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The Influence of Usage Experience on Adoption of Successive ICT Products

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ABSTRACT

When a new version of an information technology product or service appears in the market, consumers' usage experience with the prior version may influence their adoption patterns. However, this important determinant has been ignored in current research. This study uses mobile services to examine the role of usage experience. We empirically test our hypotheses by using actual field data from China. We find that, in addition to perceived usefulness and perceived enjoyment, usage experience with the prior version, that is the 2G service, has a significant influence on intentions to adopt the 3G service. Understanding the influence of usage experience is an important finding given that ICT vendors deliver successive versions of their products, and with this knowledge they could promote faster adoption and diffusion of new products. We discuss some practical implications, highlight factors that influence the adoption of newer generations of products, and delineate future research avenues.

Keywords

Usage experience, technology adoption, mobile services, information and communication technology, China

INTRODUCTION

Older technologies are continually replaced by newer ones (Norton and Bass, 1987), especially for information and communication technology (ICT). Nowadays, with the rapid development of ICT, products[1] based on the same series of ICT are also updated at an impressive rate. For example, Windows XP and Windows Vista were released by Microsoft in October 2001 and January 2007 respectively, but quickly, Windows 7 was launched in October 2009 and its successor, Windows 8, is forecasted to be released in 2012 (Fried, 2010). This phenomenon is not only applicable to the consumer market, but also to industrial products and markets. Large corporate products, such as enterprise resource planning systems and network systems are also rapidly updated, no matter whether this behavior is initiated by companies or forced by their competitors.

On the one hand, the later versions improve upon the predecessors by having a more friendly design, the addition of new features, or the modification of features to make the product more appealing and valuable (Sääksjärvi and Lampinen, 2005). On the other hand, like genetic inheritance, the successors follow the same key product concept as the predecessors, and consumers can easily notice that the modified successors are built on the original innovations (Sääksjärvi and Lampinen, 2005). Some good examples include Microsoft Office (e.g. Office 2003, Office 2007, and Office 2010), Apple iPhone (e.g. iPhone 3G, iPhone 3GS, and iPhone 4G), and smartphone operation systems. According to Garcia and Calantone (2002), such a substitution of successive generations can be classified as incremental innovation. When a successive product is introduced, an important focal question arises: does usage experience[2] influence the adoption of the successor technology? Whether the answer is in the affirmative "Yes" or negative "No" is critical to find out, because it will influence a host of important decisions on successive ICT products, such as new product development and innovation, timing of new product introduction, and new product marketing.

In essence, this focal question involves at least two areas: technology adoption or diffusion, and technological substitution. There is a substantial theories or models on adoption of new technology such as Technology Adoption Model (TAM) (Davis,

1 This term includes "service" in this study.

[2] In order to distinguish between prior experience with current products and the experience with the predecessor products, in this study, we consistently use the term "prior experience" to refer to the first one while "usage experience" to refer to the second one, which is defined as usage experience attained by customers in the use of predecessor technology.

1989), Information technology Acceptance (ITA) (Agarwal and Prasad, 1998), and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, and Davis, 2003), and a considerable literature on technological substitution such as Fisher and Pry (1971) and Norton and Bass (1989). However, the above-mentioned literature has rarely attached importance to usage experience. Even though some existing studies use the term "prior experience" (e.g. Cheong and Park, 2005; Mallat, Rossi, Tuunainen, and Oorni, 2008; Taylor and Todd, 1995; Venkatesh et al., 2003), they mainly discuss the influence of the experience attained in the prior use of the current product on the acceptance or subsequent purchase of the same product. Therefore, their findings could not answer the focal question raised in this study.

In this study, mobile technology was selected to answer this focal question. In the mobile communication market, evolution of newer versions is fast, and the transition from second generation (2G) to third generation (3G) to fourth generation (4G) occurs rapidly. This study examines the influence of 2G usage experience on 3G adoption (see Figure 1). Compared with 2G networks, 3G networks have many improvements such as greater security, higher transmission rates, and better quality of voice connection. Accordingly, 2G and 3G can be a good pair of predecessor and successor in successive generations of ICT.

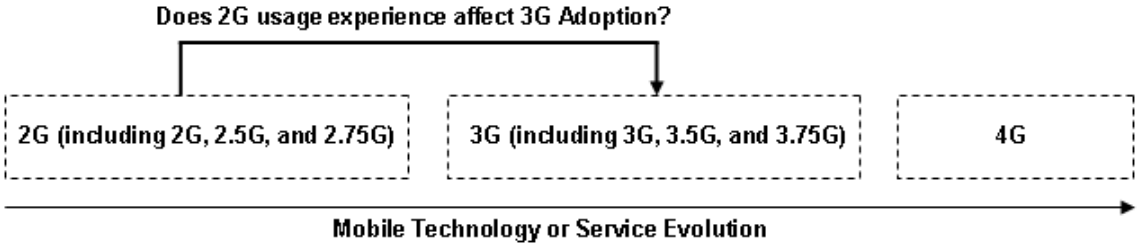


Figure 1. Focal Research Question

This study investigated 1,700 2G mobile users in China. When we collected data in China, 3G networks had not been launched but were planned to. This situation assured that the adoption intentions of 3G services could not influenced by 3G experience (that is, prior experience) or by the combination between 3G and 2G experiences, and thus eliminated the source of bias resulting from prior experience with 3G services. Besides usage experience, two more determinants (perceived usefulness and perceived enjoyment) were also included in this survey because they were identified as being influential in prior research. Hence, they were included along with usage experience so as to offer a more robust test of the relative and overall the influence of usage experience on the adoption of successive products. The main difference between 2G and 3G is mobile data services, so the investigation was focused on data services[3].

CONCEPTUAL MODEL

The Influence of Perceived values on User Adoption

Perceived values are important determinants for user acceptance of new ICT products. However, much research has revealed that it is necessary to build a multidimensional view of values in a mobile service context (Liao, Tsou and Huang, 2007; Nysveen, Pedersen and Thorbjørnsen, 2005a, b; Pihlstrom and Brush, 2008; Wang, Lin and Luarn, 2006). Perceived usefulness and enjoyment have been identified as the most important determinants of mobile services adoption in current research (Kim, Chan and Gupta, 2007; Liao et al., 2007; Nysveen et al., 2005a, b; Pagani, 2004).

Perceived usefulness comes from TAM (Davis, 1989). Here, perceived usefulness is defined as the total value a user perceives from using a new technology (Rogers, 1995). Perceived enjoyment, also called perceived playfulness (Agarwal and Karahanna, 2000; Kim et al., 2007), is a relatively new factor developed from ICT products. Perceived enjoyment is defined as an emotional reward (such as pleasure and inherent satisfaction) derived from the use of the technology or service (Igbaria, Saroj and Jack, 1996; Nysveen et al., 2005b). Moreover, the pair of perceived usefulness and enjoyment represents dyadic directions of perceived values respectively: extrinsic and intrinsic motivation in cognitive evaluation theory (Kim et al., 2007; Nysveen et al., 2005a), cognitive element and affective element in product evaluation theory (Kim et al., 2007), and

[3] This study does not distinguish between the following terms: mobile service, mobile technology, and data service. Consequently, they are alternately used in this study to express the same meaning unless otherwise specified.

utilitarian benefits and hedonic benefits in the purchase (Babin, Darden and Griffin, 1994). In sum, the pair of perceived usefulness and enjoyment is adequate to represent consumers' motivations, the values, or benefits in the adoption of new mobile technologies.

These two perceived values have been studied intensively in the context of mobile service. Most research reveals that good indicators of intentions to use new mobile services include perceived usefulness (Koivumaki, Ristola and Kesti, 2006; Mallat et al., 2008; Pagani, 2004; Wang et al., 2006), perceived enjoyment (Liao et al., 2007; Pihlstrom and Brush, 2008), or both (Cheong and Park, 2005; Kim et al., 2007; Nysveen et al., 2005a, b; Tan and Chou, 2008). Therefore, we hypothesize:

H_1: Perceived usefulness positively influences intentions to adopt new successive mobile technologies.

H_2: perceived enjoyment positively influences intentions to adopt new successive mobile technologies.

The Influence of Usage Experience on User Adoption

Customers' product knowledge has been recognized as a key concept in the information processing and decision making research (Raju, Lonial and Mangold, 1995). Three types of customer knowledge—subjective knowledge, objective knowledge, and usage experience—have been recognized in the extant research (Brucks, 1985; Raju et al., 1995). According to their research, usage experience measures the amount of purchasing or usage experience with the product or service. Raju et al. (1995) find that usage experience has a significant main effect on desire for more information and certainty of best choice, and thus influences decision making of new products. Usage experience could affect the adoption in successive ICT products through the following mechanisms.

Importantly, in the use of ICT products, users obtain knowledge or skills, which in turn strengthen their confidence on the successive ICT products. The use of ICT products involves an individual learning process because those products are usually technology-based and/or information-intensive. According to the individual learning theory (Knowles, 1998), adults can acquire two types of knowledge (subjective knowledge and objective knowledge), by themselves through human-device interaction or by exchange of knowledge with other customers. ICT products such as cellphones, especially for smart phones and PDAs, though similar to other technology-based system, have features that they can be viewed as a knowledge-based system. Each customer may tailor their system to their needs and thus use sets of different applications (data services) that are installed in their cellphones or embedded in the mobile internet. To effectively use knowledge-based system, some level of implicit learning is required, that is which occurs when a person learns unconsciously or unintentionally, without being explicitly instructed or tutored (Antony and Santhanam, 2007). Therefore, the knowledge or skills acquired in the use of ICT products such as mobile service products can be considered as a user's internal resources, which are very helpful for the adoption of new successive products (Koivumaki et al., 2006). This argument is also support by the finding that "ease of use" is a more significant factor for new adopters than experienced ones (Venkatesh et al., 2003; Kim et al., 2007). Their findings reveal that the use of ICT products requires adequate knowledge or skills, but experienced users can apply their own skills or knowledge attained in the use of predecessor products, rather heavily rely on products' ease of use. Moreover, usage experience could reduce perceived risk in the use of successive products (S ääksj ärvi and Lampinen), and therefore, it is more likely for experienced users to adopt successive products, especially for ICT products, which possess higher perceived risk than other products.

Secondly, usage experience reflects users' purchasing power in successive ICT products because how much they have paid for the existing products (i.e. 2G services) could partially predict how much they will pay for more successive products (i.e. 3G services). Besides, in general, perceived price/cost is a barrier to the adoption of ICT products (Kim, et al., 2007; Mallat et al., 2008; Pagani, 2004), but the use of predecessor technology may decrease the perceived price/cost.

Finally, customers' usage experience reflects their feelings they have experienced in the usage of existing ICT products. The experience marketing theory asserts that good customer experience produces continuous repurchase and/or early purchase of new subsequent products. Thus, we raise the following hypothesis:

H_3: Usage experience positively influences intentions to adopt new successive mobile technologies.

METHODOLOGY

This study investigated 2G mobile service users in China and their intentions to adopt 3G mobile services. Because respondents had not used 3G services before, it was necessary to introduce 3G data services for them in the survey.

Accordingly, face-to-face interview was a better choice for this study. Before the formal survey, a pilot study (including with about 30 users and 10 industrial experts) was conducted to extract and validate the measurements.

Instrument Development

As discussed above, little research focuses usage experience with predecessor technology, so it was reasonable to develop the scale for usage experience from its analogical term, prior experience. After reviewing some related research (Kim et al., 2007; Ozer, 2011; Raju et al. 1995; Venkatesh et al., 2003), we found three dimensions were very important to construct usage experience: depth, breadth, and frequency. In our study, the three measures are respectively defined as how much money and/or time they have spent on 2G data services, how many types of 2G data services they have used, and how frequently they have used 2G data services. However, only two indicators (see Table 1) remained to measure usage experience in the final survey, based on the following considerations. First, in pilot study most respondents provided the feedback that it was very difficult for them to recall how frequently they have used each mobile service and how much time in total they have spent on data services. Second, Koivumaki et al. (2006) concluded that the time spent on mobile services does not affect the perception of mobile services. Third, both breadth and depth (only refer to how much money they have spent on 2G data services, similarly hereinafter) are more objective data than the other two. As already noted, usage experience can be measured by the amount of purchasing or usage experience with the product or service (Brucks, 1985; Raju et al., 1995), so how much money they spent on data services could measure usage experience.

Because perceived values of mobile service have different measurement approaches in mobile services research, it is necessary to summarize them and demonstrate that a comprehensive and valid instrument was used.

The original scales of perceived usefulness built by Davis (1989) are task oriented. However, the measurement of perceived usefulness in mobile services includes the following three categories of aspects:

- Social aspects such as enhancing effectiveness in communicating with family and friends (Pagani, 2004; Nysveen et al., 2005a).
- Working aspects such as improving work/study/transaction performance (Cheong and Park, 2005 Wang et al., 2006; Tan and Chou, 2008) and receiving useful information (Cheong and Park, 2005; Koivumaki et al., 2006).
- Everyday living aspect such as assisting my living (Kim et al, 2007), making my life easier (Koivumaki et al., 2006) and being effective and useful to life (Cheong and Park, 2005).

Perceived enjoyment refers to an emotional award such as pleasure and inherent satisfaction (Nysveen et al., 2005b), including two categories of aspects:

- Providing positive feelings such as fun, entertainment, pleasure, novelty, and excitement, and sharing these experience with others (Pagani, 2004; Cheong and Park, 2005; Nysveen et al., 2005a, b; Kim et al., 2007; Liao et al., 2007; Pihlstrom and Brush, 2008;Tan and Chou, 2008).
- Removing negative feeling such as boring (Kim et al., 2007; Liao et al., 2007), and killing time (Tan and Chou, 2008).

Finally, 14 items (see Table 1) were created to measure these two factors: 7 for perceived usefulness and 7 for perceived enjoyment. All these items follow 7-point Likert scale: from agree very strongly (7) to disagree very strongly (1).

The respondents had not used 3G or even never heard of it, so it's not feasible to directly ask them about intentions to use 3G mobile services, as Liao et al. (2007) did in their study. After interviews with 10 industrial experts, four critical data services including video call, VOD (video on demand), full-track music download, and high-speed internet were used to measure the adoption of 3G mobile services. In the study, respondents were asked how likely they will use those four services, from very likely to use (3) to unlikely to use (1).

Data Collection

The formal survey was conducted by a professional marketing research company in China. As a third party, the marketing research company played a neutral role, thus reducing the possible bias from respondents. In order to reduce coverage error and sampling error, a stratified multistage sampling technique was used. The sampling frame was monthly report provided by Ministry of Industry and Information Technology, PRC. In total, 6 cities in three areas were chosen to allow for better coverage of the population. In each city, several locations were chosen to conduct central location test to cover various types of population.

Those users who had already had 3G usage experiences in the past six months (may be they used 3G services when they travelled to other countries) or who were younger than 15 years old were not allowed to participate in the survey. The data collection was completed in 2 weeks. Finally, 1,700 usable responses were received. The ratio of cases to free parameters

(46) is 37:1, much greater than recommendation level. They had an average age of 31.8, with a standard deviation of 10.7, and 51.9% of them were male. In addition, 72.4% of them were employed, 20% of them were students, and the others were unemployed or retired.

On average, they spent about 28 RMB (about 4 US dollars) per month with a standard deviation of 40 RMB (about 7 US dollars) on 2G data services, and used 2.5 types of data services with a standard deviation of 2.08. Their usage breadth and depth displayed long right-tail distribution; therefore, the two indicators were recorded into new variables with Likert 7-point scale according to their means and standard deviations.

RESULTS

It is recommended to split a half of sample randomly to conduct factor analysis to test measurement model and the other half to verify the structured model (Chen and Jiang, 2006; Marsh, Balla and McDonald, 1988). This study summarized and combined some items from prior research, so it is better to conduct exploratory factor analysis. After conducting the step several times, 6 of 20 items were removed due to their high cross-loading or low factor-loading. The four factors were extracted from the remaining 14 items, and explained 63.3% of total variance. Then confirmatory factor analysis was conducted by LISREL 8.70 to validate the four constructs.

Factors	Items	Factor loadings
USE: Perceived Usefulness	USE1: Facilitate my study or work	.677
	USE2: Assist my living	.813
	USE3: Let me work or study more efficiently	.745
	USE4: Strengthen communication with others	.711
	^USE5: Help me attain news or information quickly	
	^USE6: Organize my life more efficiently	
	^USE7: Improve social relationship in my circle	
ENJ: Perceived Enjoyment	ENJ1: Bring me some entertaining experience	.719
	ENJ2: Let me feel relaxed and pleased	.755
	ENJ3: Share my enjoyments with others	.713
	ENJ4: Satisfy my desire of pursuing novelty	.761
	^ENJ5: Bring fun from my living	
	^ENJ6: Dispel my loneliness when I'm alone	
	^ENJ7: Let my time for boredom elapse quickly	
EXP: Usage Experience	EXP1: How many types of mobile services I have used	.733
	EXP2: How much spent on mobile services monthly	.847
INT: Intentions to Adopt New Successive Product	INT1: How likely I will use video call	.678
	INT2: How likely I will use video on demand	.763
	INT3: How likely I will use full-track music download	.752
	INT4: How likely I will use mobile high-speed internet	.669

^ denotes the items were eliminated in factor analysis.
All statement of 14 items for the first two factors began with "using mobile services can"

Table 1. Factors, Items, and Factor Loadings

Fit Indices of the measurement model (χ^2 (71) =261.79) were as follows: χ^2/df =3.69, SRMR =.039, RMSEA = .056, NFI = .94, CFI = .96, GFI = .96, AFGI = 0.94, RFI = .93. All of them reached the recommended thresholds, demonstrating a good measurement model. Furthermore, discriminant and convergent validities, and reliability were examined. As shown in Table

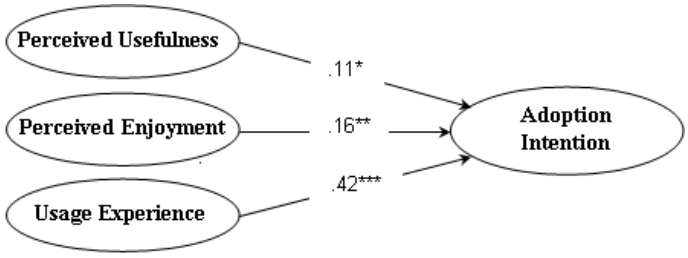
2, square root of AVE (diagonal elements) for each construct is greater than the correlations (off-diagonal elements) between this construct and other constructs, adequately indicating discriminant validity (Chin, 1998). Composite reliability of each factor is greater than .7, demonstrating good measurement reliability for constructs (Gefen et al., 2000). As known in Table 1, all factor loadings were greater than .60, adequately indicating convergent validity (Chin, Gopal and Salisbury, 1997).

					Correlations			
Factors	Mean	SD	CR	AVE	ENJ	USE	EXP	WILL
ENJ	4.83	1.17	.83	.55	.74			
USE	5.74	.98	.83	.54	.53***	.74		
EXP	3.30	1.60	.77	.63	.25**	.09*	.79	
INT	2.28	.58	.88	.52	.34**	.24**	.46***	.72

SD = standard deviations, CR = composite reliability; AVE = average variance extracted
Diagonal elements display the square root of AVE
***: significant at α=.001; **: significant at α=.01; *: significant at α=.05.

Table 2. Descriptive Statistics, Reliability, AVE, and Construct Correlation Matrix

The structural model depicted in Figure 2 was also tested. Fit indices of the structural model (χ^2 (71) =288.91) were as follows: χ^2/df =4.06, SRMR =.037, RMSEA = .060, NFI = .94, CFI = .96, GFI = .95, AFGI = 0.93, RFI = .92. All these indices reached acceptable level, demonstrating a high goodness-of-fit. Venkatesh et al. (2003) examined eight IT acceptance models, and found they explained between 17% and 42% of the variance in user adoption. In this study, R^2 (the amount of variance explained) in the structural model was .27, so it is still acceptable, especially for the model with only three exogenous constructs.



***: significant at α=.001; **: significant at α=.01; *: significant at α=.05.

Figure 2. The Structural Model

As depicted in Figure 2, the standardized path coefficients for USE→ INT, ENJ → INT, and EXP → INT were .16 (p-value = .006), .11 (p-value = .044), and .42 (p-value = .000) respectively. Therefore, H_1, H_2, and H_3 were supported. Among the three determinants, usage experience was the strongest determinant for intentions to adopt new successive mobile services.

DISCUSSION

Even though usage experience has been ignored in the adoption of successive ICT products, this study confirms the crucial role of usage experience in the adoption of successive ICT products. Furthermore, compared with the perceived values, usage experience is a much stronger determinant for intentions to adopt new successive mobile services. Moreover, customers with high usage experience have higher intentions to adopt future mobile services or technologies than those with low usage experience. Although drawn from mobile services, our conclusions could be extended to other ICT products because mobile service is a typical ICT product.

The findings on ICT can contribute to the research and practice of new product development and innovation. Most studies estimate new product failure rates at 50% or more. One of the most important reasons is that product developers mainly focus on technical elements, while ignoring customers' usage experience and its derivative issues such as product continuity and familiarity (Garcia and Calantone, 2002). Actually, the skills attained in usage are users' social or professional capital and usage habits developed from prior usage are difficult to change. If a successive product is radically innovated, users will not only lose their social capital and change their habits, but also spend time and/or money on relearning how to use it. Consequently, the adoption rate will be very low. In sum, a better understanding of customers' usage experience with prior versions can guide new product development, especially for successive generations of ICT products. The findings also point to proper timing of new product introduction. Nowadays, the time interval between two continuous generations of products is reducing sharply. However, neglecting whether users have acquired adequate skills in the use of predecessor products before new products are introduced may result in a low adoption rate, or even total failure in markets. Therefore, keeping track of users' usage skills attained in prior version could help companies decide on most appropriate opportunities to launch their new generation of products. Combining the above, another good implication is that if a successive product has to be launched before a ripe opportunity, it will be wise to choose incremental innovation, and/or proffer sufficient guidance and support. Furthermore, the findings can improve marketing strategies for new successive products through differentiating customers according to their usage skills and providing differentiated marketing for customers with different usage experience.

From a research perspective, this study has pinpointed that usage experience is important and calls for more attention and awareness among information system researchers on the role of usage experience in the adoption of successive generations of products. We studied one product and this finding has to be tested in other products as well. Research should also determine the best ways to measure usage experience. Usage experience evaluation and measurement may vary among different products and this has to be determined. The data was collected in China, which is a large ICT market and can be seen as representative. However, there could be cultural differences and the role of usage experience should be tested in other countries. Moreover, three mechanisms were raised to illustrate how usage experience influences adoption intentions in successive ICT products. However, it is unclear which one is the dominant or true illustration. Therefore, a host of related constructs such as social capital, cognitive/emotional effort, actual competence with technology, and product continuity have to be measured in future research. Overall, future research should examine the role of usage experience in other ICT products, create a comprehensive indicator to measure usage experience, explore or verify the best mechanism to illustrate the influence of usage experience, and introduce other determinants in the model to further verify the role of usage experience.

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