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Use of Electric Money in Japan

By

Tomoaki Miura

**Thesis submitted in partial fulfillment of the requirements for the
degree of Master of Science in Information Technology**

Rochester Institute of Technology

**B. Thomas Golisano College
of
Computing and Information Sciences**

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Rochester Institute of Technology
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Use of Electric Money in Japan

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Abstract

This paper will take a look at electric money and demonstrate that it cannot entirely replace cash in Japan. With the progress of Information Technology (IT), Electronic Commerce (EC, e-commerce) has recently expanded into the society in Japan. However, since Japan is still a developing nation in IT, the government has decided to advance the plan “eJapan” in 2001 that aims to make Japan the leading IT nation in the world within five years with all of the citizens actively using IT (IT Square, 2003). In the plan, the government has largely focused on five projects, which are the construction of the high-speed network infrastructure, the spread of IT training, the realization of an electronic government, the realization of keeping high security and credibility in the Information network, and the development of e-commerce (Fujisawa, 2001). The government has planned to activate the country’s economy with the spread of e-commerce.

In this context, electric money is in the spotlight as a payment tool of the next generation. Although some ways of settlement such as credit cards are now used, it is projected that electric money will become more popular in the future because of its advantages such as high security or instant settlement in comparison to other ways of payment. Besides, it is also predicted that electric money could replace cash (NTT, 2000). However, the currency of electric money is still in the tentative stage, and the adoption of electric money among the general public is still low. In addition, there are various problems or barriers preventing the prevalence of electric money. For example, all the past tests of popularizing electric money in Japan ended in failure due to the inconvenience of using it. There is a strong custom that the Japanese people mainly use cash for the shopping, whereas checks or credit cards are universal in the Western countries. There are other challenges. People are worried about crimes such as forgery and robbery of electric money in terms of security. The definition of electric money in the law is also very complicated. All of these affect the spread of electric money.

There are different opinions about electric money in Japan. One is that cash could be superseded by electric money in the future. The other is that the former opinion is rather wishful thinking, and electric money will only partly prevail as one of the payment ways. At any rate, it is said that people will readily use electric money if it is really convenient and safe to use. Both the public and the government have taken note of the future of electric money. In this connection, it is worthwhile to examine electric money and show its possibilities.

First, this paper will briefly explain the basics of electric money such as its origins, varieties and characteristics of electric money. Second, this paper will examine some examples of the past experiments and the current conditions of electric money in terms of usability. Third, this paper will examine the security of electric money. Fourth, this paper will inspect the law for supporting the use of electric money. Fifth, this paper will discuss the culture that affects on the prevalence of electric money. Finally, this paper will draw a conclusion that electric money could not entirely replace cash in Japan, namely it could only be an alternative payment way with collecting these bases.

Introduction

With the popularity of the Internet among people, e-commerce is a growing way of doing business in Japan. In this connection, electric money is the center of attention as a payment method with its advantages such as high security by comparison with other ways of settlement. However, all the past experimental tests of electric money ended in failure. Although the past tests failed, the government has largely focused on a project that makes the Integrated Circuit (IC) card the standard tool for our life. Since the IC card is expected to become popular with people, the IC card formed electric money that has advantages like high security will hold the spotlight.

There are different opinions about electric money in Japan. One is that electric money could in the future take a place of cash. The other is that electric money could serve as one of several ways of settlement. At any rate, it is a consensus that people will welcome electric money if it is well convenient and safe (NTT, 2000).

It is said that the key to whether or not electric money will be adopted by a society is usability. The basis of this idea is that if people feel greater benefit in using electric money rather than other ways of settlement such as cash cards or credit cards, the number of users logically increases. Consequently, electric money will prevail in Japan as the new payment method. To fulfill this premise, some important conditions such as building the infrastructure and establishing the law need to be satisfied.

However, there are various problems or barriers against the satisfaction of these conditions. Therefore, to demonstrate the possibilities of electric money, the author will try to verify to whether or not electric money will prevail in Japan as the new way of payment in the future. This paper will examine the past experiments and current conditions in terms of the key features, point out the challenges, and draw a conclusion.

This paper will briefly explore the background of electric money such as its origin or variations and point out the challenges toward the country's economy. Next, this paper will examine some past experiments and the current conditions of electric money in terms of usability. Then, this paper will investigate security, law and culture that are the key features for the prevalence of electric money. Finally, this paper will draw a conclusion that electric money will not replace cash in Japan.

Chapter 1: The Contours of Electric Money

In this chapter, first, the general definition of electric money will be discussed. Then, the background of the birth of electric money, the classification of it, the comparison with other payment methods, the characteristics of electric money such as suitability for micropayment, and the influence on the country's economy will be discussed.

1-1: What is Electric Money?

According to the report of a meeting about electric money and electric transaction held by the Ministry of Finance (MOF) in 1997, electric money was defined as “the mechanism of settlement to interchange digital data that is linked to money, or it is the digital data itself” (FSA, 1997). Digital data is regarded as having monetary value the same as cash. At this point, a general consensus of the definition of electric money was almost reached a consensus. Electric money is defined as “the way of settlement for transferring or saving monetary value with digital data” (Oshima, 2002). From these views, it is possible to look on electric money as a type of the payment tool that is similar to official currency.

The IC card formed electric money is a good example to explain electric money. An IC card is a plastic card with the IC chip that can record data. To use it, users need to charge monetary value into IC cards with terminals equipped with a card reader. In order to charge monetary value, users are required to input a personal identification number (PIN) and the amount of money they want to use into terminals. This operation is almost the same as withdrawing cash from the Automatic Teller Machine (ATM). The monetary value that is charged into IC cards is properly linked to user's bank accounts. In short, the IC card formed electric money is like a wallet.

1-2: The Background of the Birth of Electric Money

The progress of IT such as the development of cryptographic technology and the view of card companies for embarking on the new business are the main factors affecting the birth of electric money.

1-2-1: The Progress of IT

The progress of IT such as developing the broadband technology has increased the

number of the Internet users in Japan. According to the Internet White Paper, the Internet population in Japan as of February 2003 was about 56,453,000, and it was predicted to get up to 60,000,000 by the end of 2003 (Impress, 2003). This means that half of the Japanese population is connected to the Internet. In practice, about 73% of the whole nation now uses the Internet not only inside home but also outside with a computer or a cellular phone (Impress, 2003). The rate of using the broadband technology in 2003 has doubled when compared to the 2002 figure.

The progress of the broadband technology is a major factor in the growth of e-commerce (Sekihara, 2002). In fact, with the low and flat rates for using the broadband connection in Japan, users can retrieve, compare or check goods on the site without caring the time and money. The rate of using e-commerce among the people who use the broadband technology was 46.1%, while the rate of using e-commerce among the non-broadband technology users was 16.5% in 2002 (NRI, 2002). These data suggest that the development of the broadband technology will further expand the market of e-commerce.

E-commerce such as online shopping is becoming popular among the Japanese people. However, people have misgivings about credit card fraud in online shopping. According to the research “Face of the Web”, about 88% of the Japanese people answered that they feared credit card fraud (IT Square, 2002). Among ten countries such as the U.S that were the target of this research, “88%” was the highest rate. This result demonstrates that the Japanese people who shop online are deeply concerned about the security of using their credit cards.

To reduce concern, a new payment method that is efficient and safe must be developed (NTT, 2000). That is electric money. With the development of high security technologies such as cryptosystems, the security for protecting and saving monetary value is improved (BOJ, 1999). For example, by introducing sophisticated encipherment technology, the security level of electric money against sneaking a PIN becomes high (Futatsugi, 2000). The invention of IC cards also contributes a greater security level. For example, the IC chip in the IC card formed electric money has an advantage in comparison with a magnetic stripe that is contained on credit cards. It is much more difficult to steal or falsify the data in the IC chip than a magnetic stripe (Aoki, 1999). Thus, the growth of the Internet and the development of the security technology are the signal for the birth of electric money.

1-2-2: The Aim in the Next Business by Credit Card Companies

It is said that the credit card company's aim of realizing a cashless society with the evolution of credit cards is also leading to the birth of electric money (NTT, 2000). Credit cards such as Visa or Master have prevailed in the world, and have become one of the standard ways of payment for our life. However, to further expansion its business, credit card companies have little choice but increasing the number of credit card users, or advancing the new business (NTT, 2000).

However, improving the existing credit card business by methods such as an alliance with airlines in mileage point services is not enough to enlarge the business of credit card companies (NTT, 2000). Therefore, they have tried their hands to the business for developing electric money. Credit card companies can conventionally do business only in the framework of credit services. Making credit is the basis of their business that permits applicants to obtain a credit card, and credit is the measure of trust for financing. Since the business of credit card companies is limited to credit services, the business of electric money is an opportunity for them to begin to engage in a settlement service, namely the business of banking (NTT, 2000).

To develop credit cards with the function of electric money, it is very important to have high security. The development of technology such as encryption or IC cards meets the conditions for developing electric money. After these conditions are met, electric money such as Visa Cash has appeared to the world.

1-3: The Classification of Electric Money

Electric money can be classified in terms of the medium and the mode of circulation. The IC card formed electric money and the network formed electric money are the typical types of electric money classified by the media. The closed loop formed electric money and the open loop formed electric money are the two types of electric money classified by the mode of circulation.

1-3-1: The IC Card Formed Electric Money

The IC card formed electric money is a plastic card with the IC chip that acts like a wallet. It is required to charge monetary value as digital data into a card with machines

such as a card reader before using this electric money. The monetary value as digital data is fundamentally transferred from savings in an account of the user. It can be used for both commercial facilities and online transaction. Visa Cash or Edy is the typical examples of the IC card formed electric money (Futatsugi, 2000).

The IC card formed electric money can be also classified into two types in terms of the way of access. The contact typed IC card has terminal on the IC chip, and it is necessary to put a card into machines such as a card reader in settlement. On the other hand, since the non-contact typed IC card has the build-in IC chip inside a card, it doesn't need to be inserted a card into machines in settlement. The transaction is done with irradiating radio wave similar to a Point Of Sales (POS) system.

There are some advantages and disadvantages in both types. About the contact typed IC card, the advantages are a simple structure of card design and low production costs. However, as it is necessary to insert a card into a card reader for each use, the probability of having machine troubles is higher than that of the non-contact typed IC card. Therefore, the system for the contact typed IC card needs regular maintenance that can be expensive. And, it takes more time in transaction than the non-contact type, because transaction is handled in machines. In contrast, the non-contact typed IC card does not need to be inserted into machines and machine trouble is rare. Therefore, it doesn't need regular maintenance or maintenance costs like the contact typed IC card. In addition, as a transaction is completed in a moment with only irradiating infrared rays, instant settlement is also an advantage of this type. On the other hand, since the structure of a card is more complicated, its production costs are high.

It is predicted that the IC card formed electric money, especially the non-contact type, will be the standard of electric money because of its high security or expansive character (Futatsugi, 2000, NTT, 2000). In fact, the non-contact formed IC card has prevailed in Asia similar to tickets in public transportation. The Japan government has noted this expansive character, and has included the IC card project as a part of the eJapan plan. To reduce production costs, mass production, which requires a growth in the number of users, is necessary (Otsuka & Morioka, 1999).

1-3-2: The Network Formed Electric Money

The network formed electric money is the electric money that can be used on a

computer network such as the Internet. The monetary value as digital data is saved in the memory of a computer, and a transaction is processed through the computer network. eCash is a typical example of the network formed electric money (Futatsugi, 2000).

eCash was the first electric money for the online transaction developed in Holland. However, after some experimental tests were done in some countries, DigiCash, the company that issued eCash, went out of business. Although eCash used encryption technology, people didn't use it (NTT, 2000). While eCash was launched as having the character similar to cash, it was only usable for Internet transactions. That is to say, since people mainly do the shopping at shops in daily life, the fact that eCash can only be used at online transactions is a disadvantage to users (NTT, 2000). There were also some fatal disadvantages of the system. For example, due to the function to protect copying of data, if users moved a file that saved eCash to another file or disk, the monetary data of eCash disappeared (Taniguchi, 1998). Thus, the high security characteristics of eCash caused an unfavorable outcome to users. After the bankruptcy of DigiCash, experimental tests of network formed electric money has declined (Inoue, 2000).

1-3-3: The Closed Loop Formed Electric Money

This type of electric money is similar to a prepaid card. With a prepaid card, a specific sum of money is stored in advance, and the amount of the transaction is subtracted from a card at each use. When a user pays a shop, the amount is reduced from a card. Shops need to request the cash value from the issuers of the electric money after receiving the monetary value from customers. Monetary value as electric money circulates in the closed loop, namely monetary value always comes back to the issuers of the electric money after monetary value is once used for the shopping (NTT, 2000). Visa Cash is a typical example of the closed loop formed electric money. A debit card is similar to this type of electric money in terms of the form of circulation.

1-3-4: The Open Loop Formed Electric Money

This type of electric money is similar to cash. Once this type of electric money is issued, monetary value as electric money circulates anywhere on the network. It is not necessary for receivers such as shops to request cash from the issuers of the electric money, while receivers of the closed loop formed electric money need to request cash from the issuers after receiving the monetary value. Monetary value of the open loop formed electric money

can permanently and repetitively be used for commercial transactions after issuance. In this sense, this type of electric money is similar to cash. Mondex is a typical example of the open loop formed electric money. Because of its character that it circulates permanently like cash, it is predicted that the open loop formed electric money will prevail in the future (Futatsugi, 2000).

1-4: The Comparison between Electric Money and Other Ways of Settlement

A credit card and a debit card are the typical ways of settlement other than cash. Although the use of them seems almost the same, there is a difference between them and electric money. The IC card formed electric money has monetary value in a card, while a credit card and a debit card have no monetary value in the card (Kawahara, 1999). Each type of cards has different characteristics. In this part, since the mainstream of electric money is the IC card, the IC card formed electric money is compared with other ways of payment.

1-4-1: The Comparison between Electric Money and a Credit Card

There is a definite difference between the IC card formed electric money and a credit card. In essence, electric money is like funds, while credit card is like debt (NTT, 2000). When people do the shopping with IC cards, the amount of payment is instantly subtracted from the monetary value stored in IC cards with every purchase. On the contrary, when people do the shopping with a credit card, receivers charge the bill to the credit card company. Credit card companies pay all of the user's charge for the specific term instead of users, and charge users the entire bill once a month.

The difference in service charge is the advantage for electric money. Since a credit card is like debt, credit card companies collect interest for settlement while taking users' payment and collect a commission from stores. As the average rate of service charge is about 6% of the payment, it will not be profitable for stores if a credit card is used for low price products.

On the contrary, settlement with electric money is done instantly when people use it. The service charge such as interest on a credit card is not necessary. It is said that the average rate of service charge of electric money is about 1% (NTT, 2000). Thus, low costs for transaction is the advantage for electric money in comparison to credit cards.

A credit card has advantages such as having several ways of payment. People can use credit cards on the installment plan, while electric money has no such function. People can use credit cards for high priced goods, while electric money cannot be used for them. The IC card formed electric money has a limit on the amount of payment, typically 200 dollars. The amount of payment is limited for security reasons.

1-4-2: The Comparison between Electric Money and a Debit Card

It seems the IC card formed electric money and a debit card are similar, because both of their settlements are completed when customers use a card and enter their PINs. However, a debit card is like an ATM, while electric money is like a wallet (NTT, 2000). When people do the shopping with debit cards, the payment is instantly done after entering a PIN. In this process, if user's bank balance in a current account is come short, the terminal will display an error message, and a user cannot use a debit card for payment (Inoue, 2000). This process is like withdrawing cash from a cash desk at a shop and paying as it is. On the other hand, to use the IC card formed electric money, people need to charge monetary value into a card before shopping.

The low service charge is an advantage for debit cards and its average rate is almost the same as electric money. For users, usability of a debit card is better than that of electric money. For example, at the shopping, people need only to enter their PINs for a debit card, while people need to charge monetary value onto a card each time the monetary value in a card has been exhausted. In general, the majority opinion of users in some experimental tests of electric money is that the IC card formed electric money and debit cards are used in a similar function (e-Sopia, 1999). Therefore, for electric money to become more prevalent, it is necessary for IC cards to be equipped with more useful functions so that users feel it's more convenient than debit cards (Kawahara, 1999).

1-5: The Character of Electric Money: Advantages and Disadvantages

The two main advantages of electric money are anonymity and security (Inoue, 2000). And, its peculiar characteristic is micropayment. On the other hand, there is concern that the wide currency of electric money would affect the economy in Japan and cause hyperinflation.

1-5-1: Advantages of Anonymity and Security toward the Traditional Cards

Anonymity is a typical advantage of electric money the same as cash, and it is effective to protect users from a risk of privacy invasion. Privacy is one of the largest concerns for people. According to the research on the IC card formed electric money, as for the security of IC cards, many respondents of a questionnaire answered that a privacy protection function was essential for the IC card formed electric money to be equipped with other functions such as for protecting forgery (Tomita, 2003). As for using credit cards and debit cards, a purchase record is automatically recorded, and each individual can be identified by a PIN and name. And, a purchase record can lead to direct mail that people may not want to receive. Therefore, the character of anonymity is the advantage for protecting people's privacy. The character of anonymity also contributes to advance transfer of monetary data between people (Futatsugi, 2000). This is the feature of electric money that credit cards and debit cards don't have, because interchanging money between people with credit cards and debit cards is impossible. Thus, anonymity is an advantage of electric money in comparison with credit cards and debit cards.

Security is also an advantage of electric money by comparison with a credit card and a debit card. Most of the credit cards and debit cards use a magnetic stripe for saving data. However, the security of a magnetic stripe is weak. As the structure of a magnetic stripe is very simple, it is easy to falsify or remove data from a magnetic stripe (SSE, 2002). On the contrary, it is difficult to falsify or steal data from the IC chip. The IC chip highly excels in security in comparison to the traditional form of a card.

1-5-2: Suitability for Micropayment

It is said that electric money is well suited for the payment of a small amount for the following reasons. First, since electric money is not official currency, there is no interest on a deposit with electric money (BOJ, 1999). In general, retailers in Japan deposit sales in a bank. If a retailer puts a million dollar into a fixed deposit with a rate of interest of 0.25%, the interest will be 2,500 dollars per a year, while savings with electric money has no interest. Thus, the larger the amount of sales by cash, the more the difference in gain between electric money and cash will be expanded. As retailers are also compelled to do cashing at every payday, it is considered that electric money will not use for macropayment.

Second, most of the electric money systems have a maximum amount of a payment around 200 dollars. This is due to the security level that seems appropriate to the currency of electric money (Sugiura & Kataoka, 2003). Increasing the security of electric money will require more time at settlement. As instant settlement is one of the advantages of electric money, the increase of the security level of electric money decreases its advantages. In fact, in the experimental test of Moneo, which was the IC card formed electric money in France, security operations such as entering a PIN were removed for transactions under the 30 euros to maintain the advantage of instant settlement in electric money (Sugiura & Kataoka, 2003).

It is difficult to set a ceiling payment amount of electric money large enough for macropayment. If it is carried out, costs for the security become high, and the high security reduces the advantages of electric money for instant settlement. In addition, if there is no limit payment amount for using electric money, it will become a great risk for both users and the companies issue electric money in case of theft or falsification of electric money. In fact, in consideration of this risk, in England, the Financial Services Authority has introduced the Regulation of Electric Money Issues, and the limit payment amount of the IC card formed electric money is set 50 pound (Sugiura & Kataoka, 2003).

Finally, most of the electric money systems like the IC card formed electric money were introduced for the retail business (BOJ, 1999). One of the reasons of this is the growth of e-commerce. With the wave of popularity of e-commerce among people, a new style of business such as an online music provider has appeared. People generally buy a music CD album that is composed of many songs. The price of a music CD album is about 15 dollars. If people don't need some of the songs in an album, they have no way to take them off. However, the development of e-commerce enables people to buy only favorite songs. The price of a song that is provided by an online music provider is about one dollar. A credit card is not suitable for paying a small amount like this. Since the service charge of credit cards is high, it doesn't make a profit in micropayment. At this, electric money is considered to be suitable for this kind of new business with micropayment (Sakamoto, 1998).

For example, Moneo was developed for micropayment such as the daily small shopping or the purchase of a local train ticket. The aim of introducing Moneo was to reduce the number of small checks or coins under 30 euros (Sugiura & Kataoka, 2003). Edy, which is the IC card formed electric money in Japan, is also developed for micropayment. The data

showed that the average payment amount of users per charge at experimental tests such as Visa Cash in Japan was about 15 dollars (e-Sopia, 1999). In addition, bitWallet Corporation, the company that issued Edy, analyzed data from its own experimental test which showed that users mainly used Edy at lunchtime and the average payment amount was about 4 dollars (Watanabe, 2002). Due to the data, the company has formally decided to focus on the field of micropayment.

1-5-3: Concern for the Monetary Policy of the Government

One of the concerns if electric money universally prevails in Japan is its influence on the monetary policy of the government (Futatsugi, 2000). At a forum about the relationship between electric settlement and monetary policy held by the Bank of Japan (BOJ) in 1999, an influence on the monetary policy by the prevalence of the ways of electric settlement such as electric money was discussed as the main subject. However, the forum didn't reach a consensus on the matter, because there were different opinions about it in committee members (BOJ, 1999).

The monetary policy in Japan is that only the government has the right to produce and issue of money. The law provides that official currency is only the bank notes issued by the BOJ and the coins issued by the Japan Mint. The government controls the money supply that is the total amount of currency that circulates among the country's economy (PPO, 2002). The BOJ controls the money supply to keep a stable economy with stable prices. On the other hand, electric money is issued by private enterprises and it is not official currency. Therefore, since electric money has characteristics similar to cash and has equal value as cash widely prevails without circulating through monetary authorities, the government may not be able to manage the monetary policy. As a result, there is a possibility that the wide prevalence of electric money may affect the country's economy and cause hyperinflation (Noguchi, 1996). Since hyperinflation can cause the fall of a currency's value and bringing the sharp price increases, this matter needs to be carefully discussed.

However, despite the importance of the matter, no consensus was reached whether or not the spread of electric money would affect the monetary policy of the government (BOJ, 1999). The reason for the disagreement was the ambiguity of electric money's definition. The outbreak of inflation is based on the national-wide prevalence of electric money. The currency of electric money was in the tentative stage at that time, and it was thought that since electric money was not official currency, it would not circulate widely in the future.

The forum drew a conclusion that electric money would not affect the monetary policy for the present. However, from the long-term point of view, if the conditions for advancing the prevalence of electric money were set hereafter, there would be a possibility that the wide spread of electric money would influence on the government's monetary policy (BOJ, 1999).

To set up the conditions to popularize electric money is very important. The eJapan plan has three fundamental principles, and one of them is to set up infrastructures and supportive conditions such as the establishment of law for encouraging IT projects such as the development of e-commerce (Oyama, 2002). In this connection, there are some disadvantages of electric money. If a person lost an IC card, monetary value in a card would not be restored. Because of the character of anonymity, if somebody returns it to the police station, the owner of a card cannot be identified. One of the advantages of electric money is that people don't carry cash. If people have electric money, they don't need to have coins. However, this advantage is practically a disadvantage now (Fujio, 1998). Since people cannot use electric money everywhere in Japan now, they must also have cash for other purchases. It's not an advantage rather an inconvenience. As long as electric money can be used only in limited areas, electric money such as IC cards is only bulky for people. To improve these disadvantages, setting up the conditions for expanding the use of electric money such as building the infrastructure is very important.

In summary of the examination in this chapter, it can be gathered that the IC card and open loop formed electric money would prevail as electric money because it has some advantages such as high security or instant settlement. On the other hand, there is concern that the prevalence of electric money will affect the monetary policy of the government and cause hyperinflation. Although electric money has some advantages, it has only been used in specific fields such as public transportation. To make electric money a more useful tool of settlement, it is essential to develop the infrastructure and to make a multipurpose card of the IC card formed electric money.

To demonstrate the usability of the IC card formed electric money and the possibility of developing the system infrastructure in Japan so that people can use the IC card formed electric money everywhere, in the next chapter, the author will examine the past experiments and the current conditions of the IC card formed electric money and the contexts of the system infrastructure development in Japan and other countries.

Chapter 2: The Usability of Electric Money

It is said that one of the important keys to whether or not electric money will prevail in a society is usability. If people regard electric money as a useful tool, it will become popular. In this chapter, this paper will verify that usability is really the key for the prevalence of electric money through an examination into the past experiments and the current conditions in Japan and other countries. Next, this paper will investigate the indispensable conditions for improving usability as the key. Then, this paper will inspect these conditions and demonstrate the challenges accompanying them.

2-1: The Verification of Usability through an Examination into Past and Current Cases

In this subsection, to confirm that usability is really the key for the prevalence of electric money, the author will examine some of the past experimental cases and the current conditions in Asia.

2-1-1: The Past Experimental Tests in Japan: Super Cash and Visa Cash

In Japan, some large-scale experiments of electric money were carried out in the late 1990's. Among them, the tests of Super Cash in Shinjuku, and Visa Cash in Shibuya are the typical experimental tests of electric money in Japan. Since both these tests were carried out by the dominant businesses, Visa International and Nippon Telegraph Telephone Company (NTT), and both these cities are the largest cities in Tokyo, they were regarded as showing the future of electric money.

Super Cash was the IC card formed and closed loop electric money developed by NTT, which is the dominant communication business in Japan. The test was started in 1999 as the largest scale experiment of electric money in the world (NTT, 2000). About 20 monetary companies joined as card issuers, and about 1000 commercial facilities both retail stores such as department stores and virtual shops such as online shopping malls joined as payees this project. One of the major characteristics of this experiment was that users were able to use IC cards to do the shopping at both retail stores and virtual stores. The test lasted about 2 years. 98.4% of the total amount of Super Cash during the test was paid to retail stores. The number of issued Super Cash cards was about 20,000, though the target number was 100,000 (Oshima, 2002). And, even though the limit amount of

charging monetary value was 100,000 yen (about 950 dollars), and its amount was much higher than that of other electric money, the average transaction amount of a Super Cash card was about 2,000 yen (about 19 dollars). That is to say, this electric money was mainly used for the micropayment.

Visa Cash was also the IC card formed and closed loop electric money developed by Visa International, which is one of the dominant credit card companies in the world. One of the reasons Visa International developed Visa Cash was to remove the inconvenience of having small change (Inukai & Moriya, 2002). Visa International tested Visa Cash 59 times in 16 countries, and issued about 22,000,000 cards in 30 countries. The test in Shibuya in 1998 was the largest project among them (NTT, 2000). This test was carried out by the Shibuya Smart Card Society that was composed of Visa International and various companies such as monetary companies or other credit card companies in Japan. About 2000 shops joined this project as receivers. One of the major characteristics of this test was that it was unnecessary for users to enter a PIN in payment in order to make the most of electric money's character, namely instant settlement. This test lasted about a year, and the number of issued Visa cash cards was about 120,000, which was the target number in the project. Since the average amount of used Visa Cash cards per shopping transactions was about 1,200 yen (about 11 dollars), Visa Cash was also chiefly used for the micropayment (Inoue, 2000).

Both NTT and Visa International carried out the tests to evaluate the practical use of electric money in the future. Although both of them said the tests bore some fruits for advancing it, neither has taken root in the society (Isowa, 2001). It can be concluded from the results that the past experimental tests of electric money in Japan eventually ended in failure (Isowa, 2001, Tomita, 2003). In fact, other major experiments on electric money such as Mondex in the late 1990's were also ended just as the test, and none of them were eventually used in Japan.

The main reason causing the failure of these tests was a lack of usability (Sugiura & Kataoka, 2003). From the results of user surveys on the past tests of electric money, there are some answers in common. For example, many users complained about the inconvenience that electric money was usable at limited member of shops in the limited areas. They were required to also have money. As one of the characteristics of electric money is for realizing a cashless society, it runs in contradiction to a stated advantage. Users also complained about a lack of machines for charging monetary value into IC cards,

and inexperienced staff in member's shops. The inaptitude of the staff handling machines of electric money significantly reduced the instant settlement characteristic of electric money. Therefore, users didn't find more advantages in using electric money than using other ways of payment, or specific differences between electric money and the other methods such as cash or debit cards except for only the advantage for micropayment (e-Sopia, 1999).

In this connection, the fact that the past experiments didn't link with our daily life except for public transportation is given as one the big reasons that the past tests ended in failure (Sugiura & Kataoka, 2003). In fact, most of the projects of electric money were closed except for public transportation. Therefore, the following parts will examine the current conditions of electric money in public transportation in Asia and Japan.

2-1-2: The Current Conditions in Asia: Octopus in Hong Kong

The IC card formed electric money has prevailed in Asia such as Hong Kong or Singapore. All the countries have adopted FeliCa, which is the non-contact typed IC card developed by Sony. In this part, Octopus, which is the IC card formed electric money for public transportation in Hong Kong, will be examined.

Octopus was introduced as an IC card ticket for public transportation in 1997 and it has now become a necessity for people. It is said that about 90% of all the citizens over 15 years old in Hong Kong use Octopus. The total number of issued Octopus cards was nearly 10,000,000 by 2003, though the population of Hong Kong was about 7,000,000 (Sugiura & Kataoka, 2003). The reason people have welcomed Octopus is its convenience. The advantage for using Octopus is not simply to remove the inconvenience of having small change. Octopus can be used in almost all of the public transportation in Hong Kong such as subways and buses except for taxis. It can be charged with monetary value through an ATM at 17 monetary companies (Sugiura & Kataoka, 2003).

The fact that people can use Octopus and charge monetary value into it almost anywhere meets the usability criteria. Satisfying usability is the decisive difference between Hong Kong and Japan because most of the past tests in Japan didn't meet the convenience of the users. Using Octopus has more advantages than buying tickets with coins. First of all, ticket machines in subways in Hong Kong don't give change if passengers don't have the exact amount of the fare. Since ticket machines don't give change, passengers need to carry

lots of coins when they use public transportation, otherwise they will lose change if they don't have the same amount of coins with the fare. For example, if a fare is 50 cents, but a passenger only has a one-dollar coin, he or she will have a loss of 50 cents. Octopus has released people from that inconvenience. In fact, about 75% of all the passengers of public transportation have used Octopus (Sugiura & Kataoka, 2003). Because of its convenience, people have accepted Octopus as the better tool for using public transportation than coins. It is true that the IC card formed electric money for public transportation is widely used in Asia because of its convenience.

2-1-3: The Current Conditions in Japan: Suica

Judging from the current conditions in Asia, the opinion that the IC card formed electric money for public transportation will also prevail in Japan seems reasonable. In this part, Suica, which is the typical example of the IC card formed electric money in public transportation, will be examined.

Suica, which is the non-contact typed IC card issued by the East Japan Railway Company (JR East), was introduced in 2001 as electric tickets. Although it can be used at limited stations mostly in the Tokyo metropolitan area now, according to JR East officials, the number of users of Suica has reached 8,000,000 this year (JR East, 2004). The limit for a charge is 20,000 yen (about 190 dollars), and it can be recharged with ticket machines at every station. As the places where ticket machines are located in stations in the metropolitan area are usually crowded, Suica is very popular for the people who frequently use a train in the metropolitan area. As electric tickets for users, there are no remarkable disadvantages in Suica. Another advantage of Suica is its expansive character. It is said that one of the keys for popularizing Suica is multifunction (Inoue, 2002), and JR East has just expanded the function of Suica so that users can buy small goods such as newspapers or drinks at shops in the stations. JR East believes that the more functions that Suica has not only as tickets but also tools for doing the shopping, the more usability is improved and the greater the number of users. In fact, Octopus in Hong Kong has become a multi-purpose card so that users can use it not only for doing the shopping but also as identity cards or keys for apartments. About 160 businesses from stores to schools have now accepted Octopus, and it has completely prevailed in the society (Sugiura & Kataoka, 2003).

In summary of the examination of the past experiments and current conditions, it is clear that usability is the important key for the prevalence of electric money. In fact, people have

the belief that if electric money can be used and charged everywhere, and they feel electric money is more useful than other ways of payment, they will accept electric money as a useful tool in comparison with other ways such as coins. On the other hand, if electric money cannot be used and charged everywhere, people do not regard electric money as a useful tool and do not use it. In this connection, to satisfy the conditions of usability so that people use electric money anywhere, infrastructure constructions are very important (Oyama, 2002, Tomita, 2003). Therefore, in the following part, the infrastructure construction and the challenges against it will be examined.

2-2: The Contexts and the Challenges of developing Infrastructures for Usability

To increase the usability so that people can use electric money anywhere, the construction of infrastructures is required. Therefore, in this section, the contexts of developing the infrastructure in Asia will be examined. Then, the challenges of developing the infrastructure in Japan will be discussed.

2-2-1: The Contexts of developing Infrastructures successfully in Asia

One of the reasons that the infrastructure for using electric money in public transportation is well expanded in Hong Kong or Singapore is the scale of lands and public transportation (Abe, 2001). For example, the land area of Hong Kong is about only the half of Tokyo. The total number of lines in Japan is more than a hundred times greater than Hong Kong. There are about a hundred railroad companies in Japan, while only MTR, KCR and LRT are in Hong Kong. The land area of Singapore is about a third part of Tokyo, and there are only MRT and LRT in Singapore (JICA, no date). Since the scale of the land area and transportation system in Hong Kong and Singapore is more restricted than Tokyo, the development of infrastructures is fully practicable for these experiments.

2-2-2: The Challenges of developing Infrastructures in Japan

Since it has been shown that introducing electric money into public transportation is generally a success in Asia, it is expected that it will also apply to Japan. However, as it is clear above, there is a critical difference in the scale of the land and transportation system between Hong Kong and Japan. This is the very big problem, because developing the infrastructure for all the public transportation in Japan so that people can use electric money everywhere requires a tremendous investment.

If starting the project so that Suica can be used at all the stations (1695 stations) in JR East, the total costs for developing infrastructure will inevitably be an astronomical figure. To introduce the system for the IC card formed electric money, costs for introducing ticket gate systems and monetary value charging systems at stations, hardware such as network machines, software, and manufacturing IC cards are needed (MLIT, 2004). Suica is currently used at about a fourth of the JR East stations (about 400 stations) in the metropolitan area. The total amount of investment for developing these infrastructures at these stations was 46,000,000,000 yen (about 438,000,000 dollars). To introduce a wireless IC tag, which is the module with a built-in IC chip, will require more investment. For installing ticket gate machines, both machines for IC cards and for magnetic tickets are necessary, JR East will have double costs to install ticket gate machines (Sato, 2003).

Developing the infrastructure only in the metropolitan area is favorable to railroad companies. Although the initial investment for developing the infrastructure is huge, it pays if investment is for only the big cities. First, as Suica is the non-contact typed IC card, maintenance costs for ticket gate machines will be much lower in comparison to traditional ticket machines for magnetic tickets. Second, with a further increase of issued Suica cards, it is expected in the metropolitan area that costs for manufacturing cards will be reduced because of mass production. Third, an IC card has high security against the illegal use such as forgery by comparison with magnetic tickets or prepaid cards. Finally, after installing ticket gate machines, personnel costs that accounts for the large part of the company's budget will be greatly reduced. It is more effective for stations in the large cities, because most of the stations in these areas have many station employees (MLIT, 2004). It is estimated that developing the infrastructure in the metropolitan area will be worth the huge amount of investment.

On the contrary, there are some challenges for developing the infrastructure in all the public transportation in Japan. First, there are many red lines or companies especially in the local areas. For example, many railroad companies in countryside have just a few passengers per a day, or there are many stations that have neither station employees nor passengers are getting on and off there. These companies will not have budgets for developing costly infrastructures, and investment in the infrastructure development will not be offset due to conditions such as the small number of passengers. Second, since many elderly people live in countryside, the Digital Divide will be a challenge. Since learning a new technology such as IC cards is generally harder for the elderly, it is possible that using

the system for IC cards will be inconvenient for them. In fact, at the Board of the Ministry of Land, Infrastructure and Transport (MLIT) in 2001, as for the subject of the non-contact IC card, committee members suggested “it is essential to consider problems such as digital divide when planning to develop infrastructures in countryside” (MLIT, 2001). Since developing infrastructures will not be benefit to the elderly or a sparsely populated area, it is necessary to develop the infrastructure only in the areas that it will be advantageous (Inoue, 2001). Considering these conditions, developing infrastructures for public transportation in the whole country is visionary.

2-3: The Contexts of introducing the Multifunctional IC Card for improving Usability

The character of an IC card that is suitable for multipurpose use has been noticed in terms of linking the improvement in usability of electric money. Because of high security and big memory of an IC chip, IC cards can be used as a system to provide various services (Seto, 2003). In fact, K-Cash, which is the IC card formed electric money in Korea, has various functions. It can be used not only as electric money but also as a credit card or an identity card. Still more, K-Cash can be used for paying taxes. If extra withholding tax is collected, it automatically refunds a K-Cash card, so the people in Korea actively use it (Aoshima, 2002). This multipurpose use of electric money has been noted in Japan. In this part, the projects of the government and private enterprises for expanding services of IC cards will be covered, and then, the challenges against them will be discussed.

2-3-1: The Projects for advancing the IC Card Services with the Government

The government has started the Basic Residential Registers Network System and issued Juki-net cards (IC cards) since August 2003 as a part of the eJapan plan. According to the Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPMHAPT), “the Basic Residential Registers Network System links all municipalities and prefectures so that the central and local governments can share resident card information such as name, address, sex, and date of birth based on residential card codes”. “It is expected to help create an information infrastructure that is essential for efficient responses to the improvement of local administration such as decentralization and the IT Revolution” (MPMHAPT, no date). This system is the basis of the realization of an electric government that is one of the important projects in the eJapan plan (Oyama, 2002). The Juki-net cards record basic information about each citizen, and have been introduced by the

government for administering the nation more efficiently (Kobe Shimbun, 2002). A Juki-net card with a photograph can be used as an identity card. This card can be used for administrative services such as an application for a passport. Since IC cards have higher security and larger memory than magnetic cards, the government has planned to improve the usability of Juki-net cards by utilizing the characteristics of IC cards (MPMHAPT, no date). For example, additional options such as driver's licenses or electric money are planned. By cooperating with private enterprises, the Juki-net cards can hopefully be used as electric tickets for public transportation (Aoshima, 2003). The development of a Juki-net card as a multipurpose card has been noted because the result of a project to make a multipurpose card of a Juki-net card will largely affect on a success in the eJapan plan (Oyama, 2002).

2-3-2: The Projects for advancing the IC Card Business with Private Enterprises

Since the government has expected that the versatile character of IC cards will improve the usability of Juki-net cards, private enterprises that advance the IC card business have also extended services. For example, JR East has just started a service so that Suica can be used for shopping at stations as electric money, and with the concept of speedy micropayment. Initially, 196 shops at 64 stations mainly in the Tokyo metropolitan area will accept the card. This will be expanded to 536 shops at 206 stations by summer and eventually to 1,000 shops. JR East officials have said, "Suica would play a key role in expanding in-station businesses, such as convenience stores, restaurants and other services" (asahi.com, 2004).

JR East carried out a research study on electric money by sending a questionnaire to 300 users of Suica, 70% of the respondents answered that they wanted to use Suica as electric money. Next, 90% of the respondents answered that they would use it for shopping at stations not more than 1,000 yen (about 9 dollars) per a day. Only 10% of the respondents answered that the limit amount of charging monetary value 20,000 yen (about 190 dollars) was too low for using it, while 36% of the respondents answered that the limit amount was too high (japan.internet.com, 2003). Thus, both the company and users have the notion that the function of Suica as electric money is suitable for micropayment.

Another example is Edy, which is the non-contact formed electric money developed by Sony. Sony has established the company, BitWallet, for managing services of Edy. Many eminent companies such as Toyota or the bank of Tokyo-Mitsubishi have joined this

project. According to BitWallet, Edy had been tested in an area of Tokyo since July 1999 (Watanabe, 2004). BitWallet has started Edy's full-scale services since November 2001. By the end of 2003, the number of shops in which Edy can be used reached about 3,400, and the number of issued Edy cards exceeds 3,400,000. BitWallet officials said that they would try to provide various new services collaborated with other companies (Watanabe, 2002). For example, BitWallet has started a new service in collaboration with All Nippon Airways (ANA), one of the largest airlines in Japan. Edy's monetary value can be exchanged for mileage points of ANA. 10,000 miles points of ANA can be changed into 10,000 yen (about 95 dollars) as monetary value in Edy. And, if using ANA Edy cards to shop, a user can get 1-mile point per 200 yen (about 2 dollars) of shopping (Okada, 2003).

Edy's business is also targeting micropayment (Watanabe, 2002). Based on the results of the experimental test of Edy, BitWallet collected data in 1999. It was examined that the average amount of each use of Edy for each shopping purchase was about 400 yen (about 4 dollars), and the frequency of using Edy was very high at shops such as convenience stores or cafes. These shops had many customers who repeatedly used micropayment. Therefore, BitWallet decided to concentrate only on the micropayment business with Edy. BitWallet avoided competition with credit card companies in terms of the amount of use. BitWallet did marketing research by reviewing the past experiments and other tests of electric money before starting to issue cards. Edy has favorably prevailed in some areas (Miyazawa, 2002). BitWallet has planned to expand services with Edy in the future.

2-3-3: The Challenges for enlarging the IC Card Services

Although the government and private enterprises have planned to expand IC card services, there are two challenges for expanding IC card services. The challenges are the compatibility of the systems using IC cards and privacy protection.

The first challenge is the compatibility of the system of electric money. As it is explained at Chapter 1, there are different types of electric money, and each type has no compatibility with the others (NTT, 2000). For the IC card formed and contact typed electric money, there are mainly three modes in the system of IC card readers, and each platform is separate (Tomita, 2003). To improve the usability with the expansion of services, unification of the standards for electric money's system is essential. To set the de facto standard for electric money, adopting FeliCa, which is the non-contact IC card technology developed by Sony, seems a reasonable idea. In fact, Sony officials have said

“FeliCa’s technology has the potential to meet diverse demands from transportation tickets to e-commerce” (Sony, no date). FeliCa is widely adopted as Suica, Edy, or Octopus. In fact, more than 38,000,000 IC cards that are used FeliCa’s technology have been issued in the world, especially in Asia for public transportation. The IC card that used FeliCa’s technology has almost become the de facto standard in Asia for public transportation (Ikeda, 2003). According to Sony, FeliCa is the world’s first non-contact card certified by ISO / IEC 15408 EAL4, which is the most reliable criteria to measure security level of a system. Still more, NFCIP-1, which is the standard of Near Field Communication (NFC) for using radio wave communication, is also certified by ISO / IEC IS 18092 as the global standard of NFC. Sony developed NFCIP-1, which is a combination of FeliCa’s technology and Mifair’s technology from Philips (Tomida, 2003). In addition to its high security, the high-speed transaction is also an advantage of FeliCa (Hirano, 2002). The data communication speed of FeliCa is about double in comparison with other IC cards, and it is suitable for improving the transaction time of ticket gate machines. Therefore, FeliCa has become the de-facto standard IC card for public transportation.

In Japan, the interactive use of IC cards such as Suica and ICOCA (JR West’s IC cards) was discussed at a forum of Japan Railroad Cybernetics that was attended by both the government and common carriers. ICOCA, which is the non-contact typed IC card issued by the West Japan Railway Company (JR West), is the same as Suica, and uses FeliCa’s technology. Since the major railroad companies have adopted the same technology in IC cards, it is predicted that Suica can be used not only at stations in JR East but also in the other metropolitan areas such as Kansai. Although Suica can now be used at about 400 stations in JR East, it will be able to be used at about 1,500 stations in both JR East and other private railroads in the Tokyo metropolitan area after 2006 (MLIT, 2004).

It is projected that if users can use major railroads with only one card, then usability will dramatically improve. In fact, it will become a reality in the near future if the scheduled projects for some railroads to share IC cards happen on schedule. However, the restriction is within the transportation system within the metropolitan area.

One of the causes that a standard for electric money in Japan has not been set is the eJapan’s policy. One of the aims in the eJapan plan is to advance high technologies, and one of the basic philosophies is that the eJapan plan has urged private enterprises to take the initiative (Oyama, 2002). As a result, competition for leadership in electric money business has been started (Nakano, 2001). There are two major groups in Japan to advance

the non-contact formed IC card business. One is BitWallet that issues Edy based on FeliCa's technology developed by Sony. The other is Japan Smartcard Solutions (JSS) issued the Mondex card. Mondex is the IC card formed and open loop typed electric money developed by the National Westminster Bank in England in 1990. Then, MasterCard International bought it in 1997 for competing with Visa International's Visa Cash (Inoue, 2000). JSS has also advanced the MULTOS project. According to JSS officials, MULTOS is the Operating System (OS) for IC cards that can perform multiple functions such as credit cards or debit cards. MULTOS is the only commercial smart card technology rated at the internationally recognized ITSEC E6 high security assurance level (Tech Talk, 2003). ITSEC is the Information Technology Security Evaluation Criteria, which has been adopted in Europe as the security standard. These two major groups are competed to become the standard for the non-contact formed IC card business.

Although FeliCa is prevalent in Asia, the NTT group has developed an IC card with large memory for identity cards in partnership with other companies to compete with FeliCa (Nikkei Net, 2003). Since FeliCa is certified by ISO / IEC as the global standard of NFC, the NTT group has advanced its project of IC cards to make it the global standard (Ikeda, 2003). In this context, many businesses are engaged in electric money projects. However, the difficulty for them is to determine the winner of electric money business who will in all likelihood determine of the standard for electric money. For example, about the businesses of the NTT group, NTT Communications belongs to JSS, while NTT DoCoMo belongs to BitWallet. In addition, some big businesses such as the UFJ Bank or Dai Nippon Printing participate in both BitWallet and JSS, although they are rivals. Because of the eJapan's policy, since private enterprises are competing to make their technologies the standard of electric money, the standard has not yet been set. As a consequence, developing the infrastructure of electric money at the current time for the whole nation is impracticable, due to the lack of compatibility of each system.

The second challenge for the expansion of electric money services is privacy. Invasion of privacy is one of the greatest concerns of people for using electric money. Magdalena Yesil, the co-founder of Cyber Cash, said, "privacy is the most important key for doing electric money business well" (Tsuchiya, 1996). According to a questionnaire on the test of multifunctional IC cards in Sapporo, Japan in 2002 by MLIT, about 80% of the respondents answered that unifying all of the tickets of public transportation in the Sapporo area into IC cards was welcomed. By contrast, about 40% of the respondents answered that unifying cards such as Juki-net cards or cash cards that can identify each individual was not

welcomed. And, according to a questionnaire on the Juki-net cards, 36% respondents answered that they didn't want Juki-net cards to have the function of electric money. 61% of the respondents answered that adding a function of credit cards to the Juki-net cards was undesirable. The results show that people don't want to have a combination like electric money and other features due to potential security issues (Kagawa, 2003). Based on the results of these questionnaires, as for the expansion of IC card services, MLIT officials stated, "since there are some functions that users will not want to be added to IC cards, expanding services of IC cards should be carefully examined" (MLIT, 2004). Another official in MLIT said "the privacy protection will be a problem if personal data stored in IC cards is used for marketing" (MLIT, 2001). This is a real problem, because one of the big advantages of doing electric money business for companies is obtaining personal information for marketing. However, one of the characteristics of electric money is anonymity, the same as cash. As electric money is circulated in the digital form, it is possible to record personal data such as purchase histories. Thus, tracking information about the use of electric money such as whom, where, or when and identifying a person is, in theory, feasible (Aoki, 1999).

The am/pm Japan ("am/pm" is correct) is one of the largest convenience store chains in Japan. It has started to accept Edy at its shops since July 2002. The am/pm Japan has made alterations to its POS cash register systems to accept Edy, and now Edy can be used at every am/pm store. According to Sony officials, am/pm Japan decided to adopt Edy for improving customer satisfaction to speed up the payment process at the cash register (Sony, no date). However, the real aim of the am/pm Japan using Edy is to collect precise customer information (Takahashi, 2003). In general, to collect customer data for marketing, convenience store chains depend on staff at cash desks. The staff enters basic customer information such as gender or age into the POS registers by judging the appearance of customers. In this way, convenience store chain obtains only crude marketing information such as the relation between age and goods. Since credit cards are seldom used at convenience stores because most of the shopping is micropayment, it is very difficult for a convenience store chain to collect exact customer information for marketing (Takahashi, 2003).

Therefore, if the number of users of Edy is increased, the am/pm Japan can will be able to collect more exact customer information, which can be utilized effectively for marketing. In fact, the am/pm Japan has started using the CRM system that is linked with Edy (Matsuura, 2002). This system records purchase histories of customers when they use Edy

at stores. According to Sony officials, the usage rate of Edy at stores is only a few percent. Therefore, am/pm Japan has opened a website, Club Ap, for users to register for membership, and hopes to get 100,000 members (Sony, no date). The fact that introducing IC cards makes it possible to link the collection of exact customer information is the main reason many businesses such as the am/pm Japan have taken note of the IC card business (Takahashi, 2003).

Data such as purchase histories may lead to a problem of privacy invasion. For example, using personal data for marketing by direct mail without the knowledge of customers, or permitting the release of personal data will be considered privacy invasion (Takahashi, 2003). In fact, in consideration for the increase of the high-tech crime such as privacy invasion, the government has quickly moved a bill for protecting privacy through Congress (the law is discussed in Chapter 4). To expand services of IC cards, it is inevitable to unify unsigned IC cards with signed cards such as credit cards. Since IC cards that have only the function of electric money are used nameless, multipurpose cards eliminate the most of anonymity's character of electric money. However, to use an IC card as a multipurpose card, users inevitably need to choose a signed IC card. For using point exchange services between Edy and ANA, users are required to have credit cards or ANA mileage club cards. JR East has also issued Suica credit cards and Suica commuter tickets, which are signed cards, for increasing the number of users of Suica. The background of these trends is to gather more customer information to expand services for them such as marketing.

When the government introduced the Basic Residential Registers Network System and issued Juki-net cards, many people, local autonomous bodies, and politicians objected to it because of the potential for the release of personal information. This has become a social problem in Japan. In the age of increasing concern that is related to an invasion of privacy, the project to introduce the Basic Residential Registers Network System causes social concern (Kobe Shimbun, 2002). Therefore, if the plan to add more functions such as driver's licenses or passports to Juki-net cards is started, there is a considerable danger that all personal data not only the simple information such as name or age but also important information such as the amount of tax payment or histories of traffic violations will leak out (Kobe Shimbun, 2002). Thus, unifying all functions that can identify a person such as credit cards or driver's license number into the IC card formed electric money is potentially dangerous. In fact, as it is clear from the result of questionnaires, people don't want to have a multifunctional card that combines a Juki-net card and electric money. "Who will use electric money that is capable of going public with all the personal information" (NTT,

2000)? However, both the government and private enterprises have planned to expand the services of IC cards.

The examination above shows that whether or not people welcome electric money depends on its usability. Although it is restricted, electric money for micropayment and for public transportation is likely to prevail in a society as the useful tool. However, it is also clear here that it is quite difficult to improve the usability of electric money so that people can use electric money everywhere due to various problems such as the budget for developing infrastructures in whole the nation, the digital divide, privacy, and the compatibility of the system for electric money. In other words, as long as electric money cannot be used everywhere like currency due to these problems, it is next to impossible for electric money to replace cash.

In the following chapters, this paper will examine the prerequisite conditions for supporting the projects of both the government and private enterprises, and reducing social concern. The conditions for popularizing electric money are security and law.

Chapter 3: The Security of Electric Money

Security is one of the important keys for increasing the prevalence of electric money. One of the greatest concerns of people using electric money is high-tech crime such as falsification of personal data. Therefore, taking a safety measure with the technology so that people can safely use electric money is essential. In this chapter, the risks of the use of electric money and the security technologies to overcome the risks will be discussed. Then, vulnerability, which is the challenge of security against the prevalence of electric money, will be discussed.

3-1: The Potential Risks for using Electric Money

Since the form of electric money is electronic data, it is possible to duplicate electric money. As electric money is mainly used on the Internet, there are risks that both users and issuers are involved in high-tech crime such as spoofing or falsification (Oshima, 2002). The spoofing is the actions on the network of using other people's IDs or passwords. In general, it means the action to invade the inside of the computer system by deceiving the authentication system with other's IDs or passwords (Uchida, et. al., no date). The authentication system confirms to whether or not users who access the system are authentic by checking IDs and passwords. The falsification is the action to rewrite or erase data on the network without authority (Uchida, et. al., no date). With these actions, the high-tech crime related to electric money can happen.

According to the report on high-tech crime issued by the National Police Agency (NPA) in 2004, the total number of arrests related to high-tech crime in 2003 was 1849. This figure was more than double compared to the figure in 2000. For example, there was the matter that the staff of an electrical appliance store illegally collected the credit card information of customers, and swindled an electric money issuer out of 144,000 yen (about 1,333 dollars) by inputting the credit card information of customers into an electric money issuer's server. There has been a wave of high-tech crime recently, and people are deeply concerned about being involved in high-tech crime. According to the research on the IC card formed electric money, as for the security of electric money, many functions of security such as protections toward forgery or privacy invasion were required for IC cards (Tomita, 2003). And, according to a questionnaire on the operation of the Basic Residential Registers Network System, 83.6% of the respondents answered that they were concerned about the release of personal information (Nikkei Research, 2002). Therefore, if electric

money prevails in a society, adding high security to electric money so that people can use it safely is essential (Oyama, 2002).

3-2: The Security Technologies toward High-Tech Crime

There are some safety measures for preventing high-tech crime. Authentication by the digital signature, the biometrics, and the encryption technologies such as public key cryptosystem and secret key cryptosystem are measures against forgery or spoofing of the data in electric money. And, the tamper resistance, which is a characteristic of IC cards, is also a measure against the high-tech crime. In this part, these security measures will be examined.

3-2-1: Authentication: Digital Signature and Biometrics

Authentication is “the process of identifying an individual, usually based on a username and password. In security systems, authentication is distinct from authorization, which is the process of giving individuals access to system objects based on their identity. Authentication merely ensures that the individual is who he or she claims to be, but says nothing about the access rights of the individual” (Webopedia, no date). There are several ways of the authentication such as a digital signature and biometrics.

To protect users from troubles with transactions on the network, a function of certifying the fact that transaction is safely done is essential. Therefore, the technique of a digital signature has been devised (Komori, 2000). A digital signature is “the digital code that can be attached to an electronically transmitted message that uniquely identifies the sender. Like a written signature, the purpose of a digital signature is to guarantee that the individual sending the message really is who he or she claims to be. Digital signatures are especially important for e-commerce and are a key component of most authentication schemes” (Webopedia, no date). The sender of the data adds a cryptographic digital signature to a document that is made with a sender’s secret key. The receiver of a document decodes the digital signature with a public key, and verifies the data (e-Words, no date). There are three characteristics of a digital signature (Komori, 2000). First, it is hopefully impossible for outsiders to forge the digital signature. Second, it is also impracticable for receivers to falsify the digital signature. Third, after attaching the digital signature to a document, the sender who adds it cannot deny the fact that putting the digital signature identifies the sender.

When using cards such as IC cards or debit cards, entering a PIN is a common method for identifying user's eligibility. However, there is a risk in a PIN that it may be easy to infer from cardholder's personal data such as a birthday (Seto, 2003). To solve the problem of a PIN, the biometrics authentication is now in the spotlight. In computer security, "biometrics refers to authentication techniques that rely on measurable physical characteristics that can be automatically checked" (Webopedia, no date). There are several types of biometric identification schemes such as fingerprints, voiceprints or iris scans. For example, the IC card formed electric money may require physical data such as fingerprints for high security in terms of identifying users. Since physical data is much more complicated than a PIN, it can take more time to check the user's identity (Seto, 2003). Since introducing the system of biometrics authentication is costly, it has not currently been common (e-Words, no date).

3-2-2: The Encryption Technology: Secret Key Encryption and Public Key Encryption

In a process of authentication to protect data from troubles such as falsification, it is essential to cipher the data. Ciphering provides high security of the data on the network by transforming the data into illegible information (NTT, 2000). For ciphering and deciphering the data, keys are used (e-Words, no date). Secret key cryptosystem and public key cryptosystem are the two types of the keys.

The secret key cryptosystem is a way to cipher and decipher the data with both senders and receivers having the same key (Komori, 2000). For example, if a sender wants to deliver a message "CIA", it is necessary to change it so that others cannot understand it. At this point, a sender needs to share a codebook as a key with a receiver so that a receiver can decipher a message. For instance, if the rule is that letters from A to I are interchanged with numbers from 1 to 9, "A" is "1", "B" is "2", "C" is "3", and "I" is "9", a message would be "391". With this way, a message "391", which is the unintelligible data for others travels on the network. After receiving the data, a receiver can decipher it from "391" to "CIA". Since only a sender and a receiver have a secret key, another name of this cryptosystem is shared key cryptosystem (e-Words, no date). However, as this is a simple cryptosystem, a sender needs to transmit a key to a receiver without being hacked by others before sending a message. If a sender has many receivers with interchanging the data, all receiver need to have the key. Therefore, as it is necessary to make keys every time and pass them to

receivers without using the Internet when exchanging the data, this cryptosystem is not suitable for interchanging the data between many people such as online shopping (NTT, 2000).

The system that is suitable for exchanging the data between many people is the public key cryptosystem (NTT, 2000). This cryptosystem is a way to cipher and decipher the data with senders and receivers having different keys (Komori, 2000). They are a public key and a private key. A public key is opened for all the users on the network. Since a public key cannot decode the data that is coded by a public key, opening a public key on the Internet doesn't reduce the security level (e-Words, no date). A private key is not available on the Internet, and is used for decoding the data that is coded by a public key. As only a receiver has this key and it doesn't circulate on the network, there is no risk of being caught up in a hacking (NTT, 2000). For example, when using a credit card for shopping online, a customer sends credit card information to a shop by coding it with a public key. Then, the shop that is a receiver has the private key to decode the data of customer's credit card information, the transaction is done safely (NTT, 2000).

To use the public key cryptosystem, it is necessary for users to check to whether or not a public key is authentic (Komori, 2000). An organization that certifies a public key as authentic is the Certificate Authority (CA), which is managed by the Trusted Third Party (TTP). It is important to certify CA as a reliable organization to prevent the spread of counterfeit certificate (Shinno, 2001). The CA issues the digital certificate to insure a public key's authenticity (Komori, 2000). According to the Digital Signature Law, a company that manages the CA needs to meet requirements such as having high technology for carrying out authentication services or establishing a strict security policy (Uchida, et. al., no date). All these elements such as the public key cryptosystem and the CA are called the Public Key Infrastructure (PKI). PKI is the basis of preventing illegal activities such as falsification and securing a safe data communication (Uchida, et. al., no date).

3-2-3: The Tamper Resistance

The tamper resistance is one of the typical characteristics of an IC card. This characteristic is effective for guarding the data from illegal activities such as forgery of electric money (Komori, 2000). In general, a magnetic card is used as a credit card or a cash card. A magnetic card is a plastic card that has a magnetic stripe as memory. Since the memory capacity of a magnetic stripe is small, it has the disadvantages of not having high

security (JICSAP, no date). Therefore, it is easy for offenders to falsify or read the data in a magnetic stripe. The high-tech crime with fake credit cards is increasing rapidly in Japan. The amount of money withdrawn from ATMs with fake cash cards from October to December in 2003 was more than 100,000,000 yen (about 952,380 dollars). One of the methods of faking cash cards is skimming that reads the data from a magnetic stripe. To reduce this type of high-tech crime, many monetary companies have noted the advantages of an IC card with the high security, and have planned to introduce an IC card (Miki, 2004). IC cards have the high security due to their tamper resistant nature. If the IC chip is forcibly opened, a memory eraser function erases the data when it is illuminated. Then, the IC chip is broken (Seto, 2003). Due to the large memory capacity of the IC chip, IC cards can have higher security than the magnetic cards (Oshima, 2002).

3-2-4: The Security Level of IC Cards

The security technologies used for FeliCa and Juki-net cards will now be discussed. According to Sony officials, FeliCa ensures the high level of security using authentication and encryption. As the encryption key is dynamically generated every time mutual authentication is performed, it prevents fraud such as spoofing. In addition to these communication security functions, FeliCa offers other security features. Issuance information and change-key information are encrypted and encapsulated in packages so that they can be safely exchanged between issuers and card manufactures without revealing confidential information. A transport key scheme provides a way of avoiding fraud during a network transport of the data (Sony, no date). A transport key is a key that only official card issuers have.

According to the MPMHAPT officials, there are five major security measures in Juki-net cards; mutual authentication, password verification, access control, tamper resistance, and a transport key (MPMHAPT, 2003). First, using security algorithms, an authentication system confirms the authenticity of the Basic Residential Registers Network System and Juki-net cards. Second, by checking user's passwords, identity of card users is confirmed. Third, to protect the data from illegal accesses and fraud such as falsification of the data, a firewall can be installed. A firewall is "a functional unit that protects and controls the connection of one network to other networks. The firewall prevents unwanted or unauthorized communication traffic from entering the protected network and allows only selected communication traffic to leave the protected network" (IBM, no date). Fourth, with the tamper resistance, IC cards prevent illegal actions such as stealing the data. Finally,

by making a transport key and giving it to only official card issuers, it is effective in protecting cards from illegal actions.

Like this, the various security technologies that have been discussed are used to prevent fraud in IC cards for electric money. In general, it is said that the security level of electric money, especially the IC card formed electric money, is very high with these security technologies (Futatsugi, 2000, NTT, 2000).

3-3: The Challenges of Security: Vulnerability

Although it is said that electric money is safe due to security technologies, there is a problem related to safety, namely vulnerability. Vulnerability basically means a problem or a defect in the computer network or the system that outsiders such as hackers can exploit (e-Words, 2003). Vulnerability in security is classified into two problems, which are related to the system and the human. In this part, the problems of vulnerability in both the system and the nature of humans will be examined.

3-3-1: Vulnerability in the System

Technology is not perfect (Microsoft, no date). Although security technologies that are used for electric money have high reliability, there is always a possibility that all of them can be broken with enough time and money (MOF, 1997). Data Encryption Standard (DES), which was one of the typical secret key cryptosystem algorithms and was the standard in the U.S adopted by the National Institute of Standards and Technology (NIST), claimed that it would take more than 10,000 years to decode. However, it was pointed out that there was a risk that it would be broken in 38 years by using a special chip (Nano, 1997). DES strengthened its security level, because the risk of decoding a secret code increases with high computer performance (e-Words, 2000). That is to say, the more the security technology improves, the more the decoding technology advances. Consequently, there is a vicious cycle in the security using cryptosystem (Microsoft, no date).

Next, there is vulnerability in the system that is impossible to protect by security technologies. Physical troubles such as the system failure or the network paralysis cannot be protected in advance by security technologies (Nano, 1997). For example, the Communication Server (CS) of the Basic Residential Registers Network System in the office of one of the local autonomous bodies in Yamagata Prefecture was out of operation

about 9 hours with unknown errors (mainichi-msn325, 2004). According to Edy officials, Edy had some system troubles so that users were unable to charge monetary value, or there was a program bug in the security system. These kinds of system troubles are an everyday incident. Another trouble such as breakage of IC cards also cannot be covered by security technologies (Komori, 2000). Although an IC card has high security against illegal attacks such as falsification by the third person, it is vulnerable to physical shocks such as breakage by users. Electric money depends on the network system. Therefore, if various troubles like above often happened, it would be impossible to use electric money as currency (Nano, 1997). These weaknesses that are impossible to solve with security technologies should be dealt with other safety measures such as the establishment of the law (Sugiura & Kataoka, 2003).

Finally, the test to intrude into the Basic Residential Registers Network System done by Nagano Prefecture in 2003 is a good example to illustrate a defect in the system. Nagano Prefecture did tests twice in 2003 to check the security level of the Basic Residential Registers Network System in three ways. The first way is to intrude into the LAN in the office of some local autonomous bodies in the Nagano Prefecture through the Internet and a dial-up connection. The second way is to intrude into the server of the Basic Residential Registers Network System from the LAN in the office of some local autonomous body in the Nagano Prefecture. The third way is to break through the firewall that is set between the LAN and the CS (Suzuki, 2003). According to Nagano Prefecture officials, it was concluded, “the security level of the system is below average, and there are potential risks that personal information could be stolen or falsified” (Suzuki, 2003). Although it was not possible to invade into the system via the Internet, it was feasible to invade the system via the LAN in the office of some local autonomous body with a dial-up connection. It proved to be possible to access personal information stored in the LASDEC server (Seshita, 2003). LASDEC is the Local Authorities Systems Development Center that manages the Basic Residential Registers Network System. It was feasible to takeover the CS, which functioned as a gateway to connect a firewall of the Basic Residential Registers Network System or the LAN in the office and the Basic Residential Registers Network System (Otsu, 2003), and the staff of LASDEC noticed the fact that the server was invaded three days later the Nagano Prefecture had done an intrusion test (Seshita, 2003).

However, the MPMHAPT contradicted the result of the test. The MPMHAPT did the intrusion test of the CS and the firewall in cooperation with Shinagawa Ward, Tokyo. The result was that all of the intrusion attempted ended in failure and no vulnerability in the

security was found (Otsu, 2003). The MPMHAPT stated that the security of the Basic Residential Registers Network System seemed strong, while Nagano Prefecture stated that the security of the system had problems. Opinions about the security level completely differed.

Although both of them have tried to justify their cases, in fact, there are some problems in the security. About a safety measure, the MPMHAPT announced a policy that it was introducing authentication with fingerprints for the Office of the MPMHAPT. With this policy, the staff in the Office must use fingerprints authentication before using the Basic Residential Registers Network System to conduct executive services for the nation. Fingerprints were introduced for authentication because the government realized that a traditional security measure with passwords was insufficient to prevent fraud (mainichi-msn329, 2004). Although the MPMHAPT objected to the results of the intrusion test in Nagano Prefecture and stated that the security level of the system was high enough, the MPMHAPT officials acknowledged setting passwords was too easy (asahi.com226, 2004). By introducing fingerprint authentication, illegal access such as spoofing is effectively blocked, and to lessen the responsibility for a security measure by dispensing with regular change of passwords (mainichi-msn329, 2004).

Although increasing the security level by introducing fingerprint authentication is certainly positive for using electric money, this policy is only introduced into the offices of the MPMHAPT (mainichi-msn329, 2004). The problem is that the government has left the management of the Basic Residential Registers Network System to each local autonomous body. It is impossible with the policy of the government and the difficulty in technology to keep the security level equally high in the system, because there are about 3,200 local autonomous bodies in Japan (Seshita, 2003). For example, Kyoto city has contracted with a private enterprise to administrative Information services. However, the private enterprise caused a problem by sending e-mail with infected a virus to all the customers (Takayanagi, 2003). Thus, Kyoto city left the important information services to a company that didn't take a basic measure in security. Still worse, the MPMHAPT asserted, "since each local autonomous body has the responsibility to manage the Basic Residential Registers Network System, it is not a responsibility for the government if something troubles such as intrusion into the system happens". The government has just asked each autonomous body to keep moderate security level (Seshita, 2003). This attitude of the government is irresponsible, because the government has forcibly introduced the Basic Residential Registers Network System and required each autonomous body to operate it.

3-3-2: Vulnerability in Human Nature

Vulnerability in human nature is a very important element in information security, because people do most of the fraud such as falsification or release of personal information. No matter how the high level security is set in the network, it is worthless if people who manage it are corrupt or unskilled in security (Takayanagi, 2003). However, the problems of vulnerability related to human nature are not affirmatively tackled by most measures against the high-tech crime (Uchida, et. al., no date). It is said that technology, management, law, and ethics are the four necessities for information security, and management is the most important key (Tsujii, 2000). As for the security management, having a keen awareness of problems in security is very important for the upper management in governmental or private organizations. If the upper management does not realize the importance of information security, equipping staff with education in security, improving their morals, or providing a security policy that are essential for preventing fraud will not be done properly (Tsujii, 2000). A security policy is a guide for organizations to conduct security measures effectively (Uchida, et. al., no date).

However, it is said that Japan has low consciousness for the security (Tsujii, 2000). In fact, the government admitted, “our consciousness for the security is far lower in every measure such as a budget, talent, or systems in comparison with the U.S” (Cabinet Secretariat, 2000). It has been revealed that the security level of information management systems in the mega-banks in Japan is quite low (Sankei, 2004). According to a check of the web sites of about 3,300 companies in Japan, there were only 2 companies in which the security level was acceptable. However, after reviewing the results of examinations, the chairmen of one of the mega-banks answered at the Board of the House of Representatives that his bank had absolute confidence in its security measures. Although the mega-bank officials say that they have developed a security system following the governmental guideline for security, the domestic standard for security is quite low by comparison with the international standard like ISO17799 (Sankei, 2004). The attitude of the management of the mega-banks, which is asserting that security level is high enough, shows a lack of risk consciousness for security. Although the president of a mega-bank who said the security level was high enough, he was the person criticized by the public when the mega-bank caused large-scale system troubles in 2002. It is said that the cause of system troubles was the president’s ignorance about the information system and its significance (Yajima, 2002).

There is also a problem with security policies. Although it is essential to make a security policy for preventing high-tech crime, the results of some examinations on security policies show that the approaches to a security policy in both the governmental organization and private organization are lagging. According to the research on information security on personal data protection in local autonomous bodies examined by the MPMHAPT in 2003, 93.6% of all the 47 prefectures such as Tokyo, Osaka or Kyoto had set a security policy. However, only 49.6% of all the 3204 small autonomous bodies in each prefecture had set a security policy. Since it was clear that there were some problems in the Basic Residential Registers Network System as shown by the results of the test of Nagano Prefecture, the government should have directed each autonomous body to establish a security policy before starting to operate the Basic Residential Registers Network System (Ichishima, 2003). According to a questionnaire on cyber terrors for big companies such as common carriers or IT businesses examined by the NPA in 2000, some facts are known. First, only about 26% of common carriers had a clear awareness of the risk of cyber terror, while about 60% of IT businesses had a keen awareness of it. Second, though most of the companies answered that they had or planned to have a security policy, 57.6% of common carriers answered that they didn't plan to establish a security policy, and only 4.5% of common carriers had an established security policy. In this context, the examination in 2003 showed that only 27.2% of common carriers answered that they had an established security policy. Third, although some types of industries did not have place in technical staff for covering the security, the figure of "60%" for the common carriers was the highest rate. From these results, establishing a security measure for high-tech crime in common carriers is especially delayed and incomplete (NPA, 2000).

In summary of the examination of security in this chapter, security technologies used for electric money are generally reliable. However, vulnerability is a serious problem against the prevalence of electric money. Since electric money depends on the computer network, defects in the Basic Residential Registers Network System demonstrate several problems, because it is a national-wide system. If electric money prevails in a society as currency, it will require a network like the Basic Residential Registers Network System. Users will not accept any defects in it. Though solving vulnerability related to human nature is very important, there are many challenges. It is said that Japan has little consciousness for the security, which the government admitted. Although public transportation is considered to be a field in which electric money is prevalent, the awareness of security by common carriers is quite low and insufficient. These insufficient measures in the security lead to an

increase of the high-tech crime such as the release of personal information committed by people. At this point, security technologies cannot perfectly protect people from high-tech crime. To convince people of the safety of using electric money, the establishment of law is essential. In the following chapter, the establishment of the law and its current conditions related to electric money will be examined.

Chapter 4: The Law and Electric Money

Law is also one of the important keys for increasing the prevalence of electric money. To widely popularize electric money to the public as currency, it is essential to legalize electric money as an official payment method and set supportive conditions by the law. First, a definition of electric money in the law will be explained. Next, the current conditions of establishing the law for supporting the use of electric money will be illustrated. Finally, the challenges of the law related to the use and the prevalence of electric money will be discussed.

4-1: The Definition of Electric Money in the Law

A clear definition of electric money in the law is not yet set. According to the report on the meeting about the law of e-commerce issued by the Ministry of Justice (MOJ) in 2001, it is concluded as “defining a unified character of electric money in the law is difficult, because there are different types of electric money and various ideas on electric money and its future” (MOJ, 2001). The sectional meeting to study e-commerce hosted by the Prime Minister of Japan and His Cabinet in 1998 concluded, “it is better not to strictly define electric money, because there is a possibility of change of the meaning of electric money with the progress of technology or the development of infrastructures” (Kantei, 1998). Therefore, for the present, electric money is defined as a method of settlement that is similar to currency (Sugiura & Kataoka, 2003). The law states that currency in Japan consists of bank notes issued by the BOJ and coins issued by the Mint, and bank notes are given the force to be passable in every commercial transaction (Sugiura & Kataoka, 2003). That is to say, though electric money has a function of settlement, and its monetary value can circulate like currency, it is not approved as currency in the law at present.

4-2: The Establishment of the Law for supporting the Use of Electric Money

For the prevalence of electric money, it is very important to prepare measures such as the law so that people can use electric money safely (MOF, 1997). There are some laws for supporting the use of electric money such as protecting privacy. The Digital Signature Law, the Unauthorized Computer Access Law, and the Privacy Protection Law are laws supporting the use of electric money.

4-2-1: The Digital Signature Law

In Japan, if a digital signature was used in e-commerce and something troubling happened, there was no rule to solve it. Therefore, the government decided to establish a law on digital signatures so that people can safely use e-commerce (Hagiwara, 2000). The Digital Signature Law was enacted in 2000 to iron out information circulation by setting regulations about a digital signature and its authentication. The law has taken effect in 2001 (e-Words, 2002). With this law, electronic documents have legal force on equal terms as documents with a seal or a handwriting signature at commercial transactions. The law aims to advance e-commerce including electric money by making the most of digital signature's characteristics such as ironing simplifying the transaction of business (e-Words, 2000). Authentication of a legal digital signature is called the select authentication service, which officially authenticates a digital signature by issuing an electric certification (Hagiwara, 2000). The organizations authorized by the government can handle the select authentication service. These organizations have obligations for protecting users and maintaining the safety and reliability of authentication services (Uchida, et. al., no date). The obligation of the organizations are to maintain high security measures, to issue digital signatures to customers, complying a rule that user information is only for confirming user's identity, and to be liable for taking investigation by the authorities are the obligations (NDN, no date). Since a digital signature insures the monetary value of electric money, the law for supporting a digital signature is important for the prevalence of electric money (Tsujii, 2000).

4-2-2: The Unauthorized Computer Access Law

In 2000, there were 16 incidents in which hackers falsified the web sites of the governmental organizations. Therefore, it was clear that the security measures of the government were insufficient. However, there was no role to take action against illegal access. Therefore, the government decided to establish the law to punish illegal access and to direct companies to take security measures (Kida, no date). That is the Unauthorized Computer Access Law. This law was enacted in 1999 to prohibit the illegal use of computers, and it has taken effect in 2000. The law has banned using computers illegally with other person's IDs or passwords, attacking security holes and accessing computers for illegal actions such as falsification of the data (METI, 1999). Offenders will be punished with a maximum imprisonment of 1 year or a maximum penalty of 500,000 yen (about 4,762 dollars). People who permit illegal access by the release of passwords or IDs will

also be punished by this law, and will have a maximum fine of 300,000 yen (about 2,857 dollars) as a penalty (Uchida, et. al., no date). This law provides that system administrators should take proper precautionary measures so that the system will not be attacked or accessed illegally (METI, 1999). The system administrators need to take strict security measures such as managing passwords or controlling access (HPP, no date).

4-2-3: The Private Protection Law

With the progress of IT in Japan, the use of personal information as electronic data has been expanded. Therefore, the government decided to establish a law to protect the individual's rights, the Private Protection Law (Kantei, 2003). This law was enacted in 2003 to protect private information, and it will be taken effect in 2005. The law requires businesses that handle personal information of more than 5,000 people not to appropriate personal data for illegal use, or not to do sloppy management of personal information (Takagi, 2004). Explaining the purpose of using personal data for each person, getting personal information by agreement with each person, keeping personal data accurate, protecting personal data from theft, loss, or release, and giving a fair shake to each personal information holder are the five principles in the law (Uchida, et. al., no date). As for a penalty, if people observe that companies use their personal information for an undesirable purpose, they need to accuse companies for violating this law. After accepting appeal from victims, the authorities will direct the accused companies to improve illegal conditions. Then, if companies don't improve illegal conditions after receiving an executive order, they or their employees will be punished with a maximum penalty of 300,000 yen (about 2,857 dollars) or maximum imprisonment of a half year (Yoshikawa, 2003). In advance of legislation of the Privacy Protection Law, there is the Privacy Protection ordinance for protecting the release of personal information. According to the announcement by the MPMHAPT in 2003, 74% of all the local autonomous bodies instituted this ordinance (e-Words, 2003).

4-3: The Challenges of the Law against the Prevalence of Electric Money

Although the conditions for the prevalence of electric money seem to have gradually been set by establishing some laws, there is the no comprehensive law that supports the development and prevalence of electric money from all sides (Sugiura & Kataoka, 2003). While the authorities of electric money such as the MOF or the MLIT have made many examinations of electric money since 1996, the Electric Money Law has not been

established (Sugiura & Kataoka, 2003). One of the reasons that the proposed law was not approved was a vague definition of electric money. In addition, laws such as the Privacy Protection Law are said to be imperfect. Therefore, in this part, the challenges of the law that affects on the prevalence of electric money will be discussed.

4-3-1: The Background of not establishing the Electric Money Law

According to the report of a meeting on electronic settlement and electric money organized by the MOF in 1997, it is stated, “setting supportive conditions for the development of electric money such as the law so that people are able to use electric money safely or businesses are able to develop high-tech products related to electric money is essential” (MOF, 1997). Therefore, establishing the Electric Money Law for meeting these conditions was discussed. However, the law was eventually not approved, because there were some concerns about the legislation (Nikkei Shimbun, 1999). One of the main causes is a vague definition of electric money. Establishing the law on electric money depends on a legal definition of electric money (MOJ, 2001). Currently, the MOJ feels that defining a unified character of electric money in the law is difficult as there is disagreement within the proper authorities on a definition of electric money in the law.

With the MOF, there are two opinions about developing and issuing electric money. One is the American approach, and the other is the European approach (Sakamoto, 1998). The American approach is mainly adopted in Anglo-Saxon nations such as the U.S. This is the idea that private enterprises should develop and issue electric money with a viewpoint of economic development such as advancing the development of technology. This approach has measures for protecting consumers in case of transaction troubles (Otsuka & Morioka, 1999). The European approach has been adopted by France. This is the idea that only monetary companies should be licensed to develop and issue electric money, because electric money is quite similar to currency, and has the possibility to affect the country’s economy. Therefore, it needs to be treated carefully by official organizations (Kawamura & Morimoto, 1997). About the American approach, it is effective to use private business’s incentive to develop products, while it is necessary to establish or revise the law for permitting private businesses to issue electric money or protecting people from troubles such as bankruptcy of issuers. In the European approach, it is said a safe way to permit monetary companies to develop and issue electric money, because handling a method of settlement is the main business for them. However, to regulate agencies for developing and issuing electric money may suffocate the development of electric money due to

competition between private enterprises (Kawamura & Morimoto, 1997). Thus, these approaches have both merits and demerits.

In 1997, the MOF organized a meeting on electronic settlement and electric money. The opinion of those present was that “private enterprises are allowed to develop and issue electric money, and the law to support people should surely be established” (Sakamoto, 1998). However, adoption of this idea is not going well. First, with encouraging the development of electric money by private enterprises, various styles of electric money and the technology related to electric money are being developed. Since one of the basic philosophies in the eJapan plan is that private enterprises are central to advance the eJapan plan, it is stated that private businesses should not be discouraged from developing electric money (Sugiura & Kataoka, 2003). As a result, the fact that the technology of developing electric money has made rapid progress and produced several types of electric money makes the definition of electric money in the law more difficult.

In addition to getting behind in the establishment of the law, amending the constitution is a difficult challenge. About the issue of electric money, it is said that one of the causes the past experiments of electric money in Japan ended in failure is that since the government didn't approve electric money as currency, electric money issued by private businesses lacked credibility (Sugiura & Kataoka, 2003). In fact, according to a questionnaire on electric money for the Internet or online shopping users, many respondents answered that they would use electric money if issuers were a government agency such as the post offices or the monetary companies. In other words, 76% of the respondents answered that it was necessary for electric money to be given authentication by the government (Kugimiya, 1997). Therefore, the proper authorities explored the idea of giving an official banking license to the issuers of electric money so that they have credibility as official issuers (Harakuni, 2003). To protect users, a law must be established to insure user's monetary value when an issuer of electric money goes bankruptcy. According to a questionnaire on the IC card formed electric money, 50.7% of the respondents answered that insurance of monetary value they charged against problems such as theft was essential for the IC card formed electric money (Tomita, 2003). Therefore, the government has explored to establish the law for protecting monetary value in some ways.

However, the law such as legally approving electric money as currency or insuring monetary value in case of loss or theft has not been yet established. The difficulty of

striking a balance between protecting users and issuers, the inconsistency between traditional laws and technology development, and the competition for leadership among the proper authorities are the causes of the difficulty of revising the law. First, as for protecting users, there is a 50-dollar rule in the U.S. If cardholders of a credit card or a debit card notify a card issuer of the loss or illegal use of a card within 2 days, a ceiling on 50 dollars is set as cardholder's responsibility (Otsuka & Morioka, 1999). There are some disadvantages of introducing such a rule in Japan. If electric money prevails widely in a society, the amount of monetary value that circulates in a society will increase. Therefore, if a rule like a 50-dollar rule is enacted, issuer's responsibility in costs will grow (Otsuka & Morioka, 1999). As a result, issuers will further increase safety measures, and its costs will add services such as product prices for users (Otsuka & Morioka, 1999). If the issuers limit the services of using electric money for users, the usability of electric money will go down (Kawamura & Morimoto, 1997). There is the possibility that introducing a rule for fully protecting users brings effects such as abusing the rule or causing loose care of cards or passwords. Users want high security such as insuring monetary value for using electric money. However, if the law for protecting fully users is established, issuers will need to take much liability in costs. Thus, as it is difficult to strike a balance between protecting users and issuers, the law for protecting users in monetary value is not yet set.

Next, the cause of the difficulty and delay of establishing the law is the traditional law. Since the traditional law is not established for future technology developments such as electric money, the establishment of laws cannot keep up with the technology development (Sugiura & Kataoka, 2003). As the eJapan plan has encouraged private businesses to develop new technology, they have developed various technologies or services related to electric money, while establishing the law has been left behind. For example, since a cellular telephone that has a function of electric money is being developed, establishing the law for protecting users will be required (Nikkei Net215, 2004). However, about 20 laws such as the civil law or the commercial law must be revised to revise for introducing electric money fully in a society (Tsuchiya, 1996). In addition, it takes inestimable time to revise only one law at the Diet (Oyama, 2002). Therefore, it is almost impossible for the law to keep up with the developments of technology and fully support users for using electric money.

The competition for leadership among the proper authorities is also the cause of the difficulty and delay of establishing the law. Concerning the electric money project in the eJapan plan, there are two movements for integrating various functions into IC cards

(Kuroda, 2003). One is the movement that aims at the prevalence of multifunctional IC cards in public fields such as tickets for public transportation or driver's licenses by the MLIT. The other is the movement that aims at the prevalence of the Juki-net cards as multifunction cards in various fields from driver's licenses to credit cards by the MPMHAPT. By revising laws or establishing ordinances, the MPMHAPT has thought that the Juki-net cards can be multifunctional cards equipped with functions such as electric money or credit cards. On the contrary, the MLIT has tried to eliminate the Juki-net cards, because the Juki-net cards are unpopular with people, and they may become an obstruction for the prevalence of IC cards. Thus, the MLIT and the MPMHAPT have fought for gaining the initiative for the project of IC cards (Kuroda, 2003). These bureaucratic struggles have had a negative influence on the establishment of the law related to electric money.

4-3-2: The Problems of Existent Laws

Although the law such as the Privacy Protection Law or the Unauthorized Computer Access Law was established for protecting people from high-tech crime, there are some problems in these laws.

The effect on high-tech crime of the Unauthorized Computer Access Law is questionable (Ishida, 2001). Although actions for urging people to commit illegal access by the release of passwords or IDs will be punished by this law, actions such as releasing security holes to bulletin boards on the Internet are not prohibited by the law (Kito, no date). Since hackers can use information such as security holes to access illegally to the network, this point should be improved. The Unauthorized Computer Access Law does not take actions against hackers, only deterring hackers from doing a crime (Kito, no date). However, there is a fear that this law will not have much effect on hackers, because many highly skilled hackers exist on the network, and tracing them is very hard (Ishida, 2001). In fact, since the arrests for violating this law have all been amateur crimes, it shows that this law will not be effective for professionals such as hackers in the present state of affairs (Kito, no date). Serious high-tech crimes such as illegal access to the governmental offices have actually increased (NPA, 2004).

The Privacy Protection Law has been criticized by the Opposition, a part of the government party, and civic groups (Shimada, 2003). In fact, this bill was once rejected at the Diet in 2002. The reason for the strong criticism of this law is that if the law is

introduced, there is a risk of making information control on the people stronger by the government (Nichibenren, 2003). If this law is passed, the proper authority will be vested with strong power to crack down on the whole nation in the name of protecting the people from a privacy invasion (Shimada, 2003). Therefore, to reduce the strong criticism and to enact the law, the government announced the basic policy of the Privacy Protection Law. This policy stated that the amendment of the law minimized regulations by the government and prompted private enterprises to protect personal information from high-tech crime (The Nishinippon WEB, 2004). However, as a result, there are doubts that this law will have any actual effect, because the law applies only to cases where people who have been harmed by the use of personal data and report it to the proper authorities (Uchida, et. al., no date). Although it is difficult to decide the degree of the government participant in the regulation, this law should be a more effective deterrent against high-tech crime and will reduce concerns in safety (The Nishinippon WEB, 2004, Uchida, et. al., no date).

With the basic policy of the Privacy Protection Law, private enterprises are required to set a security policy, to educate employees on the awareness of the importance of protecting personal data, and to establish a system in companies for coping with the high-tech crime such as illegal access (goo, 2004). However, in spite of efforts to establish the law and the basic policy, many matters have been happened that do not follow the law. For example, the case of the release of personal data on about 4,500,000 Yahoo BB's customers in February 2004 has become a serious problem. Yahoo BB is the Internet connection provider of Yahoo Japan Corporation. Their customer's data was released, and a third party used the released data for blackmailing Yahoo BB (MYCOM, 2004). It is difficult to investigate the method in which the data was released, because Yahoo BB saves the access log for only a week. However, an inside job is suspected. There is also the case of the release of personal data from the NEC Corporation (NEC) where a magnetic disk storing customer's credit cards information was stolen from a company's car. Although a security policy in NEC prescribed that employees should not leave things related to customer information in a company's car, the employee concerned this matter didn't abide a policy (Sakaguchi, 2004). These kinds of crimes have happened for too often recently in Japan.

The fact that IT businesses like Yahoo BB or NEC have only partial measures for protecting personal data and the frequency of matters that are a breach of personal data are serious problems. As this paper has discussed, a lack of awareness of the importance of security in private enterprises is preventing the prevalence of electric money. This also

applies to political offices. For example, the NPA used a TV performer, who is suspected of violating the Unauthorized Computer Access Law, for public relations for information security measures (Kubota, 2004). The proper authorities of the eJapan plan should take an active part in the project of developing IT. However, as most of the committee members are not good at using IT tools such as computers, there is a woeful situation that not IT tools but papers are still the main tools used at meetings of the eJapan plan (Mitsuishi, 2003). Like these, insufficiency of having expert knowledge in IT or inconsistent directions of security measures in both the government and private enterprises will effect the realization of objectives in the eJapan plan such as advancing electric money (Mitsuishi, 2003). In fact, some major projects of the eJapan plan such as the realization of an electric government are not on schedule due to these factors (Ishii, 2004).

In summary of the examination in law in this chapter, it has shown that a clear definition of electric money has not been set is a problem for the prevalence of electric money. It is said that if electric money has a no official guarantee as currency in the law, it will be next to impossible that electric money prevails among a society (BOJ, 1999). Next, the fact that the establishment of the law for supporting the use and the prevalence of electric money has fallen behind the technology development is a challenge. It is said that if the more technology develops, the more vulnerability increases (MYCOM, 2004). Therefore, for the prevalence of electric money, the government primarily should have taken more effective measures for reassuring people about security and monetary value of using electric money, though it was difficult because of a vague definition of electric money. Finally, the competition for leadership among the proper authorities in IT projects is a hindrance to the prevalence of electric money. The proper authorities have competed in introducing multifunctional IC cards with revising the law and they think multifunctional IC cards will link with improving usability for people. However, as it is clear from the result of questionnaires about IC cards and Juki-net cards, people don't want to have a multipurpose card that combines electric money and other functions such as credit cards due to potential security issues. Bureaucracy in political offices that the first priority is aiming to have the initiative in the IT project among the proper authorities does not link to improve the usability of electric money for people and to delay and confuse the establishment of the essential law for the prevalence of electric money. Thus, there are serious imperfections in the law against the prevalence of electric money.

Chapter 5: The Cultural Influence on Electric Money

It is said that culture plays an essential role as to whether or not people need specific technologies (Samli, 1985). That is to say, a cultural element has a large effect on to whether or not people will accept electric money. In this chapter, the influence of culture on the prevalence of electric money in some countries will be examined. Then, whether or not people will use electric money in terms of culture will be discussed.

5-1: The Cultural Influence on the Prevalence of Electric Money in Some Countries

Octopus, which is the IC card formed electric money, is successfully used in Hong Kong, and there are some cultural influences that led to the prevalence of electric money. First, there is the business custom in Hong Kong that most of commercial transactions are in small lots. About 90% cases and about 70% sums of all the transactions are settled by petty cash (Sakabe, 1999). Therefore, as one of the characteristics of electric money is suited for micropayment, it is considered that electric money will prevail in Hong Kong. Second, there are originally cultural characteristics that welcome electric money in Hong Kong. The Hong Kong people accept products if it improves their life. They have radical notions that time is money, and dislike wasting time (Abe, 2001). Therefore, since Octopus improves the usability of public transportation in terms of buying tickets more quickly or receiving change, the people in Hong Kong have welcomed the use of electric money.

On the other hand, there are some countries where electric money has not prevailed. For example, Moneo, which was IC card formed electric money in France, was not used by the French people (Sugiura & Kataoka, 2003). Electric money did not prevail in France, because France is the most advanced nation in the use of debit cards (JEITA, 2001). Since the crime of pickpocketing is common in France, the French people do not carry cash around. This cultural condition helped the development of debit cards. Cash cards have been used as debit cards since 1991. And, all the cash cards were replaced magnetic cards with IC cards in 1992. Cartes Bancaires (CB) is the major debit card in France. Most adults in France have debit cards like CB, and they can use debit cards daily for micropayment in the shopping (JEITA, 2001). That is to say, debit cards that have the same characteristics of electric money such as the IC chip or a function of micropayment have already prevailed in French society as a major payment method before the birth of electric money. Therefore, it is difficult to change the custom of payment rooted in a society from debit cards such as CB to electric money such as Moneo (Sugiura & Kataoka, 2003).

5-2: The Culture in Japan

There is the strong custom that the Japanese people mainly use cash for commercial transactions. There is an idea that young people are willing to accept new technologies despite the cultural element. And, it is said that cultural characteristics have an effect on the lack of awareness in security. In this chapter, the possibility of the prevalence of electric money in the Japanese culture will be discussed.

5-2-1: The Culture of Cash Basis

The strong custom of cash transactions in Japan is a barrier to the prevalence of electric money (Kanehara, 1997). For example, the total number of issued credit cards in Japan is more than 200,000,000, which is larger than that of the U.S. (NTT, 2000) However, credit cards were used only about 7% in all the transaction in Japan (Yomiuri Online, 2002), which is about one fourth of that of the U.S. (NTT, 2000) There is background about the cash basis culture in Japan. First, according to the BOJ officials, since the BOJ has made costly technology efforts to prevent counterfeiting of bank notes, credibility of cash is very high in Japan (Nishimura, 2004). For example, cost of making a ten thousand yen bill is about 21 yen (about 2 dollars), while cost of making a hundred dollar bill is about 10 yen (about 1 dollar).

Second, there is the issue of the feel of money. The Japanese people identify with the feeling of currency such as bank notes and coins in their hands or identify them with their eyes in daily life for many years (Kanehara, 1997). On the contrary, electric money has only data, which people cannot touch and count. Only figures as the data and IC cards can be seen physically (Kanehara, 1997). Currency generates strong credibility because it can be felt (NTT, 2000). Thus, since the Japanese people have been used to this cultural element for a long time, it is very difficult for electric money to have credibility like currency.

Finally, there are countless ATMs in Japan. Through the intense competition between monetary companies for locating ATMs, Japan is the most developed country in the number of ATMs (Noguchi, 1996). In addition, banks have expanded further services of ATMs. For example, about 130 monetary companies such as city banks or local banks have integrated their ATM online systems into the common system (Nikkei Net105, 2004). Due

to this integration, customers can withdraw cash 24 hours from ATMs in nearly 130 monetary companies in Japan, having only one cash card. Some banks have recently made alliances with convenience stores such as am/pm Japan recently to locate ATMs in convenience stores. Thus, as banks have expanded the services of ATMs, withdrawing cash from ATMs has become more and more convenient for people.

5-2-2: The Possibility of Young People climbing over a Cultural Element

It is said that young people in Japan are much more adaptable to learn and accept new technologies than middle aged and elderly people (Sakamitsu, 2001). In fact, a cellular telephone that has various new technological functions such as a camera or an animation is popular among the young. In the experimental tests of electric money, one of the advanced advertising of the Visa Cash test was that the test was done in the city of the young, Shibuya (Fujio, 1998). Since both Shibuya and Shinjuku are not only the largest cities in Tokyo but also famous for gathering many young people, both Visa International and NTT expected that electric money tested in such a city would be favorably welcomed. However, these tests ended in failure.

Most of the respondents to some questionnaires about the tests of the IC card formed electric money are people in their twenties and thirties. For example, about 90% respondents of one of the questionnaires on the Visa Cash test were people in twenties and thirties (Internet Watch, 1998). There is another result of a questionnaire. About 86% respondents answered that electric money should be usable in many shops. From the results of these questionnaires, it was clear that people under in thirties especially made a point of usability when they used electric money (Kanai, no date). Since it has discussed in Chapter 2, most of the experiment tests ended in failure due to a lack of usability. Although the young people in Japan have the inclination to favorably accept new technologies, it depends on whether or not new technologies are useful. Therefore, since electric money was unable to meet conditions for improving usability, young people did not accept it.

5-2-3: The Social Environments in Japan

In connection with a problem of feeling in a cash basis culture, invisibility also affects on a lack of awareness toward security in Japan, because information is physically invisible (Tsujii, 2001). Since there used to be fewer crimes, especially high-tech crime in Japan than other advanced countries, a lower consciousness for security has formed in

Japan. According to the research on the damage of crimes, the rate of damage by computer crimes in Japan was only about 2%, whereas that of in the Western countries was from 10% to 30% (Tsujii, 2001). Therefore, it is difficult for the Japanese people to sense the full risk of high-tech crime. In this context, the fact that the governmental organization on codes and intelligence was very weak in comparison with the West also had an effect on a lack of awareness toward security after the World War II (Tsujii, 2001). In the World War II, the Japanese navy depended on not radar but eyes in reconnaissance. That is to say, the Japanese people have had the tendency to rely on senses such as sight or touch for many years.

Thus, there is the culture in Japan that people have tendency to trust in objects that they can directly feel with senses. It will be difficult for electric money to overcome the cultural preferences of the Japan society (Kanehara, 1997, Matsumoto, 1998).

Conclusion

In conclusion, electric money will not replace cash in Japan. Although the IC card formed and non-contact typed electric money is expected to take hold in a society, it will be restricted to specific fields such as public transportation in the metropolitan area, because the characteristics of electric money make it suitable for micropayment and the requirements for the number of users can be met to offset the costs for developing the infrastructure.

In general, it is said that electric money must be convenient and safe to use for prevailing widely in a society like currency. The necessary conditions for the popularization include developing the infrastructure features such as security and law. However, there are many challenges against the popularity of electric money.

There are many problems in developing the system infrastructure so that electric money can be used throughout Japan. One is its high cost. For example, there are many railroad companies that do not have large enough budgets to develop the infrastructure. There are some areas such as the countryside that developing the infrastructure will not benefit both the people there and businesses. And, there are different types of electric money, and each type is not compatible. To improve the usability with the expansion of services, unification of the standard for electric money's system is essential. However, since the government has encouraged competition for developing electric money among private enterprises with the policy of the eJapan plan, it will be more difficult to set the standard of electric money.

The technology used for the IC card formed electric money such as cryptosystem or tamper resistance has high security. However, vulnerability in safety proceeding from the human element is a challenge. For example, since electric money deeply depends on the computer network, defects in the Basic Residential Registers Network System will be a serious problem. If the government starts to expand the services of the Juki-net cards as electric money, the Basic Residential Registers Network System would be used for settlements. People will not use electric money, if it circulates on such a defective system like the Basic Residential Registers Network System. Although solving vulnerability in the human element is very important, there are many challenges against it. The fact that the government has admitted that Japan is lacking of deep consciousness for the security is a problem. For example, although public transportation is considered to be a field that electric money prevails, the security measures such as a security policy in common carriers

are especially insufficient. And, high-tech crime such as illegal access has increased. All these have resulted from the lack of awareness for the security in the upper management of governmental and private organizations.

The fact that a clear definition of electric money in the law is not yet established is the large problem, because it affects the establishment of the law that supports the use of electric money. It is said that if electric money is not given an official guarantee like currency and supportive conditions for using it in the law, circulating electric money widely in a society will be impossible. However, the comprehensive law that meets these conditions was not established. Next, establishing the law to catch up with the technology development is a challenge. Since the more technology develops, the more vulnerability heightens, people's concerns such as security for using electric money will increase. Although there are some laws such as the Privacy Protection Law for protecting people from high-tech crime, it is indicated that these laws are not enough to deter hackers from doing illegal actions. Finally, the competition for leadership among the proper authorities in the IC card project that is not regarding the usability first for people and contaminating the establishment of law is an issue. Although the authorities have planned to introduce multifunctional IC cards, people have expressed the opinion that they don't want to combine credit cards and electric money because they are worried about the high-tech crime such as privacy invasion. Integrating credit cards into the IC card formed electric money will ruin the anonymous characteristic.

The culture in Japan has a strong barrier against the prevalence of electric money. Since there is a strong custom of cash basis resulted from the culture that the Japanese people have trust in objects that they can directly feel with senses, electric money that is the untouchable and invisible method will be hard to hail in Japan.

Thus, for the present, there are various challenges for electric money to circulate in Japan like cash. Electric money is not certified as official currency in the law but is only one of the payment methods suitable for micropayment. Since this paper has discussed, only the IC card formed electric money for the limited fields such as public transportation will be a more useful tool for people than other ways of payment. Therefore, to conclude, electric money could only be an alternative payment way, but it will be impossible to replace cash in Japan due to various problems or barriers.

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