Factors Influencing Consumers' Intention to Adopt Near Field Communication Mobile Payments at the Point of Sale

Masters Thesis

Slaveya Taneva

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Advisor:
Kateryna Gavrysh

Chair of Quantitative Marketing and Consumer Analytics
L5, 2 - 2. OG
68161 Mannheim
www.quantitativemarketing.org

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List of Abbreviations

AVE	Average variance extracted
B2B	Business-to-business
B2C	Business-to-consumer
BLE	Bluetooth low energy
C2B	Consumer-to-business
C2C	Consumer-to-consumer
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CMB	Common method bias
CMV	Common method variance
CR	Construct reliability
DV	Dependent variable
EFA	Exploratory factor analysis
H	Hypothesis
IDT	Innovation diffusion theory
IT	Information technology
ItU	*Intention to use (NFC mobile payment)*
IV	Independent variable
KMO	Kaiser-Meyer-Olkin
MRA	Multiple regression analysis
MV	Mediator variable
N	Sample size
NFC	Near field communication

OED	Oxford English Dictionary
P2P	Peer-to-peer
PAF	Principal axis factoring
PCA	Principal components analysis
PeoU	*Perceived ease of use*
PIIT	*Personal innovativeness in information technology*
POS	Point of sale
PR	*Perceived risk*
PT	Prospect theory
PU_C	*Perceived usefulness & compatibility*
RMSEA	Root mean square error of approximation
SD	Standard deviation
TAM	Technology acceptance model
TiMDR	*Trust in mobile device reliability*
TiP	*Trust in provider*
TPB	Theory of planned behavior
TRA	Theory of reasoned action
UTAUT	Unified theory of acceptance and use of technology (applies to organizational contexts)
UTAUT2	Unified theory of acceptance and use of technology (applies to consumer contexts)
VIF	Variance inflation factor
WOM	Word-of-mouth
WTP	Willingness to pay

Abstract

The ubiquity of digital technologies in everyday life is set to continue transforming the ways in which consumers shop, manage their finances, and conduct payment transactions. With an increasing penetration rate of smartphones worldwide (Statista 2017a), mainstream adoption of technological innovations, such as proximity mobile payments at the point of sale, is more likely than ever. Hence, based on the innovation diffusion theory (Rogers 2003), the technology acceptance model (Davis 1989; Davis 1993), and previous research in mobile banking, mobile commerce, and mobile payments adoption, the study at hand investigates factors influencing consumers' intentions to adopt near field communication (NFC) mobile payments in a brick-and-mortar environment. Multiple statistical analyses provide support for significant effects of *perceived usefulness & compatibility*, *perceived ease of use*, *trialability*, and *perceived risk* on adoption intentions. Based on the study results, managerial implications for providers of mobile payment solutions and merchants/retailers are discussed and potential avenues for future research are proposed.

Keywords: mobile wallet, near field communication technology (NFC) mobile payments, innovation adoption, technology acceptance

1. Introduction

The widespread adoption and use of digital technologies is transforming consumers' path to purchase. For instance, the smartphone is increasingly transcending its limits of being solely a tool for interpersonal communication. It is set to become the go-to device for shopping, banking, and payment transactions too (Nielsen 2016, p. 3). Specifically, mobile devices are becoming "shopping buddies" in a brick-and-mortar environment. They simplify the process of product and service information search, price comparison, and identification of special deals and coupons for consumers, anytime and anywhere (Nielsen 2016, p. 4). Online shopping via mobile devices (m-commerce) is on the rise and expected to grow steadily in the future (Nielsen 2016, p. 6). Further, mobile banking is the preferred service for managing personal finances, especially for Millennials (aged between 21 and 34) as well as for Generation X (aged between 35 and 49) (Nielsen 2016, p. 9). Finally, the smartphone has the potential to become the go-to tool for making money transactions as well, including peer-to-peer (P2P) mobile money transfers and proximity mobile payments in physical locations, such as stores and restaurants (Nielsen 2016, p. 17). Indeed, as Perkins and Fenech (2014) predict, yesterday's and today's payment technologies (cash, credit and debit cards, online banking) will be substituted by the transaction technologies of the future – mobile payments, payments via facial and biometric recognition (Perkins and Fenech 2014, p. 9).

Mobile payments represent one of the transaction technologies of the future which is currently in the process of taking off. A mobile payment is defined as "[…] a virtual type of payment enabled by mobile device, in which money is transferred remotely or near-by from a payer to receiver via an intermediary or directly in exchange for a service, a product or as a money transfer" (Dahlberg et al. 2015, p. 3). In accordance with Dahlberg et al.'s (2015) definition, mobile payments can be subcategorized as "proximity" and "remote" (European

Payments Council 2017, p. 30). Proximity mobile payments refer to payments where "[…] the consumer and the merchant […] are in the same location and communicate directly using a proximity technology […]" (European Payments Council 2017, p. 30). Such proximity technologies include near field communication (NFC), 2D barcodes, and Bluetooth low energy (BLE) (European Payments Council 2017, p. 30), with NFC currently being the dominant one (Ernst & Young 2015, p. 2). Further, remote mobile payments refer to payments where "[…] the transaction is conducted over telecommunication networks such as GSM or internet, and can be made independently of the payer's location […]" (European Payments Council 2017, p. 30). Examples for remote mobile payments are P2P money transfers, buying flight tickets via an airline application, paying for mobile entertainment subscription, to name a few. Finally, considering that the payer and the payment receiver can be both consumers and businesses, mobile payments can also be classified as consumer-to-consumer (C2C), consumer-to-business (C2B), business-to-consumer (B2C), and business-to-business (B2B) (European Payments Council 2017, p. 30). The following discussion focusses on C2B NFC proximity mobile payments. Henceforth, the terms "NFC mobile payments" (at the POS) and "proximity mobile payments" (at the POS) will be used interchangeably.

To be able to conduct NFC mobile payments, consumers must install a mobile wallet application on their mobile devices where their debit and/or credit bank account information and loyalty card(s) information is encrypted in order to prevent unauthorized access by third parties. Some of the most popular mobile wallet solutions include *Apple Pay*, *Android Pay*, *PayPal*, and *Samsung Pay*, to name a few (Mobgen 2015, p. 8-13). Mobile wallet applications enable consumers to pay for goods and services in physical locations such as stores, supermarkets, restaurants, and vending machines, by placing their mobile device in close proximity to an NFC-enabled payment terminal and authorizing the payment transaction by entering a PIN code or via fingerprint authentication.

A major prerequisite for the adoption of NFC mobile payments is a high smartphone penetration rate. It is predicted that 2.87 billion people will be using a smartphone worldwide by 2020 (Figure 1) (Statista 2017a). In accordance with this prediction, statistical forecasts see an increase in the number of mobile payment users (Figure 2) (Statista 2017b), and, with that, an increase in the transaction value in the mobile payments market until 2021 (Figure 3) (Statista 2017c). The 2017 frontrunner economy in terms of mobile payment transaction value is China with US$ 138,272.4 million, followed by the United States, the United Kingdom, South Korea, and Japan (Figure 4) (Statista 2017d). However, it seems that, on a global scale, the adoption of mobile payments is still in its infancy. In contrast, the number of users in the digital commerce market (including payments for products and services over the Internet) (Figure 5) (Statista 2017e) and their related transaction value (Figure 6) (Statista 2017f) are skyrocketing when compared to those of mobile payments at the point of sale (POS) and P2P money transfers.

These statistics show that proximity mobile payments have a long road ahead to mainstream adoption. However, the potential of the mobile payments market is apparent. It is hence of great interest to technology adoption research, providers of mobile payment services, as well as to merchants and retailers, to gain a detailed understanding of the most important drivers and barriers of proximity mobile payments adoption. NFC mobile payments are designed to provide numerous benefits in the mobile payments ecosystem. For instance, benefits for consumers include (1) increased convenience in terms of portability since consumers can dispose of their physical wallets (Hayashi 2012, p. 43); and, (2) increased convenience in terms of flexibility of choosing between different payment instruments at the POS depending on the particular purchasing situation (e.g., credit, debit, merchant-specific cards) (Hayashi 2012, p. 43-44). Further, (3) proximity mobile payments enable a simpler and faster checkout process. In particular, the time spent for making a payment transaction at the

POS can be decreased by 15 to 30 seconds per purchase (Hayashi 2012, p. 44). Another important benefit of proximity mobile payments is the (4) increased security of payment transactions as compared to traditional modes of payment (Hayashi 2012, p. 49). As Hayashi (2012) points out, mobile payment solutions enable the so called "dynamic authentication", "[…] in which data unique to each transaction is used to authenticate the payment device" (Hayashi 2012, p. 49). Finally, consumers can benefit from promotions, loyalty and reward programs related to the use of proximity mobile payments at the POS (Hayashi 2012, p. 56-57).

Next, the new payment method also offers numerous advantages to merchants and retailers. First, as Shin (2009) maintains, mobile wallet applications enable faster checkout at the POS, which creates more opportunities for impulse purchasing (Shin 2009, p. 1344). Second, the less transparent and tangible a payment transaction (card vs. cash), the less pain of paying customers experience and the more they are willing to consume (Soman 2003, p. 182). Falk et al. (2016) provide support for this "payment transparency bias" in relation to mobile payments – the less transparent the payment method (i.e., credit/debit card, mobile payment) the more positive customers' price judgments of the store and the higher their willingness to pay (WTP) (Falk et al. 2016, p. 2422). These research findings suggest that proximity mobile payments have the potential to increase sales volumes through a payment transparency effect. A further benefit is the decrease in transaction time per customer, which in turn can decrease overall time spent in waiting lines. Consequently, faster checkout is likely to improve customers' satisfaction and loyalty with the merchant/retailer. In addition to the optimization of sales operations at checkout, merchants/retailers can also create new communication "touch points" with their customers by means of targeted mobile marketing and reward schemes (Taylor 2016, p. 162), as well as customer loyalty programs. Importantly, mobile payment transactions are a source of customer data that can provide valuable insights

into their purchasing behavior and thereby help improve the customer experience. Finally, providers of mobile payment services (i.e., mobile wallets) can benefit from the huge potential of the mobile payment market given the fact that consumers are becoming increasingly mobile in their path to purchase.

However, a number of barriers are hindering the takeoff of proximity mobile payments at the POS. For instance, the lack of agreement on technology standards as well as the creation of feasible business models for all members of the mobile payments ecosystem slow down mainstream consumer adoption (Hayashi 2012, p. 40-41). Further, concerns about the technical reliability of mobile payment technologies (Taylor 2016, p. 168), security risks, data protection and privacy (Taylor 2016, p. 173) create insecurity in merchants, retailers, and consumers. Moreover, as Dennehy and Sammon (2015) point out, the so-called "chicken-or-egg" problem holds back adoption as well. It refers to the fact that merchants and retailers are not yet willing to make costly investments in NFC-enabled payment terminals because they are unsure about the consumer demand for mobile payments. However, the unavailability of such payment terminals makes it impossible for consumers to use the new payment method even if they wanted to (Dennehy and Sammon 2015, p. 50). Therefore, it is crucial to investigate consumer attitudes towards adopting NFC mobile payments. Since these have not been studied extensively yet, there is a clear need to do so.

Hence, the research question that this study poses is: What are the most important factors influencing consumers' intention to adopt NFC mobile payments at the POS? The objectives of this research project are threefold. First, to develop a research model of NFC mobile payment adoption based on established theories and empirical evidence in the fields of innovation diffusion and technology adoption. Second, to test the model by analyzing survey data. Third, to obtain implications for marketing management of mobile payment solutions. The study at hand contributes to existing literature on mobile payments adoption in that it (1)

provides a research model focusing on NFC mobile payments in particular; and, (2) tests understudied/new constructs.

The research paper is structured as follows. Section *2. Literature Review* provides an overview of three major theories of innovation and technology adoption, as well as a review of available empirical evidence from the fields of mobile banking, mobile commerce, and mobile payments adoption. Next, Section *3. Methodological Approach* describes the proposed theoretical model, the assumptions behind it, and the hypothesized relationships between the investigated constructs. It also provides a description of the study procedure and the measures employed to operationalize the variables of interest. Section *4. Empirical Analysis and Results* is dedicated to a series of statistical procedures employed to assess the reliability and validity of the measurement instrument and to carry out hypothesis testing by means of multiple regression analysis (MRA). Finally, section *5. Discussion* focuses on the interpretation of the study findings and what they mean for mobile payment providers and merchants/retailers. The research paper concludes with an evaluation of the study limitations and provides recommendations for future research.

2. Literature Review

The innovation diffusion theory (IDT) (Rogers 2003), the technology acceptance model (TAM) (Davis 1989; Davis 1993), and the unified theory of acceptance and use of technology (UTAUT/UTAUT2) (Venkatesh et al. 2003; Venkatesh, Thong, and Xu 2012) are the three major theoretical models designed to explain and predict consumer adoption of innovations and new technologies. The following subchapter provides insights into the central tenets behind them. Subsequently, a review of available empirical research is discussed.

2.1.Theories of Innovation Adoption and Technology Acceptance

Innovation diffusion theory (IDT). IDT is one of the best known theoretical frameworks of innovation adoption. Based on years of empirical research in the fields of anthropology, sociology, education, public health and medical sociology, communications, marketing and management, and new technologies (Rogers 2003, p. 44-45), the theory has enriched our understanding of (1) what innovations are; (2) how and why they diffuse in social systems; (3) what stages consumers go through in the innovation-decision process; and, (4) what role consumer innovativeness, opinion leadership, diffusion networks, and communication channels play in the diffusion process (Rogers 2003, p. 96-98). IDT defines an innovation as "[…] an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers 2003, p. 12). As Rogers (2003) points out, an innovation is defined as such based not on its objective newness (i.e., the period since its inception) but based on individuals' subjective perception of its newness (Rogers 2003, p. 12). The diffusion of an innovation is a communication process within a social system, whereby information about the innovation is disseminated through different communication channels (Rogers 2003, p. 5). An important aspect of this process is the uncertainty that the innovation represents for potential adopters. Uncertainty in this context refers to the fact that the consequences of adopting an innovation are initially unpredictable for consumers (Rogers 2003, p. 6). A major psychological bias that can explain the effect of uncertainty on consumers is the status quo bias, which stems from prospect theory (PT) (Tversky and Kahneman 1992). In contrast to classical economic theory, which assumes that individuals are rational actors with stable preferences, PT maintains that individuals systematically deviate from this assumption of rationality (Rabin 1998, p. 11). One of the central tenets of PT is loss aversion (Tversky and Kahneman 1992, p. 299). Loss aversion is observed in risky and uncertain situations where individuals are much more susceptible to losses than to same-sized gains (Tversky and

Kahneman 1992, p. 298). The status quo bias, which is tightly linked to the concept of loss aversion, refers to individuals' tendency to prefer the current state of affairs because they anticipate potential losses to be greater than potential gains if a change in the status quo occurs (Kahneman, Knetsch, and Thaler 1991, p. 197-198). The status quo bias is applicable in the context of innovation diffusion because an innovation might represent a change in consumers' status quo and can thus be perceived as uncertain and risky.

In the field of innovation marketing, the reduction of uncertainty related to a new product or service is a major task for marketing managers. As Rogers maintains, one way to reduce uncertainty is the strategic provision of information about the innovation among the target group of potential adopters (Rogers 2003, p. 6). It is also important to make a distinction between product and service innovations when discussing uncertainty. In particular, services exhibit a higher degree of uncertainty in comparison to products because they are inherently intangible and their results are not readily observable. As Rogers (2003) argues, consumers can overcome uncertainty in two ways: by trying out the innovation on their own and by observing peers' trial and use of the innovation (Rogers, 2003, p. 177).

Further, consumers pass through a five-stage innovation-decision process. Rogers (2003) refers to it as an "information-seeking" and "information-processing activity" during which consumers pass through knowledge, persuasion, decision, implementation, and confirmation stages (Rogers 2003, p. 169). In the context of the innovation-decision process, the following five innovation attributes are viewed as the most consistent predictors of adoption: *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability* (Figure 7). According to Rogers (2003), these five attributes consistently explain between 49% and 87% of the innovation adoption variance (Rogers 2003, p. 221). In IDT, *relative advantage* is defined as the degree to which potential consumers perceive an innovation as more beneficial than the idea or technology that is currently in use (Rogers 2003, p. 15). Importantly, the

objective *relative advantage* (i.e., what experts in the field of innovation view as advantageous) is not decisive. What matters are consumers' subjective perceptions of the *relative advantage* of the innovation in question (Rogers 2003, p. 15). The second attribute, *compatibility*, refers to the extent to which consumers perceive an innovation as being compatible with their "[…] existing values, past experiences, and needs […]" (Rogers 2003, p. 15). An innovation that is inconsistent with the current state of affairs in the target group requires potential adopters to modify their norms, values, and needs. Since such a change process is usually unlikely, innovations must be as compatible with the current status quo as possible in order to be able to diffuse. The third attribute, *complexity*, refers to the degree to which potential adopters see an innovation as difficult to understand, learn to use and employ (Rogers 2003, p. 16). The fourth attribute, *trialability*, is defined as the extent to which consumers could try out and experiment with an innovation (Rogers 2003, p. 16). Finally, *observability* is the degree to which the consequences of using an innovation can be observed by other individuals (Rogers 2003, p. 16). Overall, Rogers (2003) maintains that an innovation is more likely to diffuse more rapidly if it is perceived to have a greater *relative advantage*, *compatibility*, *trialability*, and *observability*, and less *complexity* (Rogers 2003, p. 16).

Finally, IDT provides a classification of adopter categories based on the degree of their innovativeness. Rogers (2003) defines innovativeness as the tendency to adopt an innovation earlier than other consumers within a social system (Rogers 2003, p. 267). Based on their degree of innovativeness, consumers generally fall into five categories: "innovators", "early adopters", "early majority", "late majority", and "laggards" (Figure 8), where the first two adopter types are characterized with the highest degree of innovativeness (Rogers 2003, p. 280-281). Rogers (2003) refers to innovativeness as the "bottom-line behavior in the diffusion process" (Rogers 2003, p. 268) for a reason. Innovators and early adopters, being

the ones to adopt first, play a crucial role for the further diffusion of an innovation through peer effects. As thought leaders, they set an example for the less innovative, more risk-averse adopters, thus reducing their uncertainty about the consequences of adopting the innovation. In summary, IDT is one of the most comprehensive theories of innovation adoption. It therefore constitutes a major part of the current study's theoretical backbone.

Technology acceptance model (TAM). The second theoretical framework discussed here is TAM (Davis 1989; Davis 1993). TAM is a parsimonious model designed to explain consumers' intentions to use a technology as well as their actual usage behavior. It is based on attitude theory from psychology (Fishbein and Ajzen 1975) and is considered one of the most relevant models in technology acceptance literature. The original TAM (Figure 9) (Davis 1993, p. 476) includes *perceived usefulness* and *perceived ease of use* as major predictors of *attitude toward using* (an IT system), which in turn is a determinant of *actual system use*. Importantly, the effect of *perceived ease of use* on *attitude toward using* is mediated by *perceived usefulness*. Further, the model maintains that *system design features* have a direct impact on consumers' evaluations of the *perceived usefulness* and *perceived ease of use* of an IT system. Davis (1989) originally defined *perceived usefulness* as the extent to which consumers believe that a new technology would improve their job performance (Davis 1989, p. 320). Further, *perceived ease of use* is the extent to which consumers believe that a new technology would be easy to use (Davis 1989, p. 320). As Davis (1989) points out, the more useful and the easier to use a new technology is perceived as by potential users, the more likely are they to eventually adopt it (Davis 1989, p. 320). Looking at these definitions, it becomes apparent that *perceived usefulness* and *perceived ease of use* are quite similar to IDT's *relative advantage* and *complexity* constructs respectively. Further, as evident from the definition of *perceived usefulness*, TAM was initially applied to technology acceptance and use in organizational settings. However, the model has also been applied to consumer

contexts, such as adoption of electronic banking channels (Hoehle, Scornavacca, and Huff 2012, p. 128), mobile technology adoption (Sanakulov and Karjaluoto 2015, p. 256-257), mobile banking adoption (Shaikh and Karjaluoto 2015, p. 139), mobile commerce adoption (Zhang, Zhu, and Liu 2012, p. 1905), mobile payments adoption (Dahlberg et al. 2008, p. 174; Dahlberg, Guo, and Ondrus 2015, p. 274), to name a few. Importantly, the current study adopts the original definition of *perceived ease of use* and adapts the definition of *perceived usefulness* to conform to the consumer-centric context of NFC mobile payments adoption as being the degree to which using a new technology (i.e., mobile wallet, NFC mobile payment) would enhance one's performance in a particular activity (i.e., shopping, payment transactions).

Later, Venkatesh and Davis (2000) modified TAM whereby *attitude toward using* was reformulated as *intention to use*, and *actual system use* – as *usage behavior*. Similarly to the original TAM, *perceived usefulness* and *perceived ease of use* have an effect on *usage behavior* via *intention to use*. Further, *perceived ease of use* has both a direct effect and an indirect effect on *intention to use* via *perceived usefulness* (Venkatesh and Davis 2000, p. 188). To summarize, TAM is parsimonious but powerful theoretical model. Nevertheless, as Legris, Ingham, and Collerette (2003) suggest, it is necessary to extend it with further relevant predictors of *intention to use*/*usage behavior*, in order to draw a more comprehensive picture of what drives and hinders technology adoption in different contexts (Legris, Ingham, and Collerette 2003, p. 202).

Unified theory of acceptance and use of technology (UTAUT). Finally, the original UTAUT model (Figure 10) was developed by Venkatesh et al. (2003) to explain and predict adoption and use of new technologies in organizational contexts (Venkatesh et al. 2003, p. 426). Later, Venkatesh, Thong, and Xu (2012) identified the need to adapt the original model in order to explain and predict acceptance and use of new technologies in consumer contexts

(Venkatesh, Thong, and Xu 2012, p. 158). The result was a modified version of UTAUT known as UTAUT2 (Figure 11). Similarly to UTAUT, UTAUT2 states that *performance expectancy*, *effort expectancy*, and *social influence* are direct determinants of *behavioral intention* and indirect determinants of *use behavior* via *behavioral intention*. In contrast to UTAUT however, UTAUT2 considers *facilitating conditions* to have direct effects on both *behavioral intention* (to use a technology) and *use behavior*. The three additional variables included in UTAUT2 – *hedonic motivation*, *price value*, and *habit* – exhibit direct effects on *behavioral intention* and indirect effects on *use behavior* via *behavioral intention*. *Habit* is also a direct determinant of *use behavior*. Finally, *age*, *gender*, and *experience* (with a technology) represent key moderator variables in the model (Venkatesh, Thong, and Xu 2012, p. 160). Venkatesh, Thong, and Xu (2012) define the constructs in the UTAUT2 model as follows. First, *performance expectancy* refers to the degree to which users perceive a new technology as beneficial for conducting relevant activities (Venkatesh, Thong, and Xu 2012, p. 159). Second, *effort expectancy* is defined as the degree of ease of use associated with the technology (Venkatesh, Thong, and Xu 2012, p. 159). Third, *social influence* refers to the degree to which a consumer's close social circle would recommend using the technology in question (Venkatesh, Thong, and Xu 2012, p. 159). Fourth, the construct *facilitating conditions* is defined as the extent to which consumers believe that relevant resources and support would be available to use the technology (Venkatesh, Thong, and Xu 2012, p. 159). More specifically, the concrete dimensions behind this construct include consumers' knowledge of the technology, its compatibility with other technologies, as well as the availability of support by others in case consumers face difficulties while using it (Venkatesh, Thong, and Xu 2012, p. 178). Fifth, *hedonic motivation* incorporates the fun and enjoyment provided by using the technology (Venkatesh, Thong, and Xu 2012, p. 161). Sixth, *price value* is "consumers' cognitive tradeoff" between the benefits of using the technology and its

monetary cost (Venkatesh, Thong, and Xu 2012, p. 161). Finally, *habit* refers to "[…] the extent to which people tend to perform behaviors automatically because of learning […]" (Venkatesh, Thong, and Xu 2012, p. 161). To summarize, UTAUT and UTAUT2 are quite comprehensive models of technology acceptance applicable to both organizational and consumer contexts.

Finally, when comparing IDT, TAM, and UTAUT2, it becomes apparent that these models exhibit important similarities. For instance, all three theoretical frameworks include (1) a construct that refers to the usefulness or benefits that a new technology provides to consumers (i.e., *relative advantage*, *perceived usefulness*, and *performance expectancy*) as well as (2) a construct that refers to the degree of difficulty related to technology use (i.e., *complexity*, *perceived ease of use*, and *effort expectancy*). Further, as Venkatesh et al. (2003) point out, *facilitating conditions* in UTAUT/UTAUT2 incorporates IDT's *compatibility* construct (Venkatesh et al. 2003, p. 453). Also, both IDT and UTAUT2 place importance on the influence of one's social circle on innovation/technology adoption. In contrast to IDT, UTAUT2 takes into account *hedonic motivation*, *price value*, and *habit*. However, in the context of the current study, these constructs are not applicable due to the following considerations. First, NFC mobile payments have a utilitarian function rather than a hedonic one. Second, most mobile wallet applications can be downloaded and used free of charge. Hence *price value* is considered irrelevant. Third, the study focuses on participants who have no or limited experience with NFC mobile payments. *Habit* is therefore unlikely to play a role in this case. Fourth, *social influence* is also considered not applicable here since the target group of this study includes consumers from markets where proximity mobile payments are not readily available yet. It is thus not realistic to assume that *social influence* is likely to play a significant role in this context. Nevertheless, *habit* and *social influence* would be constructs of interest in a context where consumers and their social circles are more experienced in using

NFC mobile payments. Based on these considerations, the current study relies mostly on IDT and TAM as theoretical models of innovation and technology adoption.

2.2.Previous Research in Mobile Payments Adoption and Related Fields

The research field of mobile payments adoption is relatively new and offers opportunities for further investigation. The available studies are relatively few and are predominantly based on TAM (Schierz, Schilke, and Wirtz 2010; Kim, Mirusmonov, and Lee 2010; Shaw 2014; Chen 2008; Pham and Ho 2015; Shin 2009; Wei-Han Tan et al. 2014) or on UTAUT2 (Slade et al. 2015; Oliveira et al. 2016). Interestingly, IDT has not received wide attention in the mobile payments adoption literature. Single IDT elements have been incorporated only in a few studies (Chen 2008; Kim, Mirusmonov, and Lee 2010; Yang et al. 2012; Pham and Ho 2015; Oliveira et al. 2016). Alternative theoretical frameworks include perceived risk theory (Yang et al. 2015), as well as a combination of perceived value theory and perceived risk theory (de Kerviler, Demoulin, and Zidda 2016; Cocosila and Trabelsi 2016). Further, previous studies focus on (1) mobile payments as a general term incorporating both proximity and remote mobile payments (Mallat 2007; Chen 2008; Kim, Mirusmonov, and Lee 2010; Schierz, Schilke, and Wirtz 2010; Yang et al. 2012); (2) proximity mobile payments only (Wei-Han Tan et al. 2014; Pham and Ho 2015; Slade et al. 2015; Oliveira et al. 2016; Cocosila and Trabelsi 2016; de Kerviler, Demoulin, and Zidda 2016); and, (3) mobile wallets (Shin 2009; Shaw 2014). In the following sub-sections, available empirical evidence from the mobile payments literature and related research fields is reviewed.

Empirical evidence on IDT constructs. The most studied IDT construct in the mobile payments literature is *innovativeness* – either as a direct predictor of *intention* (Yang et al. 2012, p. 135; Wei-Han Tan et al. 2014, p. 302; Pham and Ho 2015, p. 167; Oliveira et al. 2016, p. 407); as an antecedent of *relative advantage* (Yang et al. 2012, p. 135), of *perceived*

ease of use (Kim, Mirusmonov, and Lee 2010, p. 312), or of *performance expectancy*, *effort expectancy*, and *compatibility* (Oliveira et al. 2016, p. 407). Overall, *innovativeness* has been found to be a significant, positive, direct predictor of *intention* in the mobile payments literature (Yang et al. 2012, p. 136; Wei-Han Tan et al. 2014, p. 302; Pham and Ho 2015, p. 166; Oliveira et al. 2016, p. 410).

Another IDT construct that has also been considered in a small number of studies is *compatibility* – either as a direct determinant of *intention* (Chen 2008, p. 37; Yang et al. 2012, p. 131; Pham and Ho 2015, p. 163) or as an antecedent of *performance expectancy* and *effort expectancy* (Oliveira et al. 2016, p. 407) as well as of *perceived usefulness* and *perceived ease of use* (Kim, Mirusmonov, and Lee 2010, p. 312). Overall, *compatibility* has been found to be a significant predictor of mobile payments adoption intentions (Chen 2008, p. 45; Yang et al. 2012, p. 135) and proximity mobile payments adoption intentions (Pham and Ho 2015, p. 165; Oliveira et al. 2016, p. 410). In other research fields, such as mobile commerce (Zhang, Zhu, and Liu 2012, p. 1905) and mobile banking (Shaikh and Karjaluoto 2015, p. 135), IDT constructs have also not been studied as extensively as TAM and UTAUT2 constructs. This creates an opportunity to fill this gap in technology adoption literature.

Empirical evidence on TAM constructs. As discussed above, *perceived usefulness* and *perceived ease of use* are considered the major predictors of *intention* in TAM. The available empirical evidence in the context of mobile payments adoption provides support for the theoretical validity of TAM. For instance, Chen (2008), Kim, Mirusmonov, and Lee (2010), and Wei-Han Tan et al. (2014) found that *perceived usefulness* and *perceived ease of use* have significant positive direct effects on the *intention to use mobile payment* (Chen 2008, p. 45; Kim, Mirusmonov, and Lee 2010, p. 317) and on the *intention to adopt mobile credit card* (Wei-Han Tan et al. 2014, p. 302). Further, these two constructs also seem to be indirect predictors of *intention* via *attitude towards use* (Shin 2009, p. 1349; Schierz, Schilke, and

Wirtz 2010, p. 214). As proposed by Davis (1993), *perceived ease of use* operates indirectly via *perceived usefulness* (Davis 1993, p. 476). This is exactly what Kim, Mirusmonov, and Lee (2010) and Schierz, Schilke, and Wirtz (2010) found in the context of mobile payments adoption (Kim, Mirusmonov, and Lee 2010, p. 317; Schierz, Schilke, and Wirtz 2010, p. 214). Finally, Shaw (2014) and Pham and Ho (2015) also found that *perceived usefulness* has a significant positive effect on *intention to use a mobile wallet* (Shaw 2014, p. 454) and on *intention to adopt NFC mobile payments* (Pham and Ho 2015, p. 166). However, their results do not support an effect of *perceived ease of use* on *intention* (Shaw 2014, p. 454; Pham and Ho 2015, p. 166). TAM constructs have also been widely studied in related research fields. For instance, *perceived usefulness* and *perceived ease of use* have been found to be significant predictors of the intention to adopt (1) mobile banking (Shaikh and Karjaluoto 2015, p. 136); (2) mobile data services, mobile banking, and mobile learning (Sanakulov and Karjaluoto 2015, p. 256-257), as well as (3) mobile commerce (Zhang, Zhu, and Liu 2012, p. 1908). In summary, *perceived usefulness* and *perceived ease of use* seem indispensable constructs in a technology adoption study.

Empirical evidence on additional relevant constructs. Additional constructs, that are not part of the discussed theoretical models of innovation and technology adoption, are very likely to play a role in the diffusion of NFC mobile payments. These include *perceived risk* and *trust* in particular.

First, *perceived risk* reflects the concept of risk aversion in the context of IDT and is considered a major barrier for consumer adoption of new technologies. In accordance with IDT and prospect theory, Mandrik and Bao (2005) maintain that "[…] the concept of perceived risk involves both the perceived uncertainty of outcomes and the perceived importance of negative consequences" (Mandrik and Bao 2005, p. 532). In the context of mobile payments adoption, *perceived risk* has been studied as a multidimensional concept.

For instance, Yang et al. (2015) investigated different risk dimensions and their relation to consumers' overall perception of value associated with mobile payments and their intention to adopt (Yang et al. 2015, p. 256). The researchers found that *perceived financial risk*, *perceived performance risk*, and *perceived privacy risk* have significant negative effects on adoption intentions (Yang et al. 2015, p. 261). Further, Cocosila and Trabelsi (2016) investigated the effects of value and risk constructs on the intention to adopt proximity mobile payments (Cocosila and Trabelsi 2016, p. 161). They found that *utilitarian* and *enjoyment value* perceptions and *psychological* and *privacy risk* perceptions are significant predictors of adoption intentions (Cocosila and Trabelsi 2016, p. 165). Other studies, however, treat *perceived risk* as a unitary rather than a multidimensional construct (Wei-Han Tan et al. 2014, p. 296; Pham and Ho 2015, p. 161-162; Slade et al. 2015, p. 215). The majority of these studies maintain that *perceived risk* is an important negative determinant of intention in the context of mobile payments (Pham and Ho 2015, p. 166; Slade et al. 2015, p. 221). Finally, *perceived risk* has been found to be a major barrier in related consumer adoption research fields too, such as mobile commerce adoption (Zhang, Zhu, and Liu 2012, p. 1909) and mobile banking adoption (Shaikh and Karjaluoto 2015, p. 135). In summary, *perceived risk* is an indispensable factor that must be considered in technology adoption studies such as the one at hand.

Second, Chandra, Srivastava, and Theng (2010) identify two types of *trust* in the context of remote mobile payment services adoption: (1) *trust* related to "mobile service provider characteristics" (including *perceived reputation* and *perceived opportunism*) and (2) *trust* in "mobile technology characteristics" (including *perceived environmental risk* and *perceived structural assurance*) (Chandra, Srivastava, and Theng 2010, p. 565-566). *Trust* related to "mobile service provider characteristics" refers to consumers' perceptions of providers' reputation and trustworthiness regarding handling customer information and

keeping their promises (Chandra, Srivastava, and Theng 2010, p. 565). *Trust* related to "mobile technology characteristics" incorporates consumers' concerns regarding system security, data privacy, and related risks (Chandra, Srivastava, and Theng 2010, p. 565). The latter type of *trust* resembles the construct *perceived risk* that this study adopts. The authors found that both types of *trust* are significant determinants of the overall *consumer trust* in mobile payment systems, which in turn has a significant positive effect on adoption intentions (Chandra, Srivastava, and Theng 2010, p. 571). Based on Chandra, Srivastava, and Theng's (2010) understanding of *trust*, Slade et al. (2015) proposed a unitary construct to measure *trust in provider* in the context of NFC mobile payment adoption (Slade et al. 2015, p. 213). They found that *trust in provider* is a significant positive predictor of adoption intentions (Slade et al. 2015, p. 221). Since this particular construct has received only a limited attention in the NFC mobile payments literature, it is necessary to provide more evidence on its relevance.

Finally, another *trust* construct of interest here is *trust in mobile device reliability*. The construct refers to the degree to which consumers perceive their mobile devices (i.e., smartphones) to be reliable for conducting NFC mobile payments. Since NFC mobile payments are initiated with mobile devices, it is paramount to understand how much consumers trust their smartphones. High levels of trust in one's mobile device are likely to decrease potential adopters' uncertainty related to the new payment method. In contrast, low levels of trust may seriously hamper adoption. This new construct is based on a qualitative study by Mallat (2007), who found that mobile device reliability represents a major concern for adopters of mobile payments (Mallat 2007, p. 426). Interestingly, *trust in mobile device reliability* has not been empirically investigated in the mobile payments literature yet. Hence, this creates an opportunity for the current study to fill this gap in previous research.

In summary, available research on consumer adoption of NFC mobile payments in particular is relatively scarce. Hence, the need for further investigation of relevant factors that can potentially stimulate or hinder the acceptance of this new payment method is apparent.

3. Methodological Approach

This section introduces the research model of the current study. The focus is thus specifically on the constructs selected for investigation and the hypothesized relationships between them. Subsequently, descriptions of the study procedure and of the measures used are provided.

3.1.Study Design

The research model of this study is based on the reviewed theoretical frameworks and empirical evidence from the mobile payments, mobile commerce, and mobile banking literature. Specifically, the research model combines TAM (Davis 1989; Davis 1993) and IDT (Rogers 2003) and extends them with additional factors that are likely to have significant effects on consumers' intention to adopt NFC mobile payments at the POS. UTAUT2 is not included due to its similarities with the established TAM and IDT, as well as due to the inapplicability of the constructs *social influence*, *hedonic motivation*, *price value*, and *habit* in the context of this study.

As discussed in the previous chapter, TAM's *perceived usefulness* and *perceived ease of use* are indispensable constructs that must be considered in a technology adoption study. Since they have been systematically found to have significant positive effects on the intention to adopt new technologies, these two constructs are included in the current research model. Since TAM's *perceived usefulness* and *perceived ease of use* are very similar to IDT's

relative advantage and *complexity* respectively, the latter two constructs are not included in the model. Further, since IDT has been systematically neglected in the mobile payments literature in favor of TAM and UTAUT2, IDT's constructs *compatibility* and *trialability* are adopted. However, the fifth innovation attribute, *observability*, is not introduced because of the private nature of NFC mobile payments. Since the process of paying with a smartphone should not be readily visible for other potential adopters, *observability* is not considered relevant in the current study. Finally, a last construct stemming from IDT is *innovativeness*. As Agarwal and Prasad (1998) point out, in the context of technology adoption, it is necessary to measure domain-specific innovativeness (Agarwal and Prasad 1998, p. 206). Hence, this study adopts a special type of *innovativeness – personal innovativeness in information technology* (PIIT). PIIT is an individual trait that refers to consumers' tendency to try and use new information technologies (Agarwal and Prasad 1998, p. 206). The term "information technology" refers broadly to "[t]he branch of technology concerned with the dissemination, processing, and storage of information, especially by means of computers" (OED Online 2017). Information technologies include, for instance, mobile applications, such as mobile wallets.

Additional constructs that TAM and IDT are extended with include *trust in provider*, *trust in mobile device reliability*, and *perceived risk*. Since *trust in provider* and *trust in mobile device reliability* have been neglected in previous research, the study at hand takes the opportunity to further investigate these constructs. Finally, *perceived risk* related to the adoption and use of NFC mobile payments is also included in the research model because it represents an indispensable factor in a technology adoption study that can seriously hamper diffusion.

In summary, the research model (Figure 12) includes (1) *perceived usefulness*, (2) *compatibility*, (3) *perceived ease of use*, (4) *trialability*, (5) *trust in provider*, (6) *trust in*

mobile device reliability, (7) *perceived risk*, and (8) *personal innovativeness in information technology* as independent variables (IVs). The dependent variable (DV) in the model is *intention to use NFC mobile payments*. Based on the discussion above, the following direct effects between the IVs and the DV are hypothesized:

H_1: *Perceived usefulness* has a positive effect on the *intention to use NFC mobile payments*.

H_2: *Compatibility* has a positive effect on the *intention to use NFC mobile payments*.

H_3: *Perceived ease of use* has a positive effect on the *intention to use NFC mobile payments*.

H_4: *Trialability* has a positive effect on the *intention to use NFC mobile payments*.

H_5: *Trust in provider* has a positive effect on the *intention to use NFC mobile payments*.

H_6: *Trust in mobile device reliability* has a positive effect on the *intention to use NFC mobile payments*.

H_7: *Perceived risk* has a negative effect on the *intention to use NFC mobile payments*.

H_8: *Personal innovativeness in information technology* has a positive effect on the *intention to use NFC mobile payments*.

Finally, based on TAM (Davis 1993, p. 476), the following moderator effect of *perceived usefulness* is hypothesized:

H_9: *Perceived ease of use* has an indirect, positive effect on *intention to use NFC mobile payments* via *perceived usefulness*.

3.2.Procedure

An online questionnaire designed to measure the constructs of interest was developed on the online platform *www.soscisurvey.de* (Appendix A). A snowball sampling technique was used to recruit participants. Initially, the survey was published on social media channels or sent out via email to potential respondents, who were asked to take part in the study and to forward the survey to other people in their social circles. The survey targeted adults over 18 years of age, who regularly use a smartphone and are also regular bank account(s) users. A further requirement was to recruit participants of different age brackets and backgrounds, in order to achieve a varied sample representing the population of mobile device and bank account users.

The survey consists of four parts. In the first part, participants are presented with a hypothetical scenario. They are asked to imagine that they have installed a mobile wallet application on their mobile device where their credit card, debit card, and customer loyalty card(s)' information is encrypted. They are informed that this mobile wallet application allows them to make NFC mobile payments at the POS in a brick-and-mortar environment by using a mobile device instead of traditional modes of payment, such as cash, physical debit or credit card. Respondents are then asked to imagine that they go grocery shopping in their favorite supermarket. After the cashier has scanned their products, they realize that they have forgotten their physical wallet and can now make use of the mobile one to pay for their groceries. They are also reminded that they can make NFC mobile payments even if their mobile device is not connected to the Internet (depending on individual mobile wallet solutions). After that, they are instructed to activate NFC on their device and place it in close proximity to the payment terminal. The smartphone would then automatically display a request for payment authorization. The payment transaction can be authorized either by entering a PIN code or by confirming their identity with fingerprint authentication. With that, the payment would be completed and stored in the history of the mobile wallet application.

This scenario was meant to explain the process of conducting NFC mobile payments because it was expected that most of the participants would not have detailed knowledge of this new mode of payment. Thus, it was important for the reliability of the survey responses that they have at least a basic idea about the process of paying with a mobile device at the POS.

In the second part of the study, respondents are instructed to indicate their degree of agreement with the statements designed to measure the nine constructs in the research model. More information about these measurement scales is available in section *3.3. Measures* below.

In the third part, participants are asked four background questions about (1) whether they have a smartphone; (2) whether they have conducted NFC mobile payments in physical stores or restaurants; (3) whether they were aware of NFC mobile payments as an alternative mode of payment prior to filling out the survey; and, (4) whether they shop online for goods and services using their mobile phones. Finally, the last section of the questionnaire includes demographic questions regarding age, gender, country of origin, education and employment status.

3.3.Measures

The constructs in the research model were measured with Likert-type scales, consisting of three or more statements. Respondents were asked to indicate their degree of agreement with these statements on a 6-point scale ranging from 1 ("strongly disagree") to 6 ("strongly agree"). Most of these scales were adapted from previous studies as follows: *perceived usefulness* (Shaw 2014, p. 457), *compatibility* (Schierz, Schilke, and Wirtz 2010, p. 213), *perceived ease of use* (Chen 2008, p. 52), *trialability* (Pham and Ho 2015, p. 169), *trust in provider* (Slade et al. 2015, p. 215), *perceived risk* (Slade et al. 2015, p. 214), *personal innovativeness in information technology* (Agarwal and Prasad 1998, p. 210), and *intention to*

use NFC mobile payments (Schierz, Schilke, and Wirtz 2010, p. 213). Importantly, it was ensured that (1) the items comprising the scales match the context of NFC mobile payments adoption, and (2) the scales correspond to the definitions of the constructs discussed previously. As one of the constructs (*trust in mobile device reliability*) has not been empirically studied in previous research yet, a new measurement scale was developed based on Mallat (2007) and researcher introspection. Since the construct is defined as the degree to which consumers perceive their mobile device as reliable for conducting NFC mobile payments, the following dimensions were included in the new scale: (1) reliability of the battery; (2) reliability of the mobile Internet connection (if such is required to conduct NFC mobile payments); (3) reliability of the mobile applications; (4) reliability of the mobile operating system (i.e., iOS, Android); (5) reliability of the available authentication methods (i.e., PIN code, fingerprint authentication); and, (6) overall mobile device reliability. An overview of the measurement scales is available in Table 1.

Finally, background questions (yes/no) and demographic questions (multiple-choice) represent categorical variables. For instance, respondents were asked to choose between six age brackets (e.g., 18 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 54 years, 55 to 64 years, 65 or older); two gender options (male, female); seven education levels (less than high school; high school graduate; trade/technical/vocational training; Bachelor's degree; Master's degree; Doctorate degree; other advanced degree), and five levels of employment (employed for wages, self-employed, unemployed, student, retired).

4. Empirical Analysis and Results

This chapter presents the results of multiple statistical procedures conducted with the statistical programs IBM SPSS and IBM SPSS Amos. These include (1) a preliminary data analysis; (2) descriptive statistics of participants' demographics and background with NFC mobile payments and mobile commerce; (3) reliability analysis of the measurement instrument; (4) validity analysis of the measurement instrument; (5) common method bias assessment; (6) hypothesis testing by means of MRA, in order to estimate the significance, strength, and direction of the direct effects of the IVs on the DV; and, (7) a small-scale mediation analysis.

4.1.Preliminary Data Analysis

A total of 123 survey responses were collected in the period between April 6, 2017 and June 5, 2017. Prior to subjecting the data to multivariate analyses, it was ensured that reverse-scaled items were transformed and invalid cases and outliers were identified. 12 of the 123 responses were considered invalid. Three of them were responses with high degradation time scores of over 100 points. High degradation time scores signal that the respective respondents have filled out the questionnaire too fast compared to other participants. Since being too fast usually indicates a poor quality of the data (SoSciSurvey 2017), these responses were not considered for further analysis. Nine unfinished responses were also excluded from the data set.

In order to analyze the data for outliers, the nine scales of items were transformed into total sum scores for each participant. As proposed by Hair et al. (2010), two methods were applied to identify outliers in the data: (1) z-scores (univariate technique) and (2) Mahalanobis D^2 (multivariate technique) (Hair et al. 2010, p. 66-67). First, z-scores were

calculated for all scale scores. This method involves the transformation of the scale scores into standard scores with a mean of 0 and standard deviation (SD) of 1, which makes them comparable (Hair et al. 2010, p. 66). As Stevens (2009) points out, cases with a z-score > 3 (absolute value) are most likely outliers (Stevens 2009, p. 14). Based on this method, one case with a z-score = -3.84 among the *perceived ease of use* z-scores was identified.

Second, Mahalanobis D^2 values were calculated in a next step, in order to identify multivariate outliers in the data. The resulting values were then compared to a chi-squared distribution with degrees of freedom (df) equaling the number of predictors (= 8) by using the 1 – Cdf. Chisq (Mahalanobis D^2, df) formula in SPSS, in order to calculate the probability that the cases in the dataset are multivariate outliers (IBM Support 2016). As none of the resulting probability values were below the conservative significance level of .001 (as proposed by Tabachnik and Fidell 2007, p. 74), it was concluded that there are no multivariate outliers in the dataset.

However, as outliers are characterized as extreme values that can potentially harm the outcomes of multivariate statistical analyses (Hair et al. 2010, p. 158), it was decided to remove the above-mentioned case with a z-score > 3. After the exclusion of this outlier, the final data set amounts to N = 110 valid cases.

4.2.Analysis of Sample Characteristics

In a second step, the demographic characteristics of the study sample were analyzed. Table 2 demonstrates that the sample is characterized by a wide range of ages between 18 and 55 – 64. However, most of the participants are aged between 18 – 24 (7.3%), 25 – 34 (46.4%), and 35 – 44 (26.4%). These statistics show that the majority of the respondents stem from technology-savvy generations. Further, the sample is relatively balanced in terms of gender: 47.3% are male and 52.7% are female. Overall, a total of 12 countries of origin are

represented, including Belgium, Bulgaria, Canada, China, Colombia, Estonia, Finland, Germany, India, Romania, Russia, and Thailand. However, the majority of respondents stem from Bulgaria (44.5%) and Germany (43.6%) – two European countries where NFC mobile payments are not readily available yet. In terms of education, most respondents report to have completed a higher education degree, such as a Bachelor's degree (25.5%) or a Master's degree (57.3%). Finally, 80% stated to be currently employed for wages and 13.6% are students.

Further, information regarding respondents' experience with and knowledge of NFC mobile payments and mobile commerce is available in Table 3. For instance, 98.2% of the participants stated that they own a smartphone. As smartphone ownership is an important characteristic of the target group of this study, this percentage is satisfactory. Moreover, as expected, 97.3% reported that they have never completed an NFC mobile payment for goods or services at a physical store or a restaurant using their smartphone. This figure satisfies the study's requirement that the sample should consist of consumers who are not users of NFC mobile payments, in order to provide a representative picture of the factors responsible for the adoption of this new mode of payment. Next, 70% stated that they were aware of NFC mobile payments as an alternative to credit/debit cards and cash prior to the completion of the survey. Finally, as expected most respondents (67.3%) stated that they have experience with online shopping for goods and services on their mobile devices. To summarize, these descriptive statistics demonstrate that remote mobile payments for goods and services over the Internet enjoy a significantly wider acceptance than proximity mobile payments. Nevertheless, there is a quite high level of awareness regarding NFC mobile payments, which indicates that the majority of the respondents are currently in the knowledge stage of the innovation-decision process.

4.3.Reliability Assessment

In a next step, the reliability of the measurement instrument was assessed by analyzing Cronbach's Alpha values of the scales, as well as the inter-item and item-total correlations. Generally, a scale is considered reliable if Cronbach's Alpha exceeds .70, the item-total correlations exceed .50, and the inter-item correlations exceed .30 (Hair et al. 2010, p. 125). Initial reliability assessments of the data (Table 4 - Table 12) suggested that some of the items must be dropped in order to increase the reliability of two of the scales: namely, one item from the *perceived ease of use* and *personal innovativeness in IT* scales respectively. After removing these items, Cronbach's Alpha values of these scales were recalculated (Table 13 and Table 14). Finally, Table 15 provides an overview of the final results of the reliability analysis. Overall, all scales exhibit quite high internal consistency above the recommended minimum of .70. Specifically, Cronbach's Alpha of five scales (*compatibility*, *trust in provider*, *trust in mobile device reliability*, *perceived risk*, and *intention to use NFC mobile payments*) equals or exceeds .90. Two scales (*perceived usefulness* and *trialability*) have Cronbach's Alpha values over .80. Finally, the *perceived ease of use* and *personal innovativeness in IT* scales exhibit Cronbach's Alpha values of over .70. All scales are characterized by very good inter-item and item-total correlations. To summarize, these results suggest that the measurement instrument is reliable.

4.4.Validity Assessment

Following the reliability analysis, a construct validity analysis of the measurement instrument was conducted. Construct validity refers to the degree to which the measured variables (i.e., items) correspond to the latent constructs they are supposed to measure (Hair et al. 2010, p. 708). As construct validity is comprised of convergent and discriminant validity (Hair et al.

2010, p. 709-710), the assessment of the latter two types of validity is in the center of the following discussion.

For this purpose, exploratory factor analysis (EFA) in IBM SPSS and confirmatory factor analysis (CFA) in IBM SPSS Amos were carried out. As the term suggests, EFA is used to explore how individual measured variables (i.e., items) in a dataset are related to each other and can be grouped together to represent a smaller number of higher-level constructs or factors (Hair et al. 2010, p. 693). In EFA, the researcher has no specific idea about the factor structure of the data in advance. In contrast to EFA, CFA is used to test and confirm a pre-defined, theory-based data structure (Hair et al. 2010, p. 693). Despite the fact that the study at hand is characterized by a pre-defined, theory-based structure of items and constructs, it was decided to conduct EFA first, because one of the scales, *trust in mobile device reliability*, is new and has not been validated yet. Another reason for conducting EFA first is to gain a first impression of the actual structure of the data.

As Hair et al. (2010) suggest, an important requirement for applying EFA is the prior assessment of the inter-correlation among the measured variables (Hair et al. 2010, p. 103). For this purpose, Bartlett's test of sphericity and Kaiser-Meyer-Olkin test of sampling adequacy (KMO) were conducted. A statistically significant Bartlett's test of sphericity and a KMO test measure above .50 at the minimum, and ideally above .80, signal that there is sufficient correlation between the variables (Hair et al. 2010, p. 104-105). The Bartlett test of sphericity is significant (χ^2 (703) = 3918.22, p = .000) and the KMO measure of sampling adequacy is .903 (Table 16), suggesting that the application of EFA is appropriate.

Next, all items, except for those dropped after the initial reliability analysis, were subjected to principal axis factoring (PAF) based on eigenvalue above 1 and with Varimax rotation. PAF was chosen over the more widely used principal components analysis (PCA) because PAF is considered most appropriate when the objective of the analysis is

identification of latent constructs rather than data reduction (Hair et al. 2010, p. 107-108). Finally, only factor loadings above the absolute value of .50 were taken into consideration as they can be regarded as practically significant for a sample size of > 110 (Hair et al. 2010, p. 117).

The results of the PAF analysis suggest that 7 factors account for 75.97% of the total variance (Table 17). The resulting rotated factor matrix (Table 18) demonstrates how the observed variables (i.e., items) load on the 7 factors. Interestingly, *perceived usefulness*, *compatibility*, and *intention to use NFC mobile payments* load on the same factor. Most of the other items load on a separate factor as expected. No cross loadings can be observed. It seems that the items representing *perceived usefulness* and *compatibility* are highly correlated with those of the DV *intention to use NFC mobile payments*. Since the presence of the DV seems to have had an effect on the distribution of the factor loadings, it was decided to remove the *intention to use* items and run a second EFA only on the items representing the IVs in the research model. The second EFA (PAF; eigenvalue > 1; Varimax rotation) resulted in a KMO test measure of .897 and a statistically significant Bartlett's test of sphericity (χ^2 (561) = 3178.55, p = .000) (Table 19). A total of 6 factors were extracted, accounting for 73.09% of the variance (Table 20). The resulting rotated factor matrix (Table 21) shows factor loadings above .50 (absolute value). Similarly to the first EFA, *perceived usefulness* and *compatibility* items load on one factor. The same is true for *trust in provider* and *trust in mobile device reliability* items. *Perceived ease of use*, *trialability*, *perceived risk*, and *personal innovativeness in IT* items load on separate factors as expected. No cross-loadings can be observed. However, two items (PeoU_03 and Trust_in_provider_04) do not load sufficiently on any factor. Therefore, they were excluded from further analyses. As *perceived usefulness* and *compatibility* items load on one factor in both EFAs, it was decided to treat them as one construct under the title of *perceived usefulness & compatibility* in further analyses. However,

trust in provider and *trust in mobile device reliability* items load on separate factors in the first EFA, but on one factor in the second EFA. For this reason, a decision to treat all *trust* items as one factor was difficult to meet at this point. A CFA was carried out in a second step, in order to assess the overall model fit as well as the convergent and discriminant validity of the scales.

For this purpose, all items retained after the reliability analysis and the EFA were modeled in path diagrams and subjected to CFA in IBM SPSS Amos. The overall model fit was assessed based on (1) χ^2 statistic, (2) two absolute fit measures (root mean square error of approximation (RMSEA) and normed χ^2), and (3) one incremental fit measure (comparative fit index (CFI)) (Hair et al. 2010, p. 672). A non-significant χ^2 test (Hair et al. 2010, p. 666), normed χ^2 < 2.0 or between 2.0 and 5.0 (Hair et al. 2010, p. 721), RMSEA < .08, and CFI > .92 suggest good model fit for a sample size of less than 250 subjects and more than 30 observed variables (i.e., items) (Hair et al. 2010, p. 672). Further, convergent validity was assessed by examining the standardized regression weights (i.e., factor loadings), average variance extracted (AVE) of the constructs as well as the construct reliability (CR) (Hair et al. 2010, p. 709). Overall, standardized factor loadings over .50, and ideally over .70, are considered significant. AVE values over .50 and CR values over .70 signal satisfactory convergent validity (Hair et al. 2010, p.709-710). Finally, discriminant validity was assessed by comparing the AVE values with the squared inter-construct correlation estimates. As a rule of thumb, if the squared inter-construct correlation estimates are lower than the AVE values, then discriminant validity is in place (Hair et al. 2010, p. 710).

An initial CFA including all items representing the IVs and the DV (Figure 13) resulted in a significant χ^2 test (χ^2 (566) = 911.94, p = .000), acceptable RMSEA = .075 and normed χ^2 = 1.611 and slightly lower CFI = .904 than required (Table 22). All standardized regression weights are higher than the minimal threshold of .50. Only four standardized

regression weights are lower than .70. However, the rest are higher than .70. All AVE and CR values are higher than the threshold values of .50 and .70 respectively (Table 23). Next, discriminant validity was assessed based on the AVE values and the inter-construct correlation estimates (Table 24). As evident in Table 25, all AVE values are higher than the squared correlations except for the squared correlation between *perceived usefulness & compatibility* and *intention to use NFC mobile payments*. This finding points to the assumption that *perceived usefulness & compatibility* construct is highly correlated with the DV. Similarly to the EFA discussed above, it was decided to exclude the DV from the CFA and focus on the IVs only. Further, the item with the lowest standardized regression weight (Perceived_usefulness_04) was also excluded in order to improve the overall model fit statistics. With that, a second CFA was carried out (Figure 14). Table 26 shows that the modifications of the measurement model have improved the model fit statistics. For instance, the χ^2 statistic (χ^2 (413) = 617.764, p = .000) is lower but the test is still significant, which points to a poor model fit. However, as Hair et al. (2010) suggest, the χ^2 statistic depends heavily on the sample size and should not be used as a single measure of model fit (Hair et al. 2010, p. 666-667). Absolute and incremental fit measures should be considered as well. The RMSEA = .067, the normed χ^2 = 1.496, and the CFI > .926 suggest very good model fit. Turning to convergent validity measures (Table 27), the majority of the standardized regression weights are > .70 and only three are < .70. All AVE and CR values are above the minimum of .50 and .70 respectively. To summarize, these results suggest satisfactory convergent validity. Finally, based on the AVE values and the inter-construct correlation estimates (Table 28), Table 29 provides evidence for satisfactory discriminant validity because all squared inter-construct correlation estimates are lower than the AVE values.

All in all, the CFAs discussed above suggest that the measurement instrument is characterized by adequate construct validity and reliability. For this reason, the application of

further multivariate analytical techniques, such as MRA, are appropriate. Importantly, based on the CFAs, it was decided to treat *perceived usefulness* & *compatibility* items as one construct, and *trust in provider* and *trust in mobile device reliability* items – as separate constructs in further analyses.

4.5.Common Method Bias Assessment

A last step before subjecting the data to MRA was to assess common method bias (CMB). Common method variance (CMV) refers to the variance caused by the method of measurement rather than by the measured constructs (Podsakoff et al. 2003, p. 879). CMV represents a major problem in survey research because it can have a significant effect on the relationships between investigated constructs (Podsakoff et al. 2003, p. 880). As Podsakoff et al. (2003) point out, CMV can be caused by (1) the fact that the measurements of the IVs and the DV are provided by the same person, as well as due to (2) particular item characteristics; (3) the context in which the items are placed in the survey; and, (4) the context in which the data were collected (Podsakoff et al. 2003, p. 881). In the current study, CMB was assessed by applying Harman's single-factor test (Podsakoff et al. 2003, p. 889). For this purpose, all measured variables (including the *intention to use NFC mobile payments* items) retained after the CFA were loaded into an EFA in IBM SPSS by specifying the extraction of only one factor without rotation. As Podsakoff et al. (2003) argue, CMB represents a problem if "[…] one general factor will account for the majority of the covariance among the measures" (Podsakoff et al. 2003, p. 889). Looking at Table 30, the total variance explained by this one factor is 42.18%, which is below the 50% threshold that Podsakoff et al. (2003) describe. This result suggests that CMB is most likely not a major problem in the current study.

4.6.Hypothesis Testing by Means of Standard Multiple Regression

Following the common method bias assessment, MRA (standard multiple regression, in particular) was carried out, in order to test hypotheses H_1 to H_8 outlined in section *3.1. Study Design*. All scales were transformed into mean scores for each participant. The resulting scale scores were then tested for the assumptions of multivariate data analysis: (1) normality and (2) linearity (Hair et al. 2010, p. 70-77). Further, the variate (i.e., the IVs observed collectively) was tested for the MRA-specific assumptions of (1) linearity, (2) constant variance of the error terms (homoscedasticity), (3) independence of residuals, and (4) normality of the error term distribution (Hair et al. 2010, p. 182). Finally, multicollinearity was assessed as well (Hair et al. 2010, p. 200-201).

Testing for normality of the IVs and the DV involved a graphical analysis of histograms and normal probability plots as well as Kolmogorov-Smirnov and Shapiro-Wilks statistical tests of normality (Hair et al. 2010, p. 72). The histograms (Figure 15), including normal distribution curves, show that most of the variables are slightly skewed to the right, which was expected given the survey nature of the data. The normal probability plots (Figure 16) show no extreme departure from normality. However, the Kolmogorov-Smirnov and Shapiro Wilks tests of normality (Table 31) provided mostly statistically significant results at α = .05, which indicates that the data are not normally distributed. The only exception is the not statistically significant Kolmogorov-Smirnov test result for *perceived risk* (D (110) = .079, p = .086).

Next, the existence of linear relationships between the individual IVs and the DV was assessed by looking at the Pearson correlations available in Table 32. As Cohen (1992) maintains, effect sizes (in absolute values) of a product-moment correlation r can be characterized as follows: (1) .10 - .30 (small correlation); (2) .30 - .50 (medium correlation); and, (3) > .50 (large correlation) (Cohen 1992, p. 157). Based on this classification, *perceived*

usefulness & compatibility (r = .841, N = 110, p = .000), *trialability* (r = .504, N = 110, p = .000), *trust in provider* (r = .648, N = 110, p = .000), and *trust in mobile device reliability* (r = .626, N = 110, p = .000) exhibit large, positive, and statistically significant correlations with *intention to use NFC mobile payments*. Further, *perceived risk* (r = -.558, N = 110, p = .000) has a large, negative, and statistically significant correlation with the DV. Finally, *perceived ease of use* (r = .441, N = 110, p = .000) and *personal innovativeness in IT* (r = .417, N = 110, p = .000) are moderately correlated with the DV. Overall, these results suggest that most of the IVs have strong linear associations with the DV.

Turning to the variate, the linearity of the relationship between the IVs, observed collectively, and the DV was assessed by analyzing the scatter plot in Figure 17, which plots studentized residuals against unstandardized predicted values (Hair et al. 2010, p. 220). As the residual values do not seem to form a distinctive pattern, but are randomly scattered above and below the zero point, the existence of a linear relationship between the variate and the DV seems plausible. Further, by looking at the same scatter plot, an inference about the homoscedasticity of residuals can be made as well. Specifically, as the residuals do not form any distinctive pattern, the assumption of homoscedasticity of residuals is met as well (Hair et al. 2010, p. 221).

Next, the assumption of independence of the error terms was tested with the help of the Durbin-Watson test. A test statistic of around 2 suggests that residuals are not correlated (Anderson et al. 2013, p. 789). As the Durbin-Watson statistic in the current analysis is 2.120 (Table 33), independence of residuals is assumed.

Further, normality of the error term distribution was tested by analyzing a histogram with a superimposed normal curve (Figure 18) and a normal P-P plot of the standardized residuals (Figure 19) (as proposed by Hair et al. 2010, p. 221). Both figures suggest that the

residuals are approximately normally distributed. With that, the assumption of normality of residuals is also met.

Finally, multicollinearity refers to a situation where one IV and a set of other IVs are highly correlated (Hair et al. 2010, p. 156). It is of particular concern in MRA due to its potential to (1) decrease the overall R^2; (2) lead to a confounded estimation of the regression coefficients; and (3) have a negative effect on the tests for statistical significance of the regression coefficients (Hair et al. 2010, p. 205). Multicollinearity was assessed (1) by examining the Pearson correlations between the IVs (Table 32) and (2) by analyzing the variance inflation factor (VIF) values (Table 34) of all IVs (Hair et al. 2010, p. 200-201). No substantial correlations ($r > .90$) between the IVs can be observed (Hair et al. 2010, p. 200) and the VIF values are well below the generally accepted threshold of 10 as well as the more conservative thresholds of 3 and 5 (Hair et al. 2010, p. 205). These results suggest that multicollinearity is not of concern in the current study.

All in all, the results discussed above suggest that most assumptions of MRA are met. The only exception is the assumption of normality of the individual variables, which can be explained by the possibility that the study participants exhibit similar characteristics and have therefore responded to the survey questions in a similar fashion. This has most probably been caused by the snowball sampling technique used to recruit respondents. However, all other important assumptions, especially those related to the variate, are given. For this reason, the application of MRA in this particular instance is considered appropriate. As evident in Table 33, the R^2 for the overall model is 78.9% with an adjusted R^2 of 77.5%, suggesting very good model fit. Overall, the IVs statistically significantly predict *intention to use NFC mobile payments*, F (7, 102) = 54.614, p = .000. Looking at the standardized coefficients and significance statistics in Table 34, *perceived usefulness & compatibility* (β = .544, p = .000) and *trialability* (β = .140, p = .017) exhibit statistically significant positive effects and

perceived risk (β = -.205, p = .001) – a statistically significant negative effect on the DV at α = .05. These standardized coefficients suggest that *perceived usefulness & compatibility* has the strongest effect, followed by *perceived risk* and *trialability*. However, the other variables in the regression model do not have statistically significant effects on *intention to use NFC mobile payments*. Overall, these results provide support for H_1, H_2, H_4, and H_7. In contrast, H_3, H_5, and H_6 are not supported and H_8 (*personal innovativeness in IT*) is very close to significance (β = .102, p = .051) but is nevertheless rejected.

4.7.Mediation Analysis

Finally, as discussed above, Davis (1993) maintains that *perceived ease of use* has an indirect effect on *intention to use* via *perceived usefulness* (Davis 1993, p. 476). This idea is reflected in H_9. In order to test this last hypothesis, a small-scale mediation analysis based on Baron and Kenny (1986) was carried out. It involves the constructs (1) *perceived usefulness & compatibility*, (2) *perceived ease of use*, and (3) *intention to use NFC mobile payments*, whereby (1) is the hypothesized mediator variable (MV), (2) is the IV, and (3) is the DV (Figure 20). As proposed by Baron and Kenny (1986), a series of simple and multiple regression analyses were conducted in order to find out whether a mediation effect is present. First, using simple regression analyses, the effect of the MV on the DV, the effect of the IV on the DV, and the effect of the IV on the MV were examined. Finally, a multiple regression analysis estimated the effects of both the MV and the IV on the DV (Baron and Kenny 1986, p. 1177). The results of the simple regressions (Table 35) show that *perceived usefulness & compatibility* (β = .841, p = .000) and *perceived ease of use* (β = .441, p = .000) have statistically significant effects on *intention to use NFC mobile payments* at α = .05 when observed separately. The same is true for the effect of *perceived ease of use* (β = .469, p = .000) on *perceived usefulness & compatibility*. However, when *perceived ease of use* (β =

.060, p = .312) and *perceived usefulness & compatibility* (β = .812, p = .000) are analyzed together, only the latter exhibits a statistically significant effect on the DV (F (2, 107) = 130.552, p = .000, R^2 = .709, R^2_{Adjusted} = .704) (Table 36). These results suggest that the effect of *perceived ease of use* on the DV is fully mediated by *perceived usefulness & compatibility*, which supports H_9. This full mediation effect can explain why *perceived ease of use* does not exhibit a statistically significant direct effect on the DV in the main MRA. The mediation effect seems to have contributed to the effect of *perceived usefulness & compatibility* on the DV in the main MRA, which is much larger than those of the other IVs in the research model.

5. Discussion

The final section of this paper is dedicated to a summary of the study findings and what they mean for providers of mobile payment solutions and merchants/retailers in terms of managerial implications. The paper then concludes with a summary of the study limitations and potential avenues for future research.

5.1. Summary of Findings

In retrospect, the main objective of this study was to identify the most important factors influencing consumers' intention to adopt NFC mobile payments at the POS. Overall, the research project at hand delivers findings in the following four areas: (1) the reliability and validity of the scales; (2) the close relationship between the constructs *perceived usefulness* and *compatibility*; (3) the results of the MRA; and, (4) the results of the mediation analysis.

First, all scales are characterized by very good reliability and validity, including the new scale for *trust in mobile device reliability*. Despite the fact that this new construct does

not exhibit a statistically significant direct effect on the DV, the scale is valid and can be adopted or adapted in future studies where mobile device reliability is considered a factor relevant for the adoption of mobile-based services. Importantly, further research of this new construct is required in the context of NFC mobile payments adoption.

Second, the results of the EFA and the CFA suggest that *perceived usefulness* (stemming from TAM) and *compatibility* (stemming from IDT) are closely related constructs. Questions that arise from this finding are (1) which of these constructs is the dominant one, and (2) can they be captured under the umbrella of a new, superordinate construct? In relation to the first question, a plausible explanation would be that *compatibility* is a strong determinant of *perceived usefulness* – the more compatible NFC mobile payments are perceived as by consumers, the higher the degree of usefulness they attach to this new mode of payment. With regard to the second question, more research is required.

Third, the outcome of the MRA demonstrates that *perceived usefulness & compatibility*, *trialability*, and *perceived risk* are significant direct predictors of *intention to use NFC mobile payments*. However, the results do not provide support for the hypothesized direct effects of *perceived ease of use*, *trust in provider*, and *trust in mobile device reliability* on the DV. *Personal innovativeness in IT* is on the brink of significance but is nevertheless rejected as well.

Finally, the small-scale mediation analysis provides support for an indirect effect of *perceived ease of use* on *intention to use NFC mobile payments* via *perceived usefulness & compatibility*. This result confirms the mediation effect depicted in the TAM model.

5.2.Managerial Implications

Important managerial implications for providers of mobile payment solutions and merchants/retailers can be drawn from the study results. First, a very positive finding is that

consumers perceive NFC mobile payments as useful, easy to learn and use, and compatible with their lifestyle, needs, and shopping habits. Since there is apparently consumer demand for this new mode of payment, merchants/retailers need to invest in NFC-enabled payment terminals, in order to enable innovators and early adopters to start using proximity mobile payments at the POS. By setting an example for the less innovative and risk-averse consumers, innovators and early adopters can drive diffusion via peer effects and word-of-mouth (WOM). Moreover, providers of mobile payment solutions can also benefit from the WOM of innovative adopters. For this purpose, providers should seek influential key users who could create buzz and awareness among potential adopters in the Internet space. In their own marketing efforts, providers should explicitly focus on the benefits that NFC mobile payments can bring to consumers. Finally, it is also worth mentioning that some of the mobile wallet providers are technology giants, such as *Apple*, *Google*, and *Samsung*. These companies are established and trusted, and can thus benefit from brand effects in promoting their mobile payment solutions.

Second, consumers are willing to try out and experiment with NFC mobile payments. This is another clear signal for merchants/retailers that they should invest in NFC-enabled infrastructure. In order to promote NFC mobile payments, providers and merchants/retailers should invest in online and onsite demonstrations to give consumers the opportunity to learn how to set up their mobile wallet and how to use it in a brick-and-mortar environment. The purpose of these demonstrations would be to decrease consumers' uncertainty about the new payment method. Importantly, providers can drive adoption of mobile wallets and NFC mobile payments by offering reward programs to consumers. A nice example of such a reward program is *Samsung Rewards* (Samsung 2017). *Samsung Pay* (*Samsung*'s mobile wallet solution) users get special promotions and can gather reward points for every mobile payment they make. Users can then redeem the reward points and get a *Samsung* product in

exchange (Samsung 2017). Further, merchants/retailers should also emphasize the fact that consumers can more easily manage and take advantage of the loyalty programs they participate in by adopting a mobile wallet. Showing potential adopters how they can use and benefit from such reward and loyalty programs should be included in the demonstrations.

Third, a major concern regarding proximity mobile payments are, as expected, the risks associated with adopting them. Experts see NFC mobile payments as safer than traditional payment methods due to a process of "tokenization". The term "tokenization" refers to the "[…] process of protecting sensitive data by replacing it with an algorithmically generated number called a token" (Square 2017). These randomly generated tokens ensure that payments are processed safely without exposing sensitive bank account data at any point of the transaction (Square 2017). Nevertheless, as mentioned above, in innovation adoption studies, consumers' subjective perception of the risks related to the use of an innovation is decisive, and not what experts say. For this reason, it is paramount for providers to educate potential users about the security benefits of mobile wallets and NFC mobile payments.

Finally, despite the fact that *trust in provider* and *trust in mobile device reliability* do not exhibit statistically significant effects in the current study, these two constructs are extremely relevant for both providers of mobile wallets and providers of mobile devices. Consumers' trust heavily relies on the security measures that providers build into their solutions. Therefore, they must ensure that no security gaps exist that could expose consumers to financial loss and threaten the adoption of innovative mobile-based services, such as mobile payments in general.

5.3.Limitations and Future Research

As all empirical work, the current study has a number of limitations. First, due to time and resource restrictions, the sample size of this study is relatively small – only 110 respondents.

Further, the non-probability snowball sampling technique used in the study has led to the recruitment of individuals who have responded in a similar fashion to the survey questions. The scale scores of the constructs in the research model are hence non-normally distributed. Nevertheless, the sample is considered representative of the target group of mobile payment services since the majority of the participants stem from technology-savvy generations and higher education backgrounds. These consumers are more likely to be open to the adoption of innovative information technologies, such as mobile wallets and NFC mobile payments.

Second, despite the fact that the sample is relatively balanced in terms of gender and includes respondents from technology-savvy generations, two large groups from different cultures – Bulgaria and Germany – make up the majority of participants. A limitation stemming from this fact is that the current study does not account for cultural differences in the responses. However, the investigation of culture as a moderator variable can be a subject to a future study on the adoption of NFC mobile payments.

Third, the study does not investigate the relationships between the IVs, *intention to use*, and actual *use behavior* due to unavailable data. Nevertheless, as Davis (1993) and Venkatesh, Thong, and Xu (2012) suggest, *intention to adopt* is a very good predictor of actual technology adoption and use (Davis 1993, p. 476; Venkatesh, Thong, and Xu 2012, p. 160). The development of a research model where intentions to use NFC mobile payments and actual adoption and usage behavior are investigated would be a subject for further research, when data becomes available with increasing diffusion.

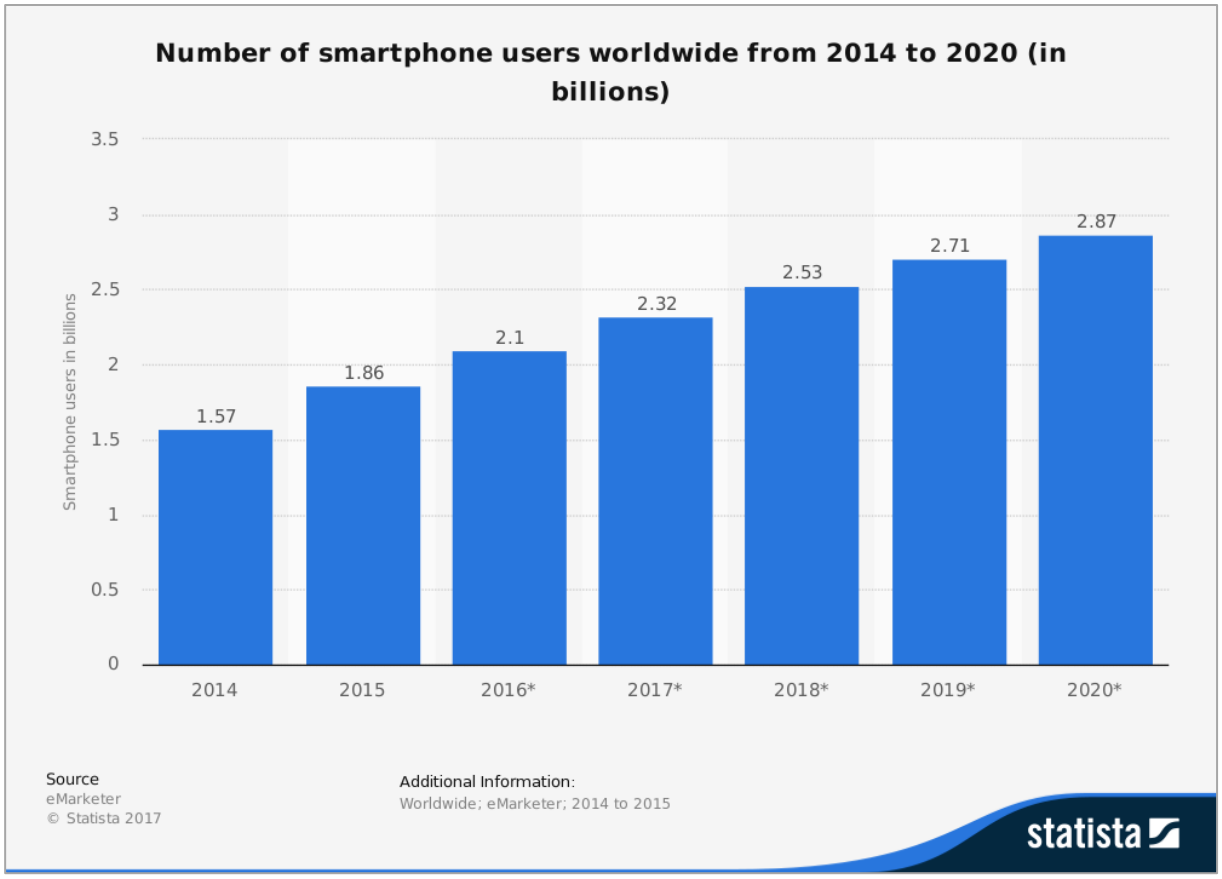
Another potential avenue for future research would be a study focusing on experienced users of NFC mobile payments and investigating the factors influencing their intentions to continue using this payment method. Further, in terms of methodology, conjoint analysis represents a beneficial method for tapping into consumers' attitudes towards a product or a service. Since conjoint analysis has been underrepresented in the mobile payments literature

in favor of survey methods, it would be beneficial to analyze the most important traits of mobile wallets and NFC mobile payments from a conjoint analysis perspective.

In conclusion, the study at hand contributes to previous research in that it provides a research model of NFC mobile payments adoption at the POS. The research model is characterized by a strong theoretical foundation in view of IDT and TAM. It also includes further new and understudied constructs that are considered relevant in this particular context. The study findings indicate that NFC mobile payments have the potential to diffuse more rapidly in the near future. Nevertheless, providers of mobile payments solutions, as well as merchants and retailers, must work towards bringing down adoption barriers related to security, trust, and NFC-enabled infrastructure.

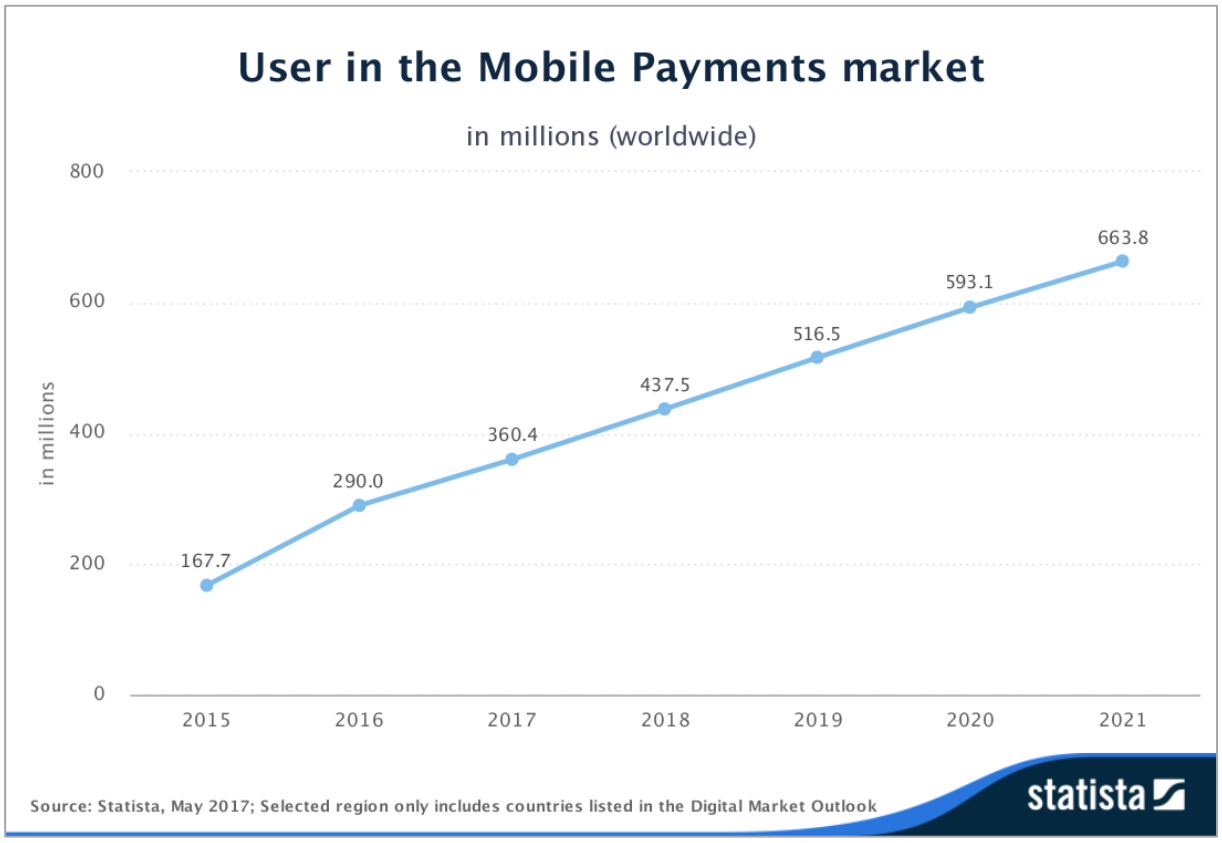
Figures

Figure 1. Number of Smartphone Users Worldwide from 2014 to 2020 (in Billions)



Source: (Statista 2017a)

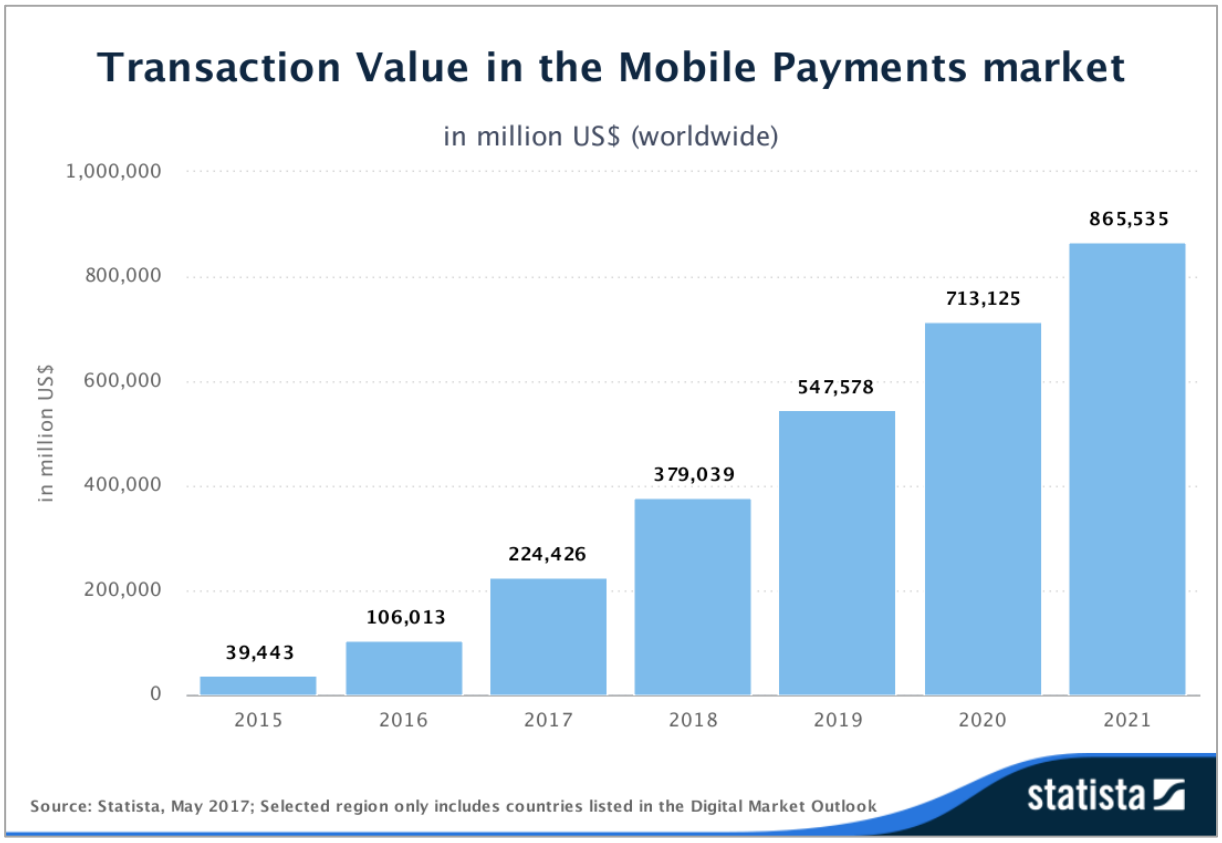
Figure 2. Users in the Mobile Payments Market



Source: (Statista 2017b)

Note: "The "Mobile Payments" segment includes transactions at Point-of-Sale that are processed via smartphone applications (so-called "mobile wallets"). Well-known providers of mobile wallets are ApplePay, Google Wallet and Samsung Pay. The payment in this case is made by a contactless interaction of the smartphone app with a suitable payment terminal belonging to the merchant. The data transfer can be made, for example, via wireless standard NFC (Near Field Communication) or by scanning a QR code to initiate the payment. A user pays for a purchase via a "Mobile Wallet" application by triggering an online bank transfer or by using a digitally stored credit or debit card (Host Card Emulation). […]" (Statista 2017g).

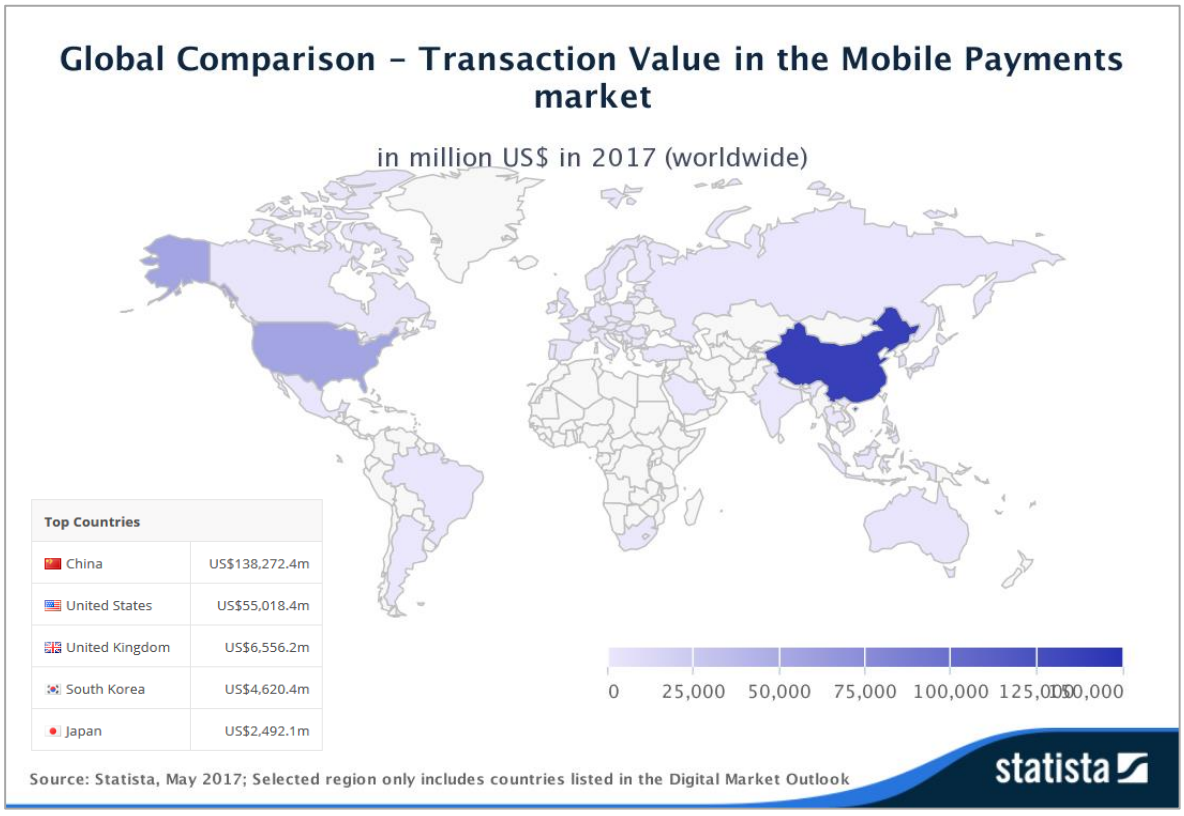
Figure 3. Transaction Value in the Mobile Payments Market



Source: (Statista 2017c)

Note: "The "Mobile Payments" segment includes transactions at Point-of-Sale that are processed via smartphone applications (so-called "mobile wallets"). Well-known providers of mobile wallets are ApplePay, Google Wallet and Samsung Pay. The payment in this case is made by a contactless interaction of the smartphone app with a suitable payment terminal belonging to the merchant. The data transfer can be made, for example, via wireless standard NFC (Near Field Communication) or by scanning a QR code to initiate the payment. A user pays for a purchase via a "Mobile Wallet" application by triggering an online bank transfer or by using a digitally stored credit or debit card (Host Card Emulation). […]" (Statista 2017g).

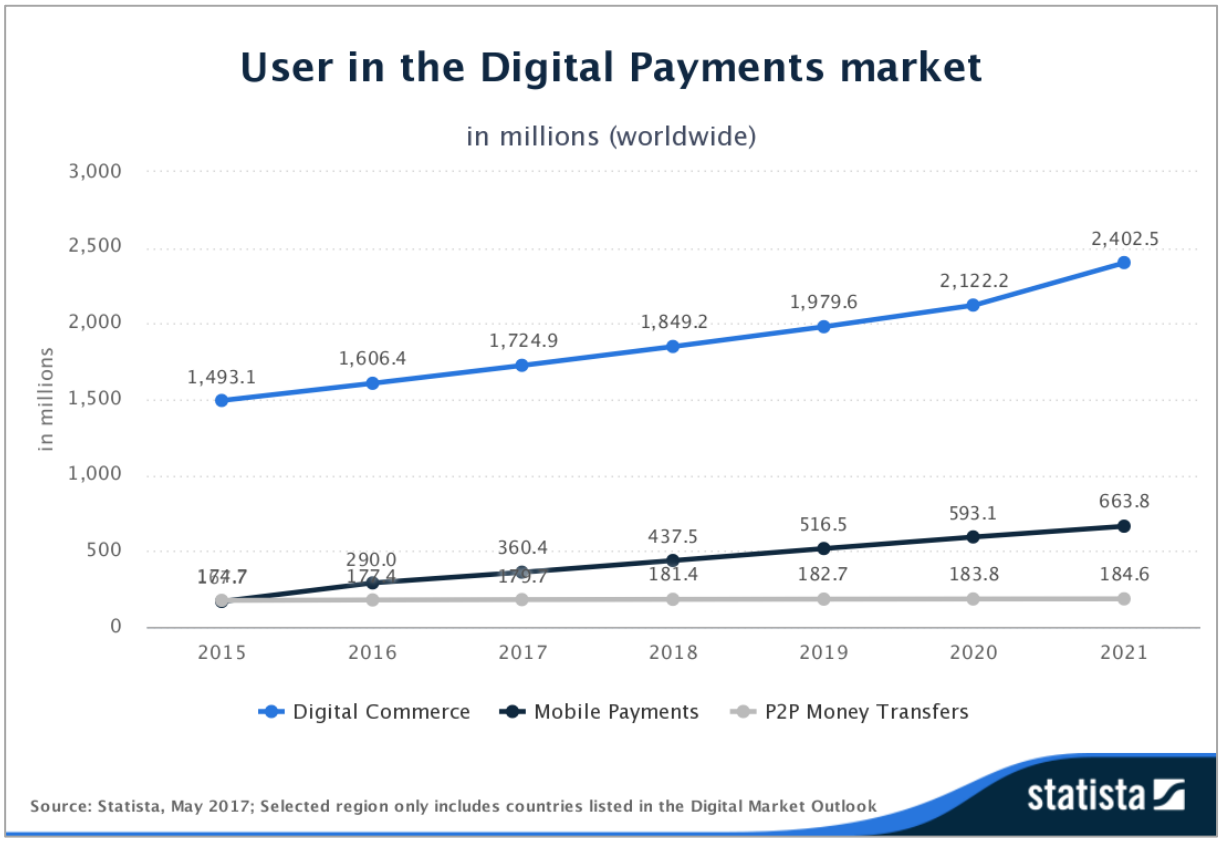
Figure 4. Global Comparison – Transaction Value in the Mobile Payments Market



Source: (Statista 2017d)

Note: "The "Mobile Payments" segment includes transactions at Point-of-Sale that are processed via smartphone applications (so-called "mobile wallets"). Well-known providers of mobile wallets are ApplePay, Google Wallet and Samsung Pay. The payment in this case is made by a contactless interaction of the smartphone app with a suitable payment terminal belonging to the merchant. The data transfer can be made, for example, via wireless standard NFC (Near Field Communication) or by scanning a QR code to initiate the payment. A user pays for a purchase via a "Mobile Wallet" application by triggering an online bank transfer or by using a digitally stored credit or debit card (Host Card Emulation). […]" (Statista 2017g).

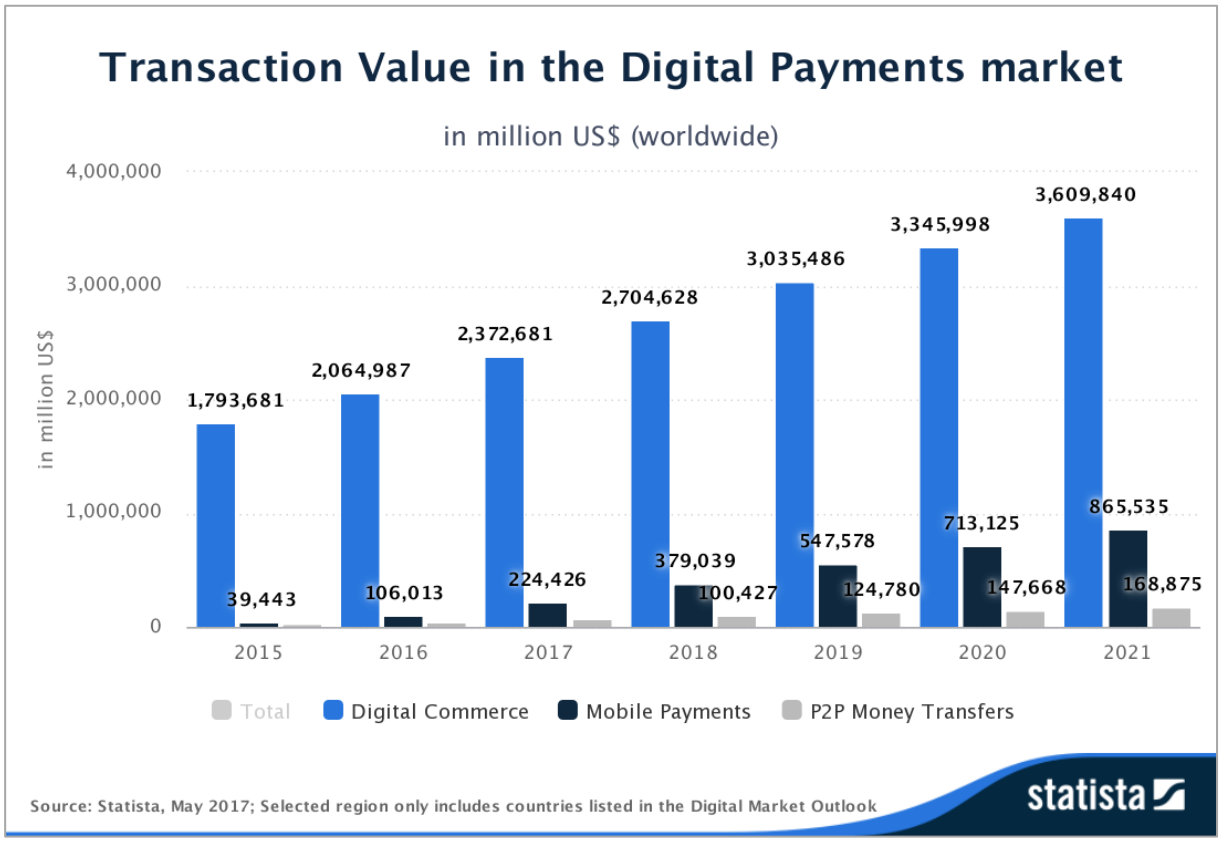
Figure 5. Users in the Digital Payments Market



Source: (Statista 2017e)

Note: "The "Digital Payments" market segment is led by consumer transactions and includes payments for products and services which are made over the Internet, mobile payments at Point-of-Sale (POS) via smartphone applications as well as cross-border Peer-to-Peer transfers between private users. The following are not included in this segment: transactions between businesses (Business-to-Business payments), bank transfers initiated online (that are not in connection with products and services purchased online), and payment transactions at the Point-of-Sale where mobile card readers (terminals) are used. The "Digital Payments" market segment is comprised of the following sub-segments: Digital Commerce, Mobile Payments, P2P Money Transfers" (Statista 2017h).

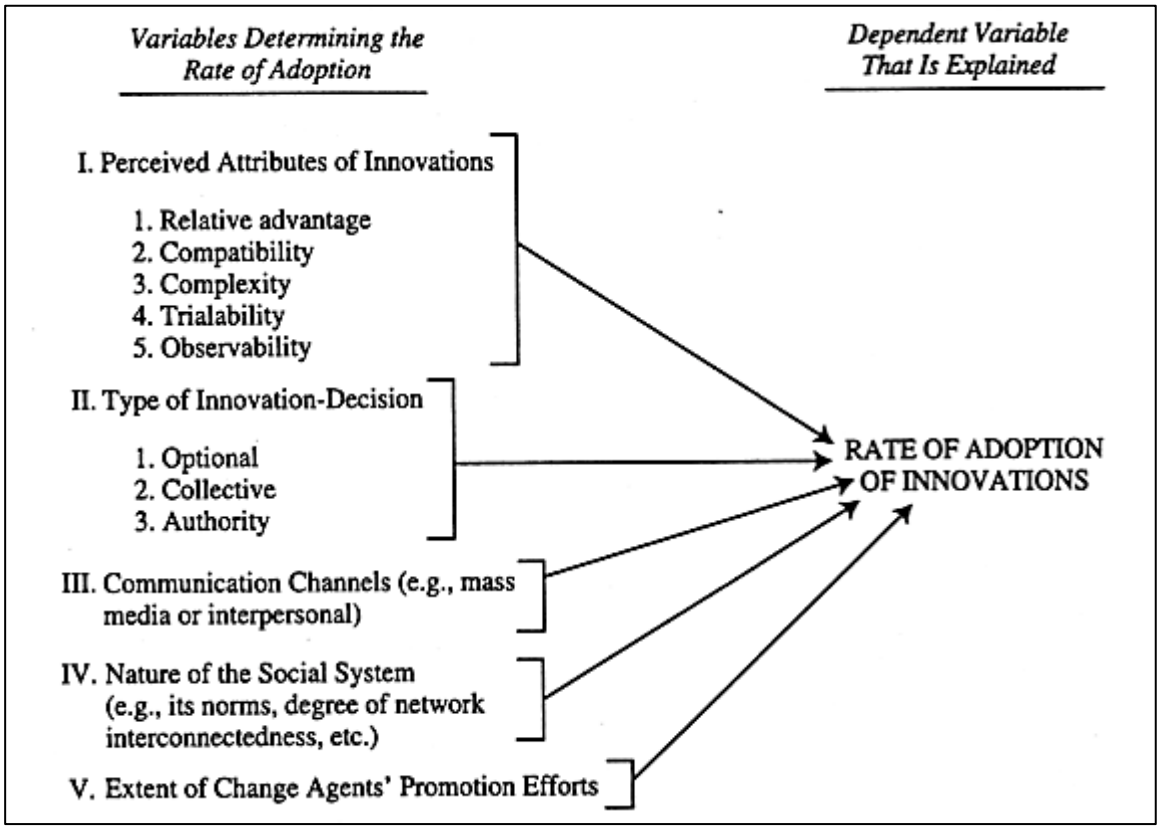
Figure 6. Transaction Value in the Digital Payments Market



Source: (Statista 2017f)

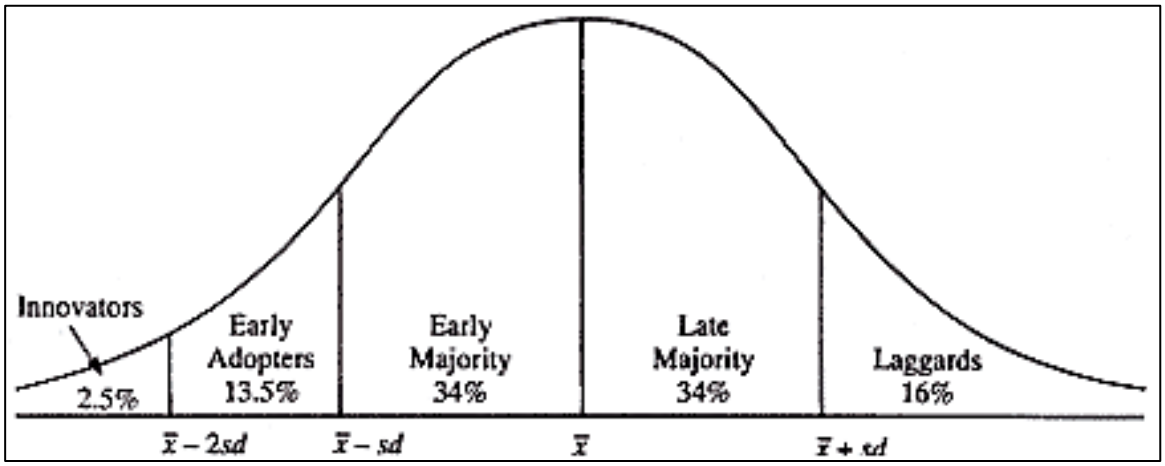
Note: "The "Digital Payments" market segment is led by consumer transactions and includes payments for products and services which are made over the Internet, mobile payments at Point-of-Sale (POS) via smartphone applications as well as cross-border Peer-to-Peer transfers between private users. The following are not included in this segment: transactions between businesses (Business-to-Business payments), bank transfers initiated online (that are not in connection with products and services purchased online), and payment transactions at the Point-of-Sale where mobile card readers (terminals) are used. The "Digital Payments" market segment is comprised of the following sub-segments: Digital Commerce, Mobile Payments, P2P Money Transfers" (Statista 2017h).

Figure 7. Variables Determining the Rate of Innovation Adoption



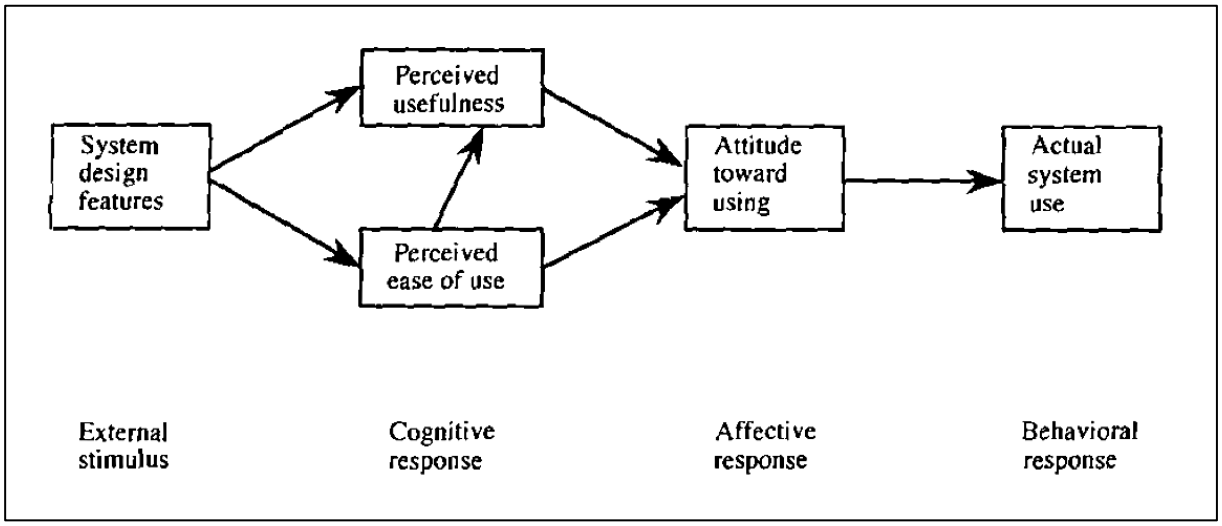
Source: Rogers (2003, p. 222)

Figure 8. Adopter Categories Based on Their Degree of Innovativeness



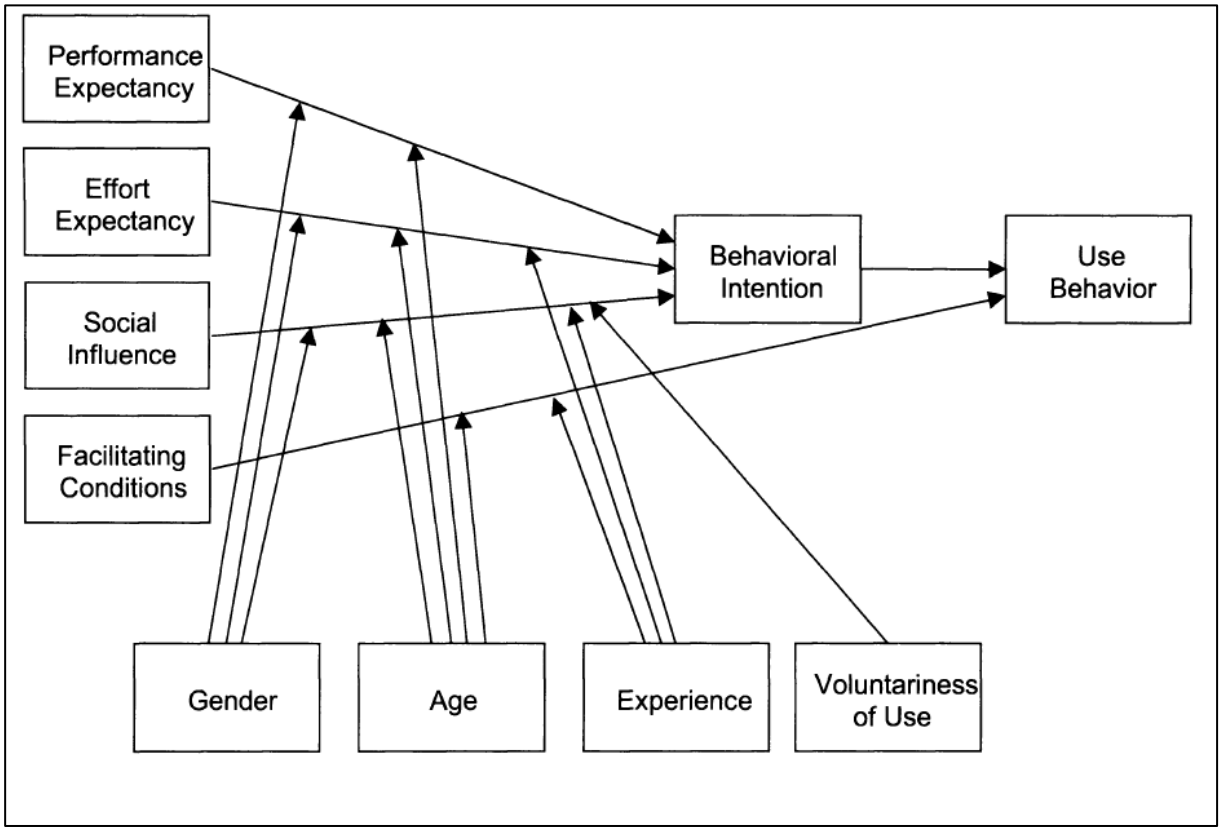
Source: Rogers (2003, p. 281)

Figure 9. Original Technology Acceptance Model



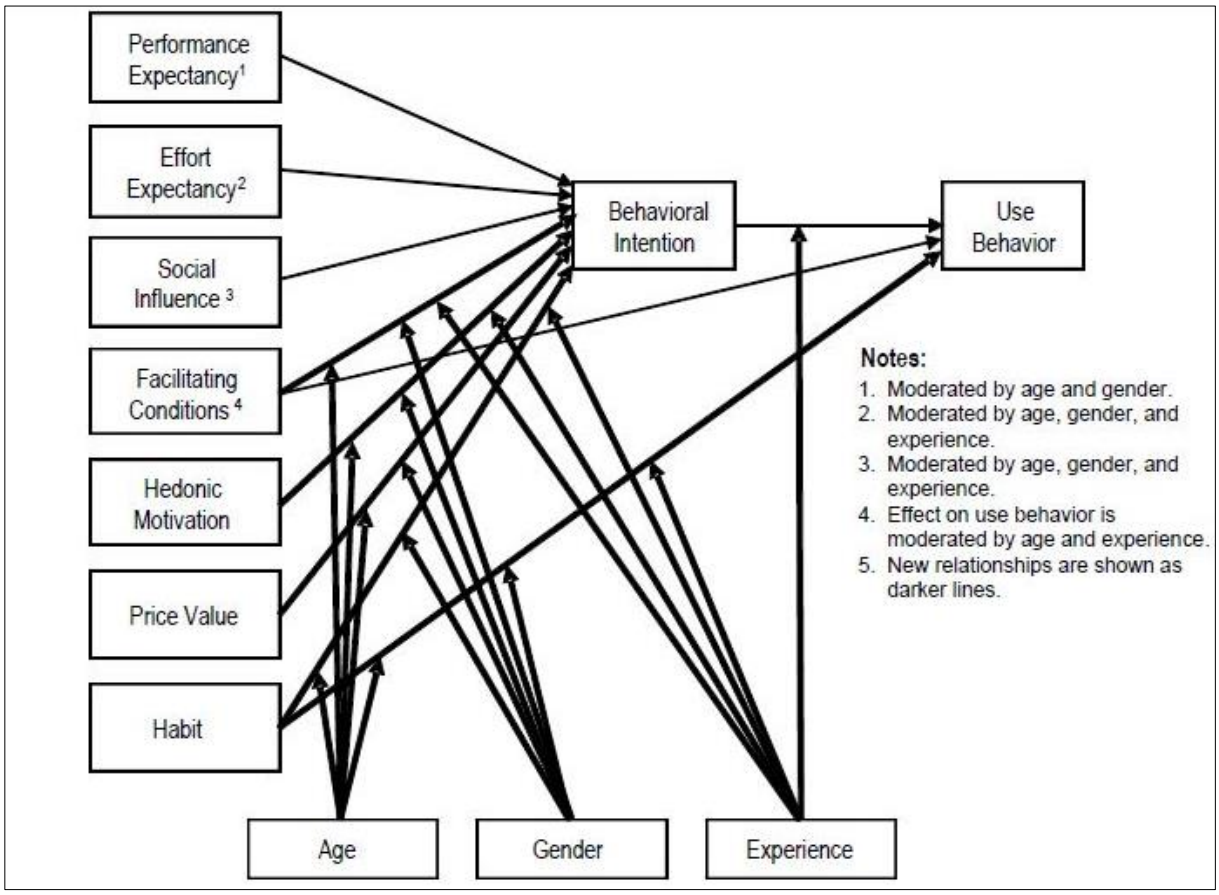
Source: Davis (1993, p. 476)

Figure 10. Model of Unified Theory of Acceptance and Use of Technology (UTAUT) in Organizational Contexts



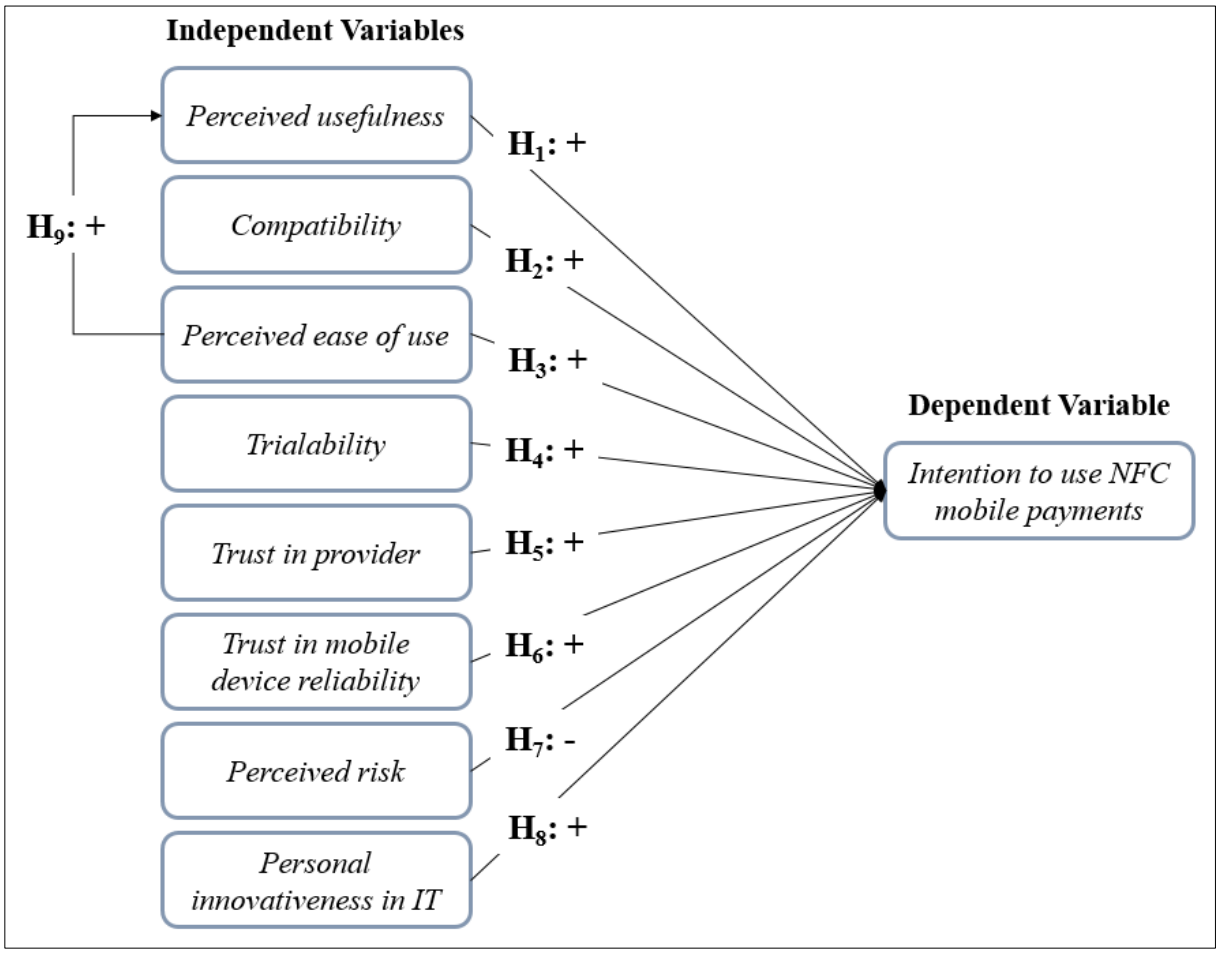
Source: Venkatesh et al. (2003, p. 447)

Figure 11. Model of Unified Theory of Acceptance and Use of Technology (UTAUT2) in Consumer Contexts



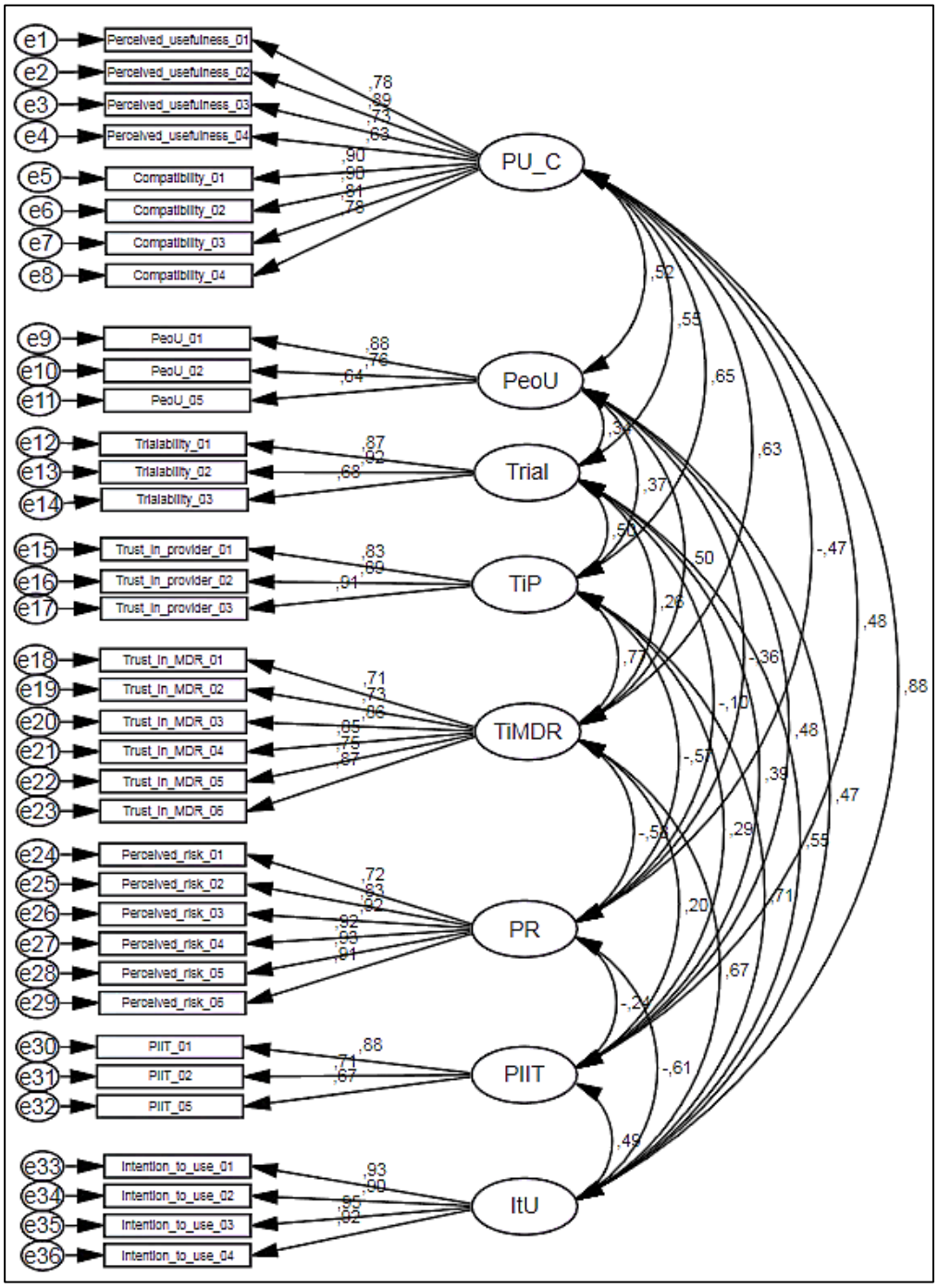
Source: Venkatesh, Thong, and Xu (2012, p. 160)

Figure 12. Research Model of Factors Influencing Consumers' Intention to Use NFC Mobile Payments



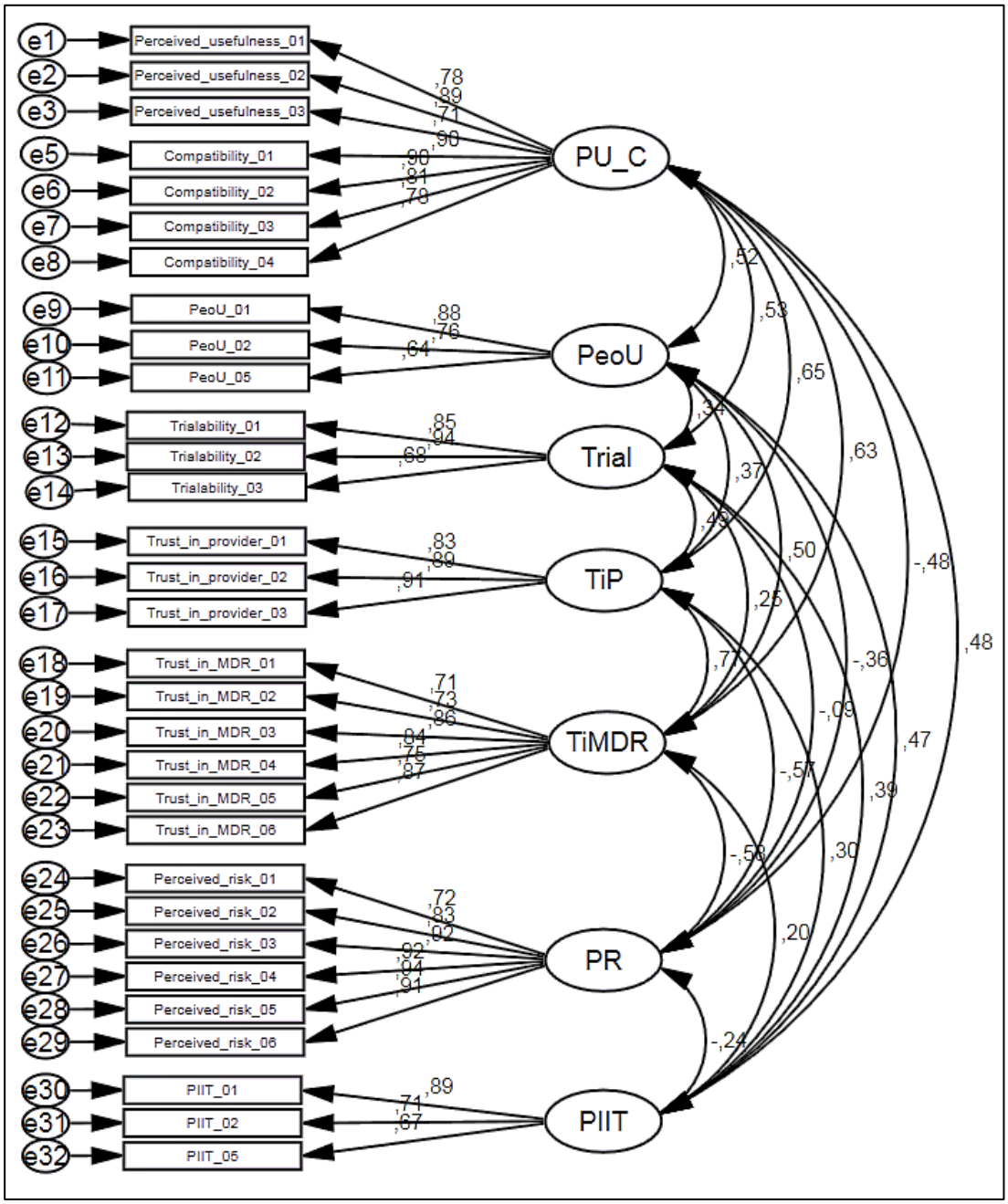
Note: H refers to "hypothesis". + and – refer to the direction of the hypothesized relationships between the independent variables and the dependent variable.

Figure 13. First CFA: Path Diagram in IBM SPSS Amos



Note: PU_C (*Perceived usefulness & compatibility*); PeoU (*Perceived ease of use*); Trial (*Trialability*); TiP (*Trust in provider*); TiMDR (*Trust in mobile device reliability*); PR (*Perceived Risk*); PIIT (*Personal innovativeness in IT*); ItU (*Intention to use NFC mobile payments*).

Figure 14. Second CFA: Path Diagram in IBM SPSS Amos



Note: PU_C (*Perceived usefulness & compatibility*); PeoU (*Perceived ease of use*); Trial (*Trialability*); TiP (*Trust in provider*); TiMDR (T*rust in mobile device reliability*); PR (*Perceived risk*); PIIT (*Personal innovativeness in IT*).

Figure 15. Histograms of All Variables with Normal Distribution Curves

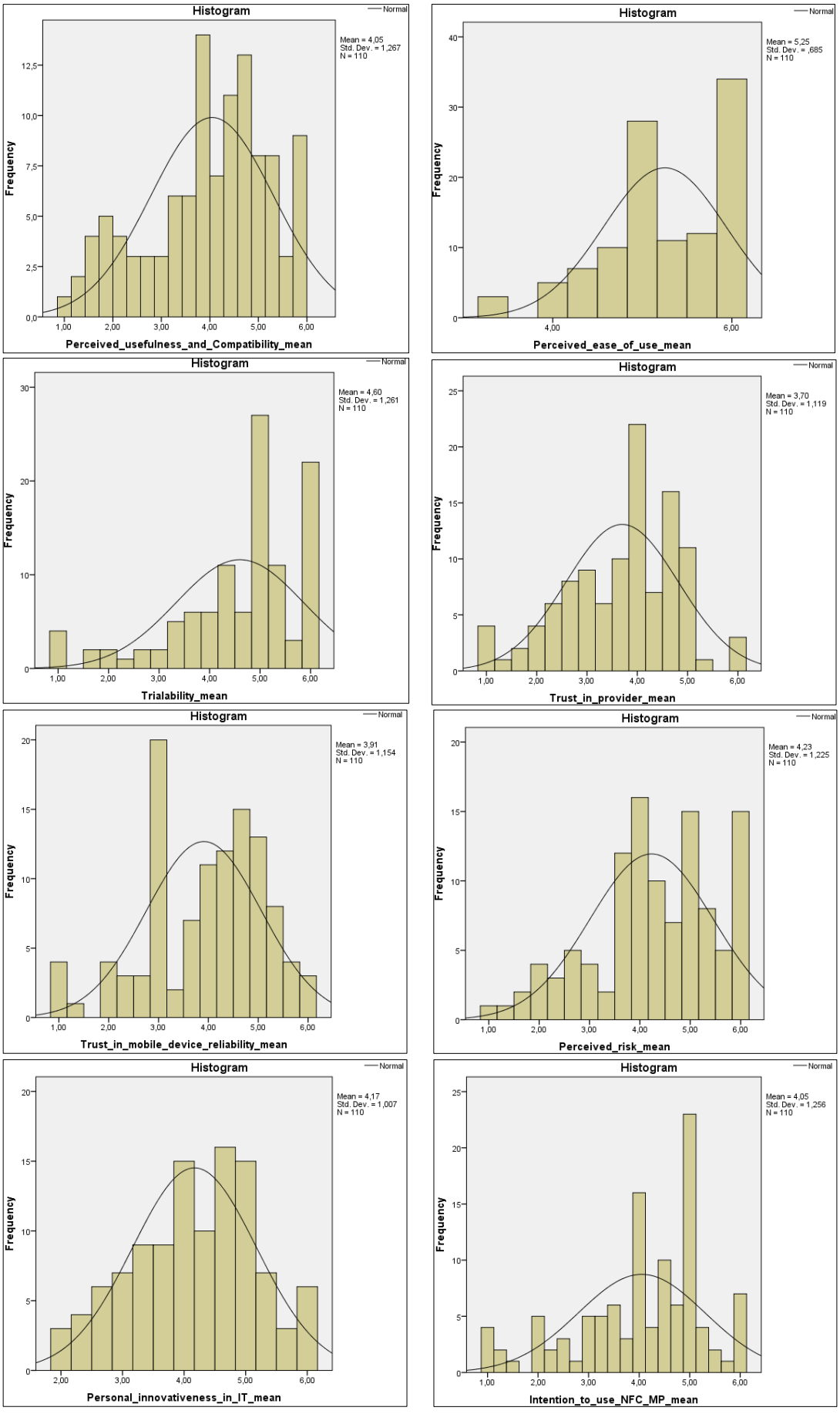


Figure 16. Normal Probability Plots of All Variables

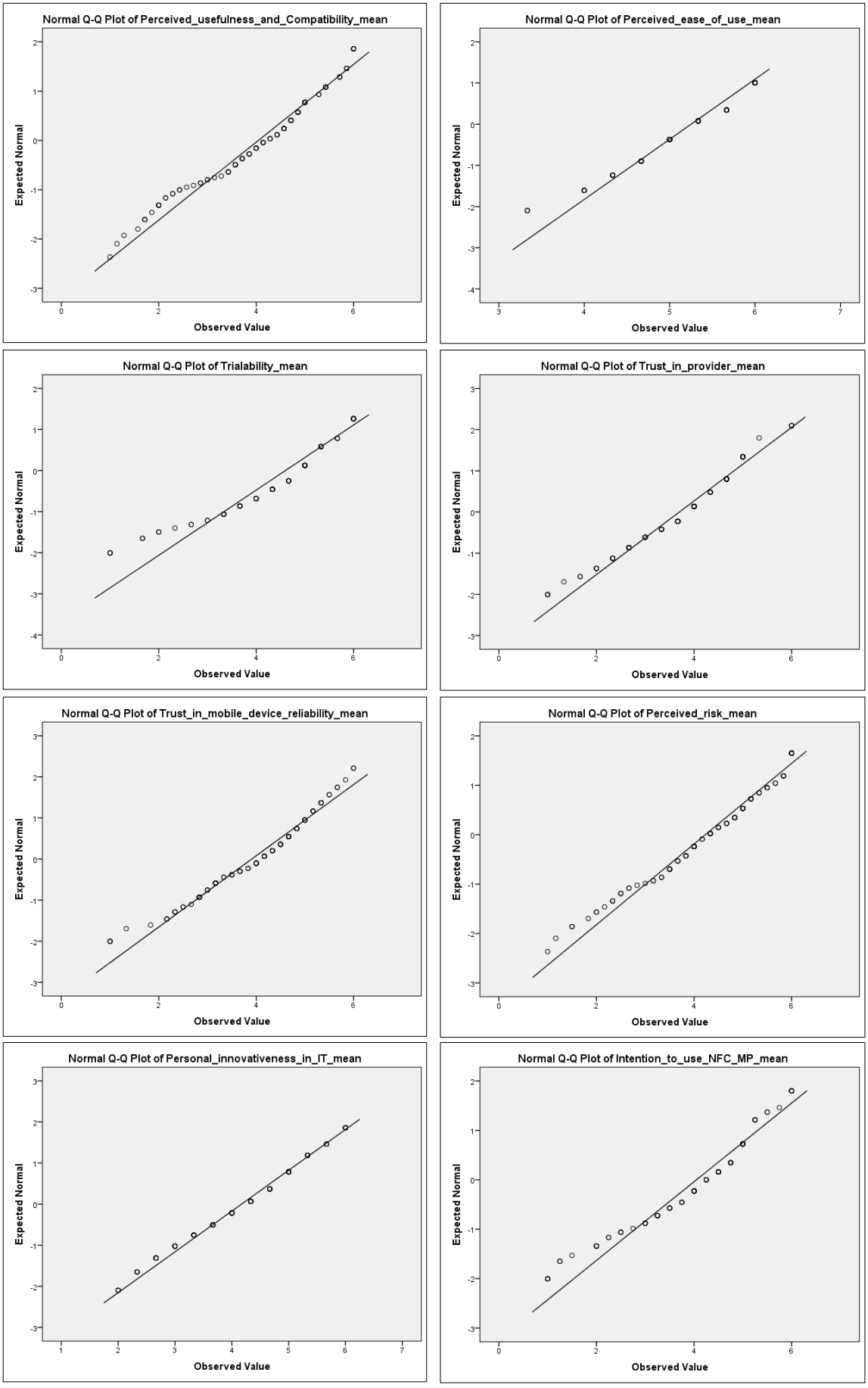


Figure 17. Scatter Plot Comparing Studentized Residuals and Unstandardized Predicted Values

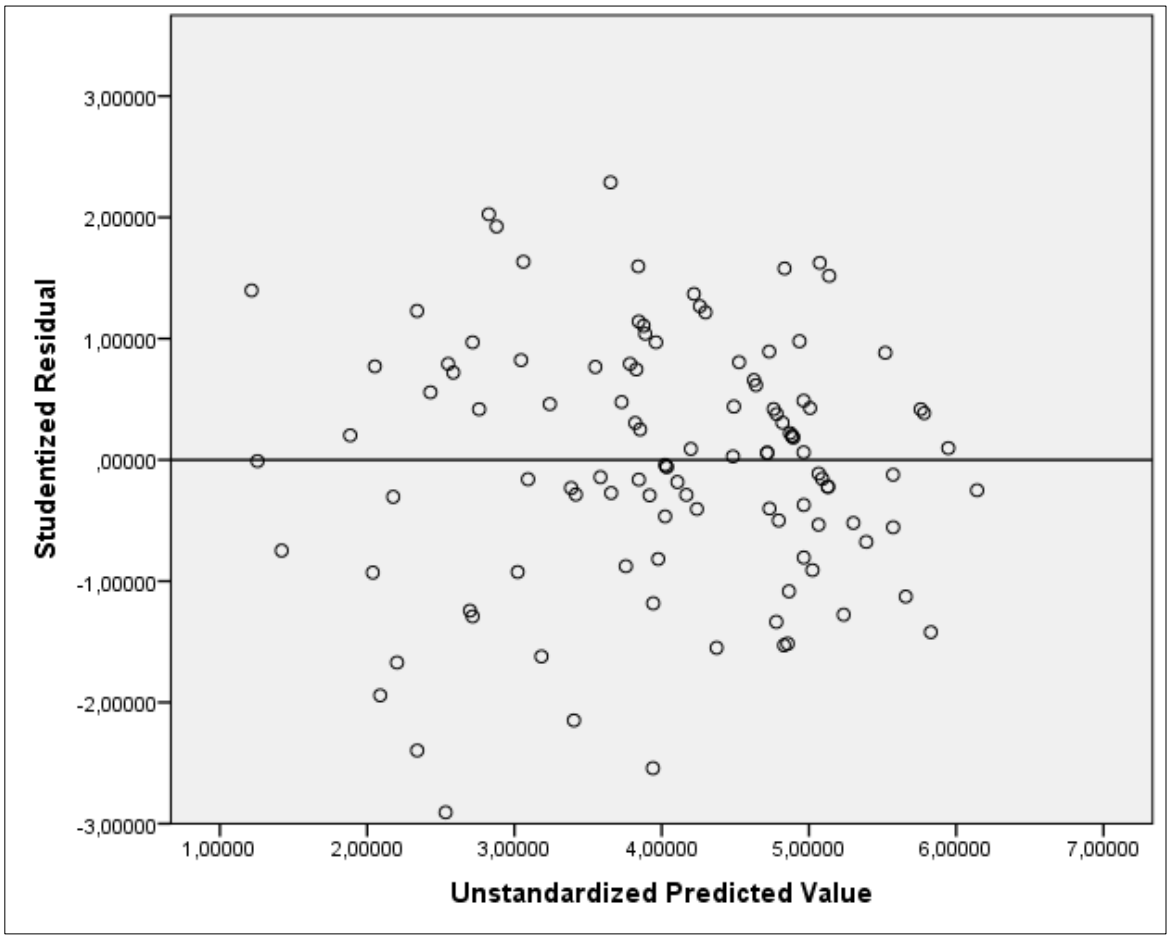


Figure 18. Histogram of Studentized Residuals with a Normal Distribution Curve

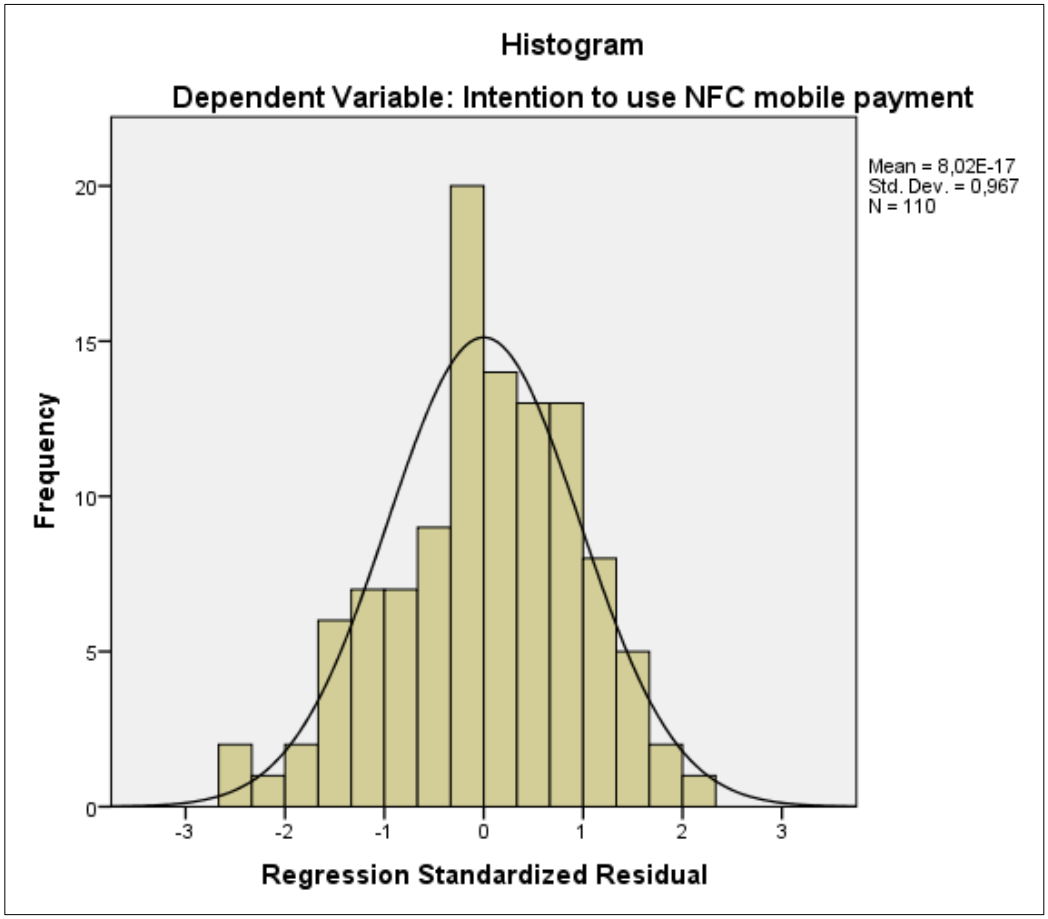


Figure 19. Normal P-P Plot of Studentized Residuals

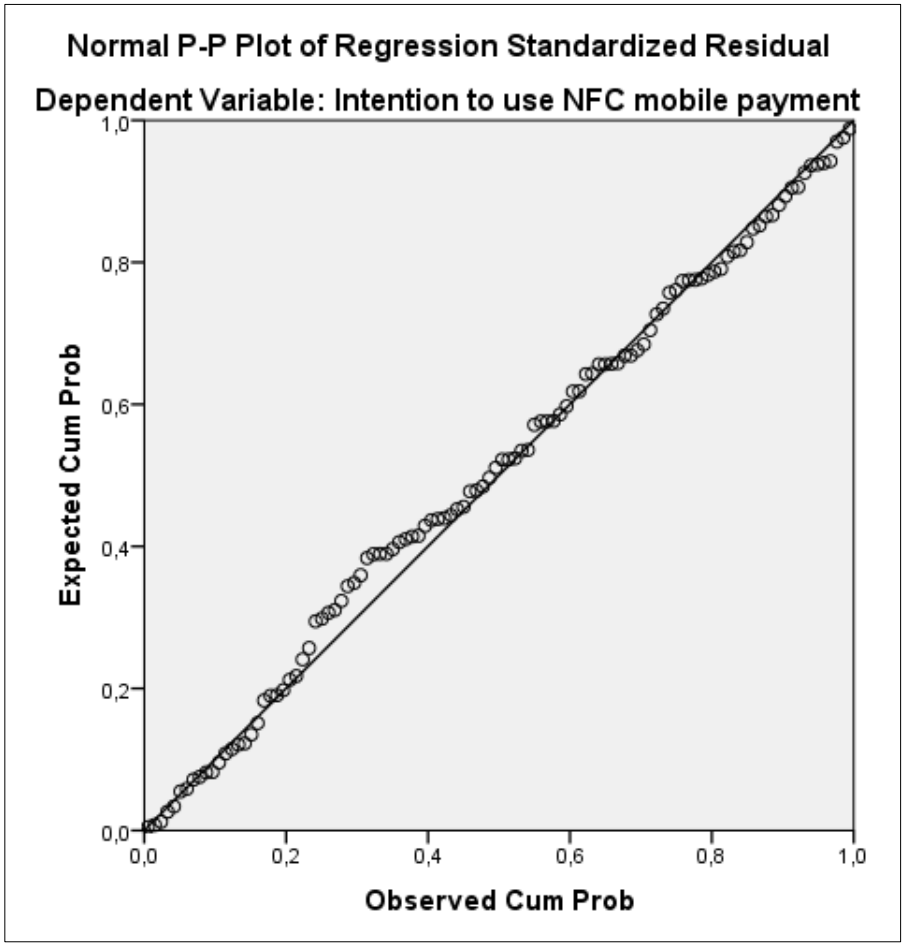
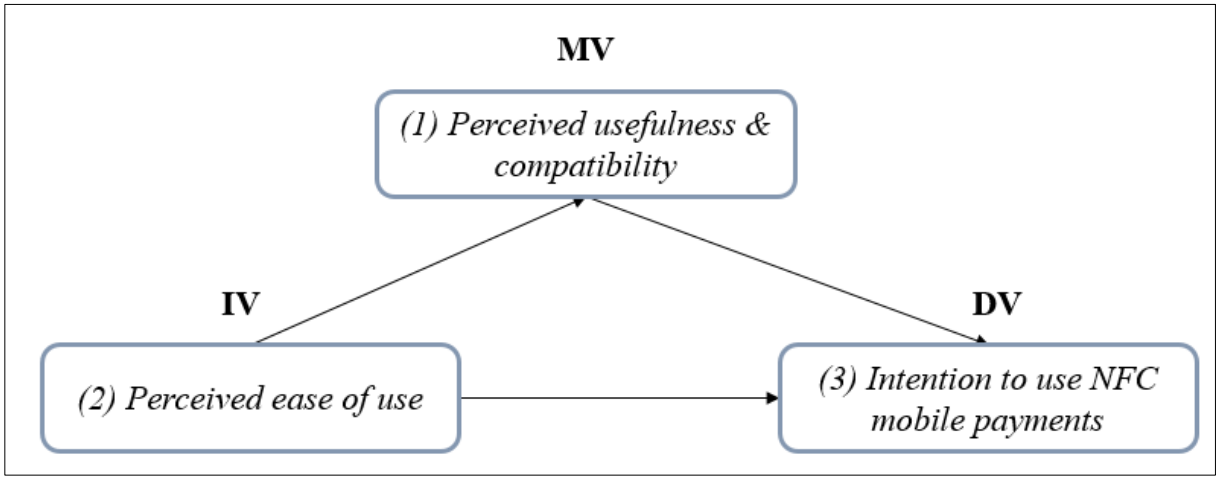


Figure 20. Mediation Analysis Model



Note:

- MV (mediator variable)
- IV (independent variable)
- DV (dependent variable)

Tables

Table 1. Measurement Scales

Construct	Items
Perceived usefulness, scale adapted from Shaw (2014)	**Perceived_usefulness_01:** Using NFC mobile payment would be useful. **Perceived_usefulness_02:** Using NFC mobile payment would be more convenient for me. **Perceived_usefulness_03:** Using NFC mobile payment would increase my shopping efficiency (i.e. shopping with minimum waste of time and effort). **Perceived_usefulness_04***:** Using NFC mobile payment would help me pay more quickly.
Compatibility, scale adapted from Schierz, Schilke, and Wirtz (2010)	**Compatibility_01:** Using NFC mobile payment fits well with my lifestyle. **Compatibility_02:** Using NFC mobile payment fits well with the way I like to purchase products and services. **Compatibility_03:** I would appreciate using NFC mobile payment instead of traditional modes of payment (e.g. credit/debit card, cash). **Compatibility_04:** I would appreciate using NFC mobile payment in addition to traditional modes of payment (e.g. credit/debit card, cash).
Perceived ease of use, scale adapted from Chen (2008)	**PeoU_01:** I believe that learning to use NFC mobile payment will be easy for me. **PeoU_02:** I believe that NFC mobile payment will be easy to use. **PeoU_03**:** I believe that when I use NFC mobile payment, the process will be clear and understandable. **PeoU_04*:** I believe that the user interface of my NFC mobile payment application will be confusing for me to use. (reverse-scaled item) **PeoU_05:** I believe that it will be easy for me to become skillful at using NFC mobile payment.
Trialability, scale adapted from Pham and Ho (2015)	**Trialability_01:** I want to be able to test NFC mobile payment first. **Trialability_02:** I want to be able to use it on a trial basis first to see what it can do. **Trialability_03:** I want to see a trial demo first.
Trust in provider, scale adapted from Slade et al. (2015)	**Trust_in_provider_01:** I believe mobile wallet service providers keep their promise. **Trust_in_provider_02:** I believe mobile wallet service providers keep customers' interests in mind. **Trust_in_provider_03:** I believe mobile wallet service providers are trustworthy. **Trust_in_provider_04**:** I believe mobile wallet service providers will do everything to secure the transactions for users.
Trust in mobile device reliability,	**Trust_in_MDR_01:** I trust in the reliability of the battery of my mobile device for making NFC mobile payments. **Trust_in_MDR_02:** I trust in the reliability of my mobile Internet

new scale	connection if such is required to make an NFC mobile payment. **Trust_in_MDR_03:** I trust in the reliability of my mobile applications. **Trust_in_MDR_04:** I trust in the reliability of my mobile operating system (e.g. iOS, Android) for making NFC mobile payments. **Trust_in_MDR_05:** I believe available authentication methods (PIN, fingerprint) to authorize NFC mobile payments are reliable. **Trust_in_MDR_06:** My mobile device is overall reliable for conducting NFC mobile payments.
Perceived risk, scale adapted from Slade et al. (2015)	**Perceived_risk_01:** I do not feel totally safe providing personal private information over NFC mobile payment systems. **Perceived_risk_02:** I am worried about using NFC mobile payment systems because other people may be able to access my bank account(s). **Perceived_risk_03:** I do not feel secure sending sensitive information across NFC mobile payment systems. **Perceived_risk_04:** I believe that overall riskiness of NFC mobile payment systems is high. **Perceived_risk_05:** The security measures built into NFC mobile payment systems are not strong enough to protect my finances. **Perceived_risk_06:** Using NFC mobile payment systems subjects your bank account(s) to financial risk.
Personal innovativeness in information technology, scale adapted from Agarwal and Prasad (1998)	**PIIT_01:** If I heard about a new information technology, I would look for ways to experiment with it. **PIIT_02:** Among my peers, I am usually the first to try out new information technologies. **PIIT_04*:** In general, I am hesitant to try out new information technologies. (reverse-scaled item) **PIIT_05:** I like to experiment with new information technologies.
Intention to use NFC mobile payments, scale adapted from Schierz, Schilke, and Wirtz (2010)	**Intention_to_use_01:** Given the opportunity, I will use NFC mobile payments. **Intention_to_use_02:** I am likely to use NFC mobile payments in the future. **Intention_to_use_03:** I am willing to use NFC mobile payments in the future. **Intention_to_use_04:** I intend to use NFC mobile payments when the opportunity arises.
* Items dropped based on the results of the reliability analysis. ** Items dropped based on the results of the EFA. *** Items dropped based on the results of the CFA.	

Table 2. Demographic Characteristics of the Study Participants

Age	**Frequency**	**%**
18 to 24 years	8	7.3
25 to 34 years	51	46.4
35 to 44 years	29	26.4
45 to 54 years	16	14.5
55 to 64 years	6	5.5
Gender	**Frequency**	**%**
Male	52	47.3
Female	58	52.7
Country of Origin	**Frequency**	**%**
Belgium	1	0.9
Bulgaria	49	44.5
Canada	1	0.9
China	1	0.9
Colombia	1	0.9
Estonia	1	0.9
Finland	1	0.9
Germany	48	43.6
India	3	2.7
Romania	1	0.9
Russia	2	1.8
Thailand	1	0.9
Education	**Frequency**	**%**
High school graduate	9	8.2
Trade/technical/vocational training	4	3.6
Bachelor's degree	28	25.5
Master's degree	63	57.3
Doctorate degree	4	3.6
Other advanced degree	2	1.8
Employment Status	**Frequency**	**%**
Employed for wages	88	80.0
Self-employed	4	3.6
Unemployed	2	1.8
Student	15	13.6
Retired	1	0.9

Table 3. Background Characteristics of the Study Participants

Question	Frequency	%
1. Do you own a smartphone?		
Yes	108	98.2
No	2	1.8
2. Have you ever completed an NFC mobile payment for goods or services at a physical store/a restaurant using your smartphone?		
Yes	3	2.7
No	107	97.3
3. Were you aware of NFC mobile payment as an alternative to credit card/debit card/cash payment at physical stores prior to completing this survey?		
Yes	77	70.0
No	33	30.0
4. Do you shop online for goods and services using your smartphone (e.g., on Amazon, Airbnb, public transportation providers)?		
Yes	74	67.3
No	36	32.7

Table 4. Initial Reliability Statistics of the *Perceived Usefulness* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.869	.871	4

Inter-Item Correlation Matrix				
	Perceived_usefulness_01	Perceived_usefulness_02	Perceived_usefulness_03	Perceived_usefulness_04
Perceived_usefulness_01	1.000	.778	.508	.571
Perceived_usefulness_02	.778	1.000	.678	.555
Perceived_usefulness_03	.508	.678	1.000	.674
Perceived_usefulness_04	.571	.555	.674	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Perceived_usefulness_01	12.43	13.862	.714	.648	.839
Perceived_usefulness_02	12.96	11.485	.782	.716	.807
Perceived_usefulness_03	13.35	12.158	.720	.605	.834
Perceived_usefulness_04	12.83	13.190	.684	.529	.847

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-to-total correlations exceed the minimum of .50. All items in this scale were retained.

Table 5. Initial Reliability Statistics of the *Compatibility* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.912	.912	4

Inter-Item Correlation Matrix				
	Compatibility_01	Compatibility_02	Compatibility_03	Compatibility_04
Compatibility_01	1.000	.868	.760	.654
Compatibility_02	.868	1.000	.756	.659
Compatibility_03	.760	.756	1.000	.626
Compatibility_04	.654	.659	.626	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Compatibility_01	11.55	16.617	.863	.784	.864
Compatibility_02	11.73	16.604	.863	.783	.864
Compatibility_03	12.19	18.064	.792	.632	.889
Compatibility_04	11.04	20.384	.696	.484	.921

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-to-total correlations exceed the minimum of .50. Despite the fact that the removal of the item Compatibility_04 would lead to a small increase in the overall reliability of the scale, it was decided to retain this item, as it exhibits satisfactory correlation to the other items and the scale.

Table 6. Initial Reliability Statistics of the *Perceived Ease of Use* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.748	.791	5

Inter-Item Correlation Matrix					
	PeoU_01	PeoU_02	PeoU_03	PeoU_04_r	PeoU_05
PeoU_01	1.000	.667	.492	.356	.561
PeoU_02	.667	1.000	.607	.351	.468
PeoU_03	.492	.607	1.000	.246	.346
PeoU_04_r	.356	.351	.246	1.000	.208
PeoU_05	.561	.468	.346	.208	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PeoU_01	19.51	9.298	.692	.544	.667
PeoU_02	19.65	8.834	.707	.563	.651
PeoU_03	20.23	7.865	.530	.383	.702
PeoU_04_r	20.42	8.484	.354	.151	.789
PeoU_05	19.75	9.416	.482	.332	.715

Cronbach's Alpha exceeds the minimum of .70. However, some of the inter-item correlations of the item PeoU_04_r are below the minimum of .30 and the item-to-total correlations of PeoU_04_r and PeoU_05 are below the minimum of .50. Thus, the item PeoU_04_r was removed, in order to increase the overall reliability of the scale from .748 to .789.

Table 7. Initial Reliability Statistics of the *Trialability* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.860	.860	3

Inter-Item Correlation Matrix			
	Trialability_01	Trialability_02	Trialability_03
Trialability_01	1.000	.794	.563
Trialability_02	.794	1.000	.658
Trialability_03	.563	.658	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Trialability_01	9.27	6.200	.751	.634	.792
Trialability_02	9.22	6.319	.827	.696	.714
Trialability_03	9.11	7.896	.642	.437	.884

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30. Item-to-total correlations exceed the minimum of .50. Despite the fact that the removal of the item Trialability_03 would lead to a small increase in the overall reliability of the scale, it was decided to retain this item, as it exhibits satisfactory correlation to the other items and the scale.

Table 8. Initial Reliability Statistics of the *Trust in Provider* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.900	.902	4

Inter-Item Correlation Matrix				
	Trust_in_provider_01	Trust_in_provider_02	Trust_in_provider_03	Trust_in_provider_04
Trust_in_provider_01	1.000	.740	.765	.633
Trust_in_provider_02	.740	1.000	.809	.586
Trust_in_provider_03	.765	.809	1.000	.646
Trust_in_provider_04	.633	.586	.646	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Trust_in_provider_01	11.45	11.076	.803	.651	.864
Trust_in_provider_02	11.65	10.026	.800	.691	.863
Trust_in_provider_03	11.66	10.390	.845	.733	.846
Trust_in_provider_04	11.10	11.265	.673	.465	.908

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-total correlations exceed the minimum of .50. Despite the fact that the removal of item Trust_in_provider_04 would lead to a small increase in the overall reliability of the scale, it was decided to retain this item, as it exhibits satisfactory correlation to the other items and the scale.

Table 9. Initial Reliability Statistics of the *Trust in Mobile Device Reliability* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.912	.913	6

Inter-Item Correlation Matrix						
	Trust_in_ MDR_01	Trust_in_ MDR_02	Trust_in_ MDR_03	Trust_in_ MDR_04	Trust_in_ MDR_05	Trust_in_M DR_06
Trust_in_ MDR_01	1.000	.724	.654	.531	.518	.592
Trust_in_ MDR_02	.724	1.000	.678	.576	.511	.613
Trust_in_ MDR_03	.654	.678	1.000	.743	.564	.766
Trust_in_ MDR_04	.531	.576	.743	1.000	.667	.737
Trust_in_ MDR_05	.518	.511	.564	.667	1.000	.651
Trust_in_ MDR_06	.592	.613	.766	.737	.651	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Trust_in_ MDR_01	19.57	34.485	.713	.587	.902
Trust_in_ MDR_02	19.80	33.464	.734	.607	.899
Trust_in_ MDR_03	19.72	33.452	.820	.714	.887
Trust_in_ MDR_04	19.36	33.261	.775	.666	.893
Trust_in_ MDR_05	19.32	34.879	.681	.518	.906
Trust_in_ MDR_06	19.50	33.720	.806	.685	.889

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-total correlations exceed the minimum of .50. All items were retained.

Table 10. Initial Reliability Statistics of the *Perceived Risk* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.951	.951	6

Inter-Item Correlation Matrix						
	Perceived_risk_01	Perceived_risk_02	Perceived_risk_03	Perceived_risk_04	Perceived_risk_05	Perceived_risk_06
Perceived_risk_01	1.000	.683	.700	.656	.657	.603
Perceived_risk_02	.683	1.000	.827	.738	.745	.745
Perceived_risk_03	.700	.827	1.000	.852	.843	.813
Perceived_risk_04	.656	.738	.852	1.000	.870	.835
Perceived_risk_05	.657	.745	.843	.870	1.000	.879
Perceived_risk_06	.603	.745	.813	.835	.879	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Perceived_risk_01	20.96	40.311	.716	.540	.956
Perceived_risk_02	21.02	37.449	.828	.718	.944
Perceived_risk_03	21.00	36.220	.907	.832	.934
Perceived_risk_04	21.21	37.286	.883	.815	.937
Perceived_risk_05	21.41	37.840	.895	.847	.936
Perceived_risk_06	21.35	38.194	.863	.806	.940

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-total correlations exceed the minimum of .50. All items were retained.

Table 11. Initial Reliability Statistics of the *Personal Innovativeness in IT* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.765	.774	4

Inter-Item Correlation Matrix				
	PIIT_01	PIIT_02	PIIT_04_r	PIIT_05
PIIT_01	1.000	.625	.387	.583
PIIT_02	.625	1.000	.265	.504
PIIT_04_r	.387	.265	1.000	.401
PIIT_05	.583	.504	.401	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PIIT_01	12.01	8.303	.692	.506	.649
PIIT_02	12.83	7.759	.571	.420	.710
PIIT_04_r	12.51	9.133	.409	.197	.793
PIIT_05	12.07	8.490	.628	.406	.679

Cronbach's Alpha exceeds the minimum of .70. Item PIIT_04_r was removed due to low inter-item and item-total correlations, contrary to the other items in the scale. The removal of PIIT_04_r increased the overall reliability of the scale from .765 to .793.

Table 12. Initial Reliability Statistics of the *Intention to Use* Scale

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.958	.959	4

Inter-Item Correlation Matrix				
	Intention_to_use_01	Intention_to_use_02	Intention_to_use_03	Intention_to_use_04
Intention_to_use_01	1.000	.825	.870	.873
Intention_to_use_02	.825	1.000	.883	.787
Intention_to_use_03	.870	.883	1.000	.876
Intention_to_use_04	.873	.787	.876	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Intention_to_use_01	12.15	14.829	.904	.822	.944
Intention_to_use_02	12.05	14.713	.869	.794	.953
Intention_to_use_03	12.13	14.039	.932	.872	.934
Intention_to_use_04	12.26	14.012	.888	.819	.948

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-total correlations exceed the minimum of .50. All items were retained.

Table 13. Recalculated Reliability Statistics of the *Perceived Ease of Use* Scale Excluding Item PeoU_04_r

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.789	.815	4

Inter-Item Correlation Matrix				
	PeoU_01	PeoU_02	PeoU_03	PeoU_05
PeoU_01	1.000	.667	.492	.561
PeoU_02	.667	1.000	.607	.468
PeoU_03	.492	.607	1.000	.346
PeoU_05	.561	.468	.346	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach ’s Alpha if Item Deleted
PeoU_01	15.04	5.558	.696	.532	.709
PeoU_02	15.18	5.159	.723	.555	.685
PeoU_03	15.75	4.224	.566	.382	.787
PeoU_05	15.28	5.489	.515	.331	.777

Cronbach’s Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-total correlations exceed the minimum of .50.

Table 14. Recalculated Reliability Statistics of the *Personal Innovativeness in IT* Scale Excluding Item PIIT_04_r

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.793	.799	3

Inter-Item Correlation Matrix			
	PIIT_01	PIIT_02	PIIT_05
PIIT_01	1.000	.625	.583
PIIT_02	.625	1.000	.504
PIIT_05	.583	.504	1.000

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PIIT_01	8.05	4.631	.698	.487	.662
PIIT_02	8.86	3.917	.633	.420	.736
PIIT_05	8.11	4.887	.597	.372	.759

Cronbach's Alpha exceeds the minimum of .70. Inter-item correlations exceed the minimum of .30 and item-total correlations exceed the minimum of .50.

Table 15. Final Results of the Reliability Analysis

Construct	**Number of Items**	**Cronbach's Alpha (> 0.70)**	**Item-total Correlations (> 0.50)**	**Inter-item Correlations (> 0.30)**
Perceived usefulness	4	0.869	✓	✓
Compatibility	4	0.912	✓	✓
Perceived ease of use	4	0.789	✓	✓
Trialability	3	0.860	✓	✓
Trust in provider	4	0.900	✓	✓
Trust in mobile phone reliability	6	0.912	✓	✓
Perceived risk	6	0.951	✓	✓
Personal innovativeness in IT	3	0.793	✓	✓
Intention to use NFC mobile payments	4	0.958	✓	✓

Table 16. First EFA: Results of KMO Test for Sampling Adequacy and Bartlett Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.903
Bartlett's Test of Sphericity	**Approx. Chi-Square**	3918.219
	df	703
	Sig.	.000

Table 17. First EFA: Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.439	43.262	43.262	16.169	42.549	42.549	7.906	20.805	20.805
2	3.910	10.289	53.550	3.658	9.627	52.176	5.650	14.868	35.672
3	2.548	6.705	60.255	2.236	5.883	58.059	3.927	10.335	46.007
4	2.140	5.632	65.887	1.800	4.737	62.796	2.501	6.581	52.588
5	1.531	4.030	69.917	1.256	3.307	66.103	2.378	6.257	58.845
6	1.296	3.409	73.327	.961	2.529	68.631	2.321	6.108	64.952
7	1.004	2.643	75.969	.691	1.819	70.450	2.089	5.498	70.450
8	.867	2.281	78.251						
9	.766	2.015	80.266						
10	.714	1.878	82.143						
11	.608	1.599	83.743						
12	.537	1.414	85.157						
13	.504	1.325	86.482						
14	.452	1.190	87.672						
15	.438	1.153	88.824						
16	.412	1.083	89.907						
17	.380	.999	90.907						
18	.340	.895	91.802						
19	.321	.846	92.648						
20	.299	.786	93.434						
21	.262	.688	94.123						
22	.248	.653	94.776						
23	.228	.601	95.377						
24	.216	.570	95.947						
25	.205	.538	96.485						
26	.184	.485	96.970						
27	.151	.397	97.367						
28	.137	.361	97.728						
29	.127	.333	98.062						
30	.123	.323	98.385						
31	.115	.303	98.687						
32	.103	.270	98.957						
33	.099	.261	99.218						
34	.077	.203	99.420						
35	.070	.184	99.605						
36	.064	.167	99.772						
37	.054	.142	99.913						
38	.033	.087	100.000						
Extraction Method: Principal Axis Factoring.									

Table 18. First EFA: Rotated Factor Matrix[a]

Items	Factor						
	1	2	3	4	5	6	7
Perceived_usefulness_01	.614						
Perceived_usefulness_02	.790						
Perceived_usefulness_03	.709						
Perceived_usefulness_04	.551						
Compatibility_01	.799						
Compatibility_02	.777						
Compatibility_03	.730						
Compatibility_04	.699						
PeoU_01				.763			
PeoU_02				.720			
PeoU_03				-			
PeoU_05				.579			
Trialability_01					.639		
Trialability_02					.836		
Trialability_03					.713		
Trust_in_provider_01						.616	
Trust_in_provider_02						.628	
Trust_in_provider_03						.625	
Trust_in_provider_04						-	
Trust_in_MDR_01			.731				
Trust_in_MDR_02			.824				
Trust_in_MDR_03			.734				
Trust_in_MDR_04			.581				
Trust_in_MDR_05			-				
Trust_in_MDR_06			.601				
Perceived_risk_01		-.706					
Perceived_risk_02		-.852					
Perceived_risk_03		-.871					
Perceived_risk_04		-.852					
Perceived_risk_05		-.861					
Perceived_risk_06		-.829					
PIIT_01							.795
PIIT_02							.685
PIIT_05							.659
Intention_to_use_01	.727						
Intention_to_use_02	.669						
Intention_to_use_03	.705						
Intention_to_use_04	.707						
Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.							
a. Rotation converged in 7 iterations.							

Table 19. Second EFA: Results of KMO Test for Sampling Adequacy and Bartlett Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.897
Bartlett's Test of Sphericity	**Approx. Chi-Square**	3178.548
	df	561
	Sig.	.000

Table 20. Second EFA: Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.650	40.148	40.148	13.348	39.259	39.259	5.468	16.083	16.083
2	3.863	11.361	51.509	3.598	10.582	49.841	5.342	15.712	31.795
3	2.500	7.352	58.861	2.144	6.307	56.147	5.176	15.222	47.018
4	2.049	6.028	64.889	1.695	4.987	61.134	2.552	7.506	54.524
5	1.509	4.437	69.326	1.217	3.579	64.713	2.319	6.821	61.345
6	1.279	3.763	73.088	.927	2.726	67.438	2.072	6.093	67.438
7	.984	2.895	75.984						
8	.831	2.444	78.427						
9	.722	2.125	80.552						
10	.615	1.809	82.361						
11	.596	1.754	84.115						
12	.497	1.462	85.577						
13	.465	1.366	86.943						
14	.439	1.290	88.233						
15	.397	1.167	89.400						
16	.382	1.123	90.523						
17	.346	1.017	91.540						
18	.320	.941	92.481						
19	.308	.907	93.389						
20	.266	.783	94.172						
21	.255	.750	94.922						
22	.227	.668	95.590						
23	.209	.616	96.206						
24	.196	.578	96.784						
25	.173	.510	97.293						
26	.147	.433	97.726						
27	.128	.376	98.103						
28	.122	.359	98.462						
29	.113	.332	98.794						
30	.107	.314	99.107						
31	.097	.285	99.393						
32	.080	.235	99.628						
33	.069	.202	99.829						
34	.058	.171	100.000						

Extraction Method: Principal Axis Factoring.

Table 21. Second EFA: Rotated Factor Matrix[a]

Items	Factor					
	1	2	3	4	5	6
Perceived_usefulness_01			.606			
Perceived_usefulness_02			.781			
Perceived_usefulness_03			.705			
Perceived_usefulness_04			.570			
Compatibility_01			.753			
Compatibility_02			.749			
Compatibility_03			.701			
Compatibility_04			.684			
PeoU_01					.787	
PeoU_02					.666	
PeoU_03					-	
PeoU_05					.560	
Trialability_01				.688		
Trialability_02				.865		
Trialability_03				.677		
Trust_in_provider_01	.623					
Trust_in_provider_02	.649					
Trust_in_provider_03	.624					
Trust_in_provider_04	-					
Trust_in_MDR_01	.705					
Trust_in_MDR_02	.708					
Trust_in_MDR_03	.780					
Trust_in_MDR_04	.685					
Trust_in_MDR_05	.594					
Trust_in_MDR_06	.718					
Perceived_risk_01		.726				
Perceived_risk_02		.839				
Perceived_risk_03		.870				
Perceived_risk_04		.850				
Perceived_risk_05		.857				
Perceived_risk_06		.823				
PIIT_01						.827
PIIT_02						.664
PIIT_05						.613
Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 7 iterations.						

Table 22. First CFA: Model Fit Statistics (for $N < 250$ and $m \geq 30$)

Fit Measures Types	Value	Threshold Value Suggesting Good Model Fit	Interpretation
Chi-square test	$\chi^2 = 911.94$ ($p = 0.000$) df = 566	Non-significant test (Hair et al. 2010, p. 666)	x
Absolute Fit Measures	RMSEA = 0.075	< .08 with CFI > .92 (Hair et al. 2010, p. 672)	✓
	Normed χ^2 (χ^2:df) = 1.611	< 2 (very good); between 2 and 5 (acceptable) (Hair et al. 2010, p. 721)	✓
Incremental Fit Indices	CFI = 0.904	> .92 (Hair et al. 2010, p. 672)	x

Note:

- N – Sample size
- m – Number of observed variables (i.e., items) in the model
- df – Degrees of freedom
- RMSEA – Root mean square error of approximation
- CFI – Comparative fit index

Table 23. First CFA: Standardized Regression Weights, AVE, and CR

Items	Constructs	Standardized Regression Weights	AVE	CR
Perceived_usefulness_01	PU_C	0.78	0.650	0.936
Perceived_usefulness_02	PU_C	0.888		
Perceived_usefulness_03	PU_C	0.728		
Perceived_usefulness_04	PU_C	0.632		
Compatibility_01	PU_C	0.899		
Compatibility_02	PU_C	0.896		
Compatibility_03	PU_C	0.815		
Compatibility_04	PU_C	0.776		
PeoU_01	PeoU	0.877	0.583	0.805
PeoU_02	PeoU	0.758		
PeoU_05	PeoU	0.637		
Trialability_01	Trial	0.865	0.689	0.868
Trialability_02	Trial	0.923		
Trialability_03	Trial	0.684		
Trust_in_provider_01	TiP	0.83	0.772	0.910
Trust_in_provider_02	TiP	0.89		
Trust_in_provider_03	TiP	0.914		
Trust_in_MDR_01	TiMD	0.707	0.636	0.912
Trust_in_MDR_02	TiMD	0.727		
Trust_in_MDR_03	TiMD	0.861		
Trust_in_MDR_04	TiMD	0.846		
Trust_in_MDR_05	TiMD	0.752		
Trust_in_MDR_06	TiMD	0.874		
Perceived_risk_01	PR	0.721	0.767	0.951
Perceived_risk_02	PR	0.828		
Perceived_risk_03	PR	0.921		
Perceived_risk_04	PR	0.924		
Perceived_risk_05	PR	0.934		
Perceived_risk_06	PR	0.907		
PIIT_01	PIIT	0.883	0.577	0.802
PIIT_02	PIIT	0.706		
PIIT_05	PIIT	0.674		
Intention_to_use_01	ItU	0.931	0.854	0.959
Intention_to_use_02	ItU	0.895		
Intention_to_use_03	ItU	0.953		
Intention_to_use_04	ItU	0.916		

Note:

- AVE – Average variance extracted is calculated by $AVE = \frac{\sum_{i=1}^{n} L_i^2}{n}$, where $\sum_{i=1}^{n} L_i^2$ is the

sum of squared standardized regression weights per construct and *n* is the number of items per construct (Hair et al. 2010, p. 709).

- CR – Construct reliability is calculated by $CR = \frac{(\sum_{i=1}^{n} L_i)^2}{(\sum_{i=1}^{n} L_i)^2 + (\sum_{i=1}^{n} e_i)}$, where $(\sum_{i=1}^{n} L_i)^2$ is the squared sum of standardized regression weights per construct and $(\sum_{i=1}^{n} e_i)$ is the sum of the error variance terms for a construct (Hair et al. 2010, p. 710).

Table 24. First CFA: Inter-construct Correlation Estimates

All Possible Construct Combinations			Inter-construct Correlation Estimates
PU_C	<-->	PeoU	0.518
PU_C	<-->	Trial	0.554
PU_C	<-->	TiP	0.65
PU_C	<-->	TiMD	0.628
PU_C	<-->	PR	-0.475
PU_C	<-->	PIIT	0.482
PU_C	<-->	ItU	0.878
PeoU	<-->	Trial	0.339
PeoU	<-->	TiP	0.371
PeoU	<-->	TiMD	0.503
PeoU	<-->	PR	-0.363
PeoU	<-->	PIIT	0.477
PeoU	<-->	ItU	0.47
Trial	<-->	TiP	0.496
Trial	<-->	TiMD	0.259
Trial	<-->	PR	-0.101
Trial	<-->	PIIT	0.394
Trial	<-->	ItU	0.552
TiP	<-->	TiMD	0.772
TiP	<-->	PR	-0.569
TiP	<-->	PIIT	0.294
TiP	<-->	ItU	0.712
TiMD	<-->	PR	-0.583
TiMD	<-->	PIIT	0.2
TiMD	<-->	ItU	0.673
PR	<-->	PIIT	-0.243
PR	<-->	ItU	-0.608
PIIT	<-->	ItU	0.487

Note: PU_C (*Perceived usefulness & compatibility*); PeoU (*Perceived ease of use*); Trial (*Trialability*); TiP (*Trust in provider*); TiMDR (*Trust in mobile device reliability*); PR (*Perceived risk*); PIIT (*Personal innovativeness in IT*); ItU (*Intention to use NFC mobile payments*).

Table 25. First CFA: Comparison of AVE Values and Squared Inter-Construct Correlation Estimates

	PIIT	PU_C	PeoU	Trial	TiP	TiMD	PR	ItU
PIIT	**0.577**							
PU_C	0.232	**0.650**						
PeoU	0.228	0.268	**0.583**					
Trial	0.155	0.307	0.115	**0.689**				
TiP	0.086	0.423	0.138	0.246	**0.772**			
TiMD	0.040	0.394	0.253	0.067	0.596	**0.636**		
PR	0.059	0.226	0.132	0.010	0.324	0.340	**0.767**	
ItU	0.237	0.771	0.221	0.305	0.507	0.453	0.370	**0.854**

Note:

- Values on the diagonal are AVE values. Values below the diagonal are squared inter-construct correlation estimates.
- PU_C (*Perceived usefulness & compatibility*); PeoU (*Perceived ease of use*); Trial (*Trialability*); TiP (*Trust in provider*); TiMDR (*Trust in mobile device reliability*); PR (*Perceived risk*); PIIT (*Personal innovativeness in IT*); ItU (*Intention to use NFC mobile payments*).

Table 26. Second CFA: Model Fit Statistics (for N < 250 and m ≥ 30)

Fit Measures Types	Value	Threshold Value Suggesting Good Model Fit	Interpretation
Chi-square test	χ^2 = 617.764 (p = 0.000) df = 413	Non-significant test (Hair et al. 2010, p. 666)	x
Absolute Fit Measures	RMSEA = 0.067	< .08 with CFI > .92 (Hair et al. 2010, p. 672)	✓
	Normed χ^2 (χ^2:df) = 1.496	< 2 (very good); between 2 and 5 (acceptable) (Hair et al. 2010, 721)	✓
Incremental Fit Indices	CFI = 0.926	> .92 (Hair et al. 2010, p. 672)	✓

Note:

- N – Sample size
- m – Number of observed variables (i.e., items) in the model
- df – Degrees of freedom
- RMSEA – Root mean square error of approximation
- CFI – Comparative fit index

Table 27. Second CFA: Standardized Regression Weights, AVE, and CR

Items	Constructs	Standardized Regression Weights	AVE	CR
Perceived_usefulness_01	PU_C	0.782	0.686	0.938
Perceived_usefulness_02	PU_C	0.891		
Perceived_usefulness_03	PU_C	0.713		
Compatibility_01	PU_C	0.896		
Compatibility_02	PU_C	0.901		
Compatibility_03	PU_C	0.811		
Compatibility_04	PU_C	0.783		
PeoU_01	PeoU	0.876	0.584	0.805
PeoU_02	PeoU	0.759		
PeoU_05	PeoU	0.638		
Trialability_01	Trial	0.851	0.690	0.868
Trialability_02	Trial	0.937		
Trialability_03	Trial	0.685		
Trust_in_provider_01	TiP	0.831	0.772	0.910
Trust_in_provider_02	TiP	0.892		
Trust_in_provider_03	TiP	0.911		
Trust_in_MDR_01	TiMDR	0.71	0.637	0.913
Trust_in_MDR_02	TiMDR	0.732		
Trust_in_MDR_03	TiMDR	0.864		
Trust_in_MDR_04	TiMDR	0.845		
Trust_in_MDR_05	TiMDR	0.746		
Trust_in_MDR_06	TiMDR	0.873		
Perceived_risk_01	PR	0.72	0.767	0.951
Perceived_risk_02	PR	0.828		
Perceived_risk_03	PR	0.919		
Perceived_risk_04	PR	0.922		
Perceived_risk_05	PR	0.936		
Perceived_risk_06	PR	0.909		
PIIT_01	PIIT	0.887	0.577	0.801
PIIT_02	PIIT	0.707		
PIIT_05	PIIT	0.667		

Note:

- AVE – Average variance extracted is calculated by $AVE = \frac{\sum_{i=1}^{n} L_i^2}{n}$, where $\sum_{i=1}^{n} L_i^2$ is the sum of squared standardized regression weights per construct and *n* is the number of items per construct (Hair et al. 2010, p. 709).
- CR – Construct reliability is calculated by $CR = \frac{(\sum_{i=1}^{n} L_i)^2}{(\sum_{i=1}^{n} L_i)^2 + (\sum_{i=1}^{n} e_i)}$, where $(\sum_{i=1}^{n} L_i)^2$ is

the squared sum of standardized regression weights per construct and $(\sum_{i=1}^{n} e_i)$ is the sum of the error variance terms for a construct (Hair et al. 2010, p. 710).

Table 28. Second CFA: Inter-construct Correlation Estimates

All Possible Construct Combinations			Inter-construct Correlation Estimates
PU_C	<-->	PeoU	0.52
PU_C	<-->	Trial	0.532
PU_C	<-->	TiP	0.651
PU_C	<-->	TiMDR	0.626
PU_C	<-->	PR	-0.483
PU_C	<-->	PIIT	0.484
PeoU	<-->	Trial	0.337
PeoU	<-->	TiP	0.37
PeoU	<-->	TiMDR	0.503
PeoU	<-->	PR	-0.364
PeoU	<-->	PIIT	0.475
Trial	<-->	TiP	0.492
Trial	<-->	TiMDR	0.254
Trial	<-->	PR	-0.094
Trial	<-->	PIIT	0.394
TiP	<-->	TiMDR	0.771
TiP	<-->	PR	-0.57
TiP	<-->	PIIT	0.296
TiMDR	<-->	PR	-0.582
TiMDR	<-->	PIIT	0.199
PR	<-->	PIIT	-0.242
PU_C	<-->	PeoU	0.52
PU_C	<-->	Trial	0.532
PU_C	<-->	TiP	0.651
PU_C	<-->	TiMDR	0.626
PU_C	<-->	PR	-0.483
PU_C	<-->	PIIT	0.484
PeoU	<-->	Trial	0.337

Note: PU_C (*Perceived usefulness & compatibility*); PeoU (*Perceived ease of use*); Trial (*Trialability*); TiP (*Trust in provider*); TiMDR (*Trust in mobile device reliability*); PR (*Perceived risk*); PIIT (*Personal innovativeness in IT*); ItU (*Intention to use NFC mobile payments*).

Table 29. Second CFA: Comparison of AVE Values and Squared Inter-Construct Correlation Estimates

	PR	PU_C	PeoU	Trial	TiP	TiMDR	PIIT
PR	**0.767**						
PU_C	0.233	**0.686**					
PeoU	0.132	0.270	**0.584**				
Trial	0.009	0.283	0.114	**0.690**			
TiP	0.325	0.424	0.137	0.242	**0.772**		
TiMDR	0.339	0.392	0.253	0.065	0.594	**0.637**	
PIIT	0.059	0.234	0.226	0.155	0.088	0.040	**0.577**

Note:

- Values on the diagonal are AVE values. Values below the diagonal are squared inter-construct correlation estimates.
- PU_C (*Perceived usefulness & compatibility*); PeoU (*Perceived ease of use*); Trial (*Trialability*); TiP (*Trust in provider*); TiMDR (*Trust in mobile device reliability*); PR (*Perceived risk*); PIIT (*Personal innovativeness in IT*).

Table 30. Results of Harman's Single-Factor Test for Common Method Bias: Total Variance Explained in EFA

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.251	43.574	43.574	14.762	42.178	42.178
2	3.750	10.715	54.289			
3	2.510	7.171	61.460			
4	2.088	5.966	67.425			
5	1.472	4.205	71.631			
6	1.270	3.628	75.258			
7	.903	2.580	77.838			
8	.756	2.159	79.998			
9	.659	1.884	81.882			
10	.611	1.746	83.627			
11	.577	1.650	85.277			
12	.478	1.366	86.643			
13	.439	1.254	87.897			
14	.411	1.175	89.072			
15	.393	1.124	90.196			
16	.372	1.064	91.260			
17	.339	.969	92.230			
18	.288	.824	93.054			
19	.276	.789	93.843			
20	.257	.734	94.576			
21	.222	.636	95.212			
22	.211	.602	95.814			
23	.207	.592	96.406			
24	.174	.497	96.903			
25	.166	.474	97.377			
26	.142	.406	97.783			
27	.126	.359	98.142			
28	.122	.349	98.491			
29	.115	.328	98.819			
30	.101	.289	99.107			
31	.085	.242	99.349			
32	.073	.208	99.557			
33	.064	.182	99.739			
34	.056	.159	99.898			
35	.036	.102	100.000			
Extraction Method: Principal Axis Factoring.						

Table 31. Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests of Normality

Variables	**Kolmogorov-Smirnov[a]**			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Perceived usefulness & compatibility	.097	110	.013	.957	110	.001
Perceived ease of use	.172	110	.000	.887	110	.000
Trialability	.197	110	.000	.874	110	.000
Trust in provider	.151	110	.000	.958	110	.002
Trust in mobile device reliability	.113	110	.001	.964	110	.004
Perceived risk	.079	110	.086	.958	110	.002
Personal innovativeness in IT	.116	110	.001	.971	110	.016
Intention to use NFC mobile payments	.148	110	.000	.931	110	.000
a. Lilliefors Significance Correction						

Table 32. Pearson Correlations between All Variables in the Research Model

Correlations									
		Intention to use NFC mobile payment	*Perceived usefulness & Compatibility*	*Perceived ease of use*	*Trialability*	*Trust in provider*	*Trust in mobile device reliability*	*Perceived risk*	*Personal innovativeness in IT*
Pearson Correlation	*Intention to use NFC mobile payment*	1,000	,841	,441	,504	,648	,626	-,558	,417
	Perceived usefulness & Compatibility	,841	1,000	,469	,507	,595	,582	-,440	,392
	Perceived ease of use	,441	,469	1,000	,245	,337	,442	-,306	,379
	Trialability	,504	,507	,245	1,000	,441	,253	-,054	,260
	Trust in provider	,648	,595	,337	,441	1,000	,702	-,507	,217
	Trust in mobile device reliability	,626	,582	,442	,253	,702	1,000	-,503	,159
	Perceived risk	-,558	-,440	-,306	-,054	-,507	-,503	1,000	-,208
	Personal innovativeness in IT	,417	,392	,379	,260	,217	,159	-,208	1,000
Sig. (1-tailed)	*Intention to use NFC mobile payment*	.	,000	,000	,000	,000	,000	,000	,000
	Perceived usefulness & Compatibility	,000	.	,000	,000	,000	,000	,000	,000
	Perceived ease of use	,000	,000	.	,005	,000	,000	,001	,000
	Trialability	,000	,000	,005	.	,000	,004	,289	,003
	Trust in provider	,000	,000	,000	,000	.	,000	,000	,011
	Trust in mobile device reliability	,000	,000	,000	,004	,000	.	,000	,049
	Perceived risk	,000	,000	,001	,289	,000	,000	.	,015
	Personal innovativeness in IT	,000	,000	,000	,003	,011	,049	,015	.

Table 33. Multiple Regression Analysis: Model Summary and ANOVA Statistics

Model Summary[b]					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Durbin-Watson**
1	.888[a]	.789	.775	.59590	2.120
a. Predictors: (Constant), *Personal innovativeness in IT, Trust in mobile device reliability, Trialability, Perceived risk, Perceived ease of use, Perceived usefulness & compatibility, Trust in provider*					
b. Dependent Variable: *Intention to use NFC mobile payments*					

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	135.755	7	19.394	54.614	.000[b]
	Residual	36.220	102	.355		
	Total	171.975	109			
a. Dependent Variable: *Intention to use NFC mobile payments*						
b. Predictors: (Constant), *Personal innovativeness in IT, Trust in mobile device reliability, Trialability, Perceived risk, Perceived ease of use, Perceived usefulness & compatibility, Trust in provider*						

Table 34. Multiple Regression Analysis: Coefficient Statistics

Coefficients[a]												
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1,049	,616		1,702	,092	-,174	2,272					
	Perceived usefulness & Compatibility	,539	,069	,544	7,836	,000	,403	,676	,841	,613	,356	,429	2,332
	Perceived ease of use	-,045	,101	-,024	-,443	,659	-,246	,156	,441	-,044	-,020	,677	1,477
	Trialability	,139	,057	,140	2,428	,017	,025	,253	,504	,234	,110	,622	1,608
	Trust in provider	,065	,082	,058	,788	,433	-,098	,228	,648	,078	,036	,385	2,598
	Trust in mobile device reliability	,136	,078	,125	1,751	,083	-,018	,290	,626	,171	,080	,405	2,467
	Perceived risk	-,210	,059	-,205	-3,564	,001	-,327	-,093	-,558	-,333	-,162	,624	1,602
	Personal innovativeness in IT	,127	,065	,102	1,972	,051	-,001	,256	,417	,192	,090	,768	1,302

a. Dependent Variable: *Intention to use NFC mobile payment*

Table 35. Mediation Analysis: Simple Regression Coefficient Statistics

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	.677	.219		3.090	.003
	Perceived usefulness & compatibility	.833	.052	.841	16.125	.000
a. Dependent Variable: *Intention to use NFC mobile payments*						

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	-.197	.839		-.235	.815
	Perceived ease of use	.809	.158	.441	5.107	.000
a. Dependent Variable: *Intention to use NFC mobile payments*						

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	-.509	.832		-.611	.542
	Perceived ease of use	.867	.157	.469	5.520	.000
a. Dependent Variable: *Perceived usefulness & compatibility*						

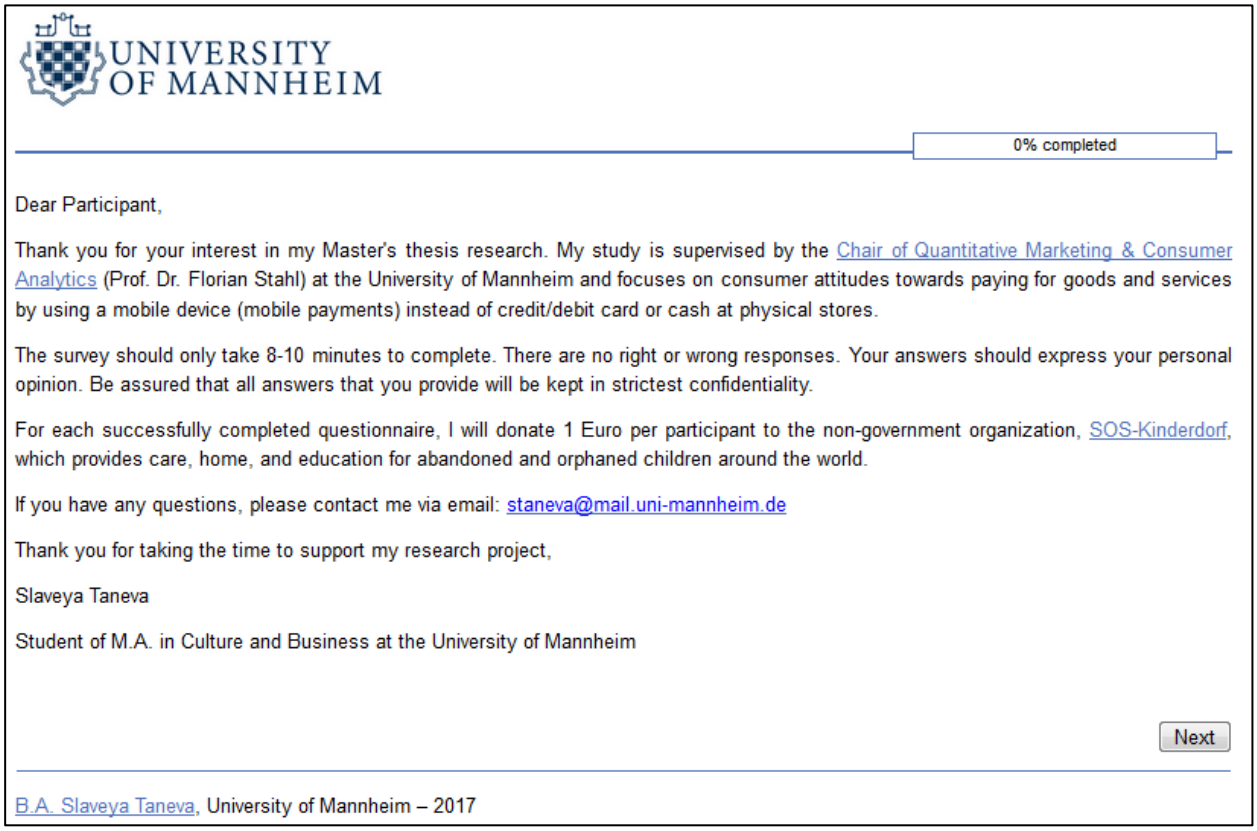
Table 36. Mediation Analysis: Multiple Regression Results

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.842[a]	.709	.704	.68351
a. Predictors: (Constant), *Perceived ease of use, Perceived usefulness & compatibility*				

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	121.986	2	60.993	130.552	.000[b]
	Residual	49.989	107	.467		
	Total	171.975	109			
a. Dependent Variable: *Intention to use NFC mobile payments*						
b. Predictors: (Constant), *Perceived ease of use, Perceived usefulness & compatibility*						

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	.213	.507		.420	.675
	Perceived usefulness & compatibility	.806	.059	.812	13.766	.000
	Perceived ease of use	.110	.108	.060	1.015	.312
a. Dependent Variable: *Intention to use NFC mobile payments*						

Appendix A: Questionnaire



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0% completed

Dear Participant,

Thank you for your interest in my Master's thesis research. My study is supervised by the Chair of Quantitative Marketing & Consumer Analytics (Prof. Dr. Florian Stahl) at the University of Mannheim and focuses on consumer attitudes towards paying for goods and services by using a mobile device (mobile payments) instead of credit/debit card or cash at physical stores.

The survey should only take 8-10 minutes to complete. There are no right or wrong responses. Your answers should express your personal opinion. Be assured that all answers that you provide will be kept in strictest confidentiality.

For each successfully completed questionnaire, I will donate 1 Euro per participant to the non-government organization, SOS-Kinderdorf, which provides care, home, and education for abandoned and orphaned children around the world.

If you have any questions, please contact me via email: staneva@mail.uni-mannheim.de

Thank you for taking the time to support my research project,

Slaveya Taneva

Student of M.A. in Culture and Business at the University of Mannheim

Next

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8% completed

Please read carefully the following scenario. The questions that follow refer to the described situation.

A mobile wallet application on your smartphone, where your credit card, debit card, and customer loyalty card(s) information is encrypted (converted into a code to prevent unauthorized access), allows you to make near field communication (NFC) mobile payments in physical stores using your mobile device, instead of cash, physical credit or debit card, as shown in the picture below. Imagine that you go grocery shopping in your favorite supermarket. After the cashier has scanned your products, you realize that you have forgotten your wallet. However, you remember that you can also pay with your mobile device. You also remember that you can make NFC mobile payments even if your device is not connected to the Internet. To pay for your groceries, activate NFC on your device and place it in close proximity to the payment terminal. The smartphone automatically displays a request for payment authorization. You authorize the payment transaction either by entering a PIN code or by confirming your identity with your fingerprint (fingerprint authentication). With that, the payment is completed and stored in the transaction history of your mobile application.

Next

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17% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
Using NFC mobile payment would be useful.	○	○	○	○	○	○
Using NFC mobile payment would be more convenient for me.	○	○	○	○	○	○
Using NFC mobile payment would increase my shopping efficiency (i.e. shopping with minimum waste of time and effort).	○	○	○	○	○	○
Using NFC mobile payment would help me pay more quickly.	○	○	○	○	○	○

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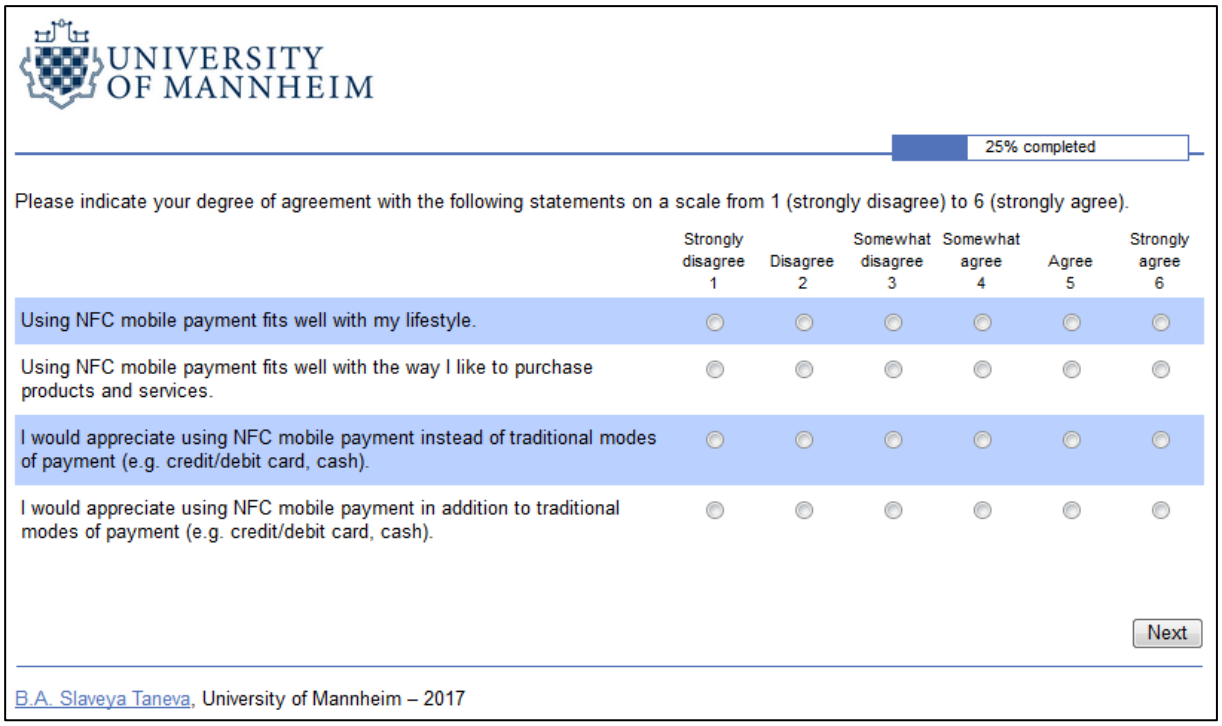

UNIVERSITY OF MANNHEIM

25% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
Using NFC mobile payment fits well with my lifestyle.	○	○	○	○	○	○
Using NFC mobile payment fits well with the way I like to purchase products and services.	○	○	○	○	○	○
I would appreciate using NFC mobile payment instead of traditional modes of payment (e.g. credit/debit card, cash).	○	○	○	○	○	○
I would appreciate using NFC mobile payment in addition to traditional modes of payment (e.g. credit/debit card, cash).	○	○	○	○	○	○

Next

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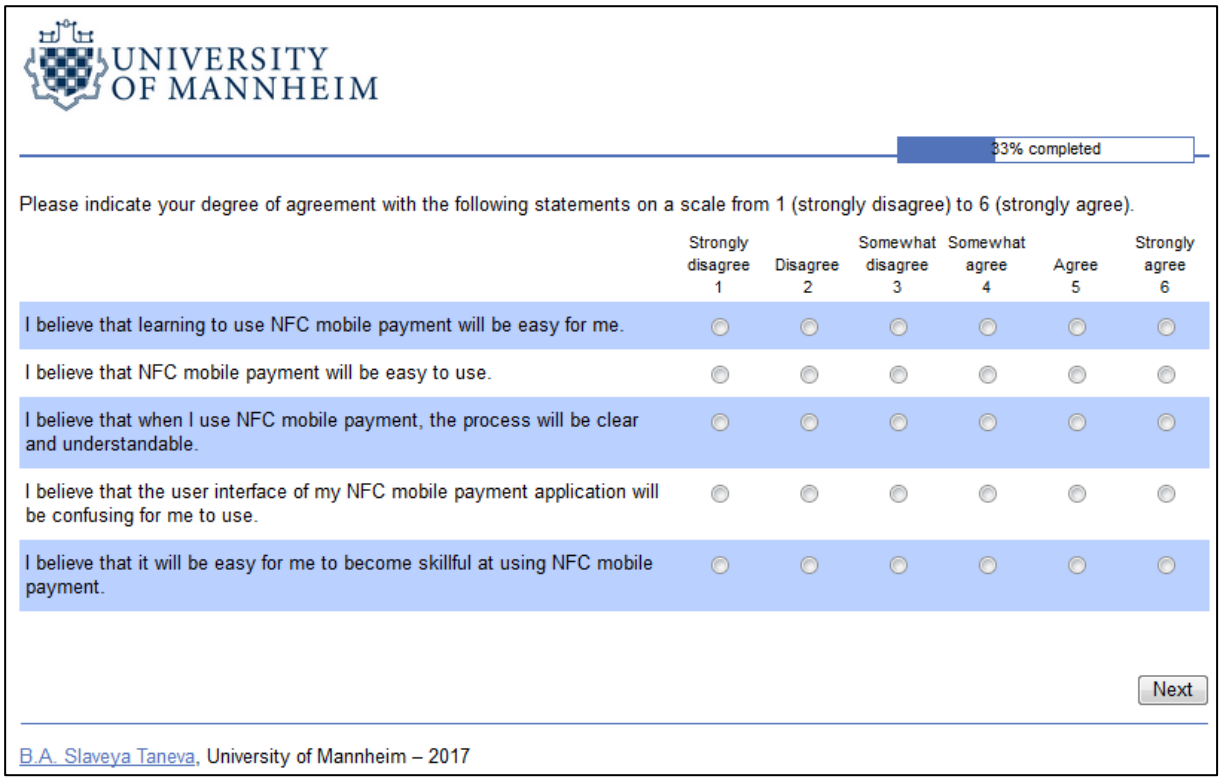

UNIVERSITY OF MANNHEIM

33% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
I believe that learning to use NFC mobile payment will be easy for me.	○	○	○	○	○	○
I believe that NFC mobile payment will be easy to use.	○	○	○	○	○	○
I believe that when I use NFC mobile payment, the process will be clear and understandable.	○	○	○	○	○	○
I believe that the user interface of my NFC mobile payment application will be confusing for me to use.	○	○	○	○	○	○
I believe that it will be easy for me to become skillful at using NFC mobile payment.	○	○	○	○	○	○

Next

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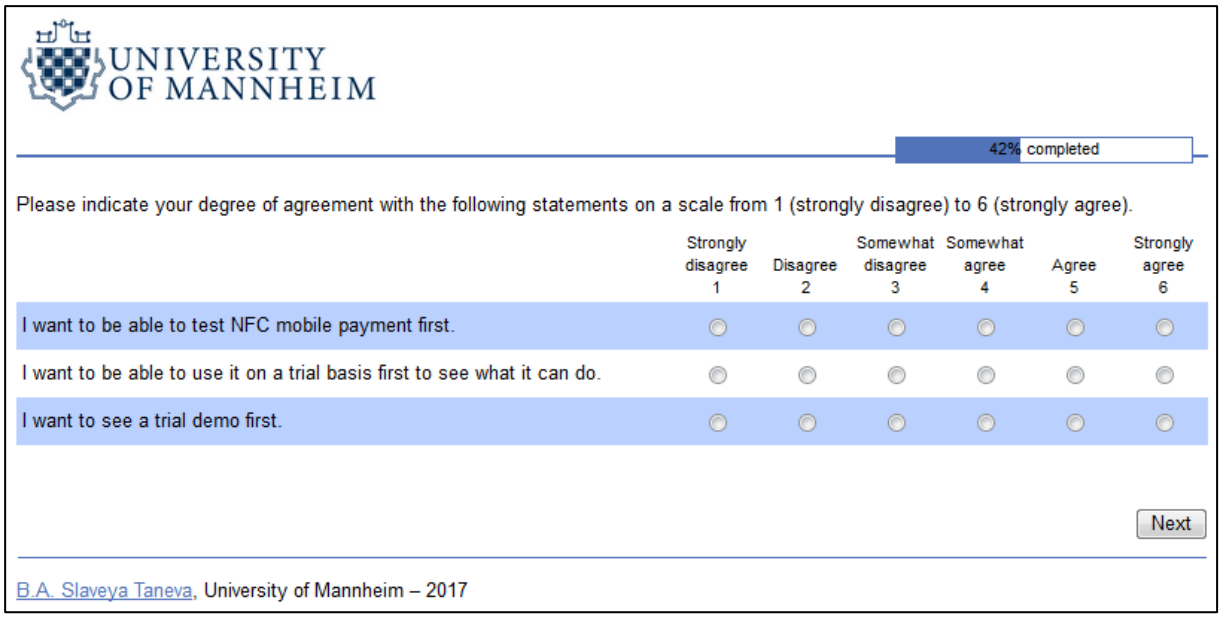

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42% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
I want to be able to test NFC mobile payment first.	○	○	○	○	○	○
I want to be able to use it on a trial basis first to see what it can do.	○	○	○	○	○	○
I want to see a trial demo first.	○	○	○	○	○	○

Next

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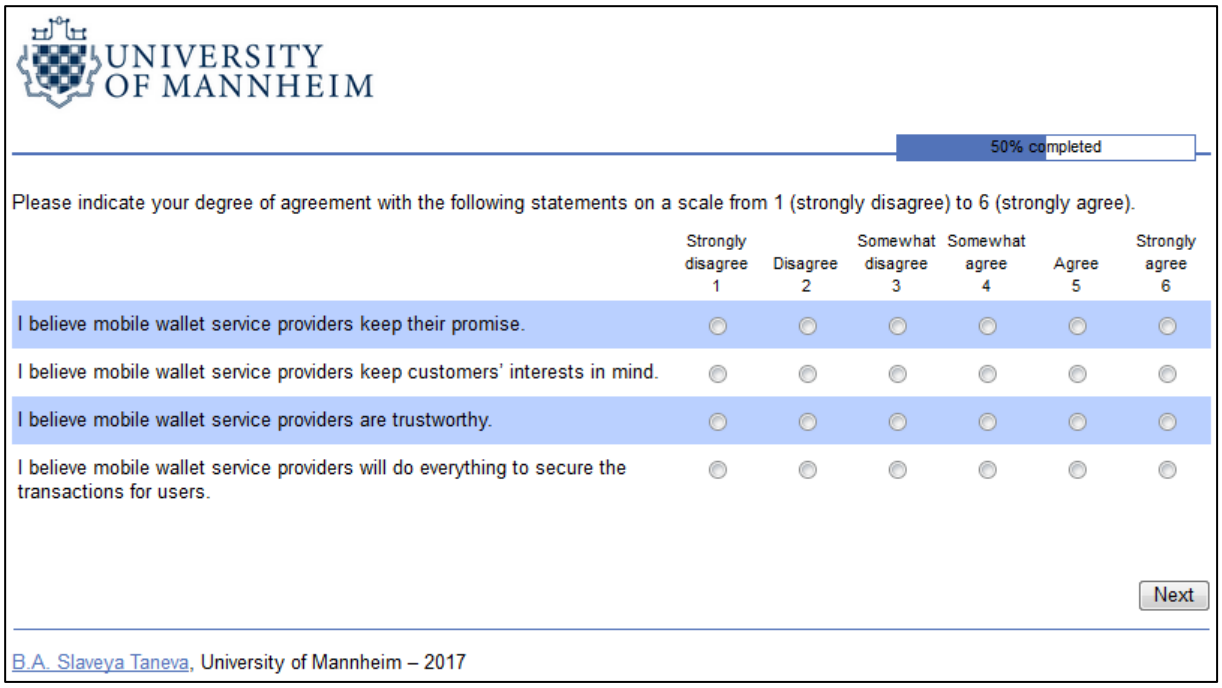

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50% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
I believe mobile wallet service providers keep their promise.	○	○	○	○	○	○
I believe mobile wallet service providers keep customers' interests in mind.	○	○	○	○	○	○
I believe mobile wallet service providers are trustworthy.	○	○	○	○	○	○
I believe mobile wallet service providers will do everything to secure the transactions for users.	○	○	○	○	○	○

Next

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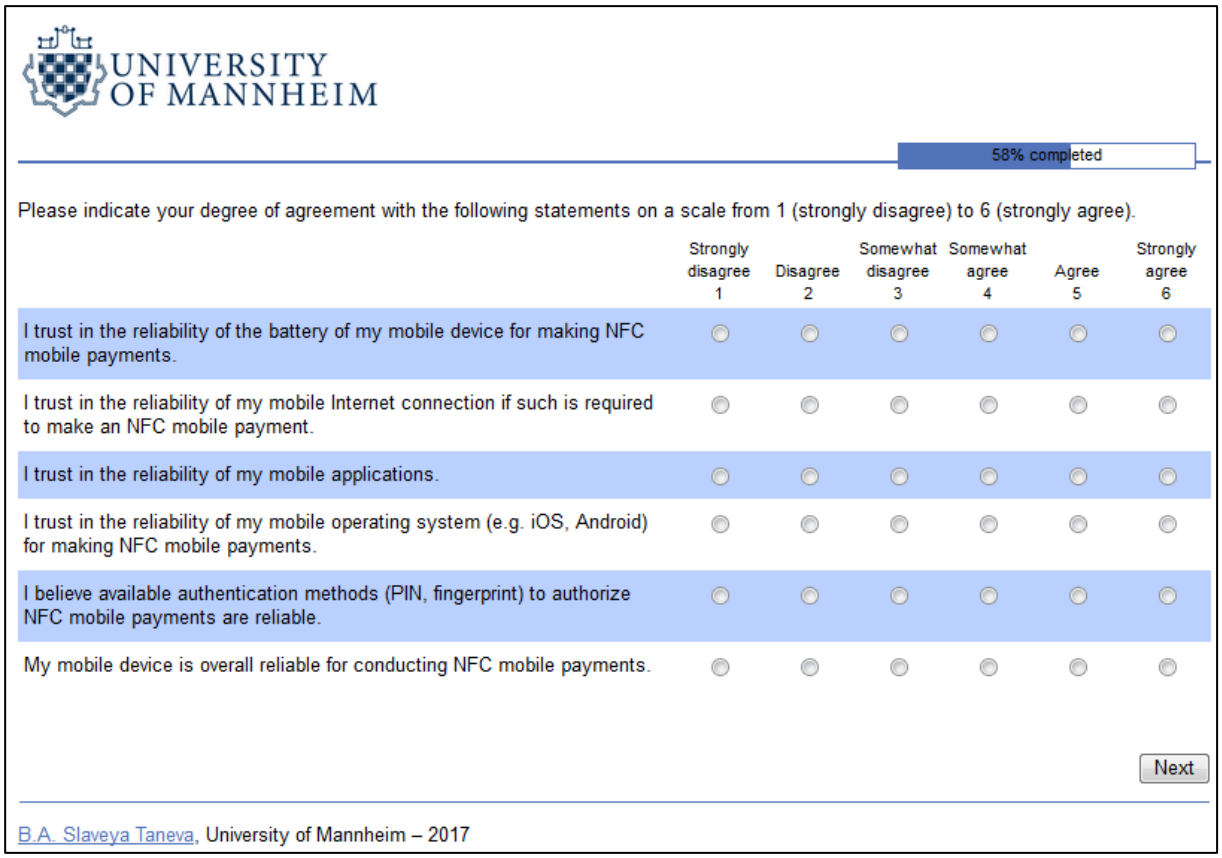

UNIVERSITY OF MANNHEIM

58% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
I trust in the reliability of the battery of my mobile device for making NFC mobile payments.	○	○	○	○	○	○
I trust in the reliability of my mobile Internet connection if such is required to make an NFC mobile payment.	○	○	○	○	○	○
I trust in the reliability of my mobile applications.	○	○	○	○	○	○
I trust in the reliability of my mobile operating system (e.g. iOS, Android) for making NFC mobile payments.	○	○	○	○	○	○
I believe available authentication methods (PIN, fingerprint) to authorize NFC mobile payments are reliable.	○	○	○	○	○	○
My mobile device is overall reliable for conducting NFC mobile payments.	○	○	○	○	○	○

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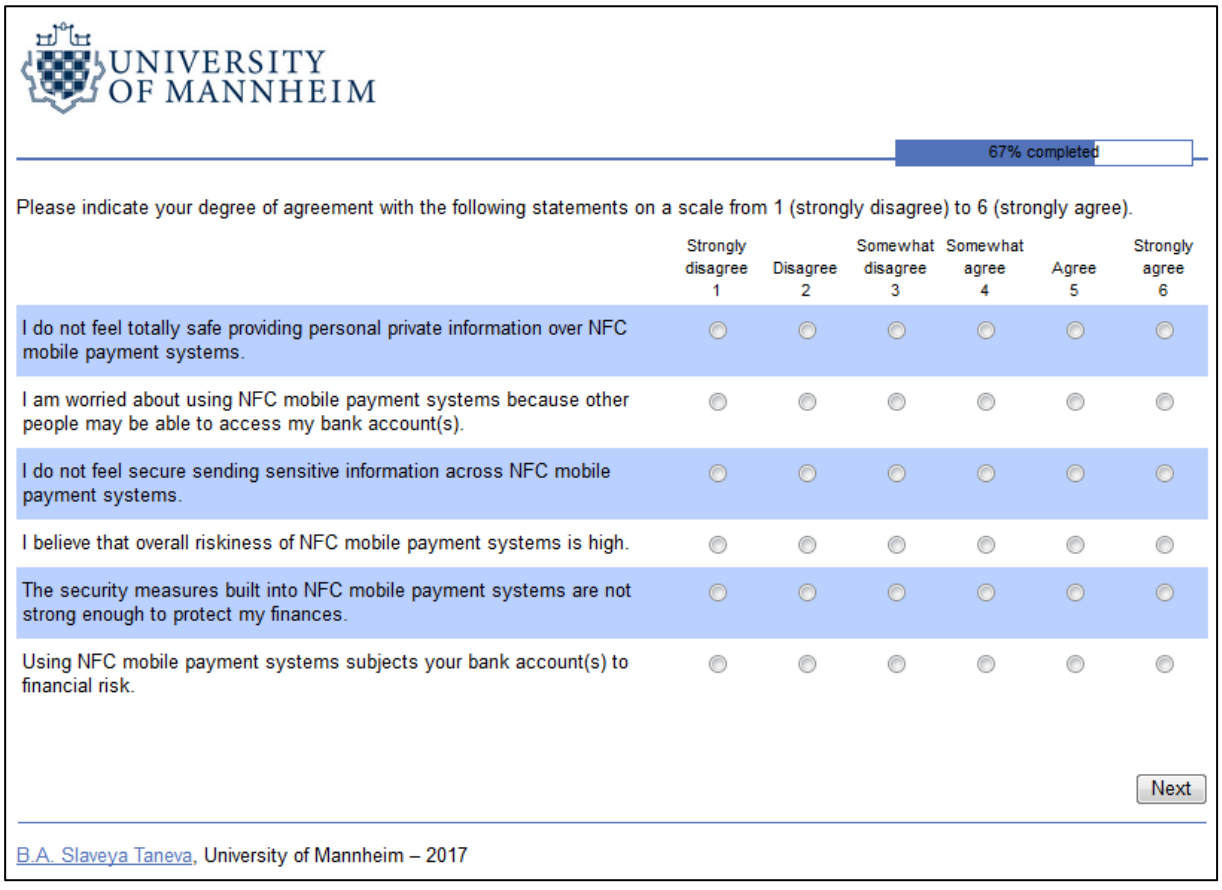

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67% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
I do not feel totally safe providing personal private information over NFC mobile payment systems.	○	○	○	○	○	○
I am worried about using NFC mobile payment systems because other people may be able to access my bank account(s).	○	○	○	○	○	○
I do not feel secure sending sensitive information across NFC mobile payment systems.	○	○	○	○	○	○
I believe that overall riskiness of NFC mobile payment systems is high.	○	○	○	○	○	○
The security measures built into NFC mobile payment systems are not strong enough to protect my finances.	○	○	○	○	○	○
Using NFC mobile payment systems subjects your bank account(s) to financial risk.	○	○	○	○	○	○

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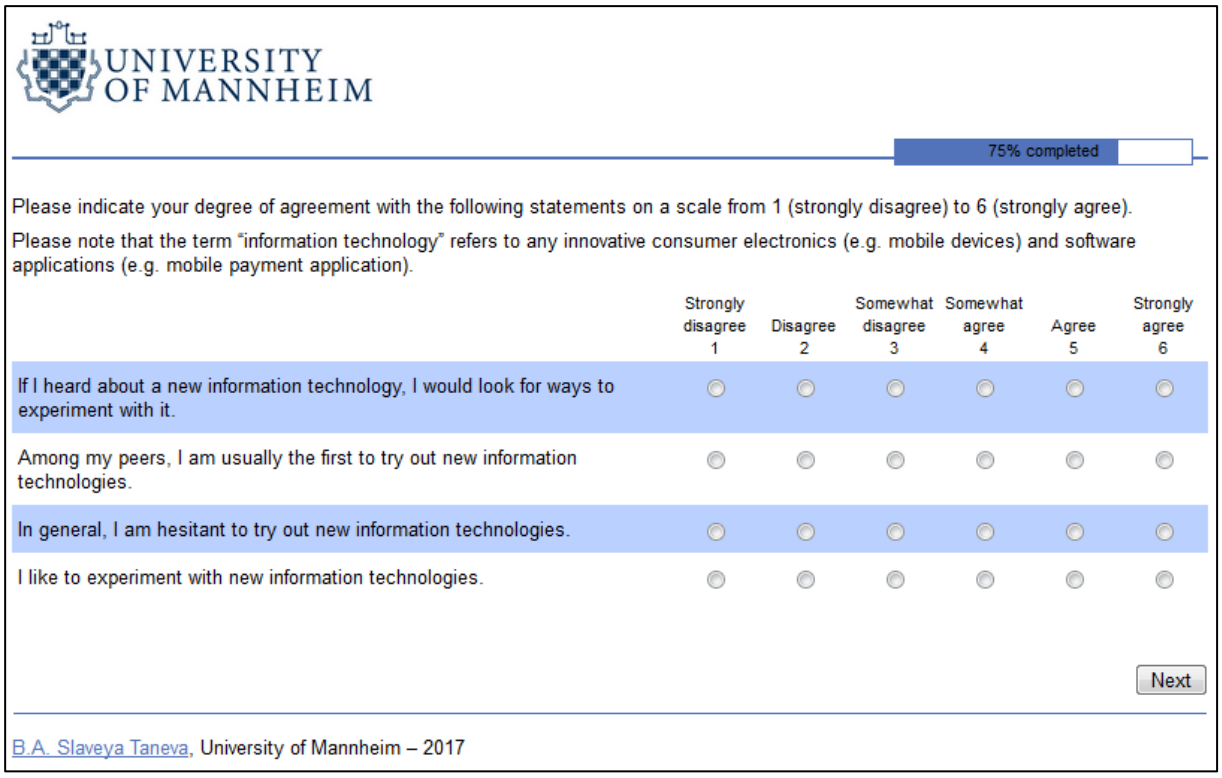

UNIVERSITY OF MANNHEIM

75% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

Please note that the term "information technology" refers to any innovative consumer electronics (e.g. mobile devices) and software applications (e.g. mobile payment application).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
If I heard about a new information technology, I would look for ways to experiment with it.	○	○	○	○	○	○
Among my peers, I am usually the first to try out new information technologies.	○	○	○	○	○	○
In general, I am hesitant to try out new information technologies.	○	○	○	○	○	○
I like to experiment with new information technologies.	○	○	○	○	○	○

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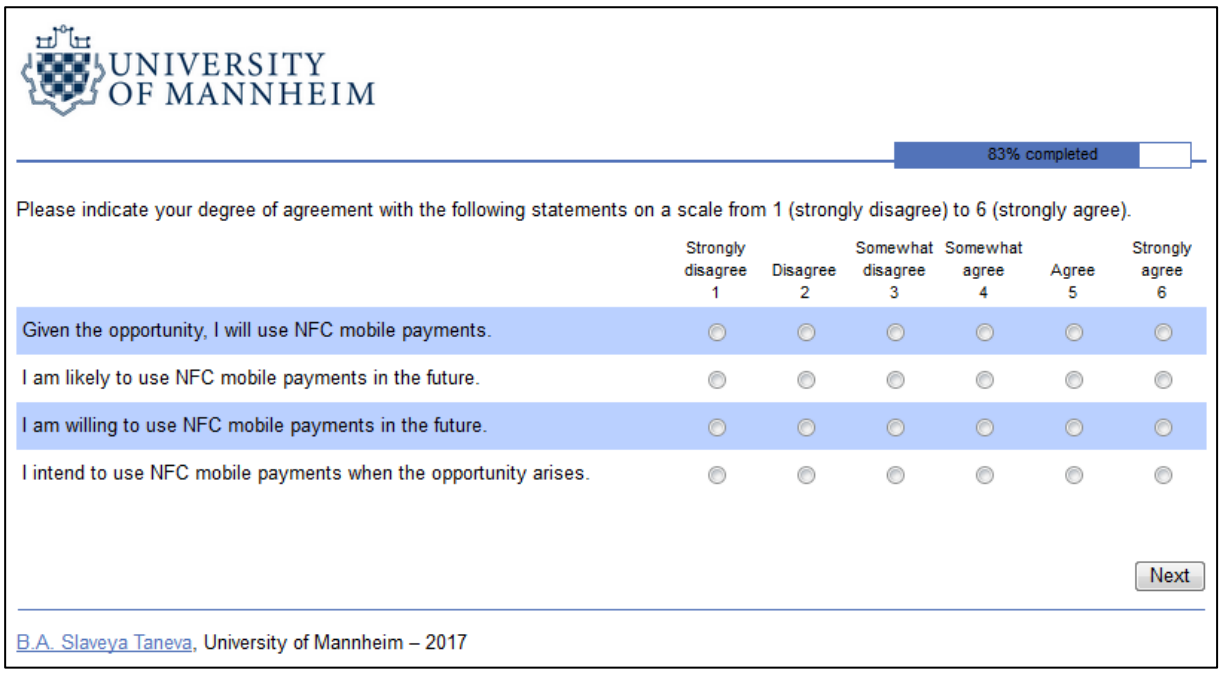

UNIVERSITY OF MANNHEIM

83% completed

Please indicate your degree of agreement with the following statements on a scale from 1 (strongly disagree) to 6 (strongly agree).

	Strongly disagree 1	Disagree 2	Somewhat disagree 3	Somewhat agree 4	Agree 5	Strongly agree 6
Given the opportunity, I will use NFC mobile payments.	○	○	○	○	○	○
I am likely to use NFC mobile payments in the future.	○	○	○	○	○	○
I am willing to use NFC mobile payments in the future.	○	○	○	○	○	○
I intend to use NFC mobile payments when the opportunity arises.	○	○	○	○	○	○

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92% completed

Do you own a smartphone?

- Yes
- No

Have you ever completed an NFC mobile payment for goods or services at a physical store/a restaurant using your smartphone?

- Yes
- No

Were you aware of NFC mobile payment as an alternative to credit card/debit card/cash payment at physical stores prior to completing this survey?

- Yes
- No

Do you shop online for goods and services using your smartphone (e.g. on Amazon, Airbnb, public transportation providers)?

- Yes
- No

What is your age?

[Please choose]

What is your gender?

- Male
- Female

What is your country of origin? Please indicate it in the empty field below:

What is the highest degree or level of school you have completed?

[Please choose]

What is your employment status?

[Please choose]

Next

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Appendix B: Literature Review Tables

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Agarwal and Prasad (1998) *[Information Systems Research]*	(1) To propose a new construct (personal innovativeness in the domain of information technology (PIIT)) that could extend existing technology acceptance models. (2) To develop and test an operational measure of this construct.	IDT, TAM, TPB, TRA	N = 175 subjects	(1) Development of a scale for measuring PIIT (2) Assessment of the reliability of the scale items (Cronbach's Alpha) and the discriminant and convergent validity of the construct (exploratory and confirmatory factor analysis) (3) Assessment of the new construct's nomological validity (multiple regression analysis to analyze the hypothesized moderating effect of PIIT on the relationships between perceptions and usage intentions)	The proposed scale for PIIT measures the conceptual construct it is meant to measure.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Baron and Kenny (1986) *[Journal of Personality and Social Psychology]*	Discussion of the distinction between moderator and mediator variables on three levels of analysis: conceptual, strategic, and statistical.	Previous studies in the field of moderator/ mediator analysis	-	Literature review and description of available statistical tests	Moderator and mediator variables are conceptually different; theorists and researchers must make a clear distinction between these two types of variables. The study provides a toolbox of analytical techniques for testing moderator and mediator effects separately and in combination.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Chandra, Srivastava, and Theng (2010) *[Communications of the Association for Information Systems]*	Investigation of consumer trust in the context of remote mobile payment services	TAM	N = 109 Singapore residents	(1) Development of a "trust-theoretic m-payment adoption model": • Mobile service provider characteristics (perceived reputation and perceived opportunism) and mobile technology characteristics (perceived environmental risk and perceived structural assurance) are determinants of consumer trust in m-payment system • Consumer trust in m-payment system is a determinant of adoption intention of m-payment system via perceived usefulness and perceived ease of use, as well as directly • Control variables: age, gender, mobile internet, internet banking (2) Multi-method approach: survey and one-to-one interviews (3) Analysis: partial least squares (PLS) method	Mobile service provider characteristics and mobile technology characteristics are significant determinants of consumer trust. Consumer trust has significant positive relationships with perceived ease of use and adoption intention. Perceived ease of use has a positive effect on perceived usefulness. Perceived usefulness is a significant predictor of adoption intention. Among the control variables, only experience with Internet banking has a significant positive effect on adoption intention. Perceived ease of use fully mediates the path from consumer trust to perceived usefulness.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Chen (2008) *[International Journal of Mobile Communications]*	To investigate which factors determine consumers' acceptance of m-payments by proposing and validating a theoretical model of m-payment adoption.	TAM, IDT	N = 299 potential m-payment adopters in the USA	(1) Development of a theoretical model of mobile payments adoption based on technology acceptance model and innovation diffusion theory: • IVs: perceived transaction convenience, perceived transaction speed, security concerns, privacy concerns, perceived usefulness, perceived risk, perceived ease of use, compatibility • DV: intention to use m-payment (2) Validation of the theoretical model using survey data (confirmatory factor analysis and structural equation modelling)	Consumer acceptance of m-payments is determined by four factors: perceived usefulness (positive effect), perceived ease of use (positive effect), perceived risk (negative effect), and compatibility (positive effect). Compatibility has the strongest effect on adoption among these factors. Transaction speed and transaction convenience positively affect perceived usefulness. Security and privacy concerns contribute significantly to the participants' perceived risk of adoption.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Cocosila and Trabelsi (2016) *[Electronic Commerce Research and Applications]*	(1) To develop a theoretical model contrasting perceived gains and costs of adopting NFC mobile payments. (2) To assess the combined effect of perceived user value and risk on the intention to adopt NFC mobile payments.	Perceived value framework	N = 289 Canadian consumers	(1) Development of a research model (capturing an integrated value-risk perception) of NFC mobile payment adoption: • IVs: gain constructs (utilitarian, enjoyment, and social value) and cost constructs (time risk, social risk, psychological risk, privacy risk) • DVs: overall risk (determined by cost constructs), integrated value-risk (determined by the gain constructs and overall risk) and behavioral intention (defined by integrated value-risk) (2) Validation of the research model by analyzing survey data using partial least squares modeling (structural equation modeling).	Significant positive effect of the gain constructs (especially utilitarian and enjoyment) on the value perception of using NFC mobile payments, as well as on behavioral intention. Significant negative effect of the cost constructs (especially psychological and privacy risks) on value perceptions, as well as on behavioral intention. Overall, consumers see more benefits than risks in adopting NFC mobile payments.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Cohen (1992) *[Psychological Bulletin]*	To provide a summary of effect size indexes and their values for small, medium, and large effects in relation to sample sizes	Significance criterion α, statistical power, sample size, effect size	-	Literature review	E.g., effect sizes of product-moment *r*: .10 (small); .30 (medium); .50 (large)

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Dahlberg, Mallat, Ondrus, and Zmijewska (2008) *[Electronic Commerce Research and Applications]*	(1) To review and summarize findings from previous mobile payments research (up to 2006). (2) To propose a theoretical framework of factors impacting the mobile payment services market. (3) To propose directions for future research in mobile-payment-related areas.	Porter's five forces model, general contingency theory	N = 73 research papers published between 1999 and 2006	(1) Literature search of online academic journals and conference databases (2) Classification of papers into categories according to the theoretical framework and analysis of methodologies applied	Most studied areas of mobile payments research at this time are mobile payment technologies and consumer power. However, more research is required in the other areas of the proposed theoretical framework, such as social and cultural factors, the role of traditional payment services compared to mobile payment services, merchant power, new e-payment services etc.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Dahlberg, Guo, and Ondrus (2015) *[Electronic Commerce Research and Applications]*	(1) To provide a critical review of mobile payments research published between 2007 and 2014. (2) To point out understudied aspects of mobile payments research.	Porter's five forces model, general contingency theory	N = 188 research papers published between 2007 and 2014	(1) Literature search of online academic journals and conference databases (2) Classification of articles based on area of research and methodology (3) Critical analysis of articles from the three most investigated research areas: "mobile payment strategy and ecosystems", "technology", and "consumer adoption" (4) Provision of guidance for future research	Three over-studied areas of mobile payments research are "technology", "consumer adoption", and "strategy and ecosystem". Other areas, such as "merchant adoption" and "environmental factors" (legal, regulatory, social, cultural) require more attention.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Davis (1989) *[MIS Quarterly]*	Development and validation of multi-item measurement scales for the theoretical constructs perceived usefulness and perceived ease of use hypothesized to be major determinants of information technology use.	Self-efficacy theory, cost-benefit paradigm from behavioral decision theory, IDT, channel disposition model	$N_{study\ 1}$ = 112 participants $N_{study\ 2}$ = 40 participants	(1) Scale development and pretest (2) Field study (study 1): assessment of the reliability, convergent validity, discriminant validity, and factorial validity of the new scales (3) Refinement of the scales based on the results of study 1 (4) Laboratory study (study 2): assessment of reliability and validity of the scales; regression analysis with perceived usefulness and perceived ease of use as predictors of system use	The measurement scales of perceived usefulness and perceived ease of use were successfully validated. Perceived usefulness and ease of use are significantly correlated with self-reported indicants of system use. Perceived usefulness has a stronger effect on system use than perceived ease of use. Perceived usefulness mediates the effect of ease of use on system usage.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Davis (1993) *[Man-Machine Studies]*	Empirical test of TAM	Fishbein and Ajzen's (1975) attitude theory	N = 112 employees of a North American corporation	(1) Development of the original TAM where: • System design features have a direct effect on perceived usefulness and perceived ease of use • Perceived usefulness and perceived ease of use have direct effects on attitude toward using • Perceived usefulness also moderates the effect of perceived ease of use on attitude toward using • Attitude toward using has a direct effect on actual system use (2) Administration of a survey (3) Regression analyses	Attitude has a significant effect on usage. Perceived usefulness has a significant strong effect on attitude. Perceived ease of use has a significant effect on attitude and a significantly strong effect on perceived usefulness. Perceived usefulness has strong direct effect on system use, as well as an indirect effect via attitude.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
de Kerviler, Demoulin, and Zidda (2016) *[Journal of Retailing and Consumer Services]*	To investigate how various benefits and risks of proximity mobile payments influence consumers' intention to adopt them, by taking into consideration the role of past experience with mobile shopping.	Theory of perceived value, valence framework, value-based adoption model, heuristic-systematic model	N = 363 mobile shoppers (divided in "in-store m-infosearch group" and "p-m-payment group")	(1) Development of hypotheses about the effects of perceived benefits and risks on the intention to use mobile payment services: • IVs: perceived utilitarian benefits (convenience, economic, informational), perceived hedonic benefits (enjoyment, experiential), perceived symbolic benefits (social), perceived risks (privacy, financial) • DV: usage intention • Additional variables: smartphone-based shopping experience, computer-based shopping experience, product involvement, purchase decision involvement, past experience (2) Assessment of the effects of perceived benefits and risks on the intention to use mobile payments by conducting a series of OLS regressions	Utilitarian, hedonic, and social benefits have positive effects and financial and privacy risks have negative effects on consumers' intention to use in-store mobile payments. Accumulated experience with in-store mobile services enhances adoption intentions.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Dennehy and Sammon (2015) *[Journal of Innovation Management]*	(1) To develop a framework for categorizing m-payments research. (2) To identify different research directions. (3) To determine the theoretical frameworks on which the reviewed studies are based. (4) To categorize them in terms of methodological approaches. (5) To identify research trends and provide recommendations for future research.	Contingency theory, categorization of stakeholders in an m-payment ecosystem	N = 20 most cited m-payment research papers between 1999 and 2014 + 20 most recently published papers between 2013 and 2014	(1) Identification of top 20 most cited m-payment research papers between 1999 and 2014 and the 20 most recently published studies between 2013 and 2014 (2) Categorization of articles based on investigated contingency factors and categories of stakeholders (4x7 matrix of research classification) (3) Classification of research studies based on their methodologies (e.g., theoretical vs. empirical)	There is a shift in m-payment research focus: e.g., increase in empirical (vs. theoretical studies); increase in studies investigating legal, regulatory, and standardization issues, as well as technology, security, and architecture issues. Consumer adoption of m-payments remains a popular research topic. There is also an increase in country-specific research projects.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Falk, Kunz, Schepers, and Mrozek (2016) *[Journal of Business Research]*	To investigate how payment transparency (cash, card, mobile payment) and basket price judgment affect consumers' overall store price image (OSPI) of retail stores.	Payment transparency concept, prospect theory	$N_{study\ 1}$ = 56 participants $N_{study\ 2}$ = 57 participants $N_{study\ 3}$ = 200 participants	(1) Study 1: online experiment examining the effect of basket price judgment (low/high budget condition) on shoppers' OSPI formation (ANOVA) (2) Study 2: online experiment; examination of the effect of payment transparency (cash vs. card) on shoppers' OSPI formation (ANOVA) (3) Study 3: laboratory experiment; examination of the effects of payment transparency (cash, card, mobile) and basket price judgment (low/high budget condition) on OSPI formation and willingness-to-pay (ANOVA)	• Study 1: Customers form a lower OSPI when their basket price judgment is favorable than when their basket price judgment is unfavorable. • Study 2: Customers form a lower OSPI when the payment method is less transparent (e.g. card payment in contrast to cash payment). • Study 3: Confirms the findings of Study 1 and 2. Also, mobile payments result in lower OSPI perceptions compared to cash and card payments. Shoppers are willing to spend more when paying with a mobile phone than with card or cash.

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Hayashi (2012) *[Economic Review – Federal Reserve Bank of Kansas City]*	(1) Literature review; (2) investigation of the benefits of proximity mobile payments for consumers	Consumer payments literature	-	Literature review; qualitative analysis of benefits of proximity mobile payments	Barriers to adoption on the supply side: creation of viable business models for market participants; agreement on technology standards. Barriers to adoption on the demand side: uncertainty about the benefits of proximity mobile payments for consumers. Benefits of proximity mobile payments: convenience, cost benefits, security, ability to manage finances and control spending anytime and anywhere, ability to receive targeted ads and promotions. Convenience and the ability to check account balances anytime and anywhere would encourage adoption. However, low merchant acceptance of proximity mobile payments hampers consumer adoption.

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Hoehle, Scornavacca, and Huff (2012) *[Decision Support Systems]*	Review of research in consumer adoption and use of electronic banking channels (ATM, telephone, Internet, and mobile banking)	Classification and definition of electronic banking channels	N = 247 peer reviewed research articles	(1) Identification, review, and analysis of previous research (2) Identification of theoretical frameworks and methodological approaches used in the literature (3) Identification of gaps in research	Qualitative research includes case studies, focus groups, grounded theory studies, and interview-based studies. Quantitative research includes survey studies and experiments. Most popular theoretical frameworks include DOI, TRA, TPB, TAM, and technology resistance theory. Most extensively studied constructs are relative advantage, compatibility, complexity, trialability, observability, attitudes towards e-banking, subjective norm, perceived usefulness, ease of use, accessibility & convenience, costs associated with use, reliability, risk, satisfaction, security, self-efficacy, service quality, trust.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Kahneman, Knetsch, and Thaler (1991) *[The Journal of Economic Perspectives]*	Documentation of available evidence supporting the existence of the endowment effect and the status quo bias and their relationship to loss aversion.	Prospect theory	-	Review of experiments testing the endowment effect, status quo bias, and loss aversion.	The endowment effect, status quo bias, and loss aversion are robust and important. They represent economic anomalies that violate standard economic theory. Hence, this theory, based on assumptions of rationality and stable preferences, should be amended in such a way as to take into consideration these anomalies, in order to make more reliable predictions.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Kim, Mirusmonov, and Lee (2010) *[Computers in Human Behavior]*	(1) To investigate the determinants of consumers' intention to adopt mobile payments. (2) To categorize m-payment users into early and late adopters and investigate their group-level attitudes towards adopting mobile payments.	TRA, TPB, TAM, UTAUT, IDT, mobile payment systems	N = 269 mobile payment users in Korea	(1) Development of a research model, including: • IVs: individual differences (personal innovativeness, m-payment knowledge), mobile payment system characteristics (mobility, reachability, compatibility, convenience), perceived usefulness, perceived ease of use • DV: intention to use m-payment (2) Analysis: structural equation modeling (3) Classification of mobile payment users into early and late adopters	Perceived ease of use and perceived usefulness are significant antecedents of the intention to use mobile payments. Individual differences, convenience, and reachability are important determinants of the perceived ease of use of m-payment. Compatibility has an insignificant effect on perceived usefulness and perceived ease of use. Mobile payment knowledge has a greater effect on perceived ease of use than personal innovativeness.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Legris, Ingham, and Collerette (2003) *[Information & Management]*	Meta-analysis of previous research based on the technology acceptance model	TAM, TRA	N = 22 research articles published between 1980 and 2001	Meta-analysis of previous studies investigating technology adoption and use	TAM is empirically proven to be a useful theoretical framework for investigating adoption and use of technology, but it should be extended with additional components in order to explain more variance.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Mallat (2007) *[Journal of Strategic Information Systems]*	(1) To investigate factors influencing consumer adoption of mobile payment services and contribute to IDT. (2) To formulate new research questions for future mobile payment studies based on the study results.	IDT, consumer life cycle theory	N = 46 subjects (forming 6 homogeneous focus groups of different ages)	Explorative, qualitative study analyzing focus group interviews. • IVs: relative advantage, compatibility, complexity, cost, network externalities, security and trust, situational factors • DV: mobile payments adoption intention	Relative advantage of mobile payments (incl. time and place independent payments, queue avoidance, complement to cash) is a valid factor that becomes more important in specific contexts (e.g., time pressure, lack of other payment methods). Mobile payments are seen as compatible when it comes to smaller amount purchases (e.g., electronic ticketing, vending machine purchases, payments at POS). Inhibitors of mobile payment adoption include complex solutions, premium pricing for m-payment services, perceived risks and incompatibility with large value purchases.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Mandrik and Bao (2005) *[Advances in Consumer Research]*	Exploration of the concept and measurement of general vs. domain-specific risk aversion	Expected utility theory, methods of risk aversion measurement (choice dilemmas, gambles, self-report measures)	$N_1 = 64$ undergraduate business students $N_2 = 92$ students	(1) Scale development for the concept of general risk aversion (2) Initial test of the scale with N_1; exploratory factor analysis (3) A study with N_2 including the new general risk aversion scale and further risk aversion measurements from previous research; exploratory factor analyses; correlation analyses	The study provides support for the possibility to measure general risk aversion by means of a self-report scale. The new scale provides a simpler way to measure risk aversion in contrast to traditional methods (e.g., choice dilemmas, gambles, etc.).

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Oliveira, Thomas, Baptista, and Campos (2016) *[Computers in Human Behavior]*	(1) To identify the direct and indirect effects of the main determinants of mobile payment adoption. (2) To identify the determinants of the intention to recommend the mobile payment technology.	UTAUT2, IDT	N = 301 students and alumni from Portuguese universities	(1) Development of a research model, including: • <u>IVs:</u> compatibility, innovativeness, performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, perceived technology security • <u>DVs:</u> Behavioral intention to adopt, behavioral intention to recommend (2) Testing of the research model with survey data using structural equation modeling	Compatibility, perceived technology security, performance expectancy, innovativeness, and social influence are most important in explaining the behavioral intention to adopt mobile payments. Behavioral intention to adopt, compatibility, innovativeness, perceived technology security, performance expectancy, effort expectancy, and social influence explain the behavioral intention to recommend mobile payments.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Pham and Ho (2015) *[Technology in Society]*	Investigation of factors affecting consumers' intention to adopt NFC-based mobile payments.	TAM, IDT	N = 402 Taiwanese consumers (not current users of NFC-based mobile payments)	(1) Development of a research model, including: • IVs: product-related (perceived usefulness, perceived ease of use, compatibility, perceived risk, perceived cost, trialability, additional values); personal-related (personal innovativeness in new technologies, absorptive capacity), trust, attractiveness of alternatives • DV: intention to adopt NFC mobile payments (2) Validation of the research model using structural equation modeling	Perceived usefulness, compatibility, trialability, additional values of NFC mobile payments, innovativeness in new technologies, and absorptive capacity have significant positive effects on the intention to adopt NFC mobile payments. Perceived risk and attractiveness of alternatives have significant negative effects on the intention to adopt. Perceived ease of use, perceived cost, and trust have no significant effects.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Podsakoff, MacKenzie, Lee, and Podsakoff (2003) *[Journal of Applied Psychology]*	Examination of how common method biases influence research results; sources of common method bias; cognitive processes through which common method biases influence participant responses; and, available procedures for identification and control of common method biases.	Previous studies in the field of common method biases	-	Literature review	Potential sources common method biases include: method effects produced by common source/rater; by the measurement items; by the context of the items within the measurement instrument; by the context in which the measures are obtained. Techniques for control/identification of common method bias: (1) improvement of the design of study procedures and (2) statistical methods, incl. Harman's single factor test, partial correlation procedures, controlling for the effects of a directly measured latent methods factor, controlling for the effects of an unmeasured latent methods factor, multiple method factors.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Rabin (1998) *[Journal of Economic Literature]*	To propose ways of modifying the utility functions employed in classical economic theory in order to account for psychological phenomena in human decision making.	Classical economic theory; reference levels, adaptation, and losses; social preferences and fair allocations; reciprocity and attribution; biases in judgment	-	Review of previous literature in psychology	Evidence that human behavior often diverges from perfect rationality (as assumed in classical economic theory), such as: reference levels, loss aversion, endowment effect, status quo bias, altruism, the law of small numbers, belief perseverance, confirmatory bias, hindsight bias, overconfidence.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Sanakulov and Karjaluoto (2015) *[International Journal of Mobile Communications]*	Review of studies on consumer adoption of mobile technologies. Analysis of the studies' theoretical backgrounds and findings. Identification of the most important predictors of mobile technology adoption.	TRA, TPB, TAM, fit-viability model, UTAUT, IDT	N = 67 empirical studies of mobile technology adoption	(1) Publication search (2) Data extraction from the selected studies (3) Meta-analysis of significant effects of variables affecting mobile technology adoption (4) Analysis of most studied areas in mobile technology adoption	TAM is the most frequently applied theoretical framework, followed by UTAUT. Perceived usefulness, perceived ease of use, attitude, social factors, performance expectance, effort expectancy, and facilitating conditions are found to be the most significant variables affecting mobile technology adoption. Most studied areas of mobile technology adoption are mobile data services, mobile banking, and mobile learning.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Schierz, Schilke, Wirtz (2010) *[Electronic Commerce Research and Applications]*	To develop and test a research model of consumer acceptance of mobile payment services.	TAM	N = 1447 consumers in Germany	(1) Development of a research model, including: • IVs: perceived compatibility, perceived security, perceived usefulness, perceived ease of use, individual mobility, subjective norm, attitude towards use • DV: intention to use (2) Analysis: structural equation modeling	The model explains 84% of the variance of the dependent variable. The proposed relationships between the variables are significant. Perceived compatibility has the greatest impact on the intention to use mobile payment services. Other key factors include individual mobility, subjective norm, perceived usefulness, perceived security, and perceived ease of use.

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Shaikh and Karjaluoto (2015) *[Telematics and Informatics]*	(1) To conduct a literature review of mobile banking adoption. (2) To summarize major findings in the field of mobile banking adoption, identify gaps in research and make recommendations for future studies.	TAM, DOI, UTAUT, TPB, Ubiquitous computing framework, Task-technology fit model	N = 55 publications on mobile banking (incl. academic papers and practitioner sources)	(1) Literature search and identification of academic and practitioner publications (2) Analysis of methodologies, geographical contexts, theoretical models applied in the studies (3) Meta-analysis of average path coefficients between antecedents of mobile banking and attitude and intention	Compatibility, perceived usefulness, and perceived ease of use are antecedents of both attitude and intention to adopt mobile banking. Credibility, social influence, perceived behavioral control/self-efficacy, and perceived cost have on average a low to medium effect on intention to use mobile banking.

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Shaw (2014) *[Journal of Retailing and Consumer Services]*	(1) To develop a research model of factors influencing consumers' adoption of the mobile wallet by extending TAM. (2) To empirically test the research model.	TAM	N = 284 university students in Canada	(1) Development of a research model: • IVs: mobile wallet self-efficacy, informal learning (incl. personal WOM and virtual WOM), perceived ease of use, perceived usefulness, trust • DV: intention to use (2) Analysis: structural equation modeling	Trust mediates the effect of informal learning on intention to use a mobile wallet. Perceived usefulness (most important factor), trust, and informal learning positive influence the intention to use a mobile wallet. The effect of perceived ease of use on intention to use is not significant. Mobile wallet self-efficacy influences perceived ease of use but not perceived usefulness.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Shin (2009) *[Computers in Human Behavior]*	To validate a research model of consumer acceptance of the mobile wallet	UTAUT, TAM	N = 296 survey respondents with mobile usage experience	(1) Development of a research model based on theory (UTAUT and TAM) and in-depth interviews and focus groups with possible mobile wallet adopters: • IVs: perceived usefulness, perceived ease of use, social influence, self-efficacy, security, trust, and attitude towards using technology • DVs: behavioral intent, usage behavior • Moderating variables: gender, age, experience, voluntariness (2) Testing of the fit between the research model and the questionnaire data using structural equation modeling (3) Moderation analysis using the split sample approach	(1) Good fit between the research model and the survey data. (2) Significant positive effects of: • Attitude on intention • Intention on behavior • Perceived usefulness on attitude • Perceived ease of use on attitude • Perceived security on intention • Trust on intention (3) Moderation effects of demographics, self-efficacy, and social influence

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Slade, Williams, Dwivedi, and Piercy (2015) *[Journal of Strategic Marketing]*	(1) To investigate factors influencing consumers' intention to adopt proximity mobile payments (using NFC technology) in the UK. (2) To compare the statistical significance of UTAUT2 with that of an extended version of UTAUT2.	UTAUT2	N = 244 consumers in the UK	(1) Development of a research model based on UTAUT2, in order to investigate predictors of consumers' intention to adopt proximity mobile payments: • IVs: performance expectancy, effort expectancy, social influence, facilitating conditions, habit, price value, hedonic motivation, perceived risk, trust in provider • DV: Behavioral intention to adopt NFC mobile payments (2) Examination of construct validity (using factor analysis) and reliability (Cronbach's Alpha) (3) Regression analysis of survey data	Performance expectancy, habit, hedonic motivation, and social influence have strongest influence on behavioral intention in UTAUT2. Performance expectancy, habit, social influence, perceived risk, and trust have strongest influence on behavioral intention in the extended UTAUT2 (improvement of the explained variance of behavioral intention).

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Soman (2003) *[Marketing Letters]*	Investigation of (1) the relationship between the perceived transparency of a payment and the perceived pain of paying; and (2) the effect of payment transparency on consumers' spending and consumption behavior.	Payment transparency of payment mechanisms (= salience of payments in physical form and amount)	$N_{study\ 1}$ = 24 participants $M_{study\ 2}$ = 232 participants $M_{study\ 3}$ = 275 grocery store receipts	Three field experiments: • Study 1: IV (payment mechanism: cash vs. card), DV (number of copies); t-tests • Study 2: IVs (payment mechanism: cash vs. card; apartment complex 1 vs. 2); DV (% of respondents who separated their laundry); logistic regression • Study 3: IV (payment mechanism: cash, check, credit card); DV (money spent)	The transparency of the payment mechanism (cash vs. card) has an effect on consumption. The less transparent a payment mechanism, the more money consumers are likely to spend. This applies to items whose consumption is flexible (in contrast to items whose consumption is inflexible).

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Taylor (2016) *[International Journal of Retail & Distribution Management]*	To provide a summary of previous research on potential benefits and risks of the adoption of mobile payment system in retail.	Previous research on mobile payments in retail.	N = 10 interviewees from 7 companies in the retail industry in Australia and New Zealand	(1) Literature review (2) Telephone interviews with senior professionals from the fast-moving consumer goods industry (3) Qualitative analysis of expert interviews	The adoption of mobile technologies in retail is crucial for companies to stay relevant in an increasingly mobile world. Security risks, data protection and privacy related to the adoption of mobile payment systems in retail must be addressed and handled in a way that protects and satisfies customers.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Tversky and Kahneman (1992) *[Journal of Risk and Uncertainty]*	Extension of prospect theory to apply to both uncertain and risky prospects with a number of outcomes (cumulative prospect theory).	Expected utility theory, prospect theory	N = 25 graduate students	(1) Review of prospect theory and experimental evidence from previous research (2) Experiment: individual choices depending on probability of occurrence (high, low) x outcomes (loss, gain) (3) Ordinal and correlational analyses of risk-seeking/risk-averse choices	Fourfold pattern or risk attitudes: risk aversion for gains and risk seeking for losses of high probability; risk seeking for gains and risk aversion for losses of low probability.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Venkatesh and Davis (2000) *[Management Science]*	Extension of the technology acceptance model by including additional determinants of *perceived usefulness* and *usage intention*. Analysis of how the effects of these determinants change with increasing user experience. Empirical tests of the enhanced theoretical model (TAM2).	TAM, TRA, TPB, work motivation theory, action theory from social psychology, task-contingent decision making from behavioral decision theory	$N_{study\ 1}$ = 38 users $N_{study\ 2}$ = 39 users $N_{study\ 3}$ = 43 users $N_{study\ 4}$ = 36 users	(1) Theoretical extension of TAM: • Determinants of perceived usefulness: subjective norm, image, job relevance, output quality, result demonstrability • IVs: perceived usefulness, perceived ease of use • DV: intention to use (which has an effect on usage behavior) • Moderator variables: experience, voluntariness (2) Four longitudinal field studies (3) Regression analyses	TAM2 accounts for 40% - 60% of the variance in usefulness perceptions and 34% - 52% of the variance in usage intentions. Social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use) exhibit significant effects on user acceptance of new technologies.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Venkatesh, Morris, Davis, and Davis (2003) *[MIS Quarterly]*	(1) Empirically compare 8 existing models of user acceptance of IT. (2) Formulate a unified model of user acceptance of IT based on the 8 models (UTAUT model). (3) To empirically validate the unified model.	TRA, TAM, motivational model, TPB, combined TAM and TPB, model of PC utilization, IDT, social cognitive theory	4 samples stemming from 4 different companies: $N_{study\ 1}$ = 54 employees $N_{study\ 2}$ = 65 employees $N_{study\ 3}$ = 58 employees $N_{study\ 4}$ = 38 employees 2 additional samples used to validate UTAUT: $N_{study\ 5}$ = 80 employees $N_{study\ 6}$ = 53 employees	(1) Review of 8 existing models of user acceptance of IT (2) 4 longitudinal field studies with employees from 4 different companies where new IT systems were introduced: • IVs: 32 IVs from the 8 models • DVs: intention in voluntary settings; intention in mandatory settings; technology use (determined by intention to use and perceived behavioral control) (3) Testing of the 8 models using partial least squares and employing a bootstrapping method (4) Analysis of moderators (experience, voluntariness, gender, and age) (4) Formulation and empirical validation of UTAUT	UTAUT outperforms the 8 models of user acceptance of IT by accounting for 70% of the variance in usage intention. Performance expectancy, effort expectancy, and social influence are direct determinants of intention to use. Intention to use and facilitating conditions are direct determinants of usage behavior. Experience, voluntariness, gender, and age play a moderating role in the model.

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Venkatesh, Thong, and Xu (2012) *[MIS Quarterly*]	To extend the initial unified theory of acceptance and use of technology (UTAUT) to study the acceptance and use of technology in consumer contexts (UTAUT2).	UTAUT, previous research in hedonic motivation, price value, and experience and habit	N = 1,512 mobile internet consumers in Hong Kong	(1) Development of UTAUT2: • IVs: performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit • DVs: behavioral intention, use behavior • Moderator variables: age, gender, experience (2) Assessment of reliability and validity of the measurement model (partial least squares technique) (3) Validation of the structural model (both UTAUT and UTAUT2)	The results support the applicability and validity of UTAUT as a theoretical base to predict consumers' behavioral intentions and technology use. The results also provide support for the applicability of UTAUT2 in consumer contexts.

Author/s (Year) *[Journal]*	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Wei-Han Tan, Ooi, Chong, and Hew (2014) *[Telematics and Informatics]*	Investigation of factors affecting consumer adoption of mobile credit card (MCC)	TAM	N = 156 bank customers of a Malaysian bank	(1) Development of a research model of MCC consumer adoption: • IVs: perceived usefulness, perceived ease of use, social influence, personal innovativeness in IT, perceived risk, perceived financial cost • DV: intention to adopt MCC • Moderating variable: gender (2) Analysis: structural equation modeling with maximum likelihood estimation (3) Multi group analysis to test for moderating effects of gender	Perceived usefulness, perceived ease of use, social influence, and personal innovativeness in IT have significant positive effects on the intention to adopt MCC. Perceived risk and perceived financial cost do not exert significant effects on the intention to adopt. There are no significant moderating effects of gender.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Yang, Lu, Gupta, Cao, and Zhang (2012) *[Computers in Human Behavior]*	(1) To develop a research model of mobile payment services adoption that brings together behavioral beliefs, social influences, and personal traits. (2) To examine whether and how the effects of these factors change over the pre- and post-adoption stages.	TRA, TPB, TAM, UTAUT, valence framework of consumer decision-making, IDT	N = 483 potential adopters + 156 current users of mobile payment services in China	(1) Development of a research model including: • IVs: behavioral beliefs (perceived risk, perceived fee, compatibility, relative advantage), social influences (subjective norm and image), personal trait (personal innovativeness in information technology) • DV: behavioral intention (2) Analysis: Structural equation modeling; path analysis with partial least squares	For potential adopters, behavioral beliefs, social influences, and personal trait have significant and direct effect on adoption intention. Social influences and personal trait also have strong indirect influence on adoption intention. For current users, the effect of perceived fee is no longer significant; the indirect effects of social influences via relative advantage and perceived risk on behavioral intention are also no longer significant. The effects of relative advantage and perceived risk on behavioral intention are stronger for current users; the effects of compatibility and perceived fee on behavioral intention are stronger for potential adopters. The direct effects of subjective norm and image on behavioral intention hold for both groups, while their indirect effects are only significant for potential adopters. Personal innovativeness affects behavioral intention directly and indirectly via relative advantage for both groups. Such effects are stronger for users.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Yang, Liu, Li, and Yu (2015) *[Industrial Management & Data Systems]*	(1) To investigate the sources of perceived risk of mobile payment adoption. (2) To investigate how different types of perceived risk influence the value perception of mobile payment services and thus affect consumer adoption.	Perceived risk theory, prospect theory, perceived value theory	N = 310 respondents in China	(1) Development of a research model, including: • <u>Determinants of perceived risk types:</u> perceived technological uncertainty, perceived information asymmetry, perceived regulatory uncertainty, perceived service intangibility • <u>IVs (perceived risk types):</u> perceived financial risk, perceived privacy risk, perceived performance risk, perceived psychological risk, perceived time risk • <u>DVs:</u> perceived value (also hypothesized to have an effect on acceptance intention), acceptance intention (2) Estimation of the research model using structural equation modeling	Perceived financial risk and perceived performance risk have strong negative effects on both perceived value and acceptance intention. Perceived privacy risk has a salient effect on acceptance intention, but no effect on perceived value. Perceived psychological risk and perceived time risk have no effects on perceived value and acceptance intention. Perceived information asymmetry, perceived technological uncertainty, perceived regulatory uncertainty, and perceived service intangibility are relevant and significant determinants of perceived risks.

Author/s (Year) ***[Journal]***	**Research Focus**	**Theoretical Background**	**Sample**	**Method/Analysis**	**Main Findings**
Zhang, Zhu, and Liu (2012) *[Computers in Human Behavior]*	(1) To develop a research model of mobile commerce adoption by extending TAM. (2) To test the research model by conducting a meta-analysis of previous studies in mobile commerce acceptance.	TAM, TPB, IDT	N = 53 research articles in mobile commerce adoption	(1) Development of a research model of mobile commerce adoption: • IVs: perceived risk, perceived cost, perceived behavioral control, subjective norm, perceived usefulness, perceived ease of use, innovativeness, compatibility, trust, perceived enjoyment, attitude • DV: behavioral intention, actual use (2) Testing the model by conducting a meta-analysis of previous studies in mobile commerce adoption (structural equation modeling) (3) Moderator analysis to test a hypothesized moderator effect of culture (Western vs. Eastern)	The relation between attitude and behavioral intention represents the strongest correlation in the model. Perceived usefulness, perceived ease of use, subjective norm, and perceived enjoyment are strongly and positively correlated with behavioral intention. The effects of perceived cost and perceived risk on behavioral intention are negative and significant. Culture appears as a moderator that makes some independent variables more or less important in Western and Eastern cultures.

References

Agarwal, Ritu and Jayesh Prasad (1998), "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research*, 9 (2), 204-215.

Anderson, David R., Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm, and James J. Cochran (2013), Statistics for Business and Economics, 12th Edition. Mason: South-Western.

Baron, Reuben M. and David A. Kenny (1986), "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations," *Journal of Personality and Social Psychology*, 51 (6), 1173-1182.

Chandra, Shalini, Shirish C. Srivastava, and Yin-Leng Theng (2010), "Evaluating the Role of Trust in Consumer Adoption of Mobile Payment Systems: An Empirical Analysis," *Communications of the Association for Information Systems*, 27 (1), 561-588.

Chen, Lei-da (2008), "A Model of Consumer Acceptance of Mobile Payment," *International Journal of Mobile Communications*, 6 (1), 32-52.

Cocosila, Mihail and Houda Trabelsi (2016), "An Integrated Value-Risk Investigation of Contactless Mobile Payments Adoption," *Electronic Commerce Research and Applications*, 20 (November-December), 159-170.

Cohen, Jacob (1992), "A Power Primer," *Psychological Bulletin*, 112 (1), 155-159.

Dahlberg, Tomi, Niina Mallat, Jan Ondrus, and Agnieszka Zmijewska (2008), "Past, Present, and Future of Mobile Payments Research: A Literature Review," *Electronic Commerce Research and Applications*, 7 (2), 165-181.

———, Jie Guo, and Jan Ondrus (2015), "A Critical Review of Mobile Payment Research," *Electronic Commerce Research and Applications*, 14 (5), 265-284.

Davis, Fred D. (1989), "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13 (3), 319-340.

——— (1993), "User Acceptance of Information Technology: System Characteristics, User Perceptions, and Behavioral Impacts," *International Journal of Man-Machine Studies*, 38 (3), 475-487.

de Kerviler, Gwarlann, Nathalie T. M. Demoulin, and Pietro Zidda (2016), "Adoption of In-store Mobile Payment: Are Perceived Risk and Convenience the Only Drivers?," *Journal of Retailing and Consumer Services*, 31 (July), 334-344.

Dennehy, Denis and David Sammon (2015), "Trends in Mobile Payments Research: A Literature Review," *Journal of Innovation Management*, 3 (1), 49-61.

Ernst & Young (2015), "Mobile Payment: War of the Wallets," (accessed August 4, 2017), [available at http://www.ey.com/Publication/vwLUAssets/ey-mobile-payment-war-of-wallets-nov-2015/$FILE/ey-mobile-payment-war-of-wallets-nov-2015.pdf].

European Payments Council (2017), "White Paper Mobile Payments," (accessed July 25, 2017), [available at https://www.europeanpaymentscouncil.eu/sites/default/files/KB/files/EPC492-09%20v5.0%20White%20Paper%20Mobile%20Payments%20-%20edition%202017.pdf].

Falk, Tomas, Werner H. Kunz, Jeroen J. L. Schepers, and Alexander J. Mrozek (2016), "How Mobile Payment Influences the Overall Store Price Image," *Journal of Business Research*, 69, 2417-2423.

Fishbein, Martin and Icek Ajzen (1975), Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading, MA: Addison-Wesley.

Hair, Joseph F., William C. Black, Barry J. Babin, and Rolph E. Anderson (2010), Multivariate Data Analysis: A Global Perspective. New Jersey: Pearson.

Hayashi, Fumiko (2012), "Mobile Payments: What's in It for Consumers?", *Economic Review – Federal Reserve Bank of Kansas City*, 1st Quarter, 35-66.

Hoehle, Hartmut, Eusebio Scornavacca, and Sid Huff (2012), "Three Decades of Research on Consumer Adoption and Utilization of Electronic Banking Channels: A Literature Analysis," *Decision Support Systems*, 54 (1), 122-132.

IBM Support (2016), "Compute Mahalanobis Distance and Flag Multivariate Outliers," (accessed July 15, 2017), [available at http://www-01.ibm.com/support/docview.wss?uid=swg21480128].

Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler (1991), "Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias," *The Journal of Economic Perspectives*, 5 (Winter), 193-206.

Kim, Changsu, Mirsobit Mirusmonov, and In Lee (2010), "An Empirical Examination of Factors Influencing the Intention to Use Mobile Payment," *Computers in Human Behavior*, 26 (3), 310-322.

Legris, Paul, John Ingham, and Pierre Collerette (2003), "Why Do People Use Information Technology? A Critical Review of the Technology Acceptance Model," *Information & Management*, 40 (3), 191-204.

Mallat, Niina (2007), "Exploring Consumer Adoption of Mobile Payments – A Qualitative Study," *The Journal of Strategic Information Systems*, 16 (4), 413-432.

Mandrik, Carter A. and Yeqing Bao (2005), "Exploring the Concept and Measurement of General Risk Aversion," *Advances in Consumer Research*, 32 (1), 531-539.

Mobgen (2015), "The Mobile Payments Landscape and its Opportunities," (accessed July 29, 2017), [available at https://www.accenture.com/t20160708T043705__w__/us-en/_acnmedia/PDF-25/Accenture-Acquires-Mobgen-Expand-European-Mobile-Payment-UK.pdf].

Nielsen (2016), "Mobile Money: From Shopping to Banking to Payments, How Mobile is Transforming Commerce Around the World," (accessed July 25, 2017), [available at http://www.nielsen.com/content/dam/nielsenglobal/eu/docs/pdf/nielsen-global-mobile-money-report.pdf].

OED Online (2017), "Information Technology," (accessed September 9, 2017), [available at http://www.oed.com/view/Entry/273052?redirectedFrom=information+technology#eid].

Oliveira, Tiago, Manoj Thomas, Goncalo Baptista, and Filipe Campos (2016), "Mobile Payment: Understanding the Determinants of Customer Adoption and Intention to Recommend the Technology," *Computers in Human Behavior*, 61 (August), 404-414.

Perkins, Ben and Celine Fenech (2014), "The Deloitte Consumer Review: The Growing Power of Consumers," (accessed July 25, 2017), [available at https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/consumer-business/consumer-review-8-the-growing-power-of-consumers.pdf].

Pham, Thanh-Thao T. and Jonathan C. Ho (2015), "The Effects of Product-related, Personal-related Factors and Attractiveness of Alternatives on Consumer Adoption of NFC-based Mobile Payments," *Technology in Society*, 43 (November), 159-172.

Podsakoff, Philip M., Scott B. MacKenzie, Jeong-Yeon Lee, and Nathan P. Podsakoff (2003), "Common Method Biases in Behavioral Research: A Critical Review of Literature and Recommended Remedies," *Journal of Applied Psychology*, 88 (5), 879-903.

Rabin, Matthew (1998), "Psychology and Economics," *Journal of Economic Literature*, 36 (1), 11-46.

Rogers, Everett M. (2003), Diffusion of Innovations. New York: Free Press.

Samsung (2017), "Samsung Rewards," (accessed September 10, 2017), [available at https://www.samsung.com/us/samsung-pay/rewards/#catalog].

Sanakulov, Nodir and Heikki Karjaluoto (2015), "Consumer Adoption of Mobile Technologies: A Literature Review," *International Journal of Mobile Communications*, 13 (3), 244-275.

Schierz, Paul Gerhardt, Oliver Schilke, and Bernd W. Wirtz (2010), "Understanding Consumer Acceptance of Mobile Payment Services: An Empirical Analysis," *Electronic Commerce Research and Applications*, 9 (3), 209-216.

Shaikh, Aijaz A. and Heikki Karjaluoto (2015), "Mobile Banking Adoption: A Literature Review," *Telematics and Informatics*, 32 (1), 129-142.

Shaw, Norman (2014), "The Mediating Influence of Trust in the Adoption of the Mobile Wallet," *Journal of Retailing and Consumer Services*, 21 (4), 449-459.

Shin, Dong-Hee (2009), "Towards an Understanding of the Consumer Acceptance of Mobile Wallet," *Computers in Human Behavior*, 25, 1343-1354.

Slade, Emma, Michael Williams, Yogesh Dwivedi, and Niall Piercy (2015), "Exploring Consumer Adoption of Proximity Mobile Payments," *Journal of Strategic Marketing*, 23 (3), 209-223.

Soman, Dilip (2003), "The Effect of Payment Transparency on Consumption: Quasi-Experiments from the Field," *Marketing Letters*, 14 (3), 172-183.

SoSciSurvey (2017), "Additional Variables in the Data Set," (accessed June 18, 2017), [available at https://www.soscisurvey.de/help/doku.php/en:results:variables].

Square (2017), "Payment Tokenization Explained," (accessed September 10, 2017), [available at https://squareup.com/townsquare/what-does-tokenization-actually-mean].

Statista (2017a), "Number of Smartphone Users Worldwide from 2014 to 2020 (in Billions)," (accessed July 9, 2017), [available at https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/].

——— (2017b), "Users in the Mobile Payments Market," (accessed July 9, 2017) [available at https://www.statista.com/outlook/331/100/mobile-payments/worldwide#market-users].

——— (2017c), "Transaction Value in the Mobile Payments Market," (accessed July 9, 2017) [available at https://www.statista.com/outlook/331/100/mobile-payments/worldwide#market-transactionValue].

——— (2017d), "Global Comparison – Transaction Value in the Mobile Payments Market," (accessed July 9, 2017), [available at https://www.statista.com/outlook/331/100/mobile-payments/worldwide#market-globalTransactionValue].

——— (2017e), "Users in the Digital Payments Market," (accessed July 9, 2017), [available at https://www.statista.com/outlook/296/100/digital-payments/worldwide#market-users].

——— (2017f), "Transaction Value in the Digital Payments Market," (accessed July 9, 2017), [available at https://www.statista.com/outlook/296/100/digital-payments/worldwide#market-transactionValue].

——— (2017g), "Market Definition: Mobile Payments," (accessed September 3, 2017), [available at https://www.statista.com/outlook/331/100/mobile-payments/worldwide#].

——— (2017h), "Market Definition: Digital Payments," (accessed September 3, 2017), [available at https://www.statista.com/outlook/296/100/digital-payments/worldwide#].

Stevens, James P. (2009), Applied Multivariate Statistics for the Social Sciences. New York: Routledge.

Tabachnik, Barbara G. and Linda S. Fidell (2007), Using Multivariate Statistics. Boston: Pearson.

Taylor, Emmeline (2016), "Mobile Payment Technologies in Retail: A Review of Potential Benefits and Risks," *International Journal of Retail & Distribution Management,* 44 (2), 159-177.

Tversky, Amos and Daniel Kahneman (1992), "Advances in Prospect Theory: Cumulative Representation of Uncertainty," *Journal of Risk and Uncertainty,* 5 (4), 297-323.

Venkatesh, Viswanath and Fred D. Davis (2000), "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science,* 46 (2), 186-204.

———, Michael G. Morris, Gordon B. Davis, and Fred D. Davis (2003), "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly*, 27 (3), 425-478.

———, James Y. L. Thong, and Xin Xu (2012), "Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology," *MIS Quarterly*, 36 (1), 157-178.

Wei-Han Tan, Garry, Keng-Boon Ooi, Siong-Choy Chong, and Teck-Soon Hew (2014), "NFC Mobile Credit Card: The Next Frontier of Mobile Payment?," *Telematics and Informatics*, 31 (2), 292-307.

Yang, Shuiqing, Yaobin Lu, Sumeet Gupta, Yuzhi Cao, and Rui Zhang (2012), "Mobile Payment Services Adoption Across Time: An Empirical Study of the Effects of Behavioral Beliefs, Social Influences, and Personal Traits," *Computers in Human Behavior,* 28 (1), 129-142.

Yang, Yongqing, Yong Liu, Hongxiu Li, and Benhai Yu (2015), "Understanding Perceived Risks in Mobile Payment Acceptance," *Industrial Management and Data Systems,* 115 (2), 253-269.

Zhang, Liyi, Jing Zhu, and Qihua Liu (2012), "A Meta-Analysis of Mobile Commerce Adoption and the Moderating Effect of Culture," *Computers in Human Behavior*, 28 (5), 1902-1911.