



Global Business Dialogue on Electronic Commerce

GBDe 2007 Issue Group

International Micropayment

Issue Group Leader: Dr. Shyue-Ching Lu, President, Chunghwa Telecom Co., Ltd.

Issue Group Members: Mr. Toshiro Kawamura, Executive Advisor, NEC Corporation

Mr. Fumio Horikawa, Representative Director and Senior Corporate Officer, Nihon Unisys

Dr. Takao Shiino, Counselor, Nomura Research Institute

Mr. Tomokazu Hamaguchi, Senior Vice President and Counselor, NTT Data

Mr. John Chen, Chairman, CEO and President, Sybase

Mr. Dennis McGuire, Chairman, TPI

1. Overview and Review of Past Work

With the growth of e-commerce and mobile commerce, micropayments are becoming increasingly important. This importance is supported by the following facts:

- Merchants strongly expect to decrease overall transaction costs.
- Demand for micropayments in daily life is growing.
- Lack of convenient and feasible on-line payment mechanisms mean the potential loss of transaction revenue from the impulsive buyers is huge.

To promote the concept of micropayments and address accompanying issues, the International Micropayment (IMP) Issue Group (IG) was established in 2005. In the past year, the IG achieved several things, including:

- Setting up and successfully carrying out several field trials for phone bill-based IMP.
- Proposing several best practices (listed below) and recommendations based on case studies of phone bill-based IMP.

- How to connect two International Micropayment Centers (IMPC).
- How to integrate domestic PSPs and connect to IMPC.
- How to extend micropayment (MP) to IMP for domestic content providers (CP).
- Taxation and settlement rule.
- Consumer dispute handling rule.

The IMP IG also addressed some IMP issues requiring further attention, such as taxation, transaction flow and secure protocol between two IMPCs, and the baseline of billing settlement.

In addition to phone bill-based IMP, the IG has begun to examine the development of international Near Field Communication (NFC) micropayments. The issues arising from extending NFC IC card-based MP to IMP are discussed in later chapters.

2. Study Topics

Based on its work last year, the IMP IG identified certain priority issues and areas requiring further attention. For example, the group recommended that:

- The interoperability and promotion of phone bill-based IMP should be encouraged, the usage of phone bill-based IMP expanded, and the issues of unequal tax barriers, non-unified secure protocol, non-unified settlement policy, and content IPR release given further attention.
- For NFC IC card-based IMP, the issues of focus this year include:
 - One mobile device that supports multiple existing standards.
 - Interflow of prepaid e-wallet for cross-border transaction.
 - Feasible business model.
 - Deterministic NFC chip specification of handset.

3. Approaches to IMP - Case Studies

International micropayments can be divided into five categories: phone bill-based, email-based, web ATM, prepaid e-wallet, and credit card. The email-based type and credit card have been well run in C2C transactions and e-commerce, but there remain concerns about potential theft of credit card numbers for this type. Web ATM is very convenient and popular, but politics and banking regulations make it more complicated than the others. Phone bill-based IMP and prepaid e-wallet (NFC IC card)-based IMP will therefore be our main focus at this stage.

3.1. Phone Bill-based IMP

In the case study of phone bill-based IMP, interoperability among Asian countries, particularly Taiwan, China and Korea, continues to be the focus of study. The IMP issues to be further addressed are summarized below.

3.1.1. System Integration

The communication protocol adopted by Taiwan, Korea and China in the case study is https protocol with 128 bits SSL, and the data structure is XML. The issues dealing with secure protocols have been resolved here, even though a few proprietary protocols exist through software adaptation. Nevertheless, the commonly adopted commercial SSL protocol is still recommended as having the greatest potential for expanding IMP adoption in the world.

3.1.2. Taxation

Basically, all taxes are charged additionally, including the withholding tax and commission fees for each IMPC, except VAT (value added tax). This means that the withholding tax and commission fee for each IMPC are not included in the list price of the goods. Although this is likely to result in disputes during the transaction flow, the problem has been mostly avoided by clear declaration and notification during critical charging nodes. On the other hand, the withholding tax for cross-border transactions (which may not be imposed by other countries) has been resolved in Taiwan, where the government has agreed to cancel cross-border transactions of digital goods.

3.1.3. Content Policy and IPR

Due to varying national regulations and policies, content allowed for sale can differ from one country to another. For example, content allowed for sale in Taiwan might not be allowed for sale in China. Because of this, a common policy was agreed upon that requires any content sold via the IMP website to be verified and approved in advance by each country. Furthermore, vendors have to comply with related IPR regulation and ensure that all content is legal for use in each country, even if it means added costs. The discrepancies in content authorization and access control among different regions are still a major bottleneck for real IMP commercial operation, especially for countries which practice strict content screening.

3.1.4. Consumer Dispute Handling

There are two types of consumer disputes. One type of dispute happens during online transactions; the other type occurs after receiving the bill. These disputes can generally be avoided by the Standard Operating Procedure (SOP) that is agreed upon after negotiations among the IMPCs.

3.1.5. Network Quality of Service (QoS) for International Content Access

The access and play of digital contents is generally not an issue for domestic transactions, but problems might arise for international access and service that is involved with real-time streaming (e.g., when the contents transmitted over the network get routed through multiple points and the network quality can not be guaranteed). One possible solution in this case is Content Distributed Network (CDN).

3.1.6. High Usage Fees for International Mobile Data Access

The cost of browsing mobile internet is generally reasonable, even at a flat rate ; however, usage fees for international access will be drastically higher because charging policies vary significantly among countries and agency fees are very high (>2 USD/kbyte). A public access network and system of simple, convenient payments are crucial conditions for the growth of mobile commerce. The cost issue needs to be addressed before IMP services can expect to move to the mobile internet.

3.2. NFC IC Card-based IMP

In 2007, because of the convenience and fast transactions of NFC proximity payments, the prepaid e-wallet and credit card embedded in IC card became more widespread. A few real-world cases are discussed below.

3.2.1. Japan

A typical example in Japan is NTT DoCoMo FeliCa payment service. KDDI has a similar micropayment solution. The major application is for transportation, such as train and subway fares, but other applications, such as vending machine payments, corporate and student ID cards, point accumulation, physical shopping and airline check-in, are also covered. The total number of cards issued for transportation applications has surpassed 17 million. The extension of the applications for cross-industry use and for adoption in multiple cities is on-going. Generally, technical issues with the payment service are less of a problem than in other countries because of FeliCa's adoption of a single NFC proprietary standard. The exchange of decryption keys among different application e-wallets, however, is a key issue that involves more than technical concerns. It calls for negotiations between parties about the choice of business model. In Japan, the world's most advanced mobile phone market, mobile phones already offer a wide variety of features; over 40% offer some form of contactless mobile payment.

3.2.2. Korea

SK Telecom (SKT) announced an NFC mobile payment field trial in cooperation with Philips Semiconductors on May 17, 2006. The example here involves T-money. The related applications for T-money include payment of transportation fares (train, subway, public bus, taxi, metro) and parking fees and for convenient store items and entertainment-related e-tickets. The total number of cards issued for transportation applications to date is over 16 million. The technical standard adopted is the Mifare system. There is an on-going plan to move the model toward cross-industry applications. Issues facing South Korea are similar to those in Japan, where they mainly concern cross-city and cross-industry availability. The usage of NFC mobile payment in South Korea is still limited to Seoul.

3.2.3. Taiwan

An example from Taiwan is Taipei EasyCard. Its application currently extends to parking, bus tolls, and convenient store payments. In order to promote contactless and mobile e-payment services through the integration of products and services of various industry members, the Proximity Mobile Transaction Service Alliance was established in Taiwan at

the end of 2004. The Alliance includes mobile operators, Taipei Smart Card Corporation, BenQ, Acer, Institute for Information Industry (III), NXP Semiconductors, MasterCard and Visa. The first Alliance initiative was a pilot run of NFC-enabled mobile handsets on the public transportation system in Taipei. In the second phase of this initiative, the alliance plans to integrate both transportation and retail micropayment plans. Alliance member companies continue to conduct NFC pilot programs.

The application of EasyCard for transportation has been successfully extended to at least three counties in northern Taiwan. Achieving interoperability with other cities, however, is an on-going challenge.

Another example is Taiwan Money card. Taiwan Money card adopts dual chips with Mifare protocol and ISO 14443 type B (T=CL) that are compatible with the transportation applications of EasyCard, complying with the government policy of one card for all cities in Taiwan. Meanwhile, an official standard set forth by the Ministry of Communications has been proposed for a single card applied in transportation field.

A consumer survey in Taiwan by Taipei Fubon Bank revealed that:

- 50% of respondents believe that a transaction with NFC mobile payment is faster than using a traditional credit card.
- 86% of respondents have not set a password for NFC mobile payment.
- Most respondents also believe that merchants have inadequate knowledge of mobile contactless transaction processes and need to learn more.

Additionally, some of the benefits for issuers who deploy the NFC mobile payment solution are:

- Increased credit card usage.
- Enhanced cardholder loyalty.
- Greater credit card usage and sales through launching of NFC benefit and loyalty programs.
- Benefits of cross-industry alliance from working together with telecom industry.

3.2.4. Hong Kong

Octopus Cards are very popular in Hong Kong and are one of the world's most successful transportation applications of micropayments. Originally launched in September 1997 to collect fares for the city's mass transit system, the Octopus Card system has since grown into a widely used payment system for virtually all public transport in Hong Kong. It is also used for payment at convenience stores, supermarkets, fast-food restaurants, on-street parking meters, car parks, and many other point-of-sale applications, such as service stations and vending machines, and for access to recreational facilities, school campuses, residential and office buildings.

There are more than 15 million Octopus Cards in circulation, twice the population of Hong Kong. The cards are used by 95% of the population of Hong Kong aged 16 to 65, generating over 10 million daily transactions worth a total of about HK\$29 billion (US\$3.7 billion) a year with over 446 service providers. Currently over 26% of Octopus transactions

are non-transport transactions. Octopus Cards launched the Octopus reward program in 2005, and it has over 1.3 million members. Nevertheless, even though contactless transport cards can generate additional transaction volume and provide additional convenience to cardholders, there are some commercial issues. One of these is the amount of investment required by businesses.

The Mobile Octopus project was designed to provide an alternative form of payment to the cards, watches, and key-fobs already available. Mobile Octopus will support all Octopus Card functions on mobile phones, provide a balance and transaction viewer as well as bonus point and e-coupon viewer, make online top-up and payment possible, and be fully compatible with the existing infrastructure for top-up and off line payments.

3.2.5. United States

Since December 2005, Visa International and Philips Electronics have been working together on a major NFC trial that allows sports fans to easily buy goods at concession stands and apparel stores at the Philips Arena stadium in Atlanta, Georgia. That's up modestly from the roughly 20 million contactless cards or tokens vendors sold in 2006. Contactless backers are targeting the cash-heavy market for purchases of \$25 or less.

Bank of America does have some contactless cards on issue, by virtue of its acquisition completed in early 2006 of MBNA, a bank with a large credit card division that has set itself up for contactless payment, mainly at American sports stadiums.

On the merchant side, 40,000 to 45,000 locations accept contactless payment in the United States, a growing yet still small percentage of all merchant locations that take card payment.

Some small or mid-tier U.S. banks, such as KeyBank, SunTrust, and Wells Fargo, among others, are issuing contactless cards, as is HSBC, on a regional basis. The 25 million contactless cards and fobs likely to be issued this year compares with the roughly 300 million credit, debit, and prepaid cards U.S. financial institutions will roll out in 2007, nearly all of them simple magnetic-stripe cards. These cost a small fraction of the price of contactless cards, which run about \$1.50 apiece in the United States. Such large issuers as Citibank, Chase, HSBC and retailer 7-Eleven have launched NFC pilots in the United States, mostly involving consumers. Bank of America began its own low-profile NFC trial late last year as part of a larger 5,000-employee pilot held at one of its corporate campuses in Delaware, home of its MBNA division.

In sum, NFC micropayments in the United States are continuously growing. The major driving force comes from banks, with credit card-based NFC financial applications the most important market for now

3.2.6. United Kingdom

In England, the Oyster card is a typical example of an NFC micropayment. Oyster is an NFC 'smartcard' that can store £90 of pay-as-you-go credit plus your Travelcard or annual Bus Pass. It can be used on Tubes, buses, DLR, trams, and some national rail services in London. The number of cards issued with transportation applications has reached 10

million. The technical standard adopted is Mifare system. Working toward cross-industry applications is the major goal at this stage. The issues are similar to those facing Korea as it enters cross-city and industry applications. The region applying NFC mobile payment is still limited to the metropolitan area.

3.2.7. Singapore

The ez-link card has been integrated into mobile phones in Singapore since September 2007, turning those phones into payment devices that will soon be accepted at over 20,000 ez-link terminals on buses and trains and at retail locations that accept ez-link payment. Besides using their NFC-enabled mobile phones as a means of payment at all ez-link acceptance points, users can use them for other innovative 'contact-less' mobile phone applications.

Internal trials are currently being conducted and plans will soon be underway to test the technology with pre-selected StarHub post-paid mobile customers. These customers will be given the opportunity to try the new NFC technology at all ez-link terminals.

The ez-link purse is a versatile contact-less technology that offers limitless possibilities in transit and a whole suite of other applications. This collaboration shows that the ez-link purse could be seamlessly integrated with an advanced technology like NFC to bring about greater ease of payment and new services.

Over 10 million of the ez-link cards have been issued to date and they have achieved more wallet share in Singapore than any other single card payment device. On a daily basis, over 4 million financial transactions are processed throughout our system and this is constantly growing with the proliferation of the ez-link card in the non-transit payment arena.

3.2.8. China/Shanghai

The typical NFC micropayment application example is ZoneCard issued by Strathclyde Partnership for Transport (SPT). The ZoneCard card has been in use since 2005. The card can be used not only to take the train, subway, and public bus, but also to use the highway. The number of issued cards having transportation-related applications is over 16 million. The technical standard adopted is Mifare system. The region of applied NFC micropayment remains limited to Shanghai.

The main NFC applications can be classified into three modes. They are card emulation mode for secure payment transactions, reader mode for service discovery applications, and P2P mode for information sharing and access control. The Mifare NFC system is widely applied in many contactless transport infrastructures all over the world. The proprietary Mifare standard is now an international standard under ISO18092 that was designed to be backward compatible with Mifare and FeliCa contactless infrastructures. The size of these ISO18092 contactless infrastructures is significant. There are over 2 million Mifare contactless readers in China alone, and almost all of Japanese contactless infrastructure is FeliCa-based. There are now many NFC projects all over the world, and these trials have become significant for the potential commercial opportunities of NFC technologies and business models. Mobile operators, financial institutions, and merchants will be the key drivers in the “NFC ecosystem” of the future.

While NFC is clearly attractive to mobile operators, there are a number of business issues to be addressed. There will certainly be some costs involved for operators to deploy NFC handsets, but the business benefits for the operator are less clear.

4. Case Study Observations

The observations are divided into two sections according to the type of case study and summarized below.

4.1. Phone Bill-based IMP

Some issues proposed last year have been effectively solved, including the integration of different micropayment systems, unequal withholding tax and billing settlements, and the counting reference of transfer rate. There are still other issues which needed to be studied further. They are described below:

4.1.1. Content IPR

Content IPR faces two kinds of problems. One has to do with the extension of licensing area and rising operational costs. The other one has to do with the approval of content export from countries with stricter screening regulations, such as mainland China. There is no guarantee that content legal in one country can be accessed by people in other countries, unless the original content license is an international version. Because of this, the rising costs associated with extending content license may be a barrier to getting content providers to join IMP. The political issues associated with content release are more complicated than the financial issues.

4.1.2. Network Quality of Service (QoS) for Content Streaming of Cross-Border Transactions

Real-time streaming in general does not have the issue of quality of service (QoS) within domestic networks, except for access control imposed by proxy configuration. Quality of service might not be guaranteed, however, when applied to foreign areas. Network routing is more complicated, and with so many network nodes, streaming can be interrupted, or crash, when the bandwidth of one node drops down for too long. The CDN approach is therefore recommended for international real-time streaming. Network QoS is a serious issue and should be handled properly for successful IMP advocacy of digital contents.

4.1.3. Phone Bill-based IMP for International Mobile Data Access

To resolve the high pricing issue, it seems inevitable that service providers will have to conduct negotiations with international organizations, such as APEC Telecommunication Committee or Global GSM Roaming Association.

4.2. NFC IC Card-based IMP

In the NFC IMP IG workshop held on July 10th, 2007, 13 speakers from different industries and 119 participants in related NFC mobile payment fields from nine countries (covering Asia, Europe and the U.S.) were invited to share their experiences and expertise. The following sections reflect the opinions expressed there as well as the findings of the IMP IG case studies.

4.2.1. Multiple Technical Standards Support

One of the objectives of the International NFC Forum was to obtain consensus and make decisions regarding the communication protocols supported by NFC (ISO14443A, ISO14443B, FeliCa) and the usage modes for NFC (device, reader, card, etc.) Transit operators have developed contactless infrastructures in major cities all over the world, but most of the transport contactless infrastructures use proprietary communication dialogs and security algorithms.

The first encouraging sign was the successful development of the Single Wire Protocol (SWP). It is the first contactless NFC solution that can support all contactless communication protocols, such as ISO14443A, ISO14443B, and FeliCa. It is believed that it will become part of NFC infrastructures.

From the operator's viewpoint, future standardization work towards interoperability will be required in order for NFC to be accepted fully by the industry and to enable compatibility among various devices produced by different manufacturers. One of the main concerns is that even though the transportation industry is often local in nature, it often adopts various proprietary standards in contactless technology. From the NFC payment service provider's viewpoint, the concern is semiconductor level. NFC chips have to support not only ISO-based standards but also widely used non-ISO-based standards. For software applications, using open standards for various financial payment programs, such as Visa and MasterCard, would enable consumers to use NFC-enabled mobile phones in different countries.

Some differences between the mobile telecom industry and the financial industry still need to be resolved, such as the means to personalize payment applications into mobile operator SIMs and to signify customer "ownership". Currently, there are two options for personalizing SIM cards with NFC mobile payment applications. One is to preload the cards with non-personalized payment applications before the mobile operator issues SIMs. The other one is to manufacture and fully personalize the SIM cards and have the financial institution distribute them as banking payment cards (in the same way that payment cards are typically supplied to cardholders) with only activation/de-activation of the pre-personalized payment application OTA. Considering the cost and ease-of-use, the option of preload is more feasible.

Another important challenge is to have a single SIM support multiple local (closed) payment applications. It would then be necessary for the reader manufacturers to make the reader compatible with both standards, in spite of the fact that most of the NFC phone solutions used both NFC Forum and ETSI standards. There did seem to be sign of a shift toward the use of financial contactless cards in transport revenue collection systems, such

as the southern Taiwan Money Card and the Citibank MasterCard PayPass card used for making transit payments in the New York subway system.

4.2.2. Moving Toward One Card for Multiple E-wallet Applications and Cross-Border Transactions

Currently the key issue for cross-border NFC micropayments is the lack of a global association or network of transport revenue collection systems that can produce the same interoperability across transport payment infrastructures. Before cross-border NFC micropayments can work, we need to get cross-city micropayments to operate successfully. There are still some technical (interoperability) issues facing cross-city usage, such as limitations on card/media (memory size), RF interface, standards, security concerns for card secret keys, and others. It does not seem possible for one card to be applied in multiple e-wallet applications without the solution supporting all contactless communications protocols and the capability of extracting information (data) from any NFC transaction. This issue has been raised to the application layer and falls in the category that calls for business negotiation. Even though transport revenue collection systems in different countries use the same contactless communications technology, they do not have any business agreements to handle cross-border transactions. Hence, it is very important for a trusted third party (TTP) to provide a secure service environment to end users, application issuers, and secure element issuers for the personalization of mobile phones and their resident payment applications. TTP will be helpful for secure key exchange of multiple e-wallets, which is the key point of single card for various transportation applications in cross-city setting. The application issue of multiple e-wallets is similar. In some countries, TTPs will need to be certified by government regulators, in the same way that bank card personalization services are subject to regulatory supervision. Nevertheless, most of the NFC pilots around the world use the same kind of NFC phone.

The degree of support from each player hinges on perceived potential benefit. As long as NFC IMP can deliver benefit to all players, the support issue will not be a problem. Hence, both the technical interoperability and readiness of commercial client devices need to be in place to promote NFC mobile payments before economies of scale are reached.

On the other hand, the trend of financial NFC payments suggests that the most important factor for success lies in making NFC mobile payments as simple as possible for consumers. Having one NFC mobile handset that supports multiple payment programs and applications, including JCB, MasterCard, and Visa, as well as regional and national ePayment programs, is essential. Incompatibility is not an issue for financial payment systems because compliance to international interoperability is effectively enforced by the card payment associations, such as their chip payment specifications and the use of open banking security algorithms and communication dialogs.

4.2.3. NFC IMP Application and Business Model

There are signs that banks in Asia already view contactless micropayments as an attractive business, including NFC mobile contactless payments.

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The barrier of higher transaction costs associated with micropayments will eventually be reduced as the number of electronic payments made over networks grows, producing a strong transition to the replacement of cash.

According to a survey by Visa International in 10 Asia-Pacific markets about consumer attitudes, the next preferred device (after cards) through which consumers would like to be able to make payments are mobile phones. The credit card mobile platform currently supports proximity payment, e-coupon, and basic account management. Three approaches to implementing this payment technology are:

- Downloading Visa application to the SIM chip.
- Placing a separate embedded Visa chip.
- Placing a Visa chip on the removable card, called SD card.

Successful implementation of contactless mobile payments will require cross-sector collaboration between mobile operators and financial institutions.

From a business perspective, contactless micropayments are attractive to financial institutions, and they intend to pursue them in the future, even though very small ticket transactions are not part of their traditional business model for electronic payments.

Possible business models include single versus multiple e-purse and prepaid versus postpaid. A multiple e-purse business model would have the advantage of minimizing the investment on the deployment. One consideration, however, is that it would require an international clearing centre and foreign currency handling, which would involve more parties and introduce additional issues, such as foreign currency, exchange rates, and credit risks. On the other hand, the participation of telecom operators will play an important role in the progress of the NFC mobile payment business. The view that contactless payments will drive mobile phone usage and spending as well as reduce churn and retain high-valued customers is the main force driving telecom operators to enter the NFC mobile payment market. Furthermore, NFC mobile payment is a must-have service for which all mobile operators should be developing a strategy, although at this moment government regulation is still conservative toward Telecom operator's NFC mobile payment services. Despite this, we believe that mobile operators should remain neutral to all payment service providers but not neutral to the solution.

The results of the NFC IMP workshop make clear that many issues still need to be resolved before the use of cross-border NFC micropayments can succeed, including:

- 50% of respondents believe that a transaction with NFC mobile payment is faster than using a traditional credit card.
- Who owns the chip space on the card (SIM or MicroSD) where the contactless application is stored?
- Who is the manager for contactless applications?
- What is the best model: embedded, SIM card or MicroSD card?
- And other major issues, such as the availability of the proprietary FeliCa security module and the volume and popularity of the NFC handsets.

5. Recommendations

There are still some issues concerning phone bill-based IMP that call for the effort from the government side, even though some issues, such as the withholding tax, the differentiation among secure transaction protocols, and system integration, have been resolved.

On the other hand, NFC IC card-based IMP is a more complicated topic. Both government and industry need to make further efforts before a system of cross-border NFC mobile payments can succeed. Some recommendations are proposed here for government and industry based on IMP IG case studies and observations.

5.1. Release Policy of Content IPR

- Government and content creators should provide a more attractive environment to encourage content providers to extend their business to the international level.
- Governments should relax restrictions that govern access to entertainment contents. The issue is more urgent for countries with stricter screening policies.

5.2. Improvement of International Network Environment

- Government should encourage Internet Service Providers (ISPs) through policy to build up a CDN-based network environment for international content access.
- Government and industry should encourage dialogue to resolve the issue of high connections fee for international mobile data access.

5.3. Multiple NFC Technical Standards Support

- Government and industry should make efforts to promote the idea of a single device supporting multiple NFC standards as well as a SIM-based international standard, such as ETSI/SWP, for cross-border NFC mobile payments.
- All international standards, either ISO14443 type series or proprietary standards, such as Mifare protocols, should be covered in SWP, if possible.

5.4. Moving toward Cross-city and Border Applications

- Government and industry should cooperate in setting forth relevant regulation on trusted third party (TTP).
- Government should be actively involved in drawing up and executing an action plan, both for cross-city and cross-border NFC mobile payments.

5.5. Establishment of Healthy Business Model for NFC IMP

- To promote the growth of NFC micropayment applications, governments should promote the construction of related applications and encourage key players to develop services through tax incentives.
- To facilitate healthy competition, governments need to make the financial regulatory environment more open.
- To ensure consumer rights, the management of prepaid e-purse should have a global consensus regulation for application providers.