A SEM-neural network approach for predicting antecedents of m-commerce acceptance

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ABSTRACT

Higher penetration of powerful mobile devices – especially smartphones – and high-speed mobile internet access are leading to better offer and higher levels of usage of these devices in commercial activities, especially among young generations. The purpose of this paper is to determine the key factors that influence consumers’ adoption of mobile commerce. The extended model incorporates basic TAM predictors, such as perceived usefulness and perceived ease of use, but also several external variables, such as trust, mobility, customization and customer involvement. Data was collected from 224 m-commerce consumers. First, structural equation modeling (SEM) was used to determine which variables had significant influence on m-commerce adoption. In a second phase, the neural network model was used to rank the relative influence of significant predictors obtained from SEM. The results showed that customization and customer involvement are the strongest antecedents of the intention to use m-commerce. The study results will be useful for m-commerce providers in formulating optimal marketing strategies to attract new consumers.

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1. Introduction

The rapid advancements in mobile technologies have stimulated higher penetration of mobile devices and the growth of its use in various areas of our lives (Dai & Palvia, 2009). The number of mobile phone subscribers is well above the number of fixed-line Internet users. Mobile penetration, i.e. the number of mobile subscriptions per 100 inhabitants, on global level stands at 96.4% (International Telecommunication Union, 2014), but it is much higher in developed countries (125.8%), where it is reaching saturation. Modern mobile devices, especially smartphones and tablets, are no longer used only for voice communication, but as complex communication devices which enable wireless Internet access, high-speed data transfer and numerous services, including rich multimedia and financial applications. For example, in developing countries, mobile phones are often the first-access device to the Internet (Nielsen, 2014).

Mobile commerce is defined as the buying and selling of goods and services through mobile devices via wireless networks (Chong, 2013a) and it is one of the fastest growing businesses today. Although often considered as an extension of e-commerce (Chong, Chan, & Ooi, 2012), m-commerce has some advantages over its predecessor, since users may conduct transactions on the Internet at any time, from anywhere. Also, it offers completely new possibilities, like location-based services. As eMarketer (2014) predicts, U.S. retail m-commerce sales (sales of digital goods, excluding sales of travel services and event and movie tickets) in 2018 will reach $132 billion, which is double of the estimates for 2014.

Despite the strong potential of mobile commerce, the actual level of such activities remains low, especially in developing countries (Bhatti, 2007; Chong, 2013c). Therefore, identification of the factors influencing the consumers’ intention to use mobile commerce applications is very important, as it would help m-commerce providers to create appropriate marketing strategies, leading to higher m-commerce adoption rates (Chan and Chong, 2012; Wei, Marthandan, Chong, Ooi, & Arumugam, 2009; Wu and Wang, 2005).

The present study fills the existing research gap by developing a new research model used for the prediction of consumers’ behavior and examination of key elements that influence the decision to use m-commerce. The originality of the model is based on the fact that it consists not only of well-known predictors of new technology adoption, like perceived usefulness, perceived ease of use and trust, but also includes variables like mobility, customization and customer involvement, whose influence on m-commerce adoption is examined in a very limited number of studies. In line with that, the main objectives of the study are to determine the most significant factors influencing m-commerce adoption and their relative
importance. One of the main drawbacks of conventional statistical techniques used for the prediction of consumers’ behavior is that they usually examine only linear relations among variables. In order to overcome this problem, relative importance of significant variables will be determined using neural networks, capable to model complex non-linear relationships.

The paper is structured as follows: Section 2 introduces the literature review of similar studies on m-commerce adoption. Section 3 outlines proposed hypotheses and research model. Section 4 details the used methodology, while Section 5 presents data analysis and the research results. In Section 6, we discuss various implications of the obtained results. Finally, in Section 7, we explain the main limitations of our study and potential steps for further research.

2. Literature review

The analysis of consumer behavior and determinants influencing their decision to adopt new technology, like m-commerce, is usually performed using some of the well-known traditional theories on technology adoption, such as the technology acceptance model (TAM), diffusion of innovation (DOI), task-technology fit (TTF), and unified theory of acceptance and use of technology (UTAUT). TAM, as one of the most common models, was proposed by Davis (1989) and it is an adaptation of the theory of reasoned action (Fishbein & Ajzen, 1975). Although it is well-established as a powerful and robust model for predicting user acceptance (Zhang, Zhu, & Liu, 2012), it is often considered incomplete (Brown & Venkatesh, 2005; Davis, 1989; Lu, Yao, & Yu, 2005). In order to better explain and predict consumer behavior, several studies have suggested that it should be extended with additional constructs (Chong et al., 2012; Wei et al., 2009; Wu & Wang, 2005).

Unlike the traditional TAM, where two of its crucial beliefs – perceived usefulness and perceived ease of use – are used as mediators between external variables and outputs (attitude towards use and/or behavioral intention), this study analyzes the direct effect of external factors on behavioral intention. Several previous studies support this attitude. For example, Wei et al. (2009), while analyzing the drivers of m-commerce adoption in Malaysia, used two TAM predictors (perceived usefulness and perceived ease of use) and added direct influence of new variables – social influence, trust and perceived cost – on consumer intention to use m-commerce. They reported that the most important adoption factors were perceived usefulness and trust. Wu and Wang (2005) added perceived risk, cost and compatibility and found compatibility and perceived usefulness as the most significant antecedents.

In the study of mobile ticketing services adoption, Mallat, Rossi, Tuunainen, and Oorni, 2008 added nine more predictors and found prior experience, compatibility and social influence as the most significant ones. Zarmpou et al. (2012) analyzed the acceptance of mobile services, and extended the model with the following variables: functionality, trust, innovativeness and relationship drivers. The results showed that the most significant predictors were innovativeness and perceived usefulness, while no significant direct influences of perceived ease of use and trust on behavioral intention were found. Tan, Ooi, Chong, and Hew, 2014 studied the determinants of NFC-based mobile credit card adoption by extending TAM constructs with new variables: social influence, personal innovativeness, perceived risk and cost, and found that personal innovativeness and perceived ease of use were the strongest predictors.

Chong et al. (2012) extended the model with trust, cost, social influence, variety of services and trialability as additional direct antecedents of intention to adopt m-commerce. They reported that the most significant factors influencing Malaysian consumers were variety of services, trust and social influence, while in the case of Chinese consumers, it was trust, social influence and cost. In the cross-cultural study of m-commerce acceptance, Dai and Palvia (2009) added eight more variables, and found that perceived usefulness and subjective norm had the most important influence on intention to use m-commerce in China, compared to perceived enjoyment and compatibility in the United States. Chong (2013b) extended basic TAM beliefs with perceived enjoyment, trust, cost, network influence and variety of services, and reported that the most influential on m-commerce adoption were network influence and trust.

In meta-analysis of numerous studies, Zhang et al. (2012) analyzed the influence of the ten most frequent predictors on behavioral intention to adopt m-commerce and reported perceived enjoyment and subjective norm as the most significant. Chemingui andallahoua (2013) also found perceived enjoyment as the most significant predictor of behavioral intention to adopt mobile financial services.

3. Development of hypotheses

Behavioral intention is often found as the best predictor of behavior, i.e. actual use of new technology (Zhang et al., 2012), and represents a central concept of both TAM (Davis, 1989) and UTAUT (Venkatesh, Morris, Davis, & Davis, 2003a) models. In the m-commerce context, behavioral intention may be defined as a consumer’s subjective probability that he/she will use mobile commerce (Zarmpou, Saprikis, Markos, & Vlachopoulou, 2012). Since m-commerce is still in its early stage of implementation, especially in developing countries, we decided, like in similar studies (Chong et al., 2012; Dai and Palvia, 2009; Wei et al., 2009; Zarmpou et al., 2012), to examine not the actual use but the behavioral intention to adopt m-commerce.

3.1. Perceived usefulness

Perceived usefulness, as one of the original TAM variables, is constantly found to have significant influence on new technology acceptance. It is usually considered as “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989; p 320). In the m-commerce context, Wei et al. (2009) defined it as the extent to which a consumer believes that, while using m-commerce, his or her job performance and daily activities will be improved. Compared to other important TAM construct – perceived ease of use – perceived usefulness usually has a stronger influence on new technology adoption (Davis, 1989). Chong (2013b) stressed the opinion that consumers will accept some new technology such as m-commerce only if they find it to be more useful than its alternatives, such as e-commerce.

Perceived usefulness was examined as a predictor of new technology acceptance in various areas, such as m-payment (Kim, Mirusmonov, & Lee, 2010; Liebana-Cabanillas, Sanchez-Fernandez, & Munoz-Leiva, 2014a; Schiertz, Schilke, & Wirtz, 2010; Shin, 2009), Internet banking (Cheng, Lam, & Yeung, 2006; Chong, Ooi, Lin, & Tan, 2010; Pikkarainen, Pikkarainen, Karjaluoto, & Pahnila, 2004), mobile Internet (Kim, Chan, & Gupta, 2007) and m-services (Mallat, Rossi, Tuunainen, & Oorni, 2009; Zarmpou et al., 2012). Wei et al. (2009) found perceived usefulness as the most significant of five examined predictors of intention to use m-commerce in Malaysia. Also, Ko, Kim, and Lee, 2009 reported perceived usefulness as a strong antecedent of intention to adopt mobile shopping in Korea. Liebana-Cabanillas, Sanchez-Fernandez, and Munoz-Leiva, 2014b found that the impact of perceived usefulness on intention to use mobile payment is significantly higher among men than among women, and that usefulness had no statistically significant effect on intention to use among women. Analyzing different m-commerce usage activities, Chong (2013c) and Chan and Chong (2013) found that perceived usefulness had significant influence on content delivery, transaction-based and entertainment activities,
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