had issued 200,000 cards and logged 250,000 transactions, an average of 2,500 weekly with the average charge between HKD 5 and HKD 10. The card is accepted at the over 1,000 ATMs of Standard Chartered and Bank of China. *Prime Visa Card* has the backing of Jetco, the region's largest automated teller machine network with 47 member banks and 1,300 ATMs in Hong Kong and Macau, a number that is important in a community that deals in cash and that expects to find an ATM on every block. In contrast, HongkongBank's Mondex program has only two pilot projects up and running, clearly far behind the local Visa effort in penetration at the moment. Both companies have been trying to enlist the metro train systems, vending machines and recreational facilities into their system. Hong Kong will soon be introducing new parking meters that will take the *Prime Visa Card*. Both groups are talking with the manufacturers of the terminals and telephones to encourage them to develop devices to support their payment systems.

Despite Visa's very strong introduction, Mondex maintains a crucial advantage over traditional credit and debit cards –

low transaction overhead and risk. Most debit/credit card transactions involve at least five parties – purchaser and bank, retailer and bank, and the settlement agency. Mondex enables chip-to-chip payments between buyer and seller, without the need for a separate settlement function. This allows person-to-person transfers of cash, and the system is portable and decentralized. Mondex provides a global, multicurrency system, which has distinct advantages for the multicultural community of Hong Kong over the single currency stored-value cards. What is happening in Hong Kong is a microcosm of the way the competition and the payment system will evolve worldwide as e-cash steadily supplants currency.

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Payments and Micropayments

The typical smart card payment is small. Average Mondex payments are less than US\$ 7.50, typically spent at news stands, fast food outlets, and on public transport systems. Higher-value transactions occur in supermarkets and petrol stations (Brown). Mondex is designed to provide an alternative means of payment to cash in the physical market place. Merchants in Hong Kong frequently describe Mondex's primary advantage being the speed of checkout, and the ability to download withdrawals directly from the bank, lowering cash handling costs.

Mondex also offers the Internet user a payment option that meets a growing need in the virtual marketplace. Hong Kong's 6 million residents are connected to the Internet through over 50 Internet Service Providers. They have one of the highest penetration rates of computer and communications technology in the world. Internet service providers are now charging US\$ 0.01 and less per access for pictures, sound and other intellectual property. Because Mondex security is implemented at the chip level, overhead costs associated with the central accounting systems of traditional credit cards do not exist. This means that Mondex transaction charges of fractions of one cent become viable. Currently, around 45% of smart card transactions in Hong Kong are between about US\$1.50 and US\$7.50 – too small to be economically feasible on a centralized credit card system. Transaction of this size are manageable with Mondex because the marginal cost of a transaction is vanishingly small.

A Mondex purchase begins with placing the Mondex card into a terminal. Several steps insure that the transferred value reaches the correct destination and that fraud does not take place.

1. *Registration* : Information from the customer's chip card is validated by the shopkeeper's card stored in the Mondex terminal, and vice versa.
2. *Value Transfer* : The shopkeeper's terminal requests payment of a certain

amount, and transmits a digital signature with the request. Both cards check the authenticity of each other's message.

3. The customer's card checks the digital signature and, if satisfied, sends the amount, with its own digital signature attached. At this point, the value is deducted from the total value on the customer's card.
4. The chip card in the shopkeeper's terminal checks the digital signature and, if satisfied, sends acknowledgement, again with a digital signature.
5. Only after the amount has been deducted from the customer's card is value added to the card in the shopkeeper's terminal. This prevents the possibility of duplication or unauthorized creation of value. The digital signature from this card is checked by the customer's card. If valid, this ends the process.
6. If at any point a check fails, e.g., because of a power failure, the protocol is designed to continue automatically and complete the transaction if possible, e.g., once power is restored. If this is not possible it automatically records a detailed log of the failed transaction.

Fraud involving banknotes and coins can take place through the use of *adequate* forgeries produced with relatively inexpensive technology. With Mondex, a *perfect* forgery of the card and its resident information is required. If a forgery of the Mondex chip or the cryptography is not perfect, it will fail. Mondex's system for completing person-to-person digital cash transactions assures that it is neither necessary nor possible to track and record details of personal transactions. Users are assured a level of privacy similar to currency-based transactions because Mondex does not track the movement of e-cash after it is issued to consumers. Its decentralized chip-on-card system allows essential information to be kept on the card, and out of central databases, insuring a high degree of privacy, portability and security.

Mondex's competitor *Prime Visa Card* bases its e-cash on different and incompatible technology platforms and business models. Visa plans to offer smart card technology on three kinds of digital cash cards:

1. Immediately disposable (one-time use)
2. Standard stored-value card
3. Two-in-one cash/credit card

Hong Kong is already familiar with *stored value cards*, as these are widely used for gate payments on Hong Kong's *metro trains* – the Mass Transit Railway and the Kowloon-Canton Railway. Credit cards are widely used in Hong Kong, though not as widely used as in the West. The *Prime Visa Card* is issued jointly by two of the three note issuing banks in Hong Kong – Standard Chartered Bank and Bank of China Group (Gypherpunks Current Archive). The *Prime Visa Card* is a disposable HKD 200 card similar to those offered for the metro trains. No application is necessary for its use, and there is an expiry date after which the card is voided, with any remaining value that is unused being non-refundable. There is no charge to the retailers. Plans are being made to make it reloadable and to combine cash and credit in a single card.

The Descent of Cash

Electronic cash is the latest progeny in an evolutionary line extending back over man's history. Early cash was typically a portable commodity of value – salt, gum, precious metals, gems and scents. These were superseded, first in ancient Greece, by minted gold and silver coins in standard weights. The importance of bullion grew over the centuries, reaching extremes in Eighteenth-Century colonial economies dependent on a steady flow of bullion from distant shores. It was during this time that Adam Smith recognized the importance of a nation's productive capacity, and set the basis for widespread circulation of paper and coin backed by the credit of a nation. At each stage, the ubiquity, utility and portability of currency improved, to the benefit of its users. New demands for

global portability are initiating another step forward in the descent of cash with the appearance of e-cash.

The significance of this evolution has its hazards, a point not lost on Hong Kong's savvy monetarists. The Monetary Authority of Hong Kong maintains a close interest in developments in electronic cash cards for three reasons:

1. The Monetary Authority must ensure the soundness of the issuer, as well as the soundness of the instrument itself. Hong Kong's own currency is issued by three private banks, and is 100% backed by US dollars held in the Exchange Fund.
2. Hong Kong's monetary policy is enacted by a currency board arrangement whereby banknotes are issued and redeemed against the US dollar at a fixed rate of about 7.8 HKD to 1 USD. The presumed convertibility of banknotes into dollars is an important anchor for currency stability. Mondex's ability to store value and purchase goods in multiple currencies presents a potential long-run challenge to this system
3. The third area of interest concerns the seigniorage of legal tender. Banknotes may be viewed as non-interest bearing liabilities on the balance sheet of the Exchange Fund. The Fund earns interest on the corresponding US dollar assets backing the banknotes. To the extent that cash cards may reduce the use of banknotes, this profit would be reduced (Fung, 1996).

As a result of these concerns, Hong Kong's Legislative Council passed the 1996 Banking Bill to control the possible misuse of electronic cash (e.g., the default of the card issuer, money laundering, possible impact on the Exchange Fund, and so forth). The legislation regulates the issue of multi-purpose stored value cards, equating them to issuance of banknotes (legal tender in Hong Kong).

This is significant. To date, only the Bank of China, Hong Kong and Shanghai Bank, and Standard Charter Bank are authorized

to issue currency in Hong Kong. Issuers of cards would need either to be banks, or would need to apply for authorization as a restricted license bank for the specific purpose of issuing the cards. Non-bank companies – transport or telecom organizations or card issuers such as Mondex or Visa – need to apply for authorization as deposit-taking companies in order to issue cards. The legislation would not apply to single-use cards, which are considered “prepayments” (Hettinga et al., 1997).

Though Hong Kong is bullish on e-cash, there are discordant notes among the songs of praise. Cash is anonymous, divisible, and usable anywhere – from street hawkers to the upscale retailers. Cold cash can be a hard act to follow. On one hand the anonymity of Mondex transactions has been called into question (as has anonym-

ity of most other modes of electronic transaction) (Banking World Hong Kong). And David Carse, the Hong Kong Monetary Authority’s deputy chief executive, suggests that e-cash might ultimately relegate banks “to providers of commodities with the high value activity being conducted elsewhere” (Mondex International Magazine). Kawika Daguio of the American Bankers Association (Hettinga and Daguio 1994) in Washington, is more specific:

“Technology alone won’t provide participants sufficient security for e-commerce to flourish. Law, tradition, good reputations and technology give rise to trust ... I think we agree that if society isn’t careful about the development of e-commerce, some electronic transactions could be made without the protection of statute or they could be covered by rules or laws

which aren’t easily enforceable ... I have trouble accepting that technical protocols may replace law, tradition, and trust. Governments’ and traditional financial institutions’ roles will not be swept away by a technological and social whirlwind.”

Electronic cash poses a serious challenge to the role of banking institutions. Electronic cash will ultimately reduce bank customers’ dependence on bank branches, a weaning process for both customers and the banks themselves. Caution may be warranted, but may arise too from the normal resistance seen when new technologies shift wealth and power from one group to another. The broad consensus seems to be that electronic cash shifts power to the hands of the consumer. This alone would be a deserving reward, however Hong Kong’s financial elite struggle to adjust to the realities of the digital age.

The Government’s Role in Diffusion of EC in Korea

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Electronic communication has been used fairly long in business transaction. Let alone with Telex, which has been in use since 1940’s, Electronic Order Entry and EDI (Electronic Data Interchange) technologies were also under consideration in limited areas back in the 1960’s. Such applications as EDI for the transportation industry, EFT (Electronic Fund Transfer) in the banking industry and CRS (Computer Reservation System) in the airline industry started their operation in the mid 70’s. The concept of IOS (Inter-organizational Information Systems) and the use of electronic media for business transactions were topics discussed widely among researchers and practitioners throughout the 80’s. Now, since the early 90’s, the Internet is used for commercial activities, and is expected to gain growing popularity. Reflecting these expectations, EC (Electronic Commerce) over Internet is being discussed more seriously from various perspectives.

The use of EDI, the precursor of EC, has contributed both to reducing data entry errors, time, and cost, and to enhancing efficiency in several aspects. As the use of advanced IT accelerates, EC is expected to make a tremendous impact on the competitiveness of firms and the structure of markets and industries (Malone et al. 1987; Benjamin/Wigand, 1995). Korea, of course, cannot be an exception. In this report we will briefly review the current state of EC in Korea and its impact in her economy. Additionally, the role of the government and the various related activities will be discussed.

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Although there is no universally accepted definition of EC, by putting essential features together we can identify a working concept of EC as ‘an IT-based transaction practice among organizations that hopes to supply and/or acquire goods and services’. The business relationships related to EC can take many forms. Business-to-business, business-to-consumer, business-to-administration, and consumer-to-administration are the typical types of such relationships (ESPRIT, 1996).

The business-to-consumer type is often classified as ‘electronic retailing, where the customer is an ordinary consumer rather than another company’. In this type, Electronic/Cyber Shopping Mall based on the WWW technology on the Internet composes the major part. Advertising and transactions of such digital products as software, music, publishing are being tried on the Internet. Complete transactions should be supported by electronic payment systems.

Another major part of EC is transaction based on EDI technology to accommodate