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The Octopus in Hong Kong: The Success of a Smart Card-based E-payment System and Beyond

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ABSTRACT

The success of the Octopus as a smart card-based E-payment system in Hong Kong is unparalleled by its counterparts worldwide. The number of daily transactions is over 8.1 million, generating over US\$7 million in revenue on average. Although the majority of these transactions are transport-related, the Octopus is seeking to extend its arms into retailing payments. This research investigates whether retailers and consumers in Hong Kong would accept the Octopus better than its rivals such as cash, credit cards, or Electronic Payment System (EPS) to become a preferred payment method for retailing in Hong Kong.

INTRODUCTION

The Octopus was first developed in September 1997 as a contactless smart card-based E-payment system for the major transportation operators in Hong Kong. Mass Transit Railway Corporation (MTRC) is the largest shareholder of the joint venture that owns and manages the Octopus – Octopus Cards Limited. There are 5 other shareholders who are also transportation operators in Hong Kong. The Octopus has established itself successfully and quickly in a closed system ever since. In April 2000, Octopus Cards Limited was authorized as a Deposit Taking Company by the Hong Kong Monetary Authority (Hong Kong Monetary Authority, 2000) so that the use of its card could be expanded to a wider base of different applications. In December 2000, the first Automatic Add-Value Service (AAVS) was officially launched, enabling personalized Octopus cards to be replenished seamlessly (Octopus Cards Limited, 2000a). The first non-transport related application was launched in October 2000 for the payment at 7-Eleven Convenience Stores (Octopus Cards Limited, 2000b).

On average, there are around 9.2 million passenger journeys on public transport in Hong Kong every day (Transport Department (HKSAR), 2004). Given that all public transport systems in Hong Kong are now equipped with the Octopus, they have provided an extremely favorable environment for the Octopus to grow. Application of smart card-based payment systems in public transport systems is not unique for the Octopus. Such an application has been witnessed in

European countries (European Committee for Banking Standards, 2003) such as Finland, Portugal, Spain, and France. In the pacific-rim region, a similar implementation strategy has been adopted by countries (Committee on Payment and Settlement Systems, 2001) such as Singapore, Taiwan, Korean, and Malaysia. However, with the around 1.11 passenger journeys on public transport per inhabitant (around 8.3 million population in Hong Kong (Census & Statistics Department (HKSAR), 2004)), the high ratio is unparalleled by other countries. It can be reasonably argued that the Octopus has a competitive advantage of establishing itself in a closed system as favorable as the transportation system in Hong Kong, which is a critical success factor for the implementation of smart card-based E-payments (Turban & Braham, 2000; Van, 2000-1).

The success of the Octopus is quantifiable. There are now over 10 million Octopus cards in circulation in Hong Kong. On average, daily transaction volume is over 8.1 million, which generates over US\$ 7 million. Tables 1 and 2 contain data primarily provided by 2 publications from Bank for International Settlements, comparing similar smart card-based E-payment technologies among 6 top countries/cities in terms of penetration rate by 2003 (Committee on Payment and Settlement Systems, 2001; European Committee for Banking Standards, 2003). As indicated in Table 1, the average number of daily transactions of the Octopus is the highest and is twofold of that of the Proton in Belgium, which ranks the second. Table 2 takes the number of population in each country/city into account, which is deemed important since Hong Kong is a small city. It is because number of cards issued solely may not reveal the truth about how prevalent the Octopus is in Hong Kong. The number of average daily transactions per 1,000 inhabitants in Hong Kong is more than 1,000 and is almost threefold of that of the CashCard in Singapore, which follows the Octopus. With reference to the data in the 2 tables, they indicate that Hong Kong citizens use the Octopus very frequently as compared to other smart card-based E-payment systems around the globe.

Country	System Name	No. of Cards Issued ('000)	Average Daily Transactions ('000)
Hong Kong	Octopus	10,400	8,140
Belgium	Proton	2,500	4,027
Singapore	CashCard	9,776	1,924
Germany	GeldKarte	60,000	313
Netherlands	Chipknip	17,400	238
Switzerland	Cash	3,692	55

Table 1: A Comparison of the Top smart Card-based E-payment Systems in 6 Countries/Cities Sorted by Average Daily Transactions

Country	System Name	No. of Cards Issued ('000)	Average Daily Transactions Per 1,000 inhabitants
Hong Kong	Octopus	10,400	1,197
Singapore	CashCard	9,776	461
Belgium	Proton	2,500	390
Netherlands	Chipknip	17,400	15
Switzerland	Cash	3,692	7
Germany	GeldKarte	60,000	4

Table 2: A Comparison of the Top Smart Card-based E-payment Systems in 6 Countries/Cities Sorted by Average Daily Transactions per 1,000 inhabitants

The Octopus has undoubtedly established itself successfully in a closed system like the public transportation system in Hong Kong. As argued by Clemons et al. (Clemons, Croson, & Weber, 1996), such an implementation strategy is critical for smart card-based E-payment systems. The Octopus has succeeded in adopting the strategy and become a preferred payment method for public transportation in Hong Kong. Now, the Octopus presents an unprecedented opportunity to study how a smart card-based E-payment system diffuses into retailing sector after it has attained a critical mass and has been widely accepted for another application. The objective of this research is to investigate the likelihood of the Octopus to become a preferred payment method for retailing after it has achieved tremendously favorable conditions in Hong Kong.

This research was a case study on the Octopus. Researchers (e.g. Kaplan & Maxwell, 1994) advocate qualitative research approach for its ability to understand a phenomenon from the point of view of the participants, which is largely lost when textual data are quantified. Such a research methodology is deemed appropriate for this study as it investigates a contemporary phenomenon within its real-life context (Yin, 2002). Data of this study came from secondary sources. The analysis was conducted by the researcher's evaluations and observations with the help of the analytical framework developed.

ANALYTICAL FRAMEWORK

Simmel (Simmel, 1900) originally published his book in German in 1900, and it was translated into English in 1990 (Simmel, 1990). Researchers have developed sociological analyses of money on the basis of Simmel's 100-year-old work (e.g. Deutschman, 1996; Ritzer, 2001; Sassatelli, 2000). Simmel concluded in his book that money would evolve in terms of functionality, and its significance as a substance would subside. He recognized the importance of substance as just a technical issue, and predicted that money would be freed from its physical form that limits the quantity of money where credit cards, EPS, and the Octopus are some exemplars. He termed functions of money as the essence of money, and concluded that it is independent of the form money may take. Attributes were developed by Simmel to categorize money and other forms of payment at various times to capture the essence of money. Although technological advancement has enabled money to exist in a variety of forms, the essence of

money remains unchanged and becomes more identifiable. Simmel's clear distinction between the essence of money and its substance has provided an excellent framework for this study.

This study aims at assessing the future of the Octopus as an E-payment system for retailing payments in Hong Kong from 11 attributes, namely divisibility, portability, durability, borrowing, ease of use, security, transaction/overhead cost, transaction error, flexibility, risk, and value of purchase. 7 of these attributes are adapted from Simmel's work (Simmel, 1990), and provide a backbone for the research framework. The rest are incorporated to account for perspectives which were less significant at the time of Simmel. Each perspective is also examined from 2 points of view, i.e. customer and retailer. The acceptance of the Octopus as a payment method is likely subject to both "pull" and "push" effects. Customers' preference over the Octopus will favorably support its diffusion while retailers can help boost its usage if they find it beneficial and install an Octopus card reader. Thus, customers' and retailers' perceptions are both relevant and require attention.

The most commonly used payment systems in Hong Kong are compared head-to-head. They are broadly classified by their nature: debit, hybrid, and credit. Under these 3 categories, it is found that there are 4 types of payment methods that consumers in Hong Kong employ most frequently. Cash and EPS (an electronic fund transfer system at point-of-sale) are the 2 exemplars of the debit nature category. EPS initiates and completes a payment process by allowing a customer to simply swipe his/her ATM card, key in amount and PIN (Personal Identification Number), then wait for a receipt. Since the ATM card enables fund transfer from the customer's account to the merchant's account, EPS is a debit payment method. Credit cards are the major payment instrument with a credit function in Hong Kong, like any other countries around the globe. Payment methods with hybrid nature refer to those possess both credit and debit functions simultaneously. In this regard, the Octopus is the prime candidate as indicated earlier. The Octopus is essentially debit in nature, however, it allows Automatic Add-Value Service (AAVS). Under the scheme, an Octopus card is backed by a bank account or a credit card where HK\$250 will be debited from the corresponding bank or credit card account and credited to the Octopus card seamlessly whenever the card's balance drops below zero. If a credit card is selected, credit element is incorporated into the Octopus card. It is noteworthy that such a service is free-of-charge.

DISCUSSION

Divisibility

The effort required and possibility of making precise payments determines divisibility of a payment method. The divisibility of the Octopus is as high as the other 2 payment mechanisms except cash. It is mainly because all these 3 payment tools employ electronic medium for payment processing. Such seamless processes enable exact payments down to pennies without incurring any additional efforts. On the other hand, cash payments always involve extra time if a precise payment is made. It becomes worse when no change is allowed. When frequent exact payments are made, it may also result in a bulky load of coins. In the same case, it may incur

unreasonably large amount of resources of retailers. Similar advantages and disadvantages should be perceived by both retailers and consumers in this context.

Portability

Portability here is concerned with how easy it is to carry a payment instrument around. It is a function of weight (or size) and degree of international recognition. Cash is regarded as the least portable among the 4. Cash gains in weight or size as the amount of money it represents increases. It becomes worse if coins are needed for exact payments. Hong Kong coins and banknotes receive local recognition only. The Octopus is considered to be moderately portable partly because its weight is independent of the amount of money one has on an Octopus card. However, there is a limit for the Octopus to leverage on this functionality as each Octopus card can store up to HK\$1,000 only. Moreover, the Octopus renders local recognition only. It is not applicable anywhere outside Hong Kong. In this regard, the Octopus is not as highly portable as credit cards. Credit cards excel in terms of portability because of their world-wide recognition – its inherent characteristic. Credit limit on a credit card can easily exceed HK\$10,000, and is unlimited in some extreme cases. As a result, credit cards are the most portable payment instrument among the 4. Both retailers and customers should perceive portability of all 4 methods without discrepancies.

Durability

The Octopus comes first in this category with obvious reasons. Octopus cards are made of polyethylene terephthalate (PET), which ensures that they are weathering-resistance. Moreover, the Octopus's contactless operation allows the cards stay in wallets or purses most of the time. Durability is thus guaranteed. ATM and credit cards are made of plastic, which is long-lasting. However, these cards are exposed to frequent swiping operations that will wear-off the cards significantly, in particular, the magnetic strip on the card. Periodic replacement of ATM and credit cards is inevitable that customers may find inconvenient. Disposal of plastic materials is not environmentally friendly.

It is a commonly known fact that cash is not durable. Although plastic banknote technology has been developed and adopted by 21 countries around the world (ABC Online, 2002), it cannot completely resolve the problem since plastic banknotes are still subject to manual or automated handling. Its durability cannot match with PET or plastic card. Coins cannot be easily distorted or broken. However, its longevity leads to unsanitary problems. In sum, cash presents a low level of durability to both customers and retailers that are mainly due to paper-based nature and frequent physical handling.

Borrowing

For consumers, payments by the Octopus may mean borrowing. Thanks to AVVS, it is possible to borrow by using the Octopus to pay because of its hybrid nature. Non AAVS-enabled Octopus cards are strictly debit in nature and do not allow any borrowing. It is the same case for cash and EPS. Credit cards, by its very nature, allow borrowing or sometimes encourage it. The credit element of credit cards does not place retailers at a risky position. Rather, the risk is borne by the

bank associated with the credit card. Retailers are also not exposed to financial risks for employing the other 3 payment methods. Thus, the Octopus does not introduce financial risks to retailers who adopt the Octopus. Its borrowing capability simply conveys financial convenience and flexibility to consumers.

Ease of Use

The Octopus is the easiest to use among the 4 from customer's perspective. Its high degree of ease of use originates from being contactless. Payment by the Octopus requires merely placing an Octopus card, which is very commonly kept in a purse or wallet, close to a card reader. In terms of ease of use, the reloading process plays a determining role. For personalized Octopus cards, which have to be coupled with AAVS, the process is effortless to consumers. Whenever a personalized Octopus card's value drops below zero after the last transaction has been made, HK\$250 will be automatically added to the card. Since no password input (like EPS), signature (like credit cards), or calculation (like cash) is required, the Octopus ranks top when it comes to ease of use. If an Octopus is not AAVS-enabled, the adding value process is not cumbersome at all. The process can be self-serviced at numerous add-value machines at train or subway stations. Or, it can be done at any retail outlets accepting the Octopus for payment, such as convenience stores, chain supermarkets, chain fast food shops...etc.

From retailer's point of view, all 3 payment methods – EPS, the Octopus, and credit cards involve machine clearing every night. The processing time follows learning curve effect, and depends on the degree of integration between the corresponding device and retailers' backend systems. With the advancement of IT and extensive experience of frontline workers on system automation, machine clearing should not be a lengthy process for retailers that operate in a large scale such as chain stores. To them, the automated process is a step closer to full system automation and integration. However, small-size retailers may not be equipped with resources to realize this potential benefit. They would rather regard the additional procedure an expense than an investment, deterring them from welcoming the 3 payment methods actively. Among the 3 payment methods, EPS and credit cards are more labor-demanding as they require amount input, card-swiping, or signature. Thus, the Octopus is as easy to use as cash for medium-size retailers or even easier for retailers that are more resourceful system-wise.

Security

The Octopus offers quite a low level of security measures. To use the Octopus for payments, it does not require authorization, signature or identification. It is the same case for cash. Anyone who is in possession of a stolen card can make payments without faking or decoding. Since all 4 forms of payment are subject to stealing, both cash and the Octopus offer minimal level of security on consumer side. However, cash is the worst since one might receive fake cash during a change process, which would not occur for the other 3 payment methods. This is probably a primary reason why other alternatives have been constantly considered. EPS is the most secure among the 4 since it is PIN protected, and the PIN is not stored on the card. In this case, PIN information cannot be compromised.

Retailers may embrace the Octopus and EPS most warmly in the context of security because of their debit nature. Their security brings no concern to retailers as it is assured that they will receive the money as soon as the transaction is completed. No forgery reports have been filed so far since the introduction of EPS and the Octopus in 1984 and 1997 respectively. The security measures offered by credit cards are clearly not enough for retailers. The root cause is its credit nature. Actual payments may not be received if the credit card used is later found forged. The signature requirement and photo identification do not help much. The likelihood of receiving fake cash faced by consumers also poses the same threat to retailers.

Transaction/Overhead Cost

Transaction or overhead costs are a prime issue for customers selecting a payment method (Committee on Payment and Settlement Systems, 2001). Such costs incurred by customers for using cash, EPS, or the Octopus are minimal, if not zero, except that it requires a one-off refundable deposit of around US\$6.4 for acquiring an Octopus card. In some cases, customers have to bear a surcharge when paying by credit cards. The surcharge normally amounts to 2-3% of purchase value. Such transaction costs can be significant depending on purchase value and frequency of purchasing.

On retailers' side, transaction or overhead costs are a more significant concern. Installation and maintenance of card reader and terminal are required for EPS, the Octopus, and credit cards, and they render fixed costs. For other indirect costs, retailers have to spare resources to clear the corresponding system every night for settlement. However, it may not incur costs if the POS is fully automated and integrated. At another end of the spectrum, it even helps streamline a transaction process and saves costs for retailers. These costs are more or less compensated by benefits derived from eliminating partly or completely cash handling. Handling of large quantity of cash is susceptible to human errors. Engaging in change processes also disallows frontline staff to attend to other customer needs to enhance customer services. As a result, indirect costs are inevitably coupled with payment by cash from retailers' perspective.

Transaction Error

The likelihood of any transaction errors is largely reduced if a POS is integrated with the device responsible for processing EPS, the Octopus, or credit card payments. Otherwise, human errors will be introduced which result in incorrect payment amount. The situation is remedied with a receipt issued to customers. It acts as a feedback mechanism. Also, transaction records are maintained, which a customer can readily verify. A cash payment is normally followed by a receipt too whereby the amount of money paid and received is recorded. However, it does not reflect what actually happened. A problem arises when there is a discrepancy. This is also a problem that places customers at a disadvantageous position since there is no record on customer's side for verification later. Cash payments, as a non-electronic method, do not facilitate an effective feedback mechanism to protect customers from financial losses as a result of transaction errors. The same applies to retailers, who receive cash for settling a transaction. As long as an EPS, Octopus, or credit card payment system is integrated with a retailer's POS system, transaction errors are significantly minimized on his/her side since human intervention is

shielded from him/her. Moreover, the 3 systems' electronic means of processing provide audit trails for future investigation if required.

Flexibility

The more retailing locations accept a payment instrument, the more flexible it is. Flexibility is primarily a concern for consumers rather than retailers. With respect to this, the Octopus lags behind when compared with the other 3 payment methods. Its infancy is the most significant contributing factor as its retailing deployment was first recorded less than 4 years ago. As a result, every stage of its retailing implementation process is developing at varying degrees. Undoubtedly, the other 3 methods of payment are much more mature than the Octopus in terms of availability and acceptance. Because of cash's well-established history, cash payment becomes a habit and so cash is by far the most popular payment method in Hong Kong. Currency to GDP ratio (7.2%) in Hong Kong is high and similar to Japan and Switzerland when compared with the G10 economies (East Asia-Pacific Central Banks and Monetary Authorities (EMEAP) Working Group on Payment and Settlement Systems, 2002). Customers are able to pay by cash at all retail stores, which welcome it with no hesitation since the payment is not on credit, albeit other inherent potential risks and errors discussed earlier.

EPS and credit cards are not as flexible as cash because devices have to be in place to make payments possible. Such devices are not prevalent enough, in particular, at small size retailers that make up a significant portion of the merchant population, which amounts to around 55,114 retail establishments in Hong Kong (Hong Kong Retail Management Association, 2004). Payment by EPS or credit cards is not always an option for customers.

There are around 2,100 retailing locations across Hong Kong where customers can make payments by the Octopus (Octopus Cards Limited, 2004b). The number represents less than 4% of the total number of retail outlets in Hong Kong. Most of the Octopus-accepting retailers are chain stores such as supermarkets, convenience stores, and fast-food shops. Thus, the applicability of Octopus payments is relatively determined by shop size. One reason for this is that chain stores are better-equipped with information systems to realize the potential benefits offered by the Octopus as a payment medium. Another deterring factor is that each personalized Octopus card can only be automatically reloaded with HK\$250 once a day (Octopus Cards Limited, 2004a). It is sufficient to pay for daily expenses, e.g. commuting, meals, and groceries. However, when it comes to shopping, it is unlikely the Octopus can allow serious shoppers to shop freely.

Risk

The risk of doing financial damage to the payer and payee of a payment tool is a primary concern to both parties. Both cash and credit cards are subject to a very high level of risk though their root causes are different. Cash is exposed to the risk that it is untraceable once it is stolen or lost. The movement of cash is isolated and free from any monitoring once it leaves its issuing bank. Thus, there is no way to stop stolen or lost cash from being used to minimize the damage. Unlike cash, it is relatively easy to keep track of a stolen or lost credit card. It is also feasible to block such a card from further use. However, potential loss of a stolen credit card would be unexpected

before the card's account is frozen. The loss is in proportion to the credit limit, and could be enormous. What could worsen the situation is when only the information on a credit card is extracted, but not the physical card itself. Without the physical disappearance of the card, report of loss mechanism will not be activated promptly. That gives the criminal unnecessarily long time frame to do the harm and places the cardholder at an unshielded position.

An Octopus card can store up to HK\$1,000 (around US\$128). Loss could be minimized if a loss report has been filed promptly because the cardholder is only liable for any loss within the first 24 hours after that. There is a surcharge of HK\$70 (around US\$10) for replacement. As a result, the maximum loss would be US\$138. However, the case is different for personalized Octopus cards though the maximum stored value and surcharge are still the same. Given the fact that personalized Octopus cards can be reloaded once every 24 hours, the cardholder of a stolen personalized Octopus card would bear an extra US\$32 potential loss, resulting in US\$170. The bright side of it is that there is a limit to the potential loss though it is unarguably not negligible.

EPS payments pose a moderate risk to customers because an ATM card is involved that may lead to disastrous outcome once the account information and PIN are compromised. On the other hand, EPS payments are not risky to retailers at all, which is due to its debit nature. It is also true for the Octopus. Retailers are assured about the receipt of money. Credit card payments are risky to retailers where cardholders can repudiate a transaction made by a lost or stolen card. Under such circumstances, a retailer would lose the product while not receiving any payment for it. Retailers experience similar risk factors with cash payments. Cash, which is used for the payment of goods, could be later found forged. As it is almost impossible to trace back to the payer, a retailer would result in giving away goods without receiving any compensation.

Value of Purchase

Credit cards and EPS are capable of facilitating high-value transactions. It depends on how much a customer has in his/her bank account to determine the maximum value of a transaction can be for EPS payments. For credit cards, the value then hinges on the credit limit set forth, which may be a multiple of the cardholder's monthly salary. In this vein, a customer's purchasing power is magnified. Cash, in theory, is able to make payments of any amount as long as one can afford. Practically speaking, however, it would be too bulky to carry a large amount of money. Thus, the bulkiness of money sets a ceiling for the maximum value of purchase that cash can handle.

The maximum value of US\$128 or HK\$1,000 that an Octopus card can store limits its applicability on high-value purchases. HK\$1,000 is enough for daily-life purchases in Hong Kong, where a newspaper costs HK\$6, a can of coke costs HK\$5, a breakfast set costs around HK\$20 and a lunch set costs around HK\$40. In fact, all these had always been solely cash-assisted transactions until the Octopus arrived. Now, customers in Hong Kong are able to pay for newspapers and cans of coke at e.g. 7-Eleven and for breakfast and lunch sets at, e.g. Café de Coral (a chain fast food shop) by the Octopus.

Limitations

This study compares the most commonly employed payment methods in Hong Kong mainly with respect to the essence of money (Simmel, 1990). With the widening spectrum of innovative tools for monetary functions, customers evaluate these tools (e.g. the Octopus) as new technologies too. Thus, the major limitation of this study is that it relatively falls short on investigating the acceptance of the Octopus as a retailing payment method from the technology acceptance perspective. At individual level, users' perceptions toward a technology significantly determine whether it would be adopted (Davis, 1989). National culture also plays a significant role in technology acceptance (Singh, Zhao, & Hu, 2003; Tung & Quaddus, 2002), which is particularly salient in the current research as Hong Kong's culture is unique where East meets West.

CONCLUSION

If the Octopus would supplant 1 among the 4 most widely adopted forms of payment available in Hong Kong, it appears that the most possible candidate is cash. From customer's point of view, the Octopus surpasses cash in 8 attributes, namely portability, divisibility, borrowing, ease of use, security, durability, transaction error, and risk – over 70% of the attributes employed in the analysis. Retailers should share the same view, except that they would arguably rank ease of use of cash higher but it would depend on how integrated their POS and back-end systems are. The Octopus outperforms credit cards and EPS in some aspects, e.g. risk level or transaction/overhead cost on both customer and retailer sides. However, the relative advantages are not as dominant as in the case of cash. Whether the Octopus could replace cash, credit cards and EPS would also hinge on user behavior with respect to diffusion of innovations (Rogers, 1983) and acceptance of technologies (Davis, 1989) at individual level. About 1-2% of all cash transactions are now made with the Octopus (Ramstad, 2004), the following enhancements must at least be incorporated before the Octopus would witness a growing number of customers waving their wallet or purse over an Octopus reader, where cash payments occur traditionally, at large-scale outlets.

AAVS plays a very critical role in facilitating and promoting the use of the Octopus as a payment method since the logistics of adding value (money) to an Octopus card is streamlined. To allow the Octopus to replace cash or even EPS and credit cards in a substantial manner, however, some crucial improvements must be made to AAVS. Personalized Octopus cards must be able to be reloaded more than once every 24 hours. In order to strike a balance between protection and convenience, cardholders should be given discretion on deciding how often their cards are reloaded and the reloading value each time. Besides, the maximum value a personalized Octopus card can store should be relaxed to accommodate more flexible application for the card. Users should always be the ultimate decision-makers as they have the best knowledge of how a system or tool can be tailored to fit their needs most effectively. Octopus cards as an E-payment tool should be no exception.

Besides individual user acceptance, stakeholders in the macro-environment also help define if a larger scale adoption of the Octopus for retailing payments would follow. The followings are some obvious stakeholders.

1. Octopus Cards Ltd. is the *sponsor*, who is also an *innovator* (Cavaye, 1995).
2. Retailers in Hong Kong are the *adopters*, who may range from *innovators* to *laggards* (Cavaye, 1995).
3. HKSAR government, in particular HK Monetary Authority (HKMA), is a *policy maker* and *regulator*. If HKMA had not authorized the Octopus Cards Ltd. as a deposit-taking company, the Octopus would not have succeeded in extending its use to non-transport-related (Hong Kong Monetary Authority, 2000).
4. Financial institutions (mainly banks) in Hong Kong, who are *facilitators* as they make AAVS possible.
5. Credit card companies, who are *competitors*, offer other E-payment alternatives such as EPS, credit cards, Mondex, VisaCash, etc.

Whether the Octopus could become ubiquitous is partially subject to how the above interact, creating an external environment which is favorable or obstructive to a sustained penetration of the Octopus into retailing payment market.

REFERENCES

- ABC Online. (2002). Mexico buys Australian banknote technology. Retrieved April 22, 2004, from <http://www.abc.net.au/pm/s666320.htm>
- Cavaye, A. L. M. (1995). The sponsor-adopter gap - differences between promoters and potential users of information systems that link organizations. *International Journal of Information Management*, 15(2), 85-96.
- Census & Statistics Department (HKSAR). (2004, March 10, 2004). Population and Vital Events. Retrieved June 18, 2004, from http://www.info.gov.hk/censtatd/eng/hkstat/hkinf/population_index.html
- Clemons, E. K., Croson, D. C., & Weber, B. W. (1996). Reengineering Money: The Mondex Stored Value Card and Beyond. *International Journal of Electronic Commerce*, 1(2), 5-31.
- Committee on Payment and Settlement Systems. (2001). *Survey of electronic money developments* (No. 48). Basel: Bank for International Settlements.
- Committee on Payment and Settlement Systems. (2003). *Statistics on payment and settlement systems in selected countries* (No. 54). Basel: Bank for International Settlements.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-339.
- Deutschman, C. (1996). Money as a Social Construction: On the Actuality of Marx and Simmel. *Thesis Eleven*, 47, 1-19.
- East Asia-Pacific Central Banks and Monetary Authorities (EMEAP) Working Group on Payment and Settlement Systems. (2002). *Payment Systems in EMEAP Economies (EMEAP Red Book)*.
- European Committee for Banking Standards. (2003). *Overview of European Electronic Purse Products*. Brussels.

- Hong Kong Monetary Authority. (2000). Granting of authorization to Creative Star Limited as a deposit-taking company. Retrieved June 5, 2004, from <http://www.info.gov.hk/hkma/eng/press/2000/20000425e4.htm>
- Hong Kong Retail Management Association. (2004). Retrieved March 18, 2004, from <http://www.hkrma.org/en/library/index.html>
- Kaplan, B., & Maxwell, J. A. (1994). Qualitative Research Methods for Evaluating Computer Information Systems. In J. G. Anderson, C. E. Aydin & S. J. Jay (Eds.), *Evaluating Health Care Information Systems: Methods and Applications* (pp. 45-68). Thousand Oaks, CA: Sage.
- Markus, M. L. (1987). Toward a critical mass theory of interactive media. *Communications Research*, 14(5), 491-511.
- Octopus Cards Limited. (2000a). Creative Star and Standard Chartered Bank introduce Automatic Add-Value Service for Personalised Octopus Card. Retrieved June 19, 2004, from <http://www.octopuscards.com/eng/general/news/index.jsp>
- Octopus Cards Limited. (2000b). History. Retrieved June 20, 2004, from <http://www.octopuscards.com/eng/general/about/history.jsp>
- Octopus Cards Limited. (2004a). Reporting Lost Cards. Retrieved March 16, 2004, from <http://www.octopuscards.com/eng/customer/report.jsp>
- Octopus Cards Limited. (2004b). Where to use Octopus? Retrieved April 10, 2004, from <http://www.octopuscards.com/eng/whatis/usage.jsp>
- Ramstad, E. (2004, Feb 19). Hong Kong's Electronic-Money Card Is a Hit. *Wall Street Journal*, p. B. 3.
- Ritzer, G. (2001). *Explorations in the Sociology of Consumption: Fast Food, Credit Cards and Casinos*. Thousand Oaks, CA: Sage.
- Rogers, E., M. (1983). *Diffusion of Innovations* (Third Edition ed.). New York: The Free Press.
- Sassatelli, R. (2000). From Value to Consumption. A Social-Theoretical Perspective on Simmel's Philosophie des Geldes. *Acta Sociologica*, 43(3), 207-218.
- Simmel, G. (1900). *Philosophie des Geldes*. Leipzig: Duncker & Humblot.
- Simmel, G. (1990). *The Philosophy of Money* (T. Bottomore & D. Frisby, Trans.). London: Routledge.
- Singh, N., Zhao, H., & Hu, X. (2003). Cultural Adaption on the Web: A Study of American Companies' Domestic and Chinese Websites. *Journal of Global Information Management*, 11(3), 63-80.
- Transport Department (HKSAR). (2004). Fixed Route Public Transport Passenger Journeys. Retrieved June 18, 2004, from http://www.info.gov.hk/td/eng/transport/surey_index.html
- Tung, L. L., & Quaddus, M. A. (2002). Cultural differences explaining the differences in results in GSS: implications for the next decade. *Decision Support Systems*, 33, 177-199.
- Turban, E., & Braham, J. (2000). Smart Card-Based Electronic Card Payment Systems in the Transportation Industry. *Journal of Organizational Computing and Electronic Commerce*, 10(4), 281-293.
- Van, H. L. (2000-1). New York City Smart Card Trial in Perspective: A Research Note. *International Journal of Electronic Commerce*, 5(2), 119-131.

Yin, R. K. (2002). *Case Study Research, Design and Methods* (3rd ed.). Newbury Park: Sage.

