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FACTORS AFFECTING THIRD-GENERATION MOBILE SERVICES: APPLYING THE PURCHASE INTENTION MODEL

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Based on the theoretical framework of the Purchase Intention Model, this study integrated the constructs of perceived over performance, perceived relative advantage, network effects, perceived enjoyment, and individual optimal stimulation level to investigate the factors affecting third-generation (3G) mobile service adoption behavior in Taiwan. Data was collected from 322 potential services users in Taiwan. The empirical results indicated that perceived need and perceived enjoyment were key factors that determined whether or not an individual would adopt 3G service. Furthermore, this study confirmed the importance of perceived over performance and relative advantage on the perceived need for 3G service. Perceived price was also found to be positively correlated with purchasability, but purchasability and network effect did not significantly impact adoption behavior. At the end of this paper, we discuss several implications for 3G service management practices and future research regarding innovative technology acceptance.

Keywords: ***purchase intention model; 3G mobile services; network effects; perceived enjoyment; perceived overperformance***

1. INTRODUCTION

Significant developments in information and communications technologies (ICTs) over the past few years have caused mobile communications technologies to evolve rapidly. In fact, several distinct standards of mobile technology have been implemented in Taiwan (Teng, Lu, and Yu 2009), including General Packet Radio Service (GPRS), Code Division Multiple Access, Wide Band Code Division Multiple Access, and High Speed Downlink Packet Access. These standards all provide mobile access to the Internet, so in addition to

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conventional phone service, telecommunications operators now have mobile services as a new revenue creation opportunity (Kuo and Yen 2009). In the second quarter of 2012, the number of mobile phone subscribers in Taiwan had risen to 29.13 million, representing a subscription penetration rate[1] of 125.2% (in other words, 122.1 mobile phone numbers for every 100 people). There were 21.77 million subscribers of third-generation (3G) services, comprising 74.7% of the total subscribers (FIND 2013). This rate implies that there may be significant business opportunities for employing mobile internet services.

Nevertheless, Anckar and D'Incau (2002) argued that popularity of mobile services cannot be measured by the popularity of mobile devices, just as the popularity of wired e-commerce cannot be measured by the popularity of computers. In fact, a survey conducted by Taiwan's market research institute, FIND, indicated that only 6.6% of all subscribers are actually using 3G/3.5G to access mobile internet services with their 3G mobile phone (FIND 2012). This study infers that 3G mobile phone services have not completely replaced earlier ones (2G/2.5G) to become the sole services on the market. This means that many people are still unwilling to use 3G services. Why are people unwilling to use 3G services? This is an important question worth investigating. Therefore, the objective of this research is to understand the acceptance of 3G services from the perspective of the consumers, and to identify factors that can predict their intention to use 3G services.

MIS researchers have adopted the theory of reasoned action (TRA) and the technology acceptance model (TAM) as fundamental and influential ICT adoption behavior theories. Several studies have discussed adoption behavior with regard to mobile communications technology by using TRA or TAM (Hung, Ku, and Chang 2003; Bruner and Kumar 2005; Luarn and Lin 2005; Wu and Wang 2005; Wang, Lin, and Luarn 2006; Lu et al. 2008; Kuo and Yen 2009; San-Martín, López-Catalán, and Ramón-Jerónimo 2013). These TRA/TAM studies discuss the adoption of an innovation primarily from the viewpoint of a single product or service. They did not consider the attractiveness of other competitive alternatives.

While TAM and TRA consider perceived usefulness, perceived ease of use, attitude, and subjective norm, we contend that there are other important dimensions and factors influencing 3G service adoption, including the competition factor between 3G and 2G/4G, 3G's own network effect, the price factor, and individual consumers' characteristics. Additionally, 3G provides services that may or may not fit customers' real demand, or may provide too many services the customer considers unnecessary, generating the so-called overperformance phenomenon (Christensen and Raynor 2003). Past studies of 3G services have not deeply considered these important constructs. In order to understand the impact of all the previously mentioned factors on 3G service adoption, this study employs the purchase intention model (PIM) (Warshaw 1980), network effects (Au and Kauffman 2001; Gowrisankaran and Stavins 2004; Wang, Hsu, and Fang 2004), perceived enjoyment (Liao, Tsou, and Huang 2007; Nysveen, Pedersen, and Thorbjornsen 2005a, 2005b; Van der Heijden 2003; Wu and Lu 2013; Kim, Kim, and Wachter 2013; Ho 2012; Cyr, Head, and Ivanov 2006; Bouwman, Carlsson, Walden, and Molina-Castillo 2009), and optimum stimulation level (Mittelstaedt, Grossbart, Curtis, and Devere 1976) to in composing our research framework.

As for the affecting factors of PIM, our study uses perceived overperformance (Christensen and Raynor 2003), relative advantage (Hsu, Lu, and Hsu 2007; Agarwal and

[1]Formula of subscription penetration rate = the number of mobile phone subscriptions/total population.

Prasad 1997; Van Slyke, Lou, and Day 2002; Brown, Cajee, Davies, and Stroebel 2003), and perceived price (Kim, Chan, and Gupta 2007; Andersson and Heinonen 2002; Luarn and Lin 2005; Wang, Lin, and Luarn 2006; Kim and Hwang 2012; Hong et al. 2008) as antecedents of the purchase intention model.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Purchase Intention Model (PIM)

Many studies have discussed mobile telecommunications technology adoption behavior by using the theory of reasoned action (TRA) or the technology acceptance model (TAM) (Bruner and Kumar 2005; Wu and Wang 2005; Hung et al. 2003; Lu et al. 2008; Kuo and Yen 2009; Wang, Lin, and Luarn 2006; Luarn and Lin 2005; San-Martín et al. 2013). Despite such widespread use, TRA has been criticized for its causal structure (Liska 1984), attitude determinants (Miniard and Page 1984), and specific context applicability (Warshaw 1980; Jamieson and Bass 1989). Abdul-Gader (1995) have proposed that because of its general nature, TRA may not be sufficiently specific to model certain contexts, such as purchase situations. Abdul-Gader also noted that TRA is only a starting point. Other more specific alternative models need to be designed to extend focus to fit specific contexts. As for TAM, Teng and colleagues (2009) indicated that most TAM studies do not distinguish adoption intention from purchase intention. Jeong and Yoo (2007) have found an indication that the PIM has better explanation power than TAM.

The PIM (Warshaw 1980) proposes a more focused version of TRA (see Figure 1). It hypothesizes a relationship between variables and a change in the way the variables are operationalized in purchase decisions (Abdul-Gader and Kozar 1995). Warshaw postulates that purchase intention of a product is a function of the purchasability of the product and perceived need (Jeong, Yoo, and Heo 2009; Teng et al. 2009; Warshaw 1980). Unlike a general model like TRA, Warshaw's model is designed to predict purchase intention and behavior (Abdul-Gader and Kozar 1995). Furthermore, Warshaw (1980) has argued that TRA has weak predictive power in marketing applications and, accordingly, suggests a new intention model specialized for product purchase situations. When compared to TRA, the PIM has shown higher stability and reliability in predicting purchase decisions, and lower multicollinearity between the independent variables of purchase decisions (Warshaw 1980;

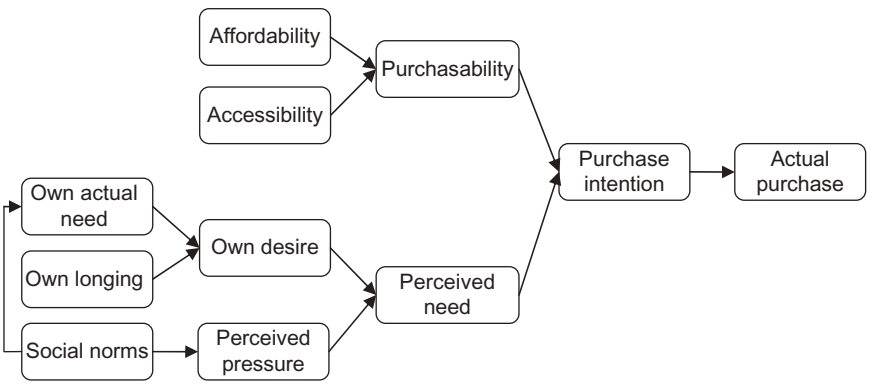


Figure 1 Purchase intention model (Warshaw 1980).

Jeong et al. 2009). Moreover, this model has proven successful in explaining and predicting purchase decisions across a wide variety of product types (Jamieson and Bass 1989).

Similarly, Warshaw (1980) has challenged TRA usability in product purchase situations, noting its limited ability to predict and explain contextually specific behavior. Warshaw's model captures two factors that influence purchase decisions: motivational and nonmotivational factors. The motivational factors indicate the willingness of a person to perform the purchase behavior. Both a person's own desire and perceived pressure determine the person's perceived need. On the other hand, nonmotivational factors are subsumed by purchasability, which is determined by both affordability and accessibility. A purchase intention of a product is postulated as a function of the purchasability of the product and the perceived need (Warshaw 1980; Jeong et al. 2009). A person's motivational and nonmotivational factors can collectively predict and explain purchase intention (Warshaw 1980; Jeong et al. 2009; Abdul-Gader and Kozar 1995).

Perceived need is a key element of the acceptance of an innovation (Rogers 1983; Leonard-Barton and Deschamps 1988). Teng and colleagues (2009) asserted that a consumer's progress through phases of the adoption decision begins with the recognition of need. Individuals who perceive a high need for 3G service could, thus, be assumed to be more likely to use it than those who do not perceive the need.

In accordance with PIM, this study posits that the intention to use 3G services also depends on an individual's financial capability and budget. When a consumer intends to adopt 3G services, he or she will conduct a cost–benefit evaluation before making the decision to purchase. The principles of cost–benefit evaluation are broadly defined as the tradeoff between total benefits received and total sacrifices (Kim, Chan, and Gupta 2007; Kim and Hwang 2012). The relative price competitiveness of available services in each society undoubtedly influences consumer choice (Aoyama 2003). If an individual perceives that the monetary cost of the services is high, the purchase intention may be reduced or postponed until the cost is perceived as acceptable. At the same time, Jeong and colleagues (2009) have suggested that purchasability and perceived need can explain purchase intention for both mobile and RFID services. Therefore, our study posits that greater perceived need for 3G service and higher purchasability of 3G service will result in a higher probability of consumers' intention to use 3G services. Based on the statements, we advance the following hypotheses:

H1. *Perceived need for 3G services will have a positive influence on intention to use.*

H2. *Purchasability of the 3G services will have a positive influence on intention to use.*

2.2. Network Effects

Network effects (also called network externalities) refer to the phenomenon that a product becomes more valuable as its user base expands. In other words, the value of a product for one user increases as more users adopt the product (Shapiro and Katz 1985, 1994). Network externality is also defined as an effect which occurs whenever the "utility that a given user derives from a good depends on the number of other users who are in the same 'network'" (Shapiro and Katz 1985). This characteristic is commonly referred to as "the more, the merrier" (Lee 2000). The guideline for success in a network effects context is maximizing the installed base rapidly rather than skimming marginal profits (Lee and O'Connor 2003). The network effect predicts that once a technology/product becomes

dominant, the process is exceedingly difficult to reverse because extremely large switching costs deter consumers from adopting new alternatives, even if they are superior (Redmond 1991; Farrell and Saloner 1986). Consumers' expectations about the future installation base and the resultant benefits of the phenomenon of "the more, the merrier" play a critical role in their product adoption decisions (Lee and O'Connor 2003).

Communication technologies such as 3G are subject to consumption network externalities, where the utility derived from the system increases with an increase in the number of users (Shapiro and Katz 1994). Constantiou, Damsgaard, and Knutsen (2007) also argued that because of the network effects, many mobile services are not valuable if used in isolation (e.g., 3G videophone service has value only if others also use it, but it offers little value to the first adopters).

Montaguti, Kuester, and Robertson (2002) indicated that direct and indirect benefits induce consumers to make decisions conditional on other consumers' adoption decisions. Network benefits encourage consumers to adopt a "dominant technology" rather than one that they might individually prefer, as dominant products tend to be supported by a wide variety of services (Chou and Shy 1990). Therefore, the presence of network externalities might encourage customers to delay adoption until uncertainty concerning that network will prevail is alleviated (Farrell and Saloner 1985).

New subscribers joining a network increase the utility for current subscribers. This process leads to self-propelling or endogenous network growth, and suggests that current subscription is positively influenced by previous subscription (Economides and Himmelberg 1995). In particular, little if any utility is gained from an individual subscribing to the network (e.g., mobile videophone or Facebook) unless there are sufficient subscribers already using the services. However, the viability of a new network relies on the spontaneous existence of an initial critical mass of subscribers (Madden, Coble-Neal, and Dalzell 2004).

Several studies contend that network effects are one of the most important environmental factors for communication technology adoption (Au and Kauffman 2001; Gowrisankaran and Stavins 2004; Wang, Hsu, and Fang 2004). Grajek (2003) also suggested that there are strong network effects in the Polish mobile telecommunications, in both statistical and economic terms. End-user perceptions of network effects have also been given considerable attention. Studies of innovations show that adoption likelihood is sensitive to critical mass and consumers' anticipation of future network size (Montaguti, et al. 2002; Shapiro and Varian 1999; Lee and O'Connor 2003). Therefore, the user will join a 3G services network only if he or she expects that 3G service critical mass will arrive in the near future. Based on the foregoing, we advance the following hypothesis:

H3. *Network effects will have a positive influence on intention to use 3G services.*

2.3. Perceived Enjoyment

Previous research has revealed significant effects of both intrinsic and extrinsic motivation on the behavioral intention to use technologies (Davis, Bagozzi, and Warshaw 1992). The perceived enjoyment as an intrinsic source of motivation refers to the willingness to perform the activity of using a system for no apparent reason other than the enjoyment of the process of performing the activity itself (Moon and Kim 2001; Nysveen, Pedersen, and Thorbjornsen 2005a; Igbaria, Schiffman, and Wieckowski 1994; Wu and Lu 2013; Kim et al. 2013; Ho 2012; Cyr et al. 2006; Bouwman et al. 2009).

3G service is so-called experiential computing (Yoo 2010). It differs from traditional MIS because it is not specifically work-related, organizational in use, productivity-enhancing, or designated for an organization's employees. 3G services are used to enhance a broader set of everyday activities, such as running, driving, listening, relaxing, and so on. Thus, experiential services are characterized by ritualistic orientation and hedonic benefits derived from the use of the services, whereas goal-directed services are characterized by instrumental orientation and utilitarian benefits related to the use of the services (Nysveen, Pedersen, and Thorbjornsen 2005a). The underlying motive for consumers' experiential behavior is to receive entertainment (Hoffman and Novak 1996). Thus, perceived enjoyment stands out as an important motive for using experiential mobile services. This indicates that an intrinsic motivational factor, such as perceived enjoyment, has a stronger effect on consumers' intentions to use experiential mobile services than it does on their intentions to use goal-directed services.

Uses and gratification research has been done on perceived enjoyment as a reward derived from the use of mobile technology or service (Hoflich and Rossler 2001; Igbaria, Parasuraman, and Baroudi 1996). Kim and colleagues (2003) have asserted that M-Internet adoption is determined by perceptions of the value of M-Internet and these, in turn, are determined by perceptions of the usefulness, enjoyment, fee, and technicality of M-Internet. The results suggest that extrinsic and intrinsic benefits prompt customers to adopt M-Internet, and that the perceived value of M-Internet is inferred not only by cognitive elements, such as usefulness and fee, but also by enjoyment, an affective element. Furthermore, Liao and colleagues (2007) have presented an extended TAM by inserting another variable, "perceived enjoyment," into the original TAM to analyze factors influencing subscribers' usage of 3G mobile services. In their study, perceived enjoyment is defined as the degree to which a person believes that use of 3G services will be interesting and associates it with enjoyment. Furthermore, Nysveen and colleagues (2005b) indicated that perceived enjoyment of using a mobile service appears to be an important intrinsic motivation for behavioral intention toward mobile services. Surveys conducted by Taiwan's market research institute, FIND, also indicate that in addition to information search and email, frequently used 3G services in Taiwan include such entertainment-related services as online entertainment and downloads of music, mobile games, songs, live ball games, and so forth (see Figure 2). Therefore, our study posits the following hypothesis:

H4. *Perceived enjoyment of 3G services will have a positive influence on intention to use 3G services.*

2.4. Perceived Overperformance of 3G Services and Perceived Need

The Innovator's Dilemma (Christensen 1997) identifies two distinct categories of innovation, sustaining and disruptive, based on the circumstances of innovation. In sustaining circumstances, the race entails making better products that can be sold for more money to an attractive customer set. In disruptive circumstances, the challenge is to commercialize a simpler, more convenient product that sells for less money and appeals to a new or unattractive customer set (Christensen and Raynor 2003). The disruptive innovation model has been used to describe how minicomputers displaced mainframes, and how personal computers displaced minicomputers (Christensen, Verlinden, and Westerman 2002).

Christensen (1997) and Christensen and Raynor (2003) identified three critical elements of disruptive innovations. First, in every market there is a rate of performance

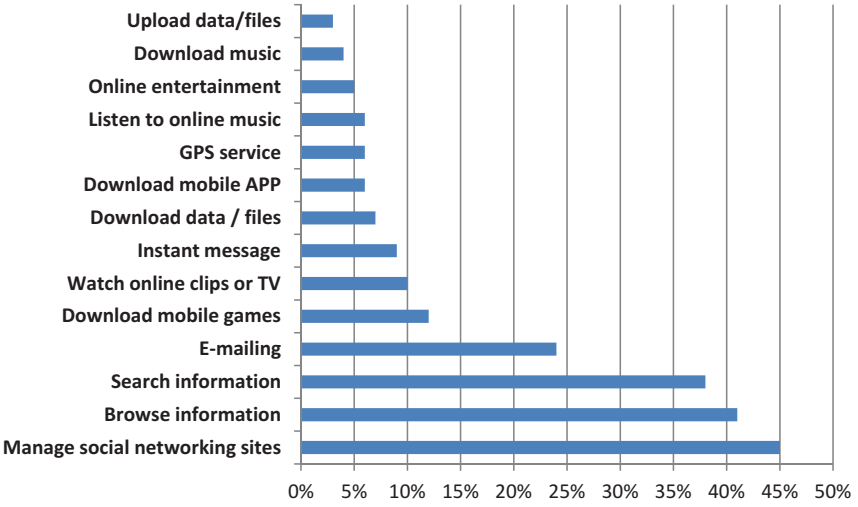


Figure 2 Major mobile network application of 3G/3.5G in Taiwan (FIND 2012).

improvement that customers can utilize or absorb, represented by the dotted line sloping gently upward across the chart (see Figure 3). For example, automobile companies continually create new and improved engines, but we cannot utilize all the performance available under the hood. Factors, such as traffic jams, speed limits, and safety concerns, constrain how much performance we can use (Christensen and Raynor 2003). To simplify the chart, Christensen depicts customers' ability to utilize improvement as a single line. In reality, there is a distribution of customers around this median: there are many such lines or tiers in a market, a range indicated by the distribution curve at the right. Customers in the highest, most demanding tiers may never be satisfied with the best that is available, and those in

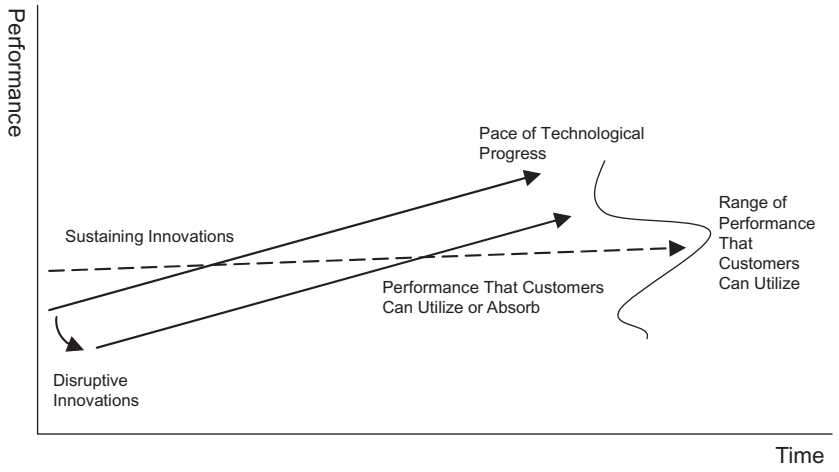


Figure 3 The disruptive innovation model (Christensen and Raynor 2003).

the lowest or least demanding tiers can be oversatisfied with very little. This dotted line represents technology that is "good enough" to serve customers' needs.

Second, the pace of technological progress almost always outstrips the ability of customers in any given tier of the market to use it. Therefore, a company whose products are squarely positioned on mainstream customers' current needs today will probably overshoot what those same customers are able to utilize in the future. This happens because companies keep striving to make better products that they can sell for higher profit margins to not-yet-satisfied customers in more demanding tiers of the market.

The third critical element of the model is the distinction between sustaining and disruptive innovation. A sustaining innovation targets demanding, high-end customers with better performance than was previously available. Disruptive innovations, on the contrary, do not attempt to bring better products to established customers in existing markets. Rather, they disrupt and redefine that trajectory by introducing products and services that are not as good as currently available products. But, disruptive technologies offer other benefits; typically, they are simpler, more convenient, and less expensive products that appeal to new or less-demanding customers (Christensen and Raynor 2003).

When the functionality and reliability of a product have become too good, there is a "performance surplus" (Christensen and Raynor 2003). Christensen et al. (2004) also considers that customers are happy to accept improved products, but they are unwilling to pay a premium price to get them. Christensen et al. (2004) indicated that one important reason why some investments in advanced technologies do not pay off is because they improve the functionality of a system that already is performing more than well enough in mainstream applications to address the needs of customers. High-definition television (HDTV) may prove to be an example of such a technology.

Borrowing the concept of performance surplus, we argue that new, but complicated and expensive products and services (i.e., 3G) are not necessarily able to replace the old one, which is simpler, more convenient, easier to use, and more affordable (i.e., 2G). For example, the 3G transmission speed is fast enough to watch mobile TV or use a videophone to connect with other people. Nevertheless, few people are actually using 3G services to watch mobile TV or use a videophone in daily life. They prefer to watch TV on the Internet at home. As another example, one Taiwanese taxi company dispatches its 1400 taxis using 2.5G GPRS. The company believes it needs to transfer only simple location data. Data volume is less than 10 bytes, which 2G performance can easily manage. Their needs do not require 3G performance levels.

According to the FIND survey, most people in Taiwan usually use the 3G services to search for information, send/receive e-mail, and enjoy online entertainment and mobile games (FIND 2012). The other services provided from service operators are seldom used (as indicated in Figure 2). Of all the applications provided, only seven types of services have usage rates higher than 7%. Most other applications have usage rates of less than 5%. We think the most likely reason is that there are too many available services at this point and consumers think a service that exceeds their need is useless. Because they do not use it, they do not want to pay for it. Therefore, we hypothesize that some 3G services suffer from perceived overperformance by consumers and we reason that perceived overperformance of the 3G services will have a negative impact on perceived need. This study advances the following hypothesis:

H5. *Perceived overperformance of 3G services will have a negative influence on perceived need.*

2.5. Relative Advantages of 3G Services and Perceived Need

As opposed to overperforming, many innovations actually provide better, attractive, new functions and services to consumers. From this perspective, innovation diffusion theory (IDT) is a fundamental technique for examining how a new technology (or "innovation") diffuses (Rogers 1983). IDT examines two major dimensions that influence a firm's adoption of innovations: innovation characteristics and organizational characteristics. Innovation characteristics are the so-called perceived attributes of innovation that encourage innovation use or ease implementation (Hsu, Kraemer, and Dunkle 2006). Rogers (1983) indicated five major attributes of innovation including relative advantage, compatibility, complexity, trialability, and observability. Rogers (1983) used these to explain how innovation diffuses and is adopted by the firm.

Agarwal and Prasad (1997) have found that relative advantage and result demonstrability are relevant in explaining acceptance of the WWW. The two variables together explained 46% of the variance in future-use intentions. Van Slyke and colleagues (2002) used IDT to investigate factors that may influence intentions to use groupware applications. He found that relative advantage, complexity, compatibility, and result demonstrability are significantly related to intention. Factors identified as influences on cell-phone banking adoption included relative advantage, trialability, and consumer banking needs (Brown et al. 2003).

Among those innovation factors, most empirical studies use three factors (relative advantage, compatibility, and complexity) as the most important innovation characteristics when examining the factors impacting innovation adoption (Moore and Benbasat 1991; Premkumar, Ramamurthy, and Nilakanta 1994; Wu and Wu 2005; Alam, Khatibi, Ahmad, and Ismail 2007; Choudhury and Karahanna 2008; Agarwal and Prasad 1997; Van Slyke et al. 2002; Brown et al. 2003). Relative advantage refers to the degree to which adopting an innovation is perceived as being better than continuing the practice it supersedes (Rogers 1983; Teo and Pok 2003). Compatibility is the degree to which the innovation fits with the potential adopter's existing values, previous experiences, and current needs (Rogers 1983; Teo and Pok 2003). Complexity represents the degree to which an innovation is perceived to be difficult to understand, learn, or operate (Rogers 1983; Teo and Pok 2003). In this study, we adopt relative advantage as an important factor to explain the adoption of new mobile services because, of the three variables, it is the one most relevant to our context (Brown et al. 2003).

Promotion of value-added services was not successful because of the bandwidth limitations of 2G and 2.5G technologies. Despite the application of package-switching technology like GPRS, development was still limited. The development of 3G-related technologies has overcome the limitation and allowed higher transmission rates and more complex e-commerce interactions (Barnes 2002), drastically reducing users' waiting time for transmission. Thus, 3G technology greatly benefits the development of mobile commerce. With the Internet available almost instantly at their fingertips, users can easily access personal information management, MMS, and GPS applications. They can search for information online, send/receive email, download games, music or data, and easily manage calendaring and scheduling. In short, with a 3G service-enabled mobile phone, users can better manage their daily lives. In comparison to 2G/2.5G and wired internet access, Lim (2001) has proposed that 3G provides the following major relative advantages: ubiquity, personalization, portability, flexibility, and dissemination.

As mentioned, our study hypothesizes that some 3G services have the property of relative advantage over competitors (i.e., 2G/2.5G, wired internet), and that the relative advantages of the 3G services may impact perceived need. This study proposes the following hypothesis:

H6. *The relative advantage of 3G services will have a positive influence on perceived need.*

2.6. Perceived Price of 3G Services and Purchasability

Perceived price symbolizes the encoding or internalization of the objective selling price of a product/service (Jacoby and Olson 1976). Jarvenpaa and Todd (1997) noted that many consumers expect lower prices because of lower setup costs, lower cost per customer contact, and lower maintenance costs for virtual stores. The higher the perceived price, the lower the perceived value. Specifically, consumers evaluated the quality of a service or product by considering the total cost of purchasing it. Nisel (2001) asserted that price incentives can significantly affect consumer choice behavior. Furthermore, Zeithaml (1988) and Zeithaml, Parasuraman, and Malhotra (2002) contended that economical shoppers usually see price as an important cost component and compare prices between alternatives, adding that consumers evaluate the quality of a product or its value in relation to the price paid.

Many studies have observed that the higher the cost of innovation, the slower the pace of innovation expansion seems to be, and that costs are an important factor affecting user's behavioral intention (Wang and Tsai 2002; Davies 1979; Mansfield 1968; Mathieson, Peacock, and Chin 2001; Wu and Wang 2005; Luarn and Lin 2005; Hung et al. 2003; Zhou 2011; Hong et al. 2008). Danaher, Hardie, and Putsis (2001) also reported that the diffusion of a subsequent generation of technology is affected by the prices of the current and earlier generations. In addition, some researchers have found that an increase in service fees is likely to be one of the most important factors causing consumers to switch services (Peizhong, Feng, and Steven 2003).

Indeed, economic motivations and outcomes are most often the focus of mobile services acceptance studies. Andersson and Heinonen (2002) have found that young customers' perceptions of M-Internet are affected when they compare the cost of mobile services with stationary internet services, which are mostly provided for free. Pakola, Pietila, Svento, and Karjaluoto (2003) have examined mobile service consumer behavior and found that price was the most important motive affecting the decision to purchase a mobile phone model, as well as pay for corresponding service items. In a study of personal adoption of mobile banking, Luarn and Lin (2005) pointed out that perceived financial cost has significantly negative effects on users' behavioral intention. Wu and Wang (2005) also discovered that perceived cost has significantly negative effects on user adoption of mobile commerce. In the case of M-Internet, customers would probably compare the fee of M-Internet usage with previously encoded prices of mobile phone calls and stationary internet access. The result of this comparison forms customers' perceptions of the fee (Kim et al. 2007, 2012). Kuo and Yen (2009) also suggested that perceived cost had a significantly negative effect on 3G usage intention. The result confirmed that the main reason why consumers do not use 3G value-added services is "excessive usage fee" (78.8%).

Riquelme (2001) examined how much self-knowledge consumers have when choosing among different mobile phone brands. Riquelme built on six key attributes related to mobile phone purchasing: telephone features, connection fee, access cost, mobile-to-mobile phone rates, call rate, and free calls. The service fee is not the only item that concerns consumers when switching from 2G to 3G: in order to use multimedia or the fast network, consumers had to acquire a new handset that could support the new technological features (Karjaluoto et al. 2005; Sun 2007). Given that the cost of accessing mobile and wireless services is higher than that of accessing wire-based internet services, Wang and colleagues (2006) suggested that financial considerations including the cost of the handset, and the subscription, service, and communication fees might influence consumer behavioral intentions to use mobile services. In other words, when consumers decide to use the service's new features, they need to pay for both the service and the new handset. Following PIM, this study investigates the following hypothesis:

H7. *Perceived price will have a positive influence on purchasability of 3G services.*

2.7. Optimum Stimulation Level

Optimum stimulation level (OSL) is defined as "a property that characterizes an individual in terms of his or her general response to environmental stimuli" by Raju (1980). Raju and Steenkamp and Burgess (2002) and Steenkamp and Baumgartner (1992) have suggested that the tendency to seek higher (or lower) OSL is based on an individual's personality and is also influenced by personality traits. Furthermore, it has also been suggested that OSL is a function of more basic personality traits (Raju 1980). The concept of OSL was originally introduced in the psychology literature by Hebb (1955) and Leuba (1955). They argued that every organism prefers a certain level of stimulation that can be termed as "optimum stimulation." Later, OSL was further applied in customer behavior and marketing literature.

According to Raju (1980), when environmental stimuli are below the optimum or lower than the individual desires, that individual will attempt to increase stimulation to achieve balance and reach his or her own optimum stimulation level. On the other hand, he or she will strive to reduce stimulation when it is above optimum (Raju 1980; Steenkamp and Baumgartner 1992; Steenkamp and Burgess 2002; Woszczynski, Roth, and Segars 2002). Therefore, individuals with high OSL require higher environmental stimulation, while lower-OSL individuals "feel more comfortable with familiar situations and stimuli, and withdraw from new or unusual ones" (Woszczynski, Roth, and Segars 2002; Steenkamp and Baumgartner 1992; Raju 1980; Mahatanankoon 2007).

Additionally, Raju (1980) said that behavior aimed at modifying stimulation from the environment in the general direction of the optimum level of stimulation could be termed "exploratory behavior." He categorized three general exploratory tendencies. First, risk taking describes exploratory behavior expressed through choices of innovative and unfamiliar alternatives that are perceived as risky. Second, variety seeking is expressed through an individual's switching within familiar alternatives including brand switching, and an aversion to habitual behavior. Third, curiosity-motivated behavior involves exploratory information seeking, interpersonal communication, and shopping. Downstream effects on actual exploratory behavior have been reported in several previous studies (Steenkamp and

Burgess 2002; Steenkamp and Baumgartner 1992; Orth, Bourrain, and Lyon 2005; Van Trijp, Hoyer, and Inman 1996).

Our review of previous OSL literature indicates that major research has focused on the psychological, customer, and marketing perspectives. There is a lack of prior OSL research related to the topic of technology acceptance, especially concerning the adoption of 3G services. Previous research has shown that OSL is an important factor in explaining a wide variety of behaviors with strong exploratory components such as risk taking, innovativeness, and variety seeking (Raju 1980; Steenkamp and Baumgartner 1992; Steenkamp and Burgess 2002; Bolger and Zuckerman 1995; Joachimsthaler and Lastovicka 1984; Venkatraman Linda and Meera 1990).

High OSL people, therefore, proceed faster to the trial stage and assume a greater risk that the product will be acceptable (Raju 1980). Kish and Donnenwerth (1969) characterized a person with high OSL as "one who has a stronger than average need to seek and approach situations, activities, and ideas which are novel, changing, complex, surprising, and more intense". Mittelstaedt and colleagues (1976) hypothesized that those with higher OSLs are likely to exhibit a greater awareness of, and a greater tendency to, evaluate, symbolically accept, try, and adopt new products and retail facilities. As the two mentioned studies have shown, high OSL people have a significantly shorter decision time from awareness to trial of new products. Furthermore, those individuals with high OSLs are more likely to seek change or variety (Raju 1980). Individuals with high OSL need more stimulation to keep their OSL in balance, and using 3G services could be considered as one way to seek change or variety to increase stimulation. Therefore, they will intend to use 3G services because of their perceived need. On the other hand, individuals with low OSL do not need more stimulation. Accordingly, we consider the following hypothesis:

H8. *The impact of perceived need on 3G services usage is moderated by the degree of optimum stimulation level.*

Based on earlier literature and a combination of the hypotheses, we have the research model shown in Figure 4.

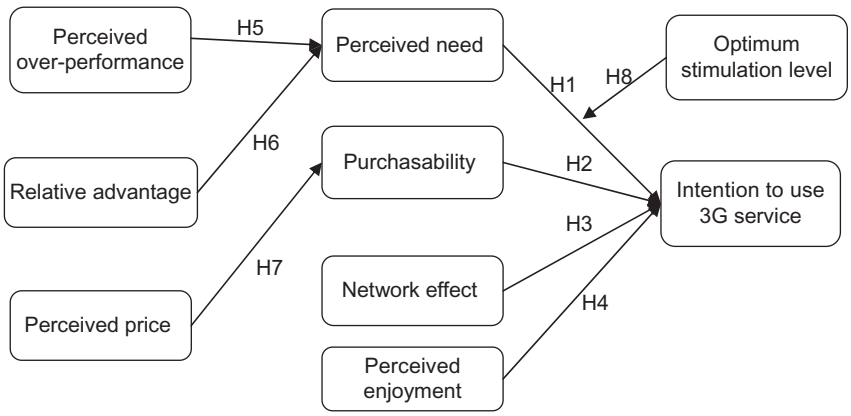


Figure 4 Conceptual research model.

3. RESEARCH METHODOLOGY

3.1. Sampling

A survey study is conducted to examine the hypotheses. Data for this study were collected primarily via an internet survey. An announcement was posted on a PTT discussion forum (telnet://ptt.c, the largest and best-known BBS in Taiwan) to recruit participants not currently subscribed to 3G services. After discarding the incomplete questionnaires, the effective sample size was 322. The demographic information of these respondents is shown in Table 1.

Kuo and Yen (2009) indicated that most people in Taiwan who have adopted mobile value-added services are between 21 and 30 years (54.2%). Therefore, if our study selects mostly from this age group for sampling, the result would represent a certain segment of the population. Overall, the sample is well qualified to assess issues related to the influences on individuals' subscription to 3G services in Taiwan (Kuo and Yen 2009; Liao et al. 2007).

3.2. Measure Development

Measurement items were developed based on a comprehensive review of the literature as well as on expert opinions. A review of literature was undertaken to identify construct definitions and any existing measures. To the extent possible, previously published items have been adopted or adapted. In short, we form the scale for each construct in the model with developed and valid measures. Table 2 shows the operational definition and sources of measurement of variables.

3.3. Reliability and Validity

Item reliability, convergent validity, and discriminant validity tests are often used to evaluate measurement models of PLS. Reliability can be assured through composite

Table 1 Sample demographics (N = 322).

Measure	Categories	Frequency	Percent (%)
Gender	Female	124	38.5
	Male	198	61.5
Education	College education	164	50.9
	Master	141	43.8
	Other	17	5.3
Age	Less than 20 years old	32	9.9
	21 ~ 30	274	85.1
	More than 30 years old	16	5.0
Occupation	Student	219	67.9
	Nonstudent	103	32.1
Income (NTD [New Taiwan Dollars])	Less than 20 thousands	228	70.8
	20 ~ 40 thousands	70	21.7
	More than 40 thousands	24	7.5
Monthly subscription fee paid (NTD)	Less than $300	128	39.8
	$300 ~ $700	154	47.8
	More than $700	40	12.4

Table 2 Operational definitions.

Constructs	Operational Definitions	# of Items	References
Intention to use 3G service	The degree to which 3G service is perceived willingness and probability to be adopted.	3	Davis, Bagozzi, and Warshaw (1989); Wang, Lin, and Luarn (2006); Kim, Chan, and Gupta (2007)
Perceived need	The extent to which the individual's assessment of the personal demand for the adoption of 3G service.	3	Warshaw (1980); Engel, Blackwell, and Miniard (1993); Abdul-Gader and Kozar (1995); Teng, Lu, and Yu (2009)
Purchasability	The extent to which the individual's judgment of his or her budget and financial capability about adoption of 3G service.	3	Warshaw (1980); Abdul-Gader and Kozar (1995); Jeong, Yoo, and Heo (2009)
Network effects	The utility that a given user derives from a good depends on the number of other users who are in the 3G service network.	6	Shapiro and Katz (1985); Shapiro and Varian (1999); Strader, Ramaswami, and Houle (2007)
Perceived enjoyment	The extent to which the activity of using the 3G services is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated.	4	Nysveen, Pedersen, and Thorbjornsen (2005a); Davis, Bagozzi, and Warshaw (1992); Van der Heijden (2003)
Perceived over-performance	The extent to which the functionality of 3G service overshoots what the customers can utilize or absorb.	6	Christensen (1997); Christensen and Raynor (2003)
Relative advantage	The degree to which adopting the 3G service is perceived as being better than using the 2G or Internet service.	5	Rogers (1983); Teo and Pok (2003)
Perceived price	The degree to which 3G service symbolizes the encoding or internalization of the objective selling price of the 3G mobile phone and service fee.	6	Jacoby and Olson (1976); Voss, Parasuraman, and Grewal (1998); Kim, Chan, and Gupta (2007)
Optimum stimulation level	A property that characterizes an individual in terms of his or her general response to environmental stimuli.	7	Raju (1980); Steenkamp and Baumgartner (1995)

reliability, Cronbach's alpha, and factor loading. Factor loading should be greater than 0.7, which can be viewed as highly reliable, whereas factors with loadings less than 0.5 should be eliminated. Our results are shown in Table 3.

Construct validity is assessed along two dimensions: convergent and discriminant. Convergent validity should be assured when multiple indicators are used to measure one construct, and can be examined by item-total correlation (ITC), composite reliability (CR), and variance, as extracted by constructs (AVE) (Fornell and Bookstein 1982). To achieve the required convergent validity, ITC should not be less than 0.3, composite reliability should be greater than 0.7, and AVE should be greater than 0.5 (Jiang, Klein, Wu, and Liang 2009). To achieve adequate discriminant validity, the correlation between pairs of constructs should be less than 0.90, and the square root of AVE should be greater than the interconstruct correlation coefficients (Fornell and Bookstein 1982). Descriptive statistics and the correlation matrix are shown in Table 4.

Table 3 The results of factor analysis.

Constructs	Indicators	Factors	
		Loadings	ITC
Intention to use 3G services	I plan to use 3G services in the future.	0.942	0.866
CR = 0.959	I intend to use 3G services in the future.	0.955	0.899
Alpha = 0.937	I predict I would use 3G services in the future.	0.930	0.842
AVE = 0.888			
Optimum stimulation level	I like to experience novelty and change in my daily routine.	0.845	0.686
CR = 0.921			
Alpha = 0.894	I like a job that offers change, variety, and travel, even if it involves some danger.	0.825	0.740
AVE = 0.699			
	I am continually seeking new ideas and experiences.	0.889	0.805
	I like continually changing activities.	0.810	0.743
	When things get boring, I like to find some new and unfamiliar experience.	0.808	0.720
Perceived need	Most of the time, I feel that I need to use 3G services.	0.928	0.836
CR = 0.957	The current 3G services offered by providers are important to me.	0.955	0.899
Alpha = 0.932			
AVE = 0.881	At present, I feel that I need to use 3G services.	0.931	0.849
Purchasability	It is not difficult financially for me to use 3G services.	0.898	0.775
CR = 0.960			
Alpha = 0.937	I can afford 3G services.	0.969	0.927
AVE = 0.889	I am able to pay for 3G services.	0.960	0.910
Perceived enjoyment	I find using 3G services entertaining.	0.902	0.797
CR = 0.944	I find using 3G services pleasant.	0.933	0.869
Alpha = 0.920	Using 3G services is exciting.	0.833	0.737
AVE = 0.808	It is fun to use 3G services.	0.924	0.860
Network effects	Many people around me use 3G services.	0.892	0.802
CR = 0.937	Many of my friends use 3G services.	0.864	0.748
Alpha = 0.920	Many of my family members use 3G services.	0.845	0.693
AVE = 0.712	Compared to 2G/2.5G, I predict the sum of users in the 3G services network will be larger in the near future.	0.847	0.839
	Compared to 2G/2.5G, I predict the market share of the 3G services network will be higher in the near future.	0.808	0.800
	Compared to 2G/2.5G, I predict the 3G services network will be the final winner in Taiwan in the near future.	0.803	0.786
Perceived over-performance	I think the 3G services are beyond my need.	0.852	0.774
CR = 0.944	Many functions that 3G services provided are useless to me.	0.854	0.805
Alpha = 0.930			
AVE = 0.737	Many functions that 3G services provided are too novel for me.	0.747	0.722
	For me, the probability of using the functions that 3G services provided are very low.	0.886	0.826
	Overall, I don't need many functions that 3G services provided at present.	0.906	0.845
	Overall, I don't need many functions that 3G services provided in my daily life.	0.896	0.804

(Continued)

Table 3 (Continued).

Constructs	Indicators	Factors	
		Loadings	ITC
Relative advantage	I think the functions of 3G services can make me get more fun or entertainment than the 2G/2.5G services.	0.822	0.721
CR = 0.934			
Alpha = 0.911			
AVE = 0.738	I think the functions of 3G services can satisfy my need of the mobile communication more than the 2G/2.5G services.	0.843	0.734
	I think the functions of 3G services can make me conduct mobile commerce more efficiently than the 2G/2.5G services.	0.880	0.810
	I think the functions of 3G services can satisfy my need of the mobile information access more than the 2G/2.5G services.	0.878	0.808
	I think the functions of 3G services can enhance the effect of social network more than the 2G/2.5G services.	0.872	0.802
Perceived price	The fee that I have to pay for the 3G mobile phone price is not too high.	0.828	0.762
CR = 0.948			
Alpha = 0.937	The fee that I have to pay for the 3G mobile phone price is reasonable.	0.880	0.825
AVE = 0.754			
	I am pleased with the price that I have to pay for the 3G mobile phone.	0.856	0.776
	The fee that I have to pay for the use of 3G services is not too high.	0.861	0.810
	The fee that I have to pay for the use of 3G services is reasonable.	0.899	0.850
	I am pleased with the fee that I have to pay for the use of 3G services.	0.884	0.810

4. DATA ANALYSIS AND RESULTS: STRUCTURAL MODEL

We assess the hypotheses by using structural equation modeling (SEM) because of its ability to validate multiple causal relationships simultaneously. SmartPLS 2.0 M3, with bootstrapping as a resampling technique (500 random samples), is used to estimate the structural model and the significance of the paths. Path coefficients and the R^2 are used jointly to evaluate the model (Chin 1998). As shown in Figure 5, all hypotheses except two (H2 and H3) are supported.

As indicated by path loadings, perceived need ($\beta = 0.323$, $p < 0.001$) and perceived enjoyment ($\beta = 0.208$, $p < 0.001$) have significantly positive effects on the intention to use 3G services. This result confirms the theoretical expectations of this study, and provides support for H1 and H4. However, the paths from purchasability and network effects to intention to use 3G services, while in the direction predicted by the model, are not significant. These four paths account for approximately 44.7% of the variance in intent to use 3G services.

In addition, consistent with hypotheses H5, H6, and H7, perceived overperformance ($\beta = -0.284$, $p < 0.001$), relative advantage ($\beta = 0.457$, $p < 0.001$), and perceived price ($\beta = 0.619$, $p < 0.001$) each has a significant direct effect on perceived need and

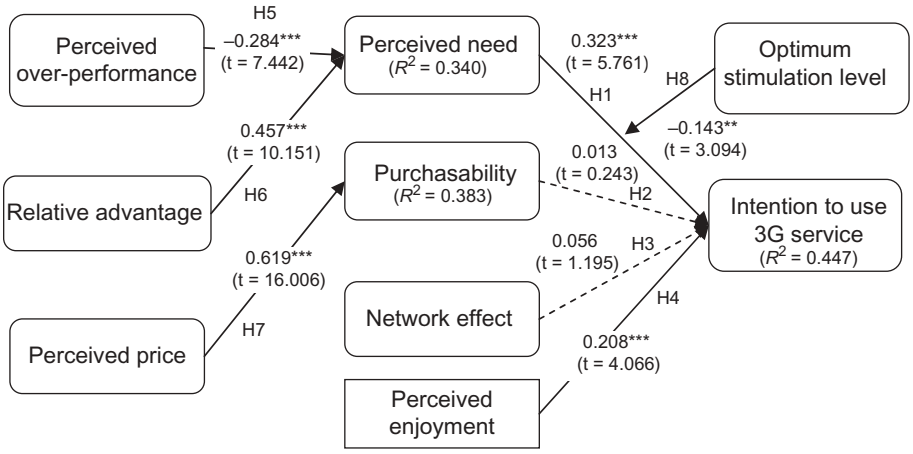
Table 4 Descriptive statistics and correlation matrix.

Variables[c]	Mean	Std. Dev.	M3[a]	M4[a]	VIF	Correlation Matrix								
						ITU	OSL	PN	PUR	PE	NE	POP	RA	PP
ITU	5.860	0.964	−0.829	0.441	N/A	**0.942**[b]								
OSL	5.380	0.996	−0.779	0.789	1.293	0.439	**0.836**[b]							
PN	4.758	1.406	−0.316	−0.642	2.252	0.576	0.415	**0.939**[b]						
PUR	4.107	1.535	−0.047	−0.647	1.795	0.279	0.179	0.480	**0.943**[b]					
PE	5.194	0.974	−0.589	0.873	1.812	0.476	0.273	0.563	0.333	**0.899**[b]				
NE	4.591	1.109	−0.231	−0.168	1.521	0.257	0.093	0.391	0.372	0.343	**0.844**[b]			
POP	4.692	1.150	−0.606	0.067	1316	−0.246	−0.200	−0.344	−0.070	−0.235	0.162	**0.858**[b]		
RA	5.332	0.961	−0.506	0.506	1.755	0.479	0.380	0.508	0.320	0.580	0.333	−0.183	**0.859**[b]	
PP	4.272	1.395	−0.135	−0.517	1.778	0.218	0.202	0.427	0.614	0.269	0.415	0.000	0.325	**0.868**[b]

[a]M3: Skewness; M4: Kurtosis.

[b]The diagonal line of correlation matrix represents the square root of AVE.

[c]ITU: Intention to use 3G services; OSL: Optimum stimulation level; PN: Perceived need; PUR: Purchasability; PE: Perceived enjoyment; NE: Network effect; POP: Perceived over-performance; RA: Relative advantage; PP: Perceived price.



Based on two-tailed test;
*p < 0.05(t ≧ 1.96); **p < 0.01(t ≧ 2.58); ***p < 0.001(t ≧ 3.29).

Figure 5 Structure model and paths coefficient.

purchasability. As for variance explanation; perceived overperformance and relative advantage, together, explain 34% of the variance in perceived need of 3G services. Perceived price accounts for 38.3% of the variance in purchasability of 3G services.

4.1. Analysis of Moderating Effect

A moderated multiple regression analysis is performed to test the moderating effect of optimum stimulation level on the relationship between perceived need and intention to use 3G services (Carte and Russell 2003). As shown in Table 5, the moderating effect is supported since both the coefficient of interaction term and R^2 change (with and without interaction term) are at a significant level. Furthermore, the negative coefficient indicates the perceived need will generate more impact on usage decision when optimum stimulation level is lower.

Table 5 Interaction effect.

Dependent Variable: Intention To Use 3G Service Moderator: Optimum Stimulation Level			
	Direct Effect	Moderating Effect	
Independent Variable	Model 0	Model 1	Model 2
Perceived need (PN)	0.450***	0.343***	0.323***
Optimum stimulation level (OSL)		0.262***	0.252***
PN * OSL			−0.143**
R^2	$R_0^2 = 0.371$	$R_1^2 = 0.427$	$R_2^2 = 0.447$
R^2 difference		0.056***	0.030***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
The f value of R^2 difference is estimated by $[(R_2^2 - R_1^2)/(df_2 - df_1)]/[(1 - R_2^2)/(n - df_2 - 1)]$.

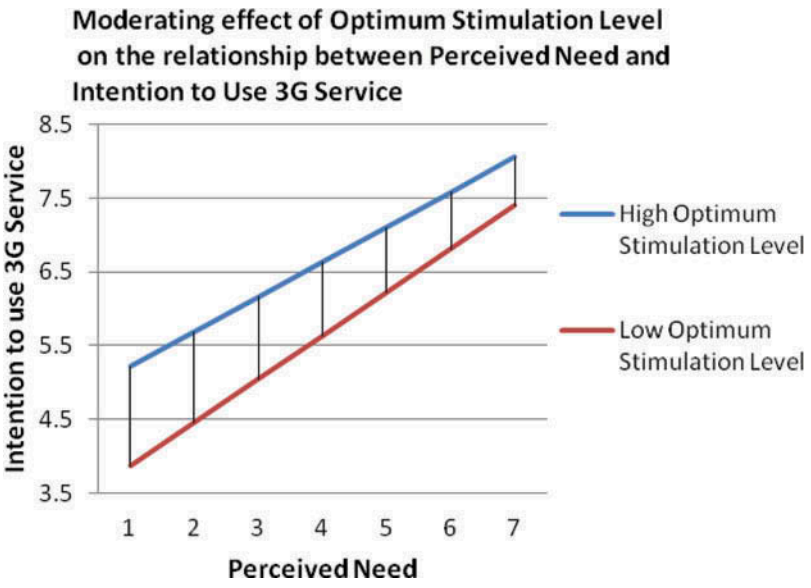


Figure 6 Simple slope analysis.

Figure 6 shows results of the simple slope analysis, which indicates an impact on intention to use 3G services that is contingent on the degree of OSL. A high level of OSL is associated with a higher impact magnitude of perceived need on intention to use 3G services. However, there is a difference between high and low OSLs when the level of perceived need is low. That is, if the perceived need of 3G services is very low, then the low-OSL individual cannot be motivated to adopt 3G services. Compared to people with high OSL, individuals with low OSL are more easily affected by a rise in perceived need, which will raise their intention to use 3G services. In other words, for low-OSL consumers, only when the perceived need is high will they have a strong intention to use 3G services. On the other hand, in comparison to low-OSL consumers, consumers with high OSL do not care as much about perceived need. Such a moderating effect has not been found in prior research, and provides important implications for practitioners.

4.2. Analysis of Mediation: Perceived Need

This study adopts the PIM as our basic, foundational research model. According to PIM, "perceived need" serves as a mediator that transfers the impact of perceived overperformance and relative advantage to usage intention. Because H2 is not supported, this study does not test whether "purchasability" serves as a mediator. In contrast to previous studies, which propose that relative advantage has a direct impact on intention to use (Rogers 1983; Hsu, Lu, and Hsu 2007; Wang, Lin, and Luarn 2006), we examine the fitness and validity of the PIM model in the 3G services usage context.

This mediating role is tested in a three-step approach. Usage intention is first regressed with perceived overperformance and relative advantage to understand their direct impact. The results indicate that perceived overperformance and relative advantage are

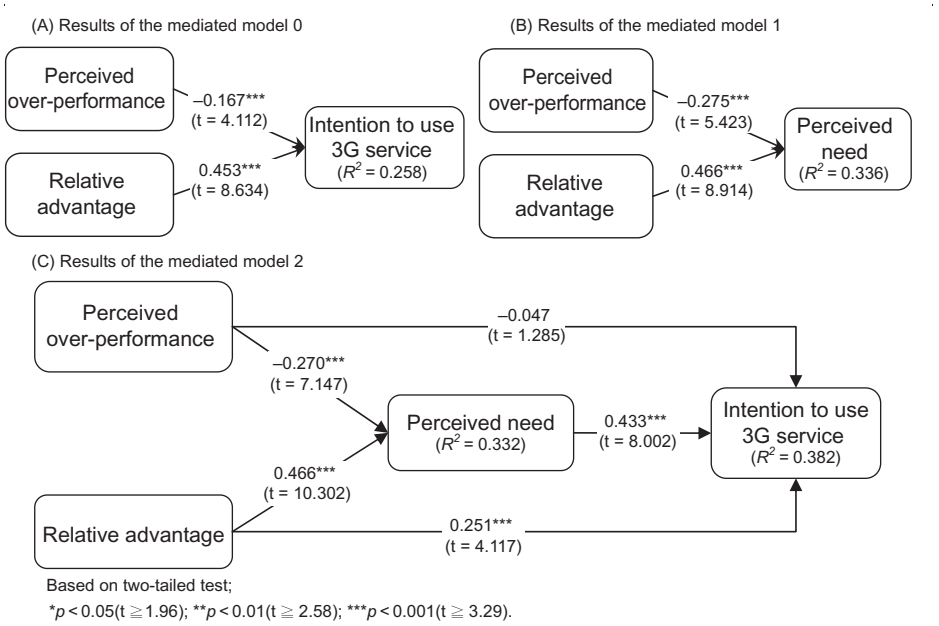


Figure 7 Results of the mediated model: Perceived need.

significantly related to usage intention, as shown in Figure 7(A). In the second step, perceived need is then regressed with perceived over-performance and relative advantage. The results indicate that relative advantage is positively related and perceived over-performance is negatively related to perceived need. As shown in Figure 7(B), both paths are significant. In the third step, the mediator is added to the first step of the research model, as shown in Figure 7(C). Several interesting results can be found in this model. The R^2 of usage intention increases significantly from 0.258 to 0.382. The effect of perceived overperformance on usage intention becomes insignificant. This means that the impact of perceived overperformance on intention to use 3G services is "fully" mediated by perceived need, while the impact of relative advantage on intention to use is reduced significantly (from 0.453 to 0.251). It also means that the impact of relative advantage on intention to use is "partially" mediated by perceived need.

This evidence validates and supports our expectations regarding the mediation effect. In addition, we conducted two Sobel tests to examine the significance level of mediation effects (Sobel 1982). The results show that the effects of perceived over-performance (z-value = 5.33, $p < 0.001$) and relative advantage (z-value = 6.32, $p < 0.001$) on intention to use 3G service are significantly mediated by perceived need. Therefore, we conclude that perceived need is a significant mediating variable in PIM within the 3G usage intention context.

5. DISCUSSION

Based on PIM, network effects, perceived enjoyment, and individual differences, this study introduces a more comprehensive model to understand the pervasive phenomenon

concerning the intention to use 3G services. In general, the empirical results encourage and provide support for the main objective of the study.

First, as for the effect of PIM on intention to use 3G services, our finding partially supports our expectations that PIM would affect intention to use 3G services. In our theoretical development, we hypothesized that perceived need (H1) and purchasability (H2) would positively influence intention to use 3G services. Our result confirmed H1; it implied that individuals are attracted by perceived need. Consistent with previous research (Teng, Lu, and Yu 2009; Rogers 1983; Leonard-Barton and Deschamps 1988), when individuals perceive more need and the difference between the "actual" and "desired" state regarding 3G services becomes perceptibly larger, they will become more anxious and eager to purchase 3G services. However, the purchasability of 3G services (H2) is found to have no influence on usage intention.

In an attempt to explain this contradictory result, we provide a potential explanation. In the past, most consumers in Taiwan perceived that using 3G services was much more expensive than using wire-based services. However, fierce competition among 3G service providers in Taiwan has dropped 3G service charges dramatically (e.g., monthly subscription fees as low as 10 U.S. dollars). Teng and colleagues (2009) also indicated that the perceived expense of 3G is not a major factor in influencing purchase intention in Taiwan. This implies that nowadays users do not consider 3G service fees to be unaffordable. Purchasability is no longer their major concern.

Second, our result suggests that while network effect does not significantly impact the intention to use 3G services (H3), perceived enjoyment does (H4). Here, network effect refers to the utility a given user derives from 3G services being dependent on the number of other users in the 3G service network. The results do not support H3 and the rationale for this insignificance is that people would like voluntarily to use 3G service in the near future regardless of the network effect. That is, no matter how high or low market share is, and no matter how many friends around them use the 3G service, these external factors have no influence on users' intentions to use 3G service.

We also find that perceived enjoyment is a stronger determinant with regard to the intention to use 3G services. As we have argued, when people perceive more enjoyment, their intention to use 3G services increases. This finding is consistent with previous research (Kim and Kwon 2003; Liao et al. 2007; Nysveen, Pedersen, and Thorbjornsen 2005b).

Third, the results indicate that perceived overperformance (H5) and relative advantage (H6) are associated with determining the individual's perceived need of 3G services. Need for 3G services is determined simultaneously by the integration of perceived overperformance (negative) and relative advantages (positive) of the services. If people perceive more "overperformance" of 3G services than "relative advantages," their perceived need and their intention to use 3G services both decrease. In addition, the result suggests that perceived price has a positive impact on purchasability of 3G services (H7). People always estimate the purchasability of a product or service by considering price. Therefore, perceived price can symbolize the purchasability of 3G services.

Fourth, the results show a significant moderating effect between perceived need and intention to use 3G services. That is, our results indicate that optimum stimulation level is a key moderating determinant for perceived need and usage intention of 3G services. This strongly supports our hypothesis (H8) and previous research (Raju 1980). It indicates that individuals with low-OSL are more easily affected by perceived need, which will increase their intention to use 3G services. In other words, they choose to use 3G services only because they perceive the need as high. This is in contrast to high OSL people who may

use 3G services out of curiosity; even when they do not have high perceived need. Finally, results of this study support the assertion that the impact of perceived overperformance on intention to use 3G services is fully mediated by perceived need.

6. RESEARCH IMPLICATIONS

6.1. Academic Implications

By extending the research regarding mobile services and innovation technology adoption decision making, this study contributes to academia in several ways. First, the study is the first to adopt the PIM model to study this phenomenon. We also argue that the PIM model is especially qualified to predict purchasing behavior, and that the literature also shows TRA to have weaker predicting power than PIM regarding purchase decisions. Second, we have adopted PIM as our central model, for the first time building an integrated research model to simultaneously investigate these complicated factors. This model is appropriate for explaining the situation when users consider purchasing (or adopting) 3G services. Third, this study is the first to introduce and confirm the important impact of perceived overperformance on perceived need of 3G service. Furthermore, we apply the concept of disruptive innovation theory to explain the causes and results of overperformance. This study is the first to introduce this important variable. Finally, the study finds that optimum stimulation level significantly moderates the magnitude of the impact of perceived need on the intention to use 3G services. Optimum stimulation level becomes important when individuals perceive that using 3G services is needful. Such a moderating effect has important implications for future studies.

6.2. Practical Implications

Several implications for practitioners can be drawn from this study. First, according to our results, perceived need and perceived enjoyment are important determining factors for consumers deciding whether or not to use 3G services. Reduced price can no longer induce the consumer to purchase. 3G providers need to focus on increasing consumers' perceived need and perceived enjoyment. Second, the findings in this study indicate that consumers will evaluate 3G services based on the aspects of perceived overperformance and relative advantage, and the resulting evaluation will influence their need cognition. Finally, in contrast to the findings of previous studies (Wang, Lin, and Luarn 2006; Luarn and Lin 2005), which have proposed that financial cost is a significant affecting factor for 3G services adoption, our result suggests that service charge was not a critical affecting factor.

Because of the fierce competition in the current 3G service market in Taiwan, telecommunication companies have reduced the fees for 3G service dramatically. Thus, it seems reasonable to conclude that at present, the strategy of reducing the price of 3G handsets or 3G service fees for any 3G provider in Taiwan may be ineffective in increasing the adoption rate. This argument is supported by our investigation. The results indicate that price and perceived purchasability have no significant impact on 3G services adoption.

7. CONCLUSIONS

The purpose of this study is to identify affecting factors on intention to use 3G services based on PIM. The results confirm a significant relationship between perceived

need, perceived enjoyment, and usage intention. Along with relative advantages proposed by Rogers (1983), borrowing from disruptive innovation theory (Christensen 1997), we have further tested and compared the underlying factors that contribute to perceived need and purchasability. We have devised a concept about the performance surplus, called "overperformance" and validated its impact on perceived need. We successfully illustrate that the effect of perceived need on usage intention is contingent on individuals' optimum stimulation level. In sum, the findings of our research help 3G services providers develop more user-acceptable 3G services and promote the new information technology to potential customers We contend that our research will help foster further insight into the phenomenon of 3G services acceptance.

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