Exploring the Factors Affecting Consumer Acceptance of Proximity M-Payment Services

Apostolos Giovanis, Androniki Kavoura, Ioannis Rizomyliotis, Sotiris Varelas, and Aspasia Vlachvei

Abstract The purpose of this study is to analyze the factors determining consumers' intentions to adopt NFC proximity mobile payment services (p-mps). An extended version of the Unified Theory of Acceptance and Use of Technology (UTAUT), a model that incorporates the most relevant theoretical approaches in the adoption literature was selected to investigate the consumers' adoption process. To empirically test the proposed model, data were collected from 513 consumers of mobile internet service providers in Greece and were analyzed using PLS. The results indicated that p-mps features, expressed by consumers' expectations about service performance and required efforts, along with the social context effects have the biggest impact on consumers' intentions to use the service, followed by channel characteristics, reflecting consumers' beliefs about p-mps usage risk and trust. Potential customers' characteristics moderating analysis suggested that the effects of performance expectancy and perceived trust on behavioral intentions are affected by gender, age and previous experience, while that of social influence only by potential customers' previous experience. Theoretical and managerial implications, limitations and suggestions for further research are provided at the end of the study.

Keywords M-payment · NFC p-mps adoption · UTAUT · Risk · Trust · Individual differences · Marketing financial self-service technologies

A. Giovanis (✉) · A. Kavoura
University of West Attica, Athens, Greece
e-mail: agiovanis@uniwa.gr

I. Rizomyliotis
University of Brighton, Brighton, UK

S. Varelas
Neapolis University of Pafos, Paphos, Cyprus

A. Vlachvei
Western Macedonia University of Applied Sciences, Kastoria, Greece

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1 Introduction

Mobile payment system (mps) is an emergent self-service technology (SST) offering payment services through mobile devices without locational and temporal restrictions [1, 2]. According to Gerpott and Meinert [3], there are two categories of mps: (a) Remote mps (hereafter r-mps), enabling payments through mobile telecommunication or Wi-Fi networks, and allow the payments for digital content or online purchases through SMS or mobile internet connection, (b) Proximity mps (hereafter p-mps), enabling payments through short-range communication technologies and allow for payments for purchases such as ticketing, vending, and point-of-sale items, employing a QRcode displayed on the smartphone, or a NFC (Near Field Communication) device or Bluetooth low energy (BLE) proximity sensing technology [3, 4]. This study focuses on NFC-enabled p-mps that has become important part of consumers' shopping experience due to the continuous advancements of the technology [3].

The study of the p-mps adoption and usage process has attracted significant attention from academics and practitioners over the last years. Yet consumers' adoption and usage of this m-service is characterized as a complex process due to interplay of many factors that are under-researched so far [2]. According to Adapa and Roy [5] and Frimpong et al. [6] there are technology-, social-, channel- and personal-related factors affecting consumer behavior towards SSTs usage intentions. Although, there are many studies that have used different well-known theoretical frameworks to investigate the adoption of p-mps, there aren't studies that have examined the interplay of all the aforementioned groups of factors in order to better understand the potential customers' decision making process, towards p-mps usage.

Thus, the purpose of this study is to identify the factors affecting the p-mps adoption process and the degree of influence of each factor leading p-mps usage intentions. Drawing on the studies of Adapa and Roy [5] and Frimpong et al. [6], four groups of innovation adoption drivers (i.e. innovation features; social context; channel credibility; and personal characteristics) mainly affect SST's usage intentions. Thus, the proposed modelling framework extends the UTAUT, proposed by Venkatesh et al. [7] and its constructs express the effects of technology-related and social-related factors, with potential users' perceived risk and trust, expressing the role of channel-related factors, and potential users' demographics in order to better predict the p-mps adoption intentions.

2 Literature Review and Proposed Model

There are several theoretical models which have been used to explain the adoption of SSTs. These models include the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), the Innovation Diffusion Theory (IDT), and the Unified Theory of Acceptance and Use of Technology Model (UTAUT) [4, 8, 9]. Focusing

on the p-mps context, the majority of the adoption studies use and support the TAM [10] and its extensions as a theoretical framework [11–16]. Despite the fact that the TAM and its extensions provide a reliable and valid modelling framework to investigate the technology adoption process, it has received a lot of criticism about its predictive ability for two reasons: Firstly, it considering two consumers' salient beliefs related to innovation's attributes (i.e. perceived usefulness and perceived ease of use), and no other external factors that might affect consumers' behavior; Secondly, it assuming that usage is volitional without constraints [7, 17].

To address these limitations Venkatesh et al. [7] proposed the UTAUT which integrates eight well established innovation adoption theoretical frameworks. The UTAUT includes three key constructs: performance expectancy (PE), effort expectancy (EE), social influence (SI) to model behavioral intentions (BI). The latter along with facilitating conditions (FC) predicts also usage behavior. These determinants are defined as follows [7, p. 447–453]: PE refers to "the degree to which a potential adopter has the opinion that the innovation adoption will help him to improve the performance of a task or work". EE refers to "the degree of ease associated with use of the innovation". SI is defined "as the degree to which an individual perceives that important others believe he or she should use the innovation" and reflects the normative drivers of the innovation adoption process. Finally, FC is defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (TPB, DTPB). The original UTAUT considers that PE, EE, and SI are antecedents of BI, while BI and FC are drivers of potential customers' actual behavior. Hence, this model assumes that the concept of "BI captures the motivational factors that affect the potential adopters' behavior and reflects the effort that they are willing to undertake in order to develop an action" [18]. This study does not consider the FC, as it investigates only potential consumers' intentions to adopt p-mps and not their actual behavior. These three variables represent the technology- and social-related variables motivating consumers to use an SST. Focusing in the context of p-mps there are three studies using UTAUT to investigate the adoption process in Malaysia, UK and USA [17, 19, 20]. All three studies support the significance of PE and BI, two of them found a significant effect of SI on BI [17, 20], and only one confirms the significance of EE on BI [19]. Lately, Slade et al. [8, 17] suggest the extension of UTAUT with perceived risk (PR) and perceived trust (PT) in order to consider the effects of SSTs' channel-related factors in the adoption process. PR in the context of SSTs expresses "the potential for loss in the pursuit of a desired outcome of using the service" [21]. PT, on the other hand, refers to potential customers' subjective belief that a service provider will fulfil its obligations [8]. Consumers often face spatial and temporal separation from their online providers and this makes them more vulnerable to greater risks as they do not have the full control of their action [8, 17]. Thus, trust in p-mps is essential to mitigate the uncertainty of m-payments to motivate the consumer to use it. Many previous studies in the field of m-services in general and mps in particular empirically validate the positive effect of PT and the negative effect of PR on BI. The studies of Slade et al. [8, 17] for example, suggest PR and PT to be included among the significant drivers of mps adoption in the UK.

Moreover, the UTAUT posits that the effects of these five constructs on BI are moderated by individual differences such as gender, age, and technology experience [7, 8, 22]. Among the three previous UTAUT studies in the context of p-mps, none of them considers the moderating role of personal factors in the adoption process. Thus, the use of the complete UTAUT is expected to provide a more comprehensive theoretical framework for predicting p-mps usage intentions and, further, better support the development of a differentiated marketing strategy towards the extension of p-mps adoption and usage. Based on the above discussion, PE, EE, SI, PR, and PT are theorized to influence behavioral intention to use a p-mps. Moreover, individual characteristics, such as gender, age, and previous experience are theorized to moderate the five previous direct relationships. Thus following the studies of Venkatesh et al. [7] and Slade et al. [8] it is hypothesized that:

H1 PE directly and positively affects BI
H2 EE directly and positively affects BI to adopt p-mps
H3 SI directly and positively affects BI to adopt p-mps
H4 PR directly and negatively affects BI to adopt p-mps
H5 PR directly and positively affects BI to adopt p-mps
H6 (a) Gender, (b) age and (c) experience moderate the positive effect of PE on BI to adopt p-mps, such that the effect will be stronger for younger males with high levels of technology experience
H7 (a) Gender, (b) age and (c) experience moderate the positive effect of EE on BI to adopt p-mps, such that the effect will be stronger for older females with low levels of technology experience
H8 (a) Gender, (b) age and (c) experience moderate the positive effect of SI on BI to adopt p-mps, such that the effect will be stronger for older males with low levels of technology experience
H9 (a) Gender, (b) age and (c) experience moderate the positive effect of PT on BI to adopt p-mps, such that the effect will be stronger for older females with limited experience of the technology
H10 (a) Gender, (b) age and (c) experience moderate the negative effect of PR on BI to adopt p-mps, such that the effect will be stronger for older females with limited experience of the technology

3 Research Methodology

To ensure the content validity of the scales used to measure the constructs of the proposed models, validated scale items from prior studies were used. As such, the scales proposed by Venkatesh et al. [22] were used to measure PE, EE, SI and BI, while those include in the study of Slade et al. [17] were used to measure PR and PT. All scale items were measured using a 7-point Likert scale with 1 corresponding to “strongly disagree” and 7 to “strongly agree”. A conclusive research design was selected in order to examine the relationships described in the conceptual framework. A convenience sampling was employed and a questionnaire was developed

and distributed to 600 individuals. This procedure resulted in 530 questionnaires. After eliminating those with unanswered items 513 questionnaires were coded for data analysis. The method of partial least squares (PLS) path methodology [23], an implementation of structural equation modeling (SEM) with Smart PLS 2.0 M3 [24], was used to examine the model and test the proposed hypotheses.

4 Results

Among the 513 survey participants 59.1% were male. In terms of age 29.6% were less than 24 years old; 30.6% were in the 25–34 age group; 19.1% were in the 35–44 age group and 20.7% were more than 45 years old. In terms of educational background 52% of the respondents have college degree or higher. The test of the measurement model involves the estimation of reliability; convergent validity, and discriminant validity of the extended UTAUT's constructs, indicating the strength of measures used to test the proposed model [23]. As shown in Table 1, all measures present high item reliability as all corresponding loadings values exceeds the cut-off value of 0.70. Composite Reliability (CR) values of all measures included in the study exceed 0.93 suggesting that all measures were good indicators of their respective components. Average Variance Extracted (AVE) values for all constructs exceed 0.77, higher than the recommended cut-off value of 0.50 [23] suggesting satisfactory convergent validity. Finally, the square roots of AVE for all first-order constructs, provided in the diagonal of the table, are higher than their shared variances providing strong evidence of discriminant validity among all first order constructs [23].

The PLS-PM method was also used to confirm the hypothesized relationships between the constructs in the proposed model. The significance of the paths included into the proposed model was tested using a bootstrap resample procedure. In assessing the PLS model, the squared multiple correlations (R^2) of the endogenous latent variable was initially examined and the significance of the structural paths was evaluated [23, 24]. The data analysis for the main effects model, depicted in Table 2a, indicates that all six hypotheses concerning the direct effects were confirmed. Significant positive relationships were yielded between PE and BI (confirming H1: $\beta = 0.31$), EE and BI (confirming H2: $\beta = 0.20$), SI and BI

Table 1 Measurement model assessment

LV	Loadings	AVE	CR	PE	EE	SI	PR	PT	ITU
PE	[0.85–0.90]	0.77	0.91	**0.88**					
EE	[0.86–0.97]	0.80	0.95	0.57	**0.89**				
SI	[0.93–0.97]	0.91	0.97	0.45	0.30	**0.95**			
PR	[0.88–0.93]	0.81	0.95	−0.35	−0.32	−0.25	**0.90**		
PT	[0.83–0.96]	0.82	0.93	0.51	0.41	0.47	−0.49	**0.91**	
ITU	[0.97–0.98]	0.95	0.98	0.66	0.56	0.52	−0.48	0.59	**0.97**

Table 2 Structural model and moderation analysis results

LV	Value	t-value	Sig.	LV	Male	Female	p-value
(a) Direct effects (pool sample)				(b) Moderating effects: gender			
PE	0.31^{***}	6.01	0.000	PE	0.35^{***}	0.24^{***}	**0.006**
EE	0.20^{***}	8.03	0.000	EE	0.19^{***}	0.18^{***}	0.673
SI	0.20^{***}	5.73	0.000	SI	0.20^{***}	0.20^{***}	0.885
PR	-0.17^{***}	−5.29	0.000	PR	-0.20^{***}	-0.16^{***}	0.282
PT	0.17^{***}	4.58	0.000	PT	0.09^{ns}	0.28^{***}	**0.000**
R^2	0.60			R^2	0.58	0.64	
LV	Young	Old	p-value	LV	High	Low	p-value
(c) Moderating effects: age				(d) Moderating effects: experience			
PE	0.36^{***}	0.24^{***}	**0.049**	PE	0.37^{***}	0.19^{***}	**0.013**
EE	0.15^{***}	0.22^{***}	0.207	EE	0.23^{***}	0.14^{***}	0.141
SI	0.23^{***}	0.15^{***}	0.153	SI	0.11^{**}	0.30^{***}	**0.001**
PR	-0.16^{***}	-0.19^{***}	0.677	PR	-0.15^{***}	-0.16^{***}	0.825
PT	0.09^{***}	0.31^{***}	**0.000**	PT	0.12^{**}	0.26^{***}	**0.049**
R^2	0.55	0.69		R^2	0.47	0.54	

(confirming H3: $\beta = 0.20$), and PT and BI (confirming H5: $\beta = 0.17$). Significant negative relationships were observed between PR and BI (confirming H4: $\beta = -0.17$). The five significant constructs explained 60% of variance in BI. Multigroup analysis [25] was used to investigate the moderating effects of individual differences on the relationships between adoption drivers and potential customer BI. As such, the pool sample separated in two groups of respondents according to their gender (male vs. females), age (young: $\leq$30 years vs. old: >30 years) and declared familiarity with m-commerce (high vs. low). As shown in Tables 2b, c, d the results suggest that gender, age and experience moderate the relationships between PE and BI (confirming H6a, H6b, H6c) and between PT and BI (confirming H9a, H9b, H9c), while experience also moderates the relationship between SI and BI (confirming H8c).

5 Discussion

The purpose of this study was to identify the factors influencing the adoption p-mps, and the degree of influence of each factors leading their usage. An extended version of the UTAUT, investigating the role of technology, social, channel and personal factors of the p-mps adoption intention, was proposed as a ground base for this study. Concurrent with the existing literature of p-mps acceptance [17, 20], the role of PE and EE, reflecting the two technology-related factors, and SI, reflecting the social-related factors, in predicting p-mps adoption was confirmed. These results suggest that p-mps service providers aiming to gain competitive advantage and increase the p-mps adoption rates have to offer platforms of great utilitarian value

(e.g. speed in task completion, convenience, etc.) which, at the same time, are free of effort and easy to use [17, 19, 22]. Moreover, they have to communicate positive testimonials of satisfied p-mps users which will increase potential consumers' awareness/trial, and educate them. In this research, in accordance with the findings of previous studies [14, 15, 17], PR and PT were also recognized as significant driver and detractor of p-mps usage intentions respectively. As such, service providers have to identify the most critical risks that tend to increase customers' fears in using p-mps and, then, select the most appropriate actions to reduce the impact of these threats. This is also expected to raise trust in p-mps transaction security. Finally, the results also confirmed the significant moderating effects of personal factors on consumers' behavior towards p-mps adoption intentions. In accordance with the relevant studies [4, 7, 8], the findings of this study confirmed the significant influence of potential users' differences in the p-mps adoption intention. More specifically, the effect of PE on BI seems to be bigger for younger males with high levels of technology experience as this group is more task-oriented. The effects of EE on BI and SI on BI are stronger for older females with low level of technology experience and the effect of SI on BI is stronger for those with low level of technology experience. These results indicate that service providers have to implement a differentiated marketing strategy in order to provide an added value to potential customers with different characteristics which lead to relevant actions efficiency optimization. Future research could be directed towards the consideration of other variables that theoretically affect the adoption mechanism, such as perceived service value, brand reputation and personal traits (i.e. innovativeness, need for control etc.) that could further improve the predicting power of the model within the m-payment services context.

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