Model of Taxi Electronic Micropayment Services

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ABSTRACT

This study analyzes the current industry status, operation framework, and strategies of micropayment services in Taiwan domestic and foreign taxi services, and discussed the patterns and factors that facilitate success to make the findings may serve as valuable, theory-based references for developers of the micropayment system in the taxi business. Based on our findings we proposed the discovery that “micropayment service provider-taxi carrier-end user” is the industrial chain of the micropayment service. This study also proposed suggestions regarding the implementation of the taxi micropayment service: first of all, a micropayment service-provider must already have operations with enough subscribers, and the provider and other locals must have the ability to introduce the micropayment system. In addition, the micropayment service-provider must solve the problems in the cost-structure of taxi carriers and take the “micropayment service provider-taxi carrier-end user” before the taxi micropayment service can be successfully implemented. Lastly, this study discovered that governmental implementation is most effective, and end users are the biggest winner in the taxi micropayment service. If the micropayment service-provider could successfully implement taxi micropayment, end users would be allowed to further enjoy transportations with a piece of plastic more conveniently, resulting in more positive effects and values.

INTRODUCTION

With the advancing Internet, the development of e-commerce and mobile-commerce has become an inevitable trend which also prompts the constant evolution and innovation of traditional payment methods as a way to respond to the emerging business and transaction models given birth to by the development of e-commerce. However, besides convenient and fast e-payment mechanisms, business models are the critical component that facilitates the popularity and value-creation of different e-payment mechanisms. Therefore, only an e-payment system that is developed after different industries’ characteristics, users’ behaviors, amount of transaction, and available soft/hardware are considered and its feasibility is analyzed can truly meet the current demands and achieve maximum return and value-creation for the entire business model and system-establishment. In this present study we analyzed the current status, operation framework, and strategies of micropayment services in domestic and foreign taxi services, and discussed the patterns and factors that facilitate success; it is wished that our findings may serve as valuable, theory-based references for developers of the micropayment system in the taxi business and for future researchers.
ELECTRONIC PAYMENT SYSTEM

The “electronic payment system” (hereafter as “e-payment system”) was first proposed by Chaum (1983), in which the three primary participants are the payer, the payee, and the bank, under certain rules and settings. More and more high-tech firms, financial institutes, academic and research organizations, researchers, and governmental agencies around the world are engaging in the research on the e-payment system, of which the more well-known examples include SET, CAFE Ticks, PayWord, iKP, and Mondex. Each e-payment system has its pros and cons, application settings, transaction rules, and requirements. An important task, therefore is to propose an e-payment system that meets our nation’s needs while works with other e-payment systems.

As the system’s features are increased or designed to meet different demands, more and more participants are now included in the system protocol. Currently, the common roles in the e-payment system are as follows:

1. Customer: synonyms include a “payer” or a “buyer.” Plays the role of using e-currency to make a payment.
2. Merchant: synonyms include a “payee” or a “seller.” Plays the role of accepting e-currency in a transaction.
3. Buyer’s bank: synonyms include an “issuing bank” or an “issuer.” Plays the role of converting an external currency into e-cash for the customer.
4. Merchant’s bank: synonyms include an “acquirer bank” or an “acquirer.” Plays the role of converting the e-currency into cash for the merchant.
5. Arbiter: also referred to as the objective third-party; it plays the role of a fair, independent, and objective third-party in the system and is in charge of settling the disputes between the participants of the system.

Janson and Waidner (1995) divided the basic structure of e-payment into six parts:

1. The Buyer
   A buyer, also referred to as a payer or consumer, is the one who purchases a product or service through an online transaction.
2. The Seller
   The seller, also referred to as the payee or merchant, is the one who sells a product or service through an online transaction.
3. The Issuer
   The purpose of an issuer, often a bank or a relevant financial institution, is to provide the buyer with the online payment tools and services. The issuer also establishes the procedures of identification and authorization, and provides the standard operating procedures of e-commerce.
4. The Acquirer
   An acquirer is a bank that provides a seller with payment-collection services and is in charge of the collection of payable amounts and the account-management for the seller. The acquirer also establishes the procedures of seller-certification/registration and provides the SOP of e-commerce.
5. The Objective Third-party
   The purpose of an objective third-party is to settle the problems and disputes emerged in e-payment transactions. It may have the power to announce a verdict over a dispute or to issue mandatory orders.

The e-payment system is becoming increasingly important in e-commerce and may even determine the success or failure of the entire transaction; therefore, security consideration is a critical factor that
determines the outcome. However, given a lack of standardized regulations over the relevant mechanisms, in our study we will organize the objectives and requirements proposed by different researchers by introducing the security-demand and practicality-demand.

1. Security-demand
   (1) Offline-verification
   The time it takes to complete a transaction would be lengthened if each transaction had to be verified by the issuer of an e-currency; therefore, the method offline-verification could be introduced to reduce the wait-time. The problems of reproduced and repeated cashing-out of an e-currency must also be prevented.
   (2) Prevention of Forgery and Alteration
   The authenticity of transaction-related information must be ensured. In a transaction, each participant must be able to verify the other’s identity in order to prevent intended forgery and alteration (e.g., transaction-related messages being extracted from a mobile device or being altered). Identification is usually achieved with an asymmetrical password mechanism. The integrity of information must also be ensured in order to prevent losses due to errors in transmission, hacking, alteration, and forgery. Through a password system, messages are converted into message-digests through One-way Hash Chain, MAC, and digital signatures.
   (3) Undeniable
   In the e-payment system, the risks between all participants must be balanced. In case of a transaction-related dispute, any participant must be able to present a receipt or signature generated from a transaction or payment as proof for arbitration in order to prevent illegal behaviors. This security-demand is usually achieved through digital-signatures or One-way Hash Chain.
   (4) Privacy
   Since online-payment involves sensitive issues such as personal asset and privacy, thus relevant measures must be provided to ensure the privacy of users or other participants. The password technique is adopted to facilitate privacy in e-payment and to ensure personal privacy.

2. Practicality-demand
   (1) Availability
   In e-payment, the equipment and related protocols accessed by each participant require certain infrastructures in the physical world in order to work smoothly. In the initial stage, therefore, relevant infrastructures must be carefully planned in order to facilitate future constructions.
   (2) Circulation
   In terms of circulation, e-payment must be like a physical store in the sense that consumers can pay in different ways, platforms, and procedures. Therefore, sellers and service-providers need to provide diverse payment methods and applications; for example, using the system to get on public transit, shop, or make payments.
   (3) Easy-to-use
   The transaction system must be easy-to-use so that it is accepted and trusted by more and more consumers. To consumers, therefore, operating procedures or connectivity must be easy to handle.
   (4) Efficiency
   When a consumer needs to use a mobile device to make an e-payment, the CPU processing requirement needs to be kept low since a mobile device’s speed is relatively slower than a personal computer.
(5) Separatability

A consumer should be allowed to make an e-payment of any amount instead of a multiple of a fixed amount.

The current e-payment is basically divided into the “credit-card payment system” and the “token payment system,” as explained below.

1. Credit-card Payment System

   In this model a credit-card is used to make payments. To make a payment, a user inputs his/her credit-card number, and once the transaction goes through, the acquirer bank transfers the amount to the merchant. The acquirer bank will also check the account with the card-issuing bank, and the transaction will show up on the user’s monthly statement. A drawback is the risk of losing the credit-card. A lost card could be used by others and result in its owner’s loss.

2. Token-payment System

   This can be further divided into three sub-systems: e-cash, e-check, and a smart-card. Regardless which is used, the legitimacy of the e-token needs to be checked at the time of payment in order to avoid issues such as repeated usage or forgery. These three sub-systems are explained in more details below.

   (1) e-cash

   The purpose of e-cash is to replace the bank notes and coins used in daily small-amount purchases. A user of e-cash has an account in an online digital bank which is often handled by a traditional bank. The user may withdraw e-cash from his/her personal account, and the amount of the cash withdrawn is encrypted with digital-signature from his/her personal computer along with a string of hidden, random numbers before the piece of data is transmitted to the bank.

   After the user’s digital-signature is decrypted by the bank, the amount is withdrawn from his/her account. The authenticated random numbers are then sent back to the user for him/her to use the amount to make a payment online.

   (2) e-check

   An e-check is used much in the same way as a traditional check; the account owner sends out an e-document containing the name of the payer, the name of the pay-out financial institution, the account number, the name of the payee, and the amount of the check. The only difference between the two is that an e-check is issued digitally and endorsed with digital-signature, and the payer, the pay-out bank, and the account number are verified through digital-signature. An e-check can be sent directly over the phone or a public network such as the Internet. After collected by a bank, the e-check is cleared through systems such as ACH (Automated Clearing House). The integration of the existing banking system and public networks has provided banks, industries, and clients with a feasible solution that focuses on the existing check-processing institutions.

   (3) Smart-card

   A smart-card can also be divided into two categories: a relationship-based smart-card and an e-purse. A so-called “relationship-based smart-card” is a IC card issued by a financial institution and can be used as a credit-card, a cash-card, access-card to multiple bank accounts, value-added marketing programs, other services, and storage of data such as the card-holder’s name, date of birth, and personal purchase records. An e-purse is a pocket sized smart-card that contains a microchip for the calculation and storage of the total amount of money available to the card-holder, allowing the person to make payments with the e-purse.
ELECTRONIC MICROPAYMENT SYSTEM

A micropayment is a payment less than $10 USD made possible with payment tools and online systems. Payment-tools include existing cash, savings, credit-cards and pre-paid cards, and new tools, or a payment system that utilizes the bill of monthly Internet or mobile phone services. With the encryption technology, the online system may be open or semi-open where an end user may complete a payment directly through the Internet. The existing systems of micropayment as complied in our study are as follows.

1. B2C micropayment

“B2C” refers to “Business to Consumer Electronic Commerce,” in which a consumer who is the end user or buyer may conduct a transaction with a company through digital data transfer. Through e-media, the consumer may learn about a product, purchase the product with a credit-card, e-check, e-cash pre-paid card, or debit card, and may even directly download the product through online transfer.

Methods of payment provided for consumers by an online seller often include using a credit-card online, faxing a purchase-order with credit-card information, account transfer, CODs, making a payment at a convenient store, a check, or a cash-bag. Of which, the two most popular methods are online credit-card payment and bank account transfer. At the moment online credit-card payment is still the fastest and most familiar way to pay; however, this method still has its risks. The B2C micropayment system’s actual applications include the e-cash prepaid card, online credit card, e-check, and debit card.

2. C2C micropayment

Consumer-to-Consumer, or C2C, involves the online transfer of cash between two individuals. With online auction sites gaining popularity, the market of C2C money-transfer services is seeing fierce competitions from online companies and the traditional financial industry. C2C does not require additional software or hardware, but a seller needs to join a membership. Micropayment service-providers settle the accounts with sellers once a month, and the rates of service charges vary among different service-providers.

The most well-known example of the actual application of C2C is PayPal. PayPal was initially designed for C2C personal transactions but is now gradually being applied to B2B and B2C payment services. In terms of service charges, a small-amount transaction for a general user is free of any service charges, and charges apply to business accounts; 30 cents are collected for each transaction, and 2.2% of the amount of the transaction is collected if the amount is $15 USD or higher.

PayPal does not require any additional software to be installed, and can be used to make payments through a PDA (Personal Digital Assistant), a web-ready mobile phone, or any devices with wireless Internet access. A payer needs to sign up for an account on PayPal. When purchasing for a product on a PayPal-certified website, the payer enters the payee’s e-mail address and amount of payment, selects the product, and the method of payment (via a credit-card, bank account, or PayPal). PayPal.com then deducts the amount through the selected method and sends out C2C payment-related instructions via e-mail, thus earning its name of “e-mail money.” The payee’s method of payment-collection includes ATM withdrawal, check, or account transfer.

The advantage of PayPal is that it provides low-cost payment-solutions for small-scaled sellers or companies that engage in small-amount transactions. Much of the cost of market-development is shifted to online customers, and the procedures are easy to follow. By using the Internet as the medium to enter the market, influences of factors such as market-acceptance are reduced, and target-clients are attracted to sign up for PayPal services. However, the interface in English hinders PayPal’s popularity in
non-English countries, and the fact that PayPal transactions are conducted in U.S. dollar also poses issues regarding the rate of foreign exchanges. In addition, both the buyer and seller must be members of PayPal and with their own accounts or internationally-accepted credit cards; otherwise, payments will not be able to go through. The seller is responsible if the buyer does not receive the payment or a forged card is involved, and the commission cost is transferred by the seller to the buyer. Problems with PayPal include consumers’ privacy-related issues, lengthy processing time, money being stolen from a hacked PayPal account, and disputes being solved by the buyer and seller alone without a third-party.

3. Mobile payment scheme

The “mobile payment scheme” refers to the use of a mobile device (such as a mobile phone or PDA) as the payment-tool for making a transaction with a commercial website or physical store. Currently most financial institutions only work with a single mobile phone carrier. Financial firms may develop a “joint system of mobile phones and banks,” including the STK (SIM Tool Kit) mobile bank, to provide additional services through a mobile phone that supports STK with an SIM card (with 32k of memory) that supports mobile-banking installed. A user may use the phone’s browser or text-messages to conduct most banking operations and receive messages from a bank. The WAP (Wireless Application Protocol; WAP) mobile banking is an open, standard wireless application protocol that serves as a platform for mobile communication servers and Internet servers to communicate with each other. A user may get online with his/her mobile phone to conduct transactions. Mobile micropayment’s actual applications include pre-paid SIM cards, mobile-banking, and the mobile payment system.

METHODOLOGY

The purposes of the study are to analyze the current status, operation framework, and strategies of micropayment services in domestic and foreign taxi services, and discussed the patterns and factors that facilitate success. However, considering that taxi electronic micropayment services is still an emerging technology and still full of uncertainty in implementation, references available on this emerging technology based industry are extremely limited, and no one has explored the topic systematically, there must be problems in this field remaining to be made clear for the reference of further studies in the future. For this reason, we have selected pilot study method as the foundation of this research.

Pilot Study is often taken as the first step in research. It can help researchers to get familiar with the situation and propose their introductory opinions which demarcate a scope for follow up studies. When researchers have no definite ideas on some issues, they usually use the pilot study method which can help them to get an in-depth understanding of the issues and establish the priority of the study, so as to improve their research design for follow up studies (Cooper & Emory, 1995).

Churchill (1995) and Zikmund (1994) pointed out that pilot study is suitable for researches that are never or seldom addressed by others involving clarification of the essence of a question and whose objective is to probe into certain thoughts, opinions, or ideas rather than to reason from certain phenomena or to offer definite solutions. The application of pilot study will be helpful to probe into fresh or ambiguous study topics, so that follow up researchers can get more understanding of the study topics. Cooper and Emory (1995) also suggested that pilot study might be the best choice when researchers had no definite ideas on certain issues.

Pilot study is often taken as the first step in research. It can help researchers to get familiar with the situation and to generate presumptions rather than to verify presumptions. When researchers have no ideas on how to carry out research on a management issue, they will use pilot study to find out, choose,
investigate, and survey study topics. The research design can be very flexible, researchers have many choices in terms of data sources and collection methods and can make adjustment according to the actual situation. Pilot studies seldom use detailed questionnaires or probability sampling method to collect data. This study is carried out by means of two frequently used approaches, i.e. secondary research and in-depth interview with knowledgeable peoples.

1. Secondary research

Generally the first step in pilot study is to collect secondary references which can help the researcher to decide topic of the study and propose presumptions. Besides literature survey, pilot study can also be carried out by means of empirical verification, i.e. the researcher select representative samples and conduct interview with them on the study topics. It is an effective method to carry out pilot study by interviewing people who are familiar with the study topics. Useful information can be acquired with the least time and efforts by means of this method.

Secondary research may be the fastest and the most economic method for researchers to find out the situation and generate presumptions. In the study, literature on the origin, definition, implementation steps, architecture, relevant theories of taxi electronic micropayment services have been collected from various channels such as the Internet, academic periodicals, theses, magazines, published books, and etc., to preliminarily probe into and discuss the study topics.

Literature on the origin, definition, implementation steps, architecture, relevant theories of taxi electronic micropayment services are collected by means of secondary research for a complete understanding of the study topics and the design of interview questionnaires. Next, the researcher conducts interviews with industrial experts to find out their opinions on the future development of taxi electronic micropayment services, current situation and strategies of the industry, then carry out analyses on the collated data.

2. In-depth interview

In the study, information such as current situation of taxi electronic micropayment services, opinions from enterprises on the future development of the industry, and strategic concerns of enterprises are collected by means of in-depth interview.

(1) Open-ended questionnaire

Open-ended questionnaire is adopted in the study according to its nature and objectives. Questions in the questionnaire are to build a framework of discussion for the interviewees rather than to provide them with a group of limited choices.

(2) Focused interview

Considering opinions of enterprises on the future development of taxi electronic micropayment services may vary in thinking orientation depending on their experience, company strategy, and environment factors, the study uses focused interview, a semi-structural interview method, to make sure interviewees can speak freely, so that the collected data may be profound enough to fit the nature and objectives of the study. The flexibility of semi-structured interview enables the interviewee to express their opinions in a detailed way according to the interview situation and reveal their emotion, idea, and social network. Answers from the interviewee are spontaneous rather than extorted, therefore characterized by highly specific, concentrative, self-revealing, and personal. Such characteristics may be helpful to the study in its collection of opinions and information from enterprises on the future development trend and strategy of taxi electronic micropayment services.

In respect of the practical application of in-depth interview, this study carries out in-depth interview with senior managers from taxi electronic micropayment service providers in Taiwan. To investigate
opinions of enterprises on the business environment, the future development and model of taxi electronic micropayment services, the in-depth interview questionnaires of the study are filled out by means of telephone interview with Taiwanese taxi electronic micropayment service providers; while the open-ended questionnaires are filled out by means of exclusive face-to-face interview with renowned Taiwanese taxi electronic micropayment service providers. By in-depth analysis of the exclusive interviews we get three research topics, i.e. current status, operation framework, and strategies of micropayment in domestic and foreign taxi services, and discussed the patterns, factors and models that facilitate success. The study is mainly on these three topics.

FRAMEWORK OF THE TAXI MICROPAYMENT INDUSTRIAL CHAIN

In this present study the taxi industrial-chain of “micropayment service provider-taxi carrier-end user” in China, Japan, Hong Kong, and Taiwan is analyzed in order to determine the factors that contribute to a successful taxi micropayment service.

After reviewing the market of the “micropayment service provider-taxi carrier-end user” taxi micropayment service in the above four markets, we have determined that the taxi micropayment service must be actively implemented by micropayment service-providers. By quickly developing a base number of subscribers based on their existing customers and promoting micropayment among end users, micropayment can then be extended to the taxi micropayment service as a way to create more access-rate and values of micropayment. Therefore, in the industrial chain of the taxi micropayment service, taxi carriers are not the service-promoter but the downstream alliance of micropayment service-providers. Through taxi carriers, micropayment service-providers provide end users with more services and additional values. We thus propose the industrial chain of “micropayment service provider-taxi carrier-end user” taxi micropayment service and use this framework to discuss our findings.

Figure 1: Framework of the Taxi Micropayment Industrial Chain

Micropayment Service-Providers

The four markets of China, Japan, Hong Kong, and Taiwan do not differ greatly in terms of techniques, products, and hardware. They all have certain capacities in terms of R&D and introduction; therefore, even when the R&D and design capacity in Japan is higher than that in China, Hong Kong, or Taiwan, micropayment can still be made widely available in the latter three by introducing the relevant techniques and hardware and having relevant, local talents and service providers.

In terms of recruitment and training, micropayment service-providers in the four markets only extend their services to the taxi micropayment service when they have a significant number of micropayment subscribers. This is because without a certain base number, no taxi carriers would be willing to join micropayment services.

In terms of product-development/manufacturing, of the four markets only the micropayment service-providers in Japan have complete R&D and manufacturing capacity of the needed techniques and hardware, and this is why Japanese micropayment service-providers can provide speedy services and diverse micropayment services that attract taxi carriers.

In terms of budgeting and planning, the micropayment service-providers in all four markets are large enterprises, government-owned or privately-owned public transportation alliances that have enough capital to build and enable the entire micropayment system, and in turn to promote the service to the
domain of taxies. This allows the participants of the above groups to have enough resources to construct the entire micropayment system to a significant scale within a short time.

Main micropayment service providers in Japan, Hong Kong, and Taiwan are consisted of governmental and private companies who must seek profit in their operations, thus they focus very much on the component of “cost.” On the other hand, since the main micropayment service-providers in Japan, Hong Kong, and Taiwan already integrated the micropayment demands in mass transit by quickly having a subscriber base, this allows their shareholders to cover the cost of building the system without having to establish the channels and clients before joining the micropayment market and in turn promoting their services to the taxi industry. In China, however, the efforts are handled by local governments, and at least millions of subscribers to the public-transit card in each region are directly allowed to use their cards to make micropayments when taking taxies. Though local governments may not be as sensitive as private companies, the services being rooted in the large number of public-transit card-holders directly allow the micropayment system to enter the taxi industry, making this practice one of the most efficient as we have determined.

The above findings all support the “micropayment service provider-taxi carrier-end user” taxi micropayment service we proposed in our study, as only micropayment service-providers (or their shareholders) with a large subscriber-base can skip the process of investing heavily in the construction of needed channels and client-base and go directly to conducting services in their local clients. This allows them to reach a significant economic scale quickly and extend their efforts to the taxi industry, which cannot be achieved directly through taxi carriers.

We then make an analysis with the scale of opportunities and determined there are significant, potential opportunities for micropayment service providers and their stakeholders who go into the taxi industry. In this regard we analyzed public-transit providers, large enterprises, and governments. In terms of public-transit service providers, they need to quickly establish a micropayment subscriber base that is based on their existing clients (passengers). Based on the client-base, they can extend their services to the domain of taxies, resulting in more end users, income, and profit, and the scale of opportunities increases as the micropayment service is accessed by more individuals, making this approach a business-platform model. As for large enterprises, they would need to build a micropayment client-base based on their existing customers. By continuing their primary services, they may introduce micropayment to achieve more end users, income, and profit. And compared to the public-transit counterpart, crossing-marketing by a large business group further improves the opportunities regarding micropayment. Though this is also a business-platform approach, it has more potential opportunities than the public-transit counterpart. For both public-transit service providers and large business groups, the flexibility of the prices of their services often reduces after their end users have accessed the micropayment service, indicting they are getting less sensitive towards the public-transit fares and prices of products/services paid through micropayment, which may also be helpful for the two above entities in their pricing strategy. Lastly, in terms of governments that have been working on tourism for the past years, providing the public and tourists with the “one-card access” to all public-transit services will definitely improve tourism, governmental performance, and national reputation. The scale of potential opportunities, therefore, is very significant to governments.

**Taxi Carriers**

In our study we discovered that the industrial structure of taxi carriers is one of the critical factors in the taxi micropayment service. In China and Japan where micropayment is promoted smoothly, their
taxi carriers are all corporations, and micropayment service-providers only need to work with a few taxi carriers to promote the taxi micropayment service in which a taxi carrier directly manages its drivers and micropayment services/hardware, proving to be more efficient than that in Hong Kong or Taiwan where most taxies are owned by individuals.

In taxi carriers’ effort of recruitment and training, besides the aforementioned influences from the industrial structure of taxi carriers, micropayment service-providers also want to work with company-owned taxi carriers -- especially those with a vast number of vehicles. Working with large-scaled taxi carriers not only facilitates management but also allows a significant economic scale to be quickly reached. On the other hand, a large-scaled taxi carrier often has better drivers, allowing even more efficiency and outcome of the promotion of the taxi micropayment service.

Budgeting and planning are also important influential factors for taxi carriers. In all four markets, the cost of the micropayment card-reader installed on each taxi is covered by the taxi driver, thus the industrial structure of taxi carriers becomes very critical in this sense. Take China for example; currently the implementation of the taxi micropayment service is led by each local government and executed by local taxi carriers, and since a region often only has one taxi carrier that owns all of the local taxi drivers, who pay rent and management fees to operate the vehicles, once the local government deices to implement the taxi micropayment service, all it has to do is to ask the taxi carrier to install a micropayment card-reader on each taxi; the cost of the card-reader is covered by governmental subsidization and the management-fees and rent paid by each driver, allowing the implementation to take place. In Japan where taxi carriers are also owned by companies, large-scaled micropayment service-providers work with large-scaled taxi carriers to quickly implement the service. On the other hand, taxies in Hong Kong and Taiwan are mostly owned by individuals, and despite the pros of having micropayment, most drivers are reluctant to pay extra for a card-reader installed, indicating the influences of budgeting and planning on taxi carriers.

When taxi carriers implement the taxi micropayment service, despite whether a taxi carrier is owned by a company, all of its taxi drivers are unable to collect cash payment immediately and must pay for the card-reader. The only difference is that the cost of the card-reader in a company-owned taxi is covered by the rent of the vehicle, whereas a card-reader in an individually-owned taxi is paid through the rent or one-time purchase by the taxi driver. When micropayment service-providers provide no incentives regarding the taxi micropayment service for taxi carriers or end users, introducing the taxi micropayment service only increases the cost for taxi drivers, and the fact that their payment-collection is delayed not only further increases their operation cost in areas where taxi drivers’ daily income is already quite low, but also affect their operation cash flow. Therefore, micropayment service-providers need to provide relevant incentives for taxi carriers and/or end users in order to promote the taxi micropayment service; otherwise, given the consideration of the size of opportunities, taxi drivers or taxi carriers may not wish to join the taxi micropayment service as there are a lack of obvious incentives and need, prohibiting the promotion of the taxi micropayment service.

Therefore, if issues related to the cost structure could be solved, incentives for taxi carriers such as being complemented by public-transit carriers, working with large enterprises to conduct advertising and marketing, and being awarded by the government would encourage them to jointly promote the taxi micropayment service. As a result, end users would be willing to take taxies that support the taxi micropayment service, and taxi carriers would also increase their business volume. In addition, taxi drivers would also be free of problems such as not carrying enough small change, thus preventing the
safety concern of robbery. Based on the above, once the cost-structure related issues are solved, taxi carriers would indeed realize the potential opportunities presented by the taxi micropayment service.

**End Users**

In terms of the distribution channel, micropayment service-providers can only smoothly promote the taxi micropayment service after having a sufficient client-base. In addition, promoting the taxi micropayment service is more likely to succeed in areas with large populations; for example, the service is more successfully promoted in China and Japan than it is in Hong Kong or Taiwan.

In terms of recruitment and training, end users need to be experienced in using micropayment. Take the “Taiwan Money Card” that is adopted by 11 highway bus carriers in the 7 counties/cities in southern Taiwan and promoted by the Ministry of Transportation and Communications, Taiwan; the people in these regions do not have the experience of those in Taipei who are already familiar with the “Easy Card” that is widely popular in Taipei, and the popularity of the Money Card did not reach the expected level. This changed, however, after the Money Card was integrated with Kaohsiung MRT’s “iPass.” Since the Money Card was launched much later than Easy Card did, it does not yet have the taxi micropayment service, indicating the difference of promoting the taxi micropayment service between different regions and metropolises. As for China, regions that currently have the taxi micropayment service only launched this service after their millions of residents are already familiar with the local smart-card system. In Japan, the taxi micropayment service was also launched after their Edy and Suica systems each have millions of micropayment end users. As for Hong Kong, though their “Octopus Card” is one of the best examples of the micropayment services and each person in Hong Kong has more than one Octopus Card, the issues of the industrial structure of their taxi carriers have prevented the promotion of the taxi micropayment service, making it one of the dissatisfactions of the public with the Octopus service-carrier, which is also working on this issue at the moment. Therefore, having end users that are already experienced in accessing micropayment services is a critical component in the promotion of the taxi micropayment service.

In terms of the factor of customers’ demands, the implementation of the taxi micropayment service is very beneficial for end users in different markets since it provides more convenience for them. To end users, if micropayment service-providers could successfully promote taxi micropayment, they would further enjoy the convenience of accessing all means of transportation with just a piece of plastic. With the positive effect of increased convenience, end users would enjoy positive growth and opportunities.

Lastly, in our study of the taxi micropayment service, we have determined that the “government” is a critical component in the entire effort. Though the government is not directly in the link of “micropayment service provider-taxi carrier-end user,” our analysis indicates it is the catalyst. Take China for example; though local governments may not be as sensitive to the cost-structure as private companies, the service is still based on the vast number of users of the public-transit smart-card, and this directly allows the taxi micropayment service to reach the economic scale, and the policy of mandatory installation of the card-readers in all taxies has also quickly made the taxi micropayment service widely available. On the other hand, micropayment service-providers in Japan, Taiwan, and Hong Kong who first started promoting the taxi micropayment service also initially relied on their client-base developed by public-transit. The earliest initiator of the taxi micropayment service in Taiwan is Taipei City Government. To summarize the above, in our study we have determined that the government is a critical factor in the promotion of the taxi micropayment service, and one of the most efficient way to promote the taxi micropayment service is through governmental policies.
CONCLUSION

We draw the conclusion of our study based on our findings.

1. The “micropayment service provider-taxi carrier-end user” is the industrial chain of the taxi micropayment service.

By analyzing the cases in China, Japan, Hong Kong, and Taiwan, we have determined that the taxi micropayment service needs to be actively promoted by micropayment service-providers by developing a client-base based on their existing clients, helping their clients get experienced in accessing micropayment, and applying micropayment to the domain of taxies in order to create more access rate and values for micropayment. Therefore, in the industrial chain of the taxi micropayment service, taxi carriers are not service-promoters but downstream alliances of micropayment service-providers, and micropayment service-providers provide more services and create more values for end users through taxi carriers.

2. The industrial structure of taxi carriers is a critical factor behind the promotion of the taxi micropayment service.

In our study we discovered that the industrial structure of taxi carriers is one of the critical factors in the taxi micropayment service. In markets where taxi carriers are all corporations, micropayment service-providers only need to work with a few taxi carriers to promote the taxi micropayment service in which a taxi carrier directly manages its drivers and micropayment services/hardware, proving to be more efficient than that in markets where most taxies are owned by individuals. Working with large-scaled taxi carriers not only facilitates management but also allows a significant economic scale to be quickly reached. On the other hand, a large-scaled taxi carrier often has better drivers, allowing even more efficiency and outcome of the promotion of the taxi micropayment service.

To summarize the above, the degree of centralization of taxi carriers affects the promotion of the taxi micropayment service. In markets where taxies are mostly privately-owned, it is better if the micropayment service-provider or the government that actively promotes the taxi micropayment service could setup an intermediating, centralized management system between private taxi owners and corporate taxi carriers (e.g., a micropayment service-provider establishing a central taxi management system between private and corporate taxies), the taxi micropayment service promoted by the micropayment service-provider can then be promoted through this central management and reach economic effects.

3. Suggestions for Promoting the Taxi micropayment Service

(1) A micropayment service-provider must have a sufficient client-base.

Our case analysis indicates that micropayment service-providers only extend their service to taxies after they have developed a sufficient client-base. A micropayment service-provider can only be spared of the investment in distribution channels by already having a sufficient client-base, as this would allow them cost-efficiency and to extend their services in the domain of taxies; this kind of practice, however, cannot be directly achieved by taxi carriers.

(2) A micropayment service-provider or a local talent must be capable of introducing the micropayment.

A market that is capable of introducing the taxi micropayment service already has sufficient techniques, products, and hardware. Even if a market has no such R&D and design capacity, the introduction of relevant techniques and hardware and having relevant domestic talents and companies can still make micropayment popular and allow the service to be extended to taxies. Having a complete set
of R&D/design capacity, products, techniques, and hardware is determined by whether micropayment service-providers have the relevant techniques that allow them to quickly introduce joint-services, diverse micropayment services, and attract taxi carriers to micropayment.

(3) The issues with the cost-structure of taxi carriers need to be solved.

We discovered that micropayment service-providers need to solve the issues with the cost-structure of taxi carriers before they can promote the taxi micropayment service. For example, we have determined that the main promoters of the taxi micropayment service are the public-transit carriers and large enterprise that provide micropayment services, as well as the government. Incentive such as taxi carriers and public-transit carriers complementing each other, engaging in advertising-collaboration and incentives with large enterprises, and being awarded by the government all help promote the taxi micropayment service. As a result, end users would be willing to take taxies that support the taxi micropayment service, and taxi carriers would also increase their business volume. In addition, taxi drivers would also be free of problems such as not carrying enough small change, thus preventing the safety concern of robbery. Based on the above, once the cost-structure related issues are solved, taxi carriers would indeed realize the potential opportunities presented by the taxi micropayment service.

(4) Promotion by the government is the most efficient way to go.

Take China for example; though local governments may not be as sensitive to the cost-structure as private companies, the service is still based on the vast number of users of the public-transit smart-card, and this directly allows the taxi micropayment service to reach the economic scale, and the policy of mandatory installation of the card-readers in all taxies has also quickly made the taxi micropayment service widely available, making this practice one of the most efficient as we have determined.

(5) End users are the biggest winner of the taxi micropayment service.

To summarize the above, in the “micropayment service provider-taxi carrier-end user” taxi micropayment service, micropayment service-providers extend their services and gain additional income through the taxi micropayment service; taxi carriers can expand their client-base through the taxi micropayment service introduced from micropayment service-providers and acquire additional revenue.

In terms of the factor of customers’ demands among end users, the implementation of the taxi micropayment service is very beneficial for end users in different markets since it provides more convenience for them. To end users, the only thing remained unchanged is the micropayment card they hold. If micropayment service-providers could successfully promote taxi micropayment, they would further enjoy the convenience of accessing all means of transportation with just a piece of plastic. With the positive effect of increased convenience, end users would enjoy positive growth and opportunities.

Positive gains represent end users’ direct economic benefits. Under the principle of supply and demand, regardless end users’ price-flexibility of taking a taxi, their need for taxies will grow if the service is promoted by micropayment service-providers or the government. The size of opportunity represents positive, external benefits such as “convenience” generated by economic growth. In other words, under the same principle, when incentives are provided by micropayment service-providers and the government regarding taxi micropayment service, end users will be more likely to access the taxi micropayment service when micropayment service-providers integrate different domains of application together.

Figure 2: Framework of the factors leading to the success of the taxi micropayment services

Based on the above concept of “value-creation” and economics, we further take the “top-down” perspective to think about the incentives in the “micropayment service provider-taxi carrier-end user’
industrial chain regarding the marketing and promotion of the taxi micropayment service. To micropayment service-providers, they have extended their services by reaching the taxi industry; in other words, the service of micropayment yields additional marginal returns based on the existing client-base. To taxi carriers, there is a significant “one shot experience” difference between privately-owned and corporate-owned taxies; a passenger, in his/her entire lifetime, may have taken a privately-owned taxi once, yet he/she may prefer or stick to a certain taxi carrier due to the safety, convenience, or other reasons brought forth by the good management system (such as a corporate-owned taxi has appearance and expiry-related regulations). Therefore, a taxi carrier with good corporate regulations may enjoy the benefits brought by its scale, which is a significant difference between privately-owned and corporate-owned taxi carriers. This also forces micropayment service-providers to choose corporate taxi carriers since the former must have a strong client-base fore they can expand their services, and corporate taxi carriers can also enjoy additional revenue from the micropayment service-providers’ client-base. End users not only enjoy more convenient with their micropayment card, but the discounts provided by micropayment service-providers or the government further increase end users’ benefits as all they have to do is to swipe their card and enjoy the convenient services. Therefore, compared to micropayment service-providers and taxi carriers, end users are the real biggest winner of the taxi micropayment service.

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