



Key determinants of sustainable smartcard payment



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ABSTRACT

This paper aims at examining the sustainability of smartcard payment in retailing and consumer services. The analytical results of our survey data suggest that usefulness, ease of use, convenience, automatic add-value service, security, reliability, and participation of popular service providers have considerable effects on continuous use of smartcard payment. The present work empirically identifies and justifies the key determinants of sustainable smartcard payment from the consumer perspective. The findings provide managerial insights for the implementation of cutting-edge technology to enhance sales and service operations and make important contributions to research and practice in technology-based service innovation and service operations management.

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1. Introduction

The implementation of advanced technology is of importance to the enhancement of retail service operations at the point of sales (Pantano, 2010; Pantano and Naccarato, 2010). The innovative smartcard systems carrying the brand of Octopus have been customized to support micro-payments for a variety of products and services in the retail sector of Hong Kong. The systems support various service providers to simultaneously share an integrated information technology infrastructure, which possesses the capacities of executing a large number of transactions and settling high-frequency micro-payments involving a relatively small amount of money value. According to the latest statistics (Octopus, 2013), 95% of Hong Kong people who are aged 16–65 have Octopus smartcards, and over 23 million smartcards are in circulation. The smartcard systems facilitate an average of more than 12 million transactions a day with value at greater than HK\$130 million. The present smartcard network includes 5,400 service providers and 12,000 outlets ranging from supermarkets, convenience stores, restaurants, cafes, and vending machines, to leisure facilities, with many other service providers being interested in implementing the smartcard systems together with the relevant devices to support their services and business operations.

Smartcard payment can be considered as a clearly defined case that has achieved market success as a technology-based service innovation, which has been evolved and developed with the

advancement of radio frequency identification technology. The smartcard is a stored value card, which has a built-in antenna and an integrated circuit for processing transactions data. In addition, a card reader installed at a retail outlet is connected to the backend systems, which can promptly process transactions data. When a smartcard is placed on a card reader at a point of sales, the card reader immediately deducts the relevant amount from the stored value of the smartcard. Previous studies show that convenience of remote execution is an immediately striking feature of smartcard (Cooper et al., 1996). In addition, usefulness, ease of use, and reliability are important factors that influence consumer acceptance (Davis and Mitchell, 1996). However, novelty is insufficient to explain consumer adoption of a technology-based service (Plouffe et al., 2000, 2001). In particular, reliability and security are critical, because consumers are concerned about risk and uncertainty in payment (Shelfer and Procaccino, 2002). There is little doubt that smartcard payment is a particular form of technology-based service, which especially involves transactions and service elements at the point of sales. Thus, it is worthwhile to examine the relevant attributes in association with consumers' use of smartcard payment. However, there is limited empirical work with regard to smartcard payment at the point of sales in retail markets and services.

This paper aims at examining the sustainability of smartcard payment in retailing and consumer services. We design a multi-attribute model in line with the theoretical underpinnings of technology acceptance and service quality. The reasoning of the theories of bounded rationality (Simon, 1972) suggests that it is necessary to focus on a core subset variables with respect to the context of smartcard payment. Thus, we propose relevant

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hypotheses in light of the background of smartcard payment. In addition, we collect survey data from individual consumers to test the hypotheses. The present empirical work makes important contributions to research and practice, because it enhances the understanding of consumer behavior regarding the use of smartcard payment in retailing and consumer services. The empirically-grounded findings to be presented in the following sections identify the key determinants that influence consumers' continuous use of smartcard payment, and examine the major considerations of smartcard payment in retail services. The findings also provide managerial insights for implementing advanced technology to facilitate retail service operations in different contexts. This paper begins with theoretical background and hypotheses. In addition, it explains our research method and presents the empirical results. Moreover, it discusses the findings and implications. Lastly, it summarizes the present work and provides suggestions for future research.

2. Theoretical background and hypotheses

2.1. Theoretical background

The technology acceptance model (TAM) (Davis, 1989) and SERVQUAL (Parasuraman et al., 1988) lay theoretical foundations for the present study. In addition, the theories of bounded rationality (Simon, 1972) provide a systematic reasoning for concentrating on core variables to examine the determinants of smartcard payment. Drawing the relevant theoretical underpinnings, we construct a multi-attribute model and propose ten hypotheses to examine consumer use of smartcard payment in retail markets and services.

As an information system theory, TAM aims at examining how users accept and use information systems (Davis, 1989; Davis et al., 1989), which has two key measures—perceived usefulness and perceived ease of use. It is an extension of the theory of reasoned action (TRA) (Ajzen and Fishbein, 1980). The previous works show that TAM has been applied to examine the adoption and use of information systems and technological innovations in a variety of situations, while the users are assumed to be cognitive and rational decision makers. TAM serves as a theoretical foundation for examining the antecedents and phenomenon of technology adoption (Taylor and Todd, 1995). Numerous studies reveal empirical evidence on the relationships between perceived usefulness, perceived ease of use, and system usage (e.g., Mafé and Blas (2007), Liao and Shi (2009), Müller-Seitz et al. (2009), Baier and Stüber (2010), Domina et al. (2012), Truong (2013)). Apart from the antecedents like usefulness and ease of use, the existing works incorporate other factors to explore consumer adoption of service innovations. This is because usefulness and ease of use are insufficient to produce comprehensive understanding of different types of technology-based service innovations. It has been recognized that situational factors in association with a particular technology-based service innovation must be consistently examined (Dabholkar and Bagozzi, 2002; Dashac and Sajjbc, 2008).

As a systematic framework for the evaluation of service quality, SERVQUAL has been widely used to measure service quality in different contexts (Vazquez et al., 2001; Olsen and Skallerud, 2011). According to Parasuraman et al. (1988), SERVQUAL consists of a multiple-item scale. With regard to the development in online services, Zeithaml et al. (2002) review the knowledge in relation to service quality through websites. Parasuraman et al. (2005) suggest E-S-QUAL that is a multiple-item scale for examining electronic service quality. Despite the dimensions of SERVQUAL and E-S-QUAL could be employed to explore technology-based services, a simple application may result in incomplete findings

and limited insights. Therefore, it is necessary to cope with the contextual aspects of smartcard payment.

In line with the theoretical underpinnings of TAM and SERVQUAL, we formulate our multi-attribute model to examine smartcard payment from the consumer perspective. In particular, we integrate and blend TAM and SERVQUAL by extracting the most relevant antecedents to truly represent the phenomenon of smartcard payment in our model and hypotheses. Actually, it is imperative to explore the circumstances of smartcard payment in retail services in order to identify the specific contextual variables of smartcard payment. First, we clearly define the two antecedents of TAM such as usefulness and ease of use in line with the background of smartcard payment, when adapting these two attributes in our model. Second, we take contextual variables into account and customize measurements in association with smartcard payment with reference to SERVQUAL. In this study, consumers are assumed to have rational thinking and reasoned actions when using smartcard payment. We consistently examine service characteristics of smartcard payment to identify specific contextual variables and appropriate measures in formulation of our hypotheses. In particular, usefulness, ease of use, convenience, compact design, automatic add-value service, reliability, security, substitution capability, provision of incentives, and service provider participation are incorporated into our research model, because they are relevant to the use of smartcard payment in retail services. In the next subsection, we further discuss these dimensions and propose ten hypotheses to articulate their effects on continuous use of smartcard payment. In addition, we empirically test their effects using survey data based on a multi-attribute model to be illustrated in the section of research method.

Furthermore, the reasoning of theories of bounded rationality suggests that cost concomitant with the number of variables can be decreased if the opportunity set is rationally made smaller, and it works against efficiency if enhancement is sought in each and every dimension (Simon, 1972). In line with the theories of bounded rationality and the equilibrium approach to empirical analysis, consumer responses to our research questions can be interpreted as an operational proxy for continuous use of smartcard payment in practice. Thus, it is feasible to suggest a multi-attribute model to assess the implied causal relationships between the potential variables and continuous use, although the variables associated with the use of the smartcard present an *embarrass des richesses*. Given such a situation, substantial costs will be involved if enhancement is sought in each and every dimension. The reasoning of the theories of bounded rationality supports that the opportunity set could be made smaller if we concentrate on those core variables that influence continuous use of smartcard payment.

2.2. Hypothesis development

2.2.1. Usefulness

In the present study, usefulness refers to the extent to which the consumers believe that using the smartcard can enhance micro-payment efficiency in retail services, which is consistent with the main measure in technology adoption (Davis, 1989; Rogers, 1995; Dashac and Sajjbc, 2008; Müller-Seitz et al., 2009). In the context of smartcard, it is imperative to justify the benefit that consumers expect to gain from using smartcard payment and capture the extent to which the consumers view the innovation offering value over an efficient way of performing payment especially for small amount of transactions at point of sales. The smartcard systems have been recently implemented to facilitate sales and service operations and allow consumers to use smartcard payment. The consumers might repeatedly use the smartcard

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