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What determines the use of mobile internet and mobile payment? Implications from previous literature

ปัจจัยอะไรที่ส่งผลต่อการรับมาใช้ของบริการอินเทอร์เน็ตผ่านอุปกรณ์เคลื่อนที่และการชำระเงินแบบอิเล็กทรอนิกส์ผ่านอุปกรณ์เคลื่อนที่? ข้อสรุปจากการทบทวนวรรณกรรม

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ABSTRACT

Since the early 2010s, the rapid growth of smart phone adoption has transformed mobile phone to not only a device for voice services, but also a multimedia device from camera, music players, internet browsers, high quality video and even an alternative method of payment. With a number of social and economic benefits of mobile internet and mobile payment, it is important to understand what determines the use of mobile internet and mobile payment. The objectives of this study are to explore what determines mobile internet and mobile payment adoption by analysing and reviewing previous studies on the determinants of mobile internet and mobile payment in the past decades. The findings are that security and privacy of services, price of services, quality of services, availability of services, income of users, age of users, education level of users and users' attitudes affect the adoptions. In addition, applying broadband ecosystem concept can support the explanation of the development of mobile internet and mobile payment on broadband policy.

Keywords : Mobile Internet, Mobile Payment, Adoption, Broadband Ecosystem

บทคัดย่อ

การเติบโตอย่างรวดเร็วของการรับมาใช้โทรศัพท์เคลื่อนที่แบบ Smart Phone ตั้งแต่ปี พ.ศ. 2553 ที่ผ่านมานั้น เปลี่ยนแปลงการใช้โทรศัพท์เคลื่อนที่จากเพียงแค่บริการด้านเสียง ไปสู่บริการอื่นๆ มากมาย เช่น กล้องถ่ายรูป เครื่องเล่นเพลง และรวมถึงการใช้บริการอินเทอร์เน็ตผ่านอุปกรณ์เคลื่อนที่ (Mobile Internet) และการชำระเงินแบบอิเล็กทรอนิกส์ผ่านอุปกรณ์เคลื่อนที่ (Mobile Payment) ด้วยประโยชน์ทั้งต่อเศรษฐกิจและสังคมของ Mobile Internet และ Mobile Payment ทำให้เป็นเรื่องสำคัญที่จะเข้าใจว่าอะไรคือปัจจัยสำคัญในการใช้ Mobile Internet และ Mobile Payment บทความฉบับนี้ศึกษาถึงปัจจัยที่ส่งผลต่อการรับมาใช้ของบริการอินเทอร์เน็ตผ่านอุปกรณ์เคลื่อนที่และการชำระเงินแบบอิเล็กทรอนิกส์ผ่านอุปกรณ์เคลื่อนที่ โดยวิธีการศึกษาแบบการทบทวนวรรณกรรมจากบทความศึกษาอื่นๆในช่วงทศวรรษที่ผ่านมา ผลการศึกษาพบว่าความปลอดภัย ราคา คุณภาพ และการเข้าถึงของ Mobile Internet และ Mobile Payment รวมไปถึงรายได้ อายุ การศึกษา และทัศนคติของผู้ใช้อีกนั้น มีผลต่อการใช้ Mobile Internet และ Mobile Payment ยิ่งไปกว่านั้น เมื่อนำแนวคิดในเรื่องของ Broadband Ecosystem มาอธิบายยังช่วยอธิบายความรู้ที่ได้จากบทความนี้ไปใช้กับนโยบายบรอดแบนด์แห่งชาติอีกด้วย

Introduction

Since the 2000s, mobile communications network have been continuously developed to provide better quality and faster internet services through UMTS[1] technology and recently LTE[2] technology. With extensively improved technologies, the mobile phone is no more a device for only voice and text message but has become a device for internet services, from simple internet browsing to watching high-quality video on demand. In addition, the development of internet service on a mobile phone makes mobile phone become as an alternative mean for the payment through internet service as well. Mobile internet as well as mobile payment can greatly support not only economic development but also the social development of a country by creating more benefits through other services in, such as, public sector, health care

1 UMTS = Universal Mobile Telecommunications System

2 LTE = Long Term Evolution

sector, education sector, entertainment sector, and banking sector. Hence, the use of mobile internet and mobile payment can accelerate economic growth and support more social interactions. Furthermore, mobile internet is also one of the policy tools to bridge the digital divide gap in the area where fixed broadband cannot be reached (Srinuan et al., 2012) while mobile payment is able to increase the financial inclusion for those who do not have a bank account as well. Therefore, it is important for the policy makers to understand what determines the use of mobile internet and mobile payment; hence, they can apply the appropriate policy to support higher and more efficient use of mobile internet and mobile payment. Not only the regulators, but the service providers can benefit by understanding the consumers' behaviour on mobile internet and mobile payment adoptions as well since they can launch suitable business and marketing plans to fit their target customers. This study, therefore, aims to explore what determines the use of mobile internet and mobile payment by analysing and reviewing previous studies on the determinants of mobile internet and mobile payment in the past decades. Nevertheless, this paper is not a typical literature review study where a number of papers in the research areas are categorised and classified in groups. Instead, the summary and implications for both policy makers and private sector are then suggested from the analysis of previous literature. Previous literature used for analysing comes from both qualitative and quantitative studies; however, the main focuses of this paper are on the empirical researches.

This study consists of 6 sections. After a background to point out the importance of the study in this introduction section, overviews of mobile internet and mobile payment including their benefits are shown in Section 2. The research methods in this study are then more explained in Section 3. In Section 4, previous literature on mobile internet and mobile payment is presented and the analytical discussion is followed in Section 5. Lastly, the conclusion and the implications of this paper are provided in the last section, Section 6.

Overviews of Mobile Internet and Mobile Payment

Figure 1 presents the growing numbers of both mobile internet and mobile payment year by year from 2015 to 2019. According to the forecast from figure 1, it seems that both mobile internet and mobile payment will have important roles in the near future. Hence, the purposes of this section are to facilitate readers to understand the background on the development of mobile internet and mobile payment as well as their current situations. In addition, the benefits of both mobile internet and mobile payment are also explained in this section to emphasise the importance of the mobile internet and mobile payment for economy and society. Furthermore, these overviews can also present and imply how important to understand what determines mobile internet and mobile payment adoption.

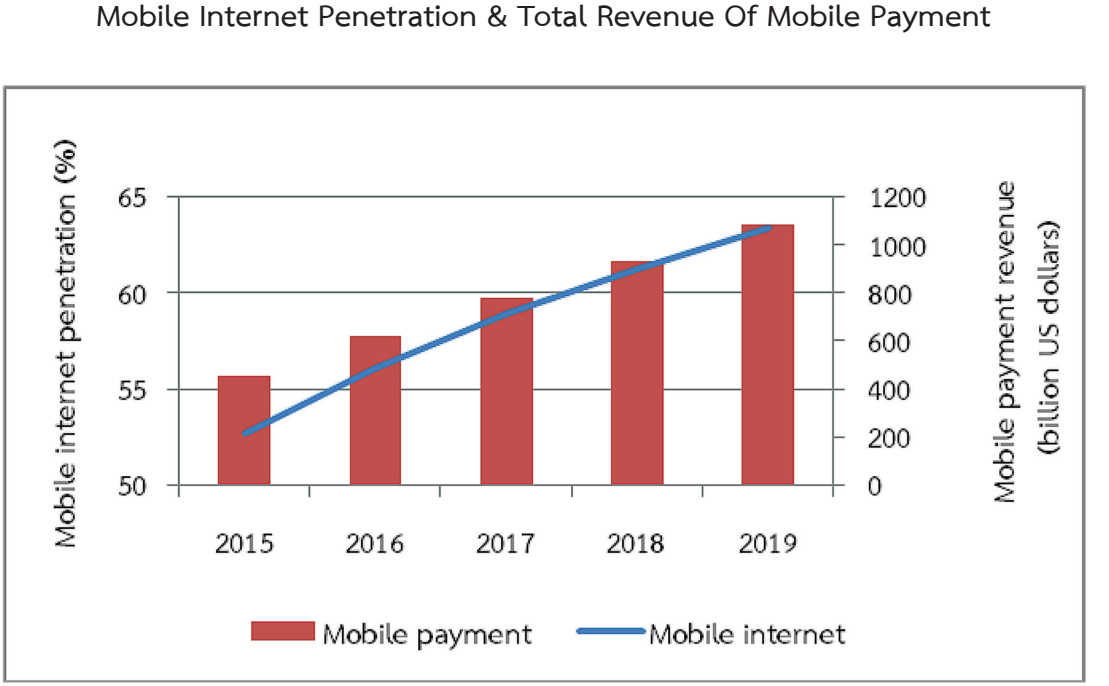

Figure 1 Estimated mobile internet penetration and mobile payment revenue worldwide

Source : Statista (2016)

1. Background of Mobile Internet and Its Benefits

While a 2G system mobile network which allowed low-speed data has been introduced since the early 1990s, mobile internet, however, has not been introducing until late 1990s. At the early stage, mobile internet was in a form of WAP[3] on the technology called GPRS[4]. According to Vodafone (2013), the handsets, which WAP can be used, were introduced to Europe around 1999. The use of mobile internet at that time, however, was very limited due to its slow connection speed as well as high tariffs at that time. Based on the definition by GSMA[5], the speed connection for GPRS is only up to 40 kbps as equal to a dial-up modem. With a slow internet connection, even the leading country in telecommunications in Europe like Sweden, at that time, the number of mobile internet users with GPRS technology was only above 500,000 in 2003 (approximately 5.6 percent of total population in 2003). Moreover, the average data usage per person was only about 0.16 Mb/month (PTS 2004). Even though mobile internet had been used very little in the early 2000s, this was not the case in Japan where the i-mode system, created by the biggest mobile operator in Japan, was very popular there. Impressively, Japan is also the first country in the world to launch the 3G system mobile network. Competing with Japan, mobile internet in South Korea was also started around 1999 and quickly taken off in only a few years due to its 3G mobile network development. At the early 2000s, mobile internet in South Korea can provide internet speed up to 2.4 Mbps which allowed better quality content and applications such as video and MP3 download, full motion TV and transaction payment (Forge and Bohlin, 2008). Following Japan and South Korea, 3G system mobile network in Europe was later commercially introduced in 2003 by 3 (Hutchison) in Italy and the UK. The reasons for slow development in Europe are that most mobile incumbents in Europe did not have any incentive to promote 3G mobile services since they had recently developed and upgraded their 2G mobile networks at that time. (Gruber, 2005).

3 WAP = Wireless Applications Protocol

4 GPRS = General Packet Radio Service

5 GSMA is an association for mobile operators worldwide, consisting almost 800 operators

Nevertheless, technologies of mobile internet in other countries, later on, have been continuously and globally developed from GPRS to EDGE (branded as 2.5G), UMTS (3G) which significantly improved mobile internet experience with download speed around 2 Mbps, and recently LTE (4G) which is the latest technology providing much faster internet connection. LTE technology has been first commercially deployed by TeliaSonera in 2009 in Norway and Sweden (TeliaSonera, 2010). Following Norway and Sweden, the US, Germany, Japan, South Korea and other leading countries in telecommunications have also commercially rolled out LTE technology a few years after. Particularly South Korea, their development of LTE technology has been very impressive. The 4G coverage in South Korea is almost 100 percent by only within 9 months after rolling out (Arthur D. Little, 2012). Currently, as of 2015, although the number of subscribers of 4G mobile connection is still less than 3G mobile connection, 4G mobile traffic has already surpassed the number of 3G traffic (CISCO, 2016). Besides the continued development of mobile internet technology, another reason which significantly increase the widely use of mobile internet is the rapid growth of smartphone adoption in the recent years. In addition, there are also other devices such as tablets and phablets[6] which can provide mobile internet. According to the forecast by CISCO (2016), the ratio of smart to non-smart devices and connections will be converted to the opposite from 36:64 in 2015 to 67:33 in 2020. This forecast implies that, globally, mobile internet is likely to be one of the dominating telecommunications services in an upcoming future.

On the benefits of using mobile internet, Thompson Jr. and Garbacz (2011) applied both econometrics model and stochastic frontier model and suggested that mobile broadband has a significant effect on the economic growth by reducing the inefficiency. In addition, the countries with a lower income benefit the impacts from mobile broadband more than countries with higher income. Similar to the benefits of broadband deployment (as mobile broadband is also one type of broadband), mobile broadband can bring more jobs, increase productivity gains and raise household revenues.

6 Phablets are smartphones with the larger screen than normal smartphones, but smaller than tablets

The benefits of mobile broadband can also indirectly facilitate and accelerate more efficient technologies and innovations in other sectors such as banking, entertainment, education and public services (ITU, 2012). Moreover, mobile broadband can be used to fill the digital divide gaps especially in the rural area where fixed broadband is not available (Srinuan et al., 2012 and Prieger, 2013). It is therefore very important for policy makers to understand mobile internet adoption in order to provide effective broadband policy, particularly on the demand side.

2. Background of Mobile Payment and Its Benefits

The definition of mobile payment is somewhat various, inconsistent and sometimes mixed with the definition of mobile money and/or mobile banking. According to EC (2012), mobile payment means the purchase of services or goods that the payments are initiated, transmitted or confirmed by mobile devices. EC (2012) also further categorises mobile payment into two types of payment: 1) Remote mobile payment and 2) Proximity payment. Remote mobile payment is mostly conducted via the internet (sometimes it can also be done through SMS) which is later charged by mobile operators to both prepaid and postpaid customers. The payment part can be paid in many forms such as through debit card, credit card, e-wallet or directly charge from airtime top-up or monthly telephone bill as well. Usually, remote mobile payment can be considered as an electronic payment (e-payment); hence, the definition of mobile payment and e-payment can be difficult to distinguish from each other, which leads to some confusion at times. Another type of mobile payment is proximity payment which is usually conducted at the point of sales using near field communication (NFC) technology. Hence, this type of mobile payment requires the buyers who have a mobile phone equipped with NFC technology and the sellers with a reader module. Proximity payment is often done for using public transport or buying products from particular stores, usually franchise ones. Nevertheless, for the purpose of consistency with mobile internet section, this paper focuses more on the remote mobile payment in which transactions have been done via mobile internet.

Even though mobile payment has been introduced for more than a decade, around the early 2000s, the use of mobile payment was still surprisingly limited. Similar to mobile internet, the widely use of mobile payment in the early 2000s only occurred in Japan through their i-mode system. The big advantage of the i-mode system is that it allows customers to make transactions by charging via their subscriptions without using a credit card (Akimoto, 2011). Outside of Japan, surprisingly, in contrast to the development of the mobile internet as well as most of new technologies and innovations, mobile payment adoption has, later on, instead rapidly increased from the developing countries while developed countries have been gradually and slowly adopting mobile payment. According to Flood et al. (2013), the early use of mobile payment system is in a form of mobile money in developing countries which had been developed from the prepaid subscription. One of the reasons for the success of mobile money in developing countries is that there were many people who still do not have a bank account. On the other hand, this type of mobile money is more or less irrelevant in developed countries where the financial system and institution have already been fully developed and mature. Even though mobile payment system has been continuously evolved, the global use of it has been only limited to a moderate level. Until around 2010, with the global rising of a smartphone, there have been several applications, content, services and goods which require consumers to pay; hence, the most convenient method is paying through their smartphones. Since then, even though mobile payment is still an alternative way of payment to paying by cash or card, it currently has the fastest growth in comparison to other types of payment.

On the benefits of mobile payment, the adoption of mobile payment can support more financial inclusion for individuals and businesses. In addition, mobile payment can reduce costs and time spending to both sellers as well as buyers. According to BCG (2011), the access to mobile financial services, including mobile payment, has a positive effect on both economic and social perspectives. For the economic benefits, mobile financial services can facilitate users by saving costs and time as well as increasing domestic capital formation. Ultimately, mobile financial services can create

more jobs and employment as well as stimulate higher GDP growth. For the social perspective, reducing the number of financial exclusion can lead to less inequality and smaller gaps of the social divide. While any country can benefit from higher financial inclusion rate, in general, the positive impacts of financial inclusion are stronger in countries with low inclusion rate.

Research Methodology

The research approaches used in this paper are mainly analysing and reviewing previous literature. Nevertheless, the main objectives of this study are not to include all studies related to mobile internet and mobile payment and classified them in categories as in most literature review papers. For this type of classification review, see more comprehensive studies in Dahlberg et al., (2007) and Dennehy and Sammon (2015). These authors have reviewed and classified the studies on mobile payment acceptance from 1999 until the year before their publications (2006 and 2014 respectively). In addition, the studies on mobile payment acceptance have so far been very popular in the last decade while the results are more or less pointed to the same direction. Therefore, a different style of literature review study is needed. Accordingly, this study aims to explore what determines the use of mobile internet and mobile payment through selected previous studies. Then, it analyses through the consensus as well as some critics of earlier studies. Hence, this study only chooses some of the previous studies on the determinants of mobile internet and mobile payment in the past decades which related to the main idea of this paper. The literature used in this study is mainly based on the adoption perspective, both for mobile internet and mobile payment. Particularly, this study pays more attention on quantitative and/or empirical studies compared to qualitative researches. Then, the chosen literature is categorised into two groups, mobile internet and mobile payment. The review of the literature is ordered by the theme of discussion. In each theme, the literature is also chronically ordered. This paper, therefore, attempts to analyse only large enough numbers of literature to be able to compare the differences and similarities as well as derive the consensus

and conclusion from the previous studies. Lastly, the implications are later suggested. More empirical researches on mobile internet and mobile payment have been continuously conducted both in technology management and economics areas in the past decades. With more and more empirical evidences, it is sometimes better to take a step back and look from the outside as a neutral perspective. This is one of the advantages of literature review approach which is that it can reduce biases of the author(s) by reviewing different types of studies and comparing whether it is consistent or against with previous ones. In addition, literature review paper can support other researchers in the future by collecting, categorising and analysing previous studies in similar areas provided in the same article. However, the drawbacks of this approach are that the literature review should be presented as a part of the study, not the whole study itself. Also, the implications derived from the literature review sometimes can be difficult to objectively justify as it is only document analysis, not empirical analysis. Nevertheless, literature review paper can be very useful as the subjects can be analysed in different angles and facilitate other studies to build up from what has been done so far easier and more convenient. For example, in telecommunications studies, Cambini and Jiang (2009) is a comprehensive literature review on broadband investment which has been widely cited by many researchers not only from the broadband investment research but also from other broadband related topics. In a similar way, so far, the studies on mobile internet and mobile payment adoption have been conducted several times, but have not yet been thoroughly reviewed. While this study may not be able to provide the reviews as complete as in Cambini and Jiang (2009), it is a good first step to facilitate other future empirical researches as well as more comprehensive literature reviews on mobile internet and mobile payment adoption.

Previous Studies

1. Literature Review on Mobile Internet/Broadband Adoption

The studies on mobile internet are usually developed from either the studies on the technology acceptance of new services or the economic/econometrics studies

on telephone/fixed internet adoption. At the start of 2000s, the studies on mobile internet were mainly from case studies in Japan and South Korea as at that time both countries are leading in mobile internet adoption while other countries still focused mainly on fixed internet. Hence, the availabilities of the data were only from these two countries. Examples of these early studies are Funk (2005), Cheong and Park (2005) and Okazaki (2006). Funk (2005) has interviewed several firms which provide mobile or content services in Japan. The author has forecasted the use of mobile phone in the future that mobile phone would evolve and be able to provide some content applications such as multi-channel shopping, portable entertainment, marketing and using to get tickets or money. For a case study in South Korea, Cheong and Park (2005) applied Technology Acceptance Model (TAM) to analysed mobile internet acceptance in South Korea. The authors found that the consumers' attitude on mobile internet can significantly affect their adoption. Okazaki (2006) is among the early studies who investigate whether customers' behaviour and their demographic characteristics are related to mobile internet adoption in Japan. Using two-step cluster analysis, the author found that a cluster of single and young office workers is the cluster that has the most positive attitude towards mobile internet adoption.

After Japan and South Korea, mobile internet has later been more developed in other leading European countries, such as Sweden. Thus, the data has become more available and more researches on mobile internet or mobile broadband have been conducted accordingly. The study by Westlund and Bohlin (2008) is among the case studies of mobile internet researches in Sweden. The authors have obtained the Swedish national survey in 2007 and applied descriptive statistical approach. At that time, more than 70 percent of the population still did not use mobile internet. Their study suggested the main reasons for not using mobile internet at that time were the uncertainty of the price of mobile internet, small overviews of the content and the slow internet speed when comparing to fixed internet. Nevertheless, we can see that all these obstacles are mostly disappeared at the recent time. The price of mobile broadband is now even cheaper than fixed broadband, the smartphone

has a reasonably bigger screen than the old tradition feature phone, and mobile broadband is now much faster to be able to provide high-quality video content. This development of smartphone then leads to the study of customer behaviours and their demographic characteristics towards smartphone (mobile broadband) adoption in Sweden. The recent study by Kongaut and Bohlin (2016) have applied econometric models and analysed the characteristics of mobile broadband users through their smartphone adoption. The authors suggested that the respondents who are younger, having higher income and higher education (at least university level) tend to adopt mobile broadband in comparison to those who are older, having less income and lower education. Interestingly, the authors further investigated the impacts on usage as well. They found that for those who adopt mobile broadband, it is the lower income group that has more probability of using mobile broadband for social network and internet telephone than the higher income group. For further reading, other mobile internet case studies of other developed countries are, for example, Bouwman et al. (2010) for a study in the Netherlands, Finland and Greece and Hill et al. (2010) for a study in an Australian market. For an example of mobile internet study in developingcountries, Srinuan et al. (2012) have analysed mobile internet access and usage in Thailand using econometric models. The authors found that the price of mobile internet affects mobile internet adoption. Also, the respondents who are in the working age (25-49 years) and living in the capital city (Bangkok) have more probabilities to adopt mobile internet.

2. Literature Review on Mobile Payment

In a similar way to mobile internet study, mobile payment adoption literature can be seen as two tracks from either the studies on the technology acceptance of new services or the economics/econometrics studies of adoption and usage. Early studies on mobile payment adoption mostly applied Technology Acceptance Models (TAM) to determine what the factors for consumers to use mobile payment are. Apparently, there are a large numbers of TAM studies on mobile payment in the last decade. Examples are Dahlberg et al. (2003), Zmijewska et al. (2004), Dewan and Chen

(2005) and Schierz et al. (2010)[7]. Pousttchi (2003) was among earlier researches of mobile payment adoption. The author has proposed the conditions for acceptance and usage of mobile payment. These conditions are costs, security and comfort of use. On the TAM studies, Dahlberg et al. (2003) were among the early studies on mobile payment by using TAM approach based on two rounds of focus group interviews. The authors suggested that trust should be an important factor to explain mobile payment adoption. Zmijewska et al. (2004) have expanded the conditions for acceptance and usage of mobile payment to six factors, which are easy to use, usefulness, mobility, cost, trust and expressiveness. Dewan and Chen (2005) have investigated the slow adoption of mobile payment in the US. The authors found that the main reasons for the lack of adoption of mobile payment in the US are the concerns on security and privacy. Viehland and Leong (2007) have nicely categorised the previous studies into four groups by their focuses, which are 1) security, 2) convenience, 3) cost and 4) usefulness. The authors then mentioned that previous literature tended to conclude that to increase mobile payment adoption, one or more of these four factors need to be improved. These groups of factors from previous studies can be used in different name depending on the authors. For example, in a similar approach, Schierz et al. (2010) also suggested that mobile payment adoption is mainly based on compatibility, mobility and subjective norm.

On the other hand, mobile payment adoption researches can also apply economic/econometric models; however, this type of research on mobile payment is more limited. In addition, it is generally in a form of one type of mobile internet usages; hence, mobile payment is implicitly in the mobile internet studies. An example of these researches is Kongaut and Bohlin (2016). One of their findings is the use of a smartphone in Sweden for online shopping which can be equally seen as the use of mobile payment. Their results show that gender (male), income (low), age (young) and education (at least university level) have significantly positive effects on the use

7 These studies are only examples as there are many more studies on mobile payment using TAM approach

of smartphone for online shopping.

3. Comments on The Methodology of Previous Literature

According to previous studies, two main methods to understand what determines the use of mobile internet and mobile payment are Technology Acceptance Model (TAM) and multi-regression on economic models. TAM is mostly used in the management discipline while multi-regression is applied towards economically oriented studies. Both methods, however, have advantages and disadvantages. TAM approach, especially on the mobile payment acceptance, is broadly popular and highly cited among researchers in management field. In addition, TAM also has a good reputation in researches in many sectors outside of mobile communication and generally regarded as an important tool to understand the potential adopters of new innovations. It is also flexible enough to extend more complex version of the model. However, the main criticism of the TAM approach is the subjective data as it is self-reported. Another drawback of TAM approach is the effects from external factors. TAM approach focuses on the acceptance and attitude of the users or potential users; however, other factors which are not users' attitudes such as education level, living areas or the price of services may have some significant impacts on the adoption (Chutter, 2009). For multi-regression analysis, the benefits of this approach are that it solves one of the TAM limitations since it can include both users' attitude and external factors as independent variables in the models. In addition, the sophistication of an econometric approach implies more rigorousness in the methodology and high standard of the paper. Nevertheless, the important limitations of multi-regression analysis are the correctness of economic models and econometric equations which heavily rely on the economic assumptions and models which sometimes are given by unpractical assumptions. Therefore, the readers need to concern that implications from the results need to be interpreted based on these assumptions. Furthermore, the empirical data used in this approach is typically in a micro-level. This type of data set means that the studies are based on a particular city or country which is sometimes difficult to generalise into broader

implications as countries have different cultures and characteristics. Accordingly, this is why the literature review study is needed, to compare and evaluate different case studies.

Discussion

1. What Determines The Use of Mobile Internet and Mobile Payment?

In general, it seems that mobile internet and mobile payment adoptions rely on the users and potential users' attitude and characteristics. However, the other main drivers of the adoption, the availabilities and qualities of the infrastructure and services, are also important. While there are several determinants on mobile internet and mobile payment adoption, as in Table 1, it can be categorised into two groups which are 1) service-related and 2) user-related. For example, a group of service-relate consists of security, price, quality and availability of mobile internet and mobile payment while a group of user-relate determinants can include users' attitude, their education, their gender and their income. These two groups can be considered as a supply-demand perspective as well (a service-related group can be considered as a supply side while the user-related group is seen as a demand side).

Service-related (supply side)	User-related (demand side)
- Security and privacy - Price/costs - Availability of the service (e.g. living area) - Quality of the service (e.g. faster speed, bigger screen, and better hand sets)	- Gender, - Income - Age - Education - Users' attitude (e.g. perceive that services are convenient, useful or easy to use)

Table 1 Examples of service-related group and user-related group

Source: Compiled by author from Section 4

Deriving from previous literature in Section 4, Table 1 shows general determinants on mobile internet and mobile payment; however, the significant effects of each determinant on the adoptions are various in different countries.

Service-Related (Supply Side)

Security and privacy: Particularly in developed countries, the concerns on cyber security, fraud, scam and data privacy can significantly hinder the use of mobile internet and especially mobile payment. For example, as in Dewan and Chen (2005), the main reason for slow adoption of mobile payment in the US was the concern on security and privacy. Similarly, in the EU, 72 percent of internet users are worried about giving too much their private data when using internet (Valant, 2015).

Price/costs: In a basic economic concept, with a constant income, when the prices of products or services are lower, the demand for the services will be higher. Similarly, tariffs of using mobile internet and mobile payment nowadays are much lower compared to tariffs in the last decade; hence, mobile internet and mobile payment are now more accessible to many people.

Availability of the services: Availability of the services is very straightforward. If the services are not available in the areas, the potential users cannot use the services even though they want to. Therefore, it is important for a country to provide the coverage of mobile internet cover all areas or very close to 100 percent to make sure everyone has the same opportunity to use the services.

Quality of the service: In general, quality is the next factor after availability. For example, two areas both have internet coverage; however, one area has an average mobile internet speed of 20 Mbps and another has only 1 Mbps. Then, applications and services of mobile internet and mobile payment can be used more efficient in the first area in comparison to the latter one. Moreover, the quality of the service is

not limit to only the speed of mobile internet, but it can also be the quality of the handsets or the quality of mobile payment system.

User-Related (Demand Side)

Gender: In general, gender may not be a good variable to determine mobile internet and mobile payment adoption because different countries have different norms and cultures. Many times, gender can give different results in different countries. However, for business owners, sometimes gender can determine the use of some applications and services in the mobile internet or mobile payment; hence, it can facilitate their marketing plans.

Income: Similar to the price concept, with prices of services are constant, the demand for the normal goods will be higher when their incomes are increased. Nevertheless, some applications of mobile internet and mobile payment can save the users' costs. Therefore, it is possible that people with lower income have more probabilities to adopt particular services/applications than people with higher income. Examples are money transfer which is normally used more in developing countries.

Age: Many studies (for example, Okazaki, 2006 and Kongaut and Bohlin, 2016) have suggested that younger generations are likely to adopt mobile internet than older generation while Srinuan et al. (2012) mentioned that people at the working age (in Thailand) have more probability of using mobile internet more than other groups.

Education: Education can be referred as a skill and competence of using mobile internet and mobile payment. It is important to understand that it is not necessary that higher education leads to higher skills of using services. However, there are more probabilities that people with higher education will be more familiar with mobile internet and mobile payment, partly due to the type of their works and lifestyles.

Users' attitudes: Users' attitudes or user acceptance factors have been extensively proposed in TAM during the last decade. Zmijewska et al. (2004) have included six user acceptance factors in their study which are 1) perceived ease of use, 2) perceived usefulness, 3) perceived cost, 4) perceived mobility, 5) perceived trust, and 6) perceived expressiveness. Nevertheless, some of the factors are already parts of other determinants such as cost and trust. Also, ease of use and usefulness may be arguably included in quality of the services. Hence, for this study, users' attitudes are mainly referred as individual personal taste which can be considered as perceived expressiveness in Zmijewska et al. (2004).

2. Supply and Demand Side – Mobile Internet and Mobile Payment in Broadband Ecosystem

The previous sub-section has shown what determines the use of mobile internet and mobile payment. Understanding these determinants can facilitate policy makers to provide efficient policy tools and stimulate businesses for private sectors as well. The development of mobile internet and mobile payment can stimulate the growth of the broadband ecosystem. Figure 2, adapted from Raja et al. (2010) and Kongaut and Bohlin (2015), presents where mobile internet and mobile payment are in the broadband ecosystem, which consists of four layers of broadband infrastructure, broadband services, content and applications, and end users. Mobile internet nowadays is able to provide fast speed connection which is considered as mobile broadband; hence, the mobile internet can be categorised as broadband service in broadband ecosystem. Mobile payment is considered as one of important mobile internet applications; therefore, it belongs to content and applications in the ecosystem. With the relationships between each element in the broadband ecosystem as in figure 2, there is no surprise that countries like Japan and South Korea where the mobile internet has been facilitated early on, mobile payment is also broadly adopted in those countries accordingly.

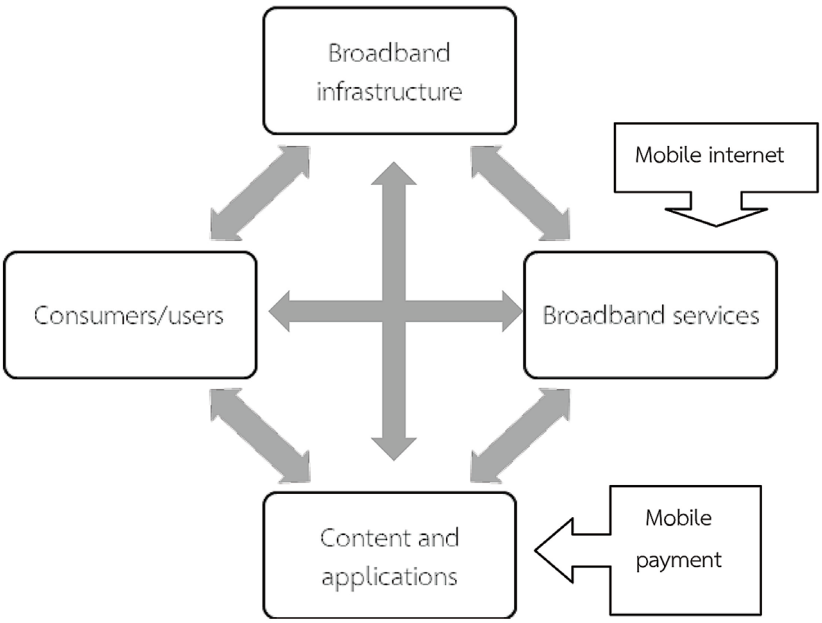

Figure 2 Mobile internet and mobile payment in broadband ecosystem (Adapted from Raja et al., 2010 and Kongaut and Bohlin., 2015)

Back to this paper, understanding what determines the use of mobile internet and mobile payment means perceiving both service-related determinants (supply side-broadband service/content and applications) and user-related determinants (demand side-consumers). In general, it is almost universal belief that broadband can benefit a country both in economic and social perspectives. Therefore, this is why it is important to understand these determinants of mobile internet and mobile payment in order to develop the broadband ecosystem and eventually accelerate economic growth of a country.

Conclusion and Implications

1. Summary

This paper, so far, presents the background and the development of mobile internet and mobile payment adoption. Previous studies suggested that there are several factors to determine mobile internet and mobile payment adoption, including security and privacy of services, price of services, quality of services, availability of services, income of users, the age of users, education level of users and users' attitudes. These factors can be categorised into two groups; service-related which is considered as a supply side and users-related which is referred as a demand side. In addition, using broadband ecosystem concept, mobile internet, and mobile payment can be placed on broadband services and content and applications accordingly. Hence, understanding the determinants of mobile internet and mobile payment adoption can support the development of broadband ecosystem as a whole through broadband policy on mobile internet and mobile payment.

2. Implications

Implications from this study are categorised into two perspectives as implications for policy makers and implication for businesses. For the policy perspectives, considering broadband ecosystem in Section 5, understanding service-related determinants (supply side) of mobile internet and mobile payment can support policy on broadband services and content and applications layers while understanding user-related determinants (demand side) can benefit broadband policy on the consumer layer. Furthermore, the impacts also pass through to other layers in the broadband ecosystem; hence, applying a broadband policy of mobile internet and mobile payment at the same time to different layers of the broadband ecosystem and multiply the impacts of policy on society and economy[8]. In addition, understanding the determinant of the user side also facilitates the policy makers to decide efficient demand-side policy; for

8 Further readings on ICT ecosystem and broadband ecosystem are in Fransman (2007), Raja et al. (2010) and Kongaut and Bohlin (2015)

example, reducing tax, providing subsidy or giving mobile internet and mobile payment literacy on target groups. As for the business point of views, understanding a particular group of users using a certain type of applications can support a company to plan appropriate marketing strategies. For example, if companies know gender and age groups of online shopping users, they can select the services and products fitting with their target customers.

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