

## **THE EFFECT OF NETWORK EXTERNALITIES ON THE PERCEPTION OF A NEW SERVICE OFFERING: MOBILE BANKING**

Soo Yeong Ewe, Sunway University, Malaysia  
Sheau Fen Yap, Auckland University of Technology, New Zealand  
Christina Kwai Choi, Monash University Sunway Campus, Malaysia

### **ABSTRACT**

This study extends previous research by determining if potential adopters' perception of innovation characteristics mediates the effects of network externalities towards their intention to use mobile banking. The study also explores the possible moderating effects of technology anxiety between network externalities, innovation characteristics and intention to use mobile banking.

### **BACKGROUND**

Research on the adoption of innovation has established the importance of the characteristics of innovation; in particular, Roger's (1995) five characteristics of innovation, namely relative advantage, compatibility, complexity, trialability and observability (e.g. Agarwal and Prasad, 1997; Moore and Benbasat, 1991; Van Slyke, Ilic, Lou and Stafford, 2007). This study seeks to extend our understanding of innovation adoption by examining the effect of network externalities (NE) on the perception of innovation characteristics and adoption. Specifically, this study addresses three research questions: Does NE contribute to a consumer's perception of these innovation characteristics? To what extent does perception of innovation characteristics mediate the effects of NE on intention to use mobile banking? How does technology anxiety influence the relationship between NE, innovation characteristics and intention to use mobile banking? This research is set in Malaysia, a developing nation with a modern economy. Although mobile technology significantly impacts a bank's operational efficiency, and improves value delivery and customer service (Luarn & Lin, 2005), the adoption of mobile banking in developing nations is slow. Results from this research should highlight the reasons for the lack of interest to adopt mobile banking.

This study is informed by two theories – network externalities and the diffusion of innovation. NE is an Economic theory that has been defined as a change in the benefit that an agent (i.e. a consumer) derives from a good when the number of other agents (i.e. other consumers) consuming the same kind of good changes (Liebowitz and Margolis, 1994). NE can be categorized as direct (i.e., perceived number of users) and indirect (i.e., perceived availability of complementary service). Direct NE exist when an increase in the number of users have a direct effect on the perceived quality of the product or service and indirect NE exist when the utility of the users increase due to the availability of complementary products (Katz and Shapiro, 1986).

The diffusion of innovation theory explains why and how fast a new technology or idea diffuses among the members of a social system (Roger, 1995). The theory purports that

the perceived characteristics of an innovation are important determinants of the rate of adoption of an innovation. A meta-analysis by Tornatzky and Klein (1982) suggests that among the five innovation characteristics established by Rogers (1995), relative advantage, complexity and compatibility have the most consistent significant relationship with intention to use across a broad range of innovations. Therefore, this research focuses on these three innovation characteristics:

**Perceived relative advantage** is the degree to which an innovation is perceived as being better than the idea it supersedes (Rogers, 1995).

**Perceived complexity** is the perception of the extent to which an innovation is relatively difficult to understand and use (Rogers, 1995).

**Perceived compatibility** is the degree to which an innovation is perceived to be consistent with the existing values, past experiences and needs of the potential adopters (Rogers, 1995).

While there is much evidence that innovation characteristics influence the adoption of new technology (e.g. Agarwal and Prasad, 1997; Van Slyke et al., 2007), a gap exist in our understanding of whether network externalities act as an antecedent of consumer perceptions of innovation characteristics, and whether these innovation characteristics mediate the effect of NE on the intention to adopt new technology.

## CONCEPTUAL FRAMEWORK

In this study, we propose that network externalities are significant antecedents of three dimensions of innovation characteristics. Specifically, the purpose of the hypothesized model is to empirically examine the direct relationship between the perceived number of users and perceived availability of complementary service. It also examines the impact of perceived availability of complementary service on three dimensions of innovation characteristics (relative advantage, complexity and compatibility).

Based on theoretical rationale of previous studies (e.g. Shurmer, 1993; Smallwood & Conlisk, 1979), we expect that a positive perception of the availability of complementary services will lead to positive attitudes about its relative advantage and compatibility; in turn, this favourable perception will increase their adoption intent. Further, the perception that there are more complementary services available will negatively influence belief regarding the complexity of mobile banking, and consequently affect the intention to use mobile banking.

Technology anxiety is defined as the feelings of apprehension that one experiences when using technology (Compeau and Huff, 1999). Igarria and Iivari (1995) argue that individuals who experience high level of technology anxiety are likely to behave more rigidly, and hence may have lower intention to use mobile banking compared to those with lower technology anxiety. As mobile banking is new and explicitly a payment-related technology, technology anxiety may play a moderating role that dilutes the influence of NE and consumers' perceptions of innovation characteristics on their intent to use.

Figure 1 depicts the theoretical model that incorporates the moderating role of technology anxiety and the mediating effects of innovation characteristics on the relationship between NE and the intention to adopt mobile banking.

"Insert Figure 1 about here"

## RESEARCH METHOD

All measurement items employed in this study were adapted from past studies and proven to have sound psychometric quality. Seven-point Likert-type scales were used to measure responses of all scale items. Expert judges evaluated the items in order to enhance the face validity of the research instrument. In addition, the instrument was pre-tested among university employees and students ( $N = 50$ ). The final questionnaire was administered to bank customers with at least one regular bank account and a mobile phone. After explaining the purpose of the survey, and upon the respondent's consent to participate in the survey, the questionnaire was personally administered to reduce non-response bias.

## RESULTS

The results were analyzed using 368 completed questionnaires. The questionnaires were almost equally distributed between male and female respondents, with males slightly more than females. The majority of respondents were young people between the ages of 20 to 29 years old, representing the main group of mobile phone users and potentially the most important target segment for mobile banking.

A two-step approach was adopted for measurement scale validation and structural analysis using structural equation modeling (Anderson and Gerbing, 1988). The measurement model suggest that there is adequate evidence of convergent and discriminant validity. The structural model testing revealed a satisfactorily fit model ( $\text{Chi-square} = 841.654$ ,  $\text{CFI} = 0.928$ ,  $\text{TLI} = 0.920$ ,  $\text{RMSEA} = 0.068$ ). Alternative model testing revealed that the partial mediator model provided the best overall fit to the data compared to the rival model (i.e., full mediator model and direct effect model). Hence, the partial mediator model was used for hypotheses testing.

Overall, the path estimate revealed that: (a) Direct NE i.e., the perceived number of users positively influence the perceptions of availability of complementary service; (b) Indirect NE i.e., perceptions of the availability of complementary service positively influence the intention to use mobile banking service; and (c) Perception of availability of complementary service is related to each of the innovation characteristics; however, only perceived complexity and perceived compatibility significantly predict the intention to use mobile banking.

In order to test for mediation effects, three different structural relationships for each innovation characteristic were compared using a nested model approach (Anderson and Gerbing, 1988). The finding suggests innovation characteristics, that is, perceived relative advantage, perceived complexity, and perceived compatibility, play a partial mediator

role between perceived availability of complementary service and intention to use mobile banking. Finally, the moderating effect of technology anxiety on the postulated relationships specified was analyzed using multi-group analysis. Contrary to our expectation, technology anxiety did not moderate any of the relationships specified in the structural model.

## DISCUSSION AND IMPLICATIONS

This study provides a preliminary theoretical framework drawn from economics and marketing to examine the observed variations in the influence of NE in mobile banking. The investigation of the relationship between the antecedents and consequences in the hypothesized model, together with an understanding of how strong these relationships are, fills a knowledge gap regarding the adoption intent of mobile banking in Malaysia.

The results revealed that the perceived number of users had a significant positive impact on the perceived availability of complementary services. Further, the findings add to the existing literature by proposing the importance of NE as an essential antecedent of innovation characteristics which influences the adoption of an innovation. Bank marketers should account for the impact of NE in their marketing strategies.

Among the three dimensions of innovation characteristics, perceived compatibility seems to exert the strongest impact on the intention to use mobile banking, and perceived relative advantage has the least impact on intention to use mobile banking. These findings suggest that instead of communicating the advantages of mobile banking service, banks should communicate the compatibility of mobile banking with current lifestyles, values, and past banking experiences.

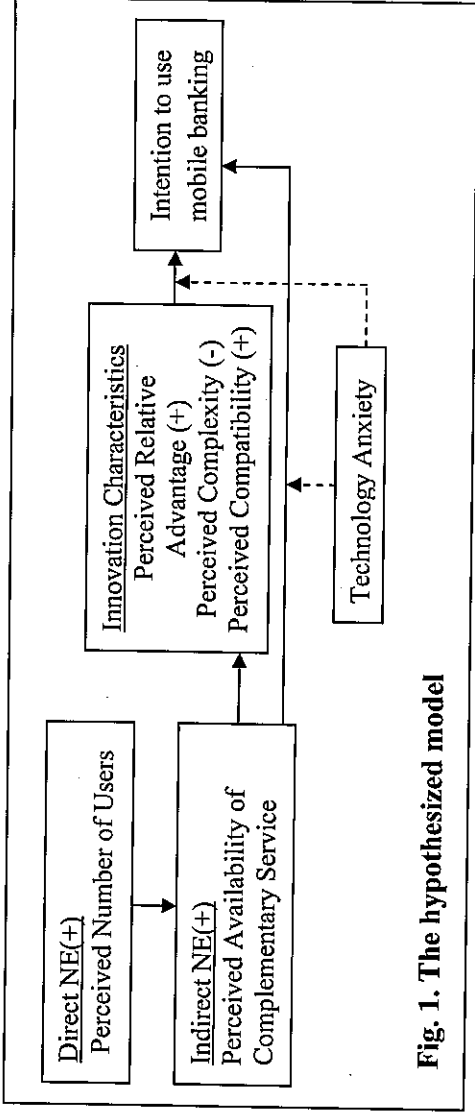
Contrary to past research which suggest the importance of technology anxiety in the adoption of new technological products, this study did not find any significant relationship between technology anxiety and NE, perceived innovation characteristics and intention to use mobile banking. This result is likely to be due to our research context, mobile banking, which is probably not considered to be highly technological in nature. Future research would need to examine this relationship using other different contexts to understand the role of technology anxiety within this theoretical model. In addition, extending the theoretical model to other contexts will enhance its generalizability.

## REFERENCES

- Agarwal, R., & Prasad, J. (1997). The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies. *Decision Sciences*, 28 (3), 557-582.
- Anderson, J. C., & Gerbing, D. W. (1988). Structural Equation Modeling in Practice: A Review and Recommended Two-step Approach. *Psychological Bulletin*, 103 (3), 411-423.

- Compeau, D. H., & Huff, S. (1999). Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study. *MIS Quarterly*, 23 (2), 145-158.
- Igarria, M., & Ivari, J. (1995). The Effects of Self-efficacy on Computer Usage. *Omega, International Journal of Management Science*, 23 (6), 587-605.
- Katz, M., & Shapiro, C. (1986). Technology Adoption in the Presence of Network Externalities. *The Journal of Political Economy*, 94 (4), 822-841.
- Liebowitz, S., & Margolis, S. E. (1994). Network Externality: An Uncommon Tragedy. *The Journal of Economic Perspectives*, 8 (No. 2), 133-150.
- Luarn, P., & Lin, H. H. (2005). Toward an Understanding of the Behavioral Intention to Use Mobile Banking. *Computers in Human Behavior*, 21, 873-891.
- Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, 2 (3), 192-221.
- Rogers, E. (1995). *Diffusion of Innovations*. New York: The Free Press.
- Shurner, M. (1993). An Investigation into Sources of Network Externalities in the Packaged PC Software Market. *Information Economics and Policy*, 5 (3), 231-251.
- Smallwood, D., & Conlisk, J. (1979). Product Quality in Markets Where Consumers are Imperfectly Informed. *Quarterly Journal of Economics*, 93 (1), 1-23.
- Tornatzky, L., & Klein, R. (1982). Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings. *IEEE Transactions on Engineering Management*, EM-29, 28-45.
- Van Slyke, C., Ilie, V., Lou, H., & Stafford, T. (2007). Perceived Critical Mass and the Adoption of a Communication Technology. *European Journal of Information Systems*, 16, 270-283.

**FIGURE**



**Fig. 1. The hypothesized model**