A GENERATION COMPARISON OF MOBILE PAYMENT ACCEPTANCE FACTORS: AN EMPIRICAL INVESTIGATION

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Research paper

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Abstract

Many unsuccessful initiatives for establishing technological solutions of mobile payment (m-payment) services in stationary trade have been detected in the past few years. Therefore, following research deals with possible explanations for insufficient diffusion. A lack of research was analyzed by investigating the moderating effect of being a Digital Native (DN) or Digital Immigrant (DI) regarding technological factors influencing the attitude towards using m-payment systems. Our findings deepen the understanding of consumers’ needs and personal characteristics in the adoption of m-payment technology. The theoretical basis is built on a modified TAM and Prensky’s (2001) cultural generation concept. Hence, the technical field of m-payment is connected to a theory of identity. The study results displayed a greater degree of technological affinity concerning all factors examined in the group of DN. By using a moderated regression analysis, we verified the negative influence of perceived security and risk having a significantly stronger effect on the attitude of DIs. Additionally, further results confirm the enormous importance of security in innovative payment processes. The results reinforce the importance of a target group-specific communication of an easy and secure payment-transaction to DIs. Furthermore, divergence of former research could be explained through the results of our cultural approach.

Keywords: moderating effect of generation, mobile payment diffusion, technological adoption, generation-specific communication.

1 Introduction

Technological advances in the market for mobile devices have led to completely new mobile application fields over the past decade. Consequently, these devices become indispensable for modern digital society, as one can see by the fact that 49 million Germans own smartphones (Statista, 2016). The mobile phone has developed from a communication tool to a multifunctional information system. To meet the increasing need on mobility and facilitate the payment process, there had been some efforts to enable mobile phones to pay directly at the point-of-sale (POS) in the 1990s (Lerner, 2013). Companies introduced diverse services onto the market as a practical realization of this technology. Regarding the actual distribution, the Near Field Communication (NFC) technology or the scan of a Quick Response (QR) code are the most notable systems used to transfer data (Neßler et al., 2016). Our investigation concentrates on mobile payment (m-payment) processes at the stationary POS. This subcategory of m-payment is called “proximity mobile payment,” which is defined by a physical presence of the customer as well as a physical infrastructure in trade (Slade et al., 2015; Smart Card Alliance, 2007). We justify this focus because the stationary POS is the trading form with the highest sales volume of 411.3 billion € in Germany (GfK, 2016). So far, 70 percent of Germans have not paid by mobile at all (PwC, 2016) and none
of the m-payment systems could satisfy the heterogeneous customers’ needs. The latter include technical aspects, such as ease of use or perceived usefulness (Arvidsson, 2014; Dahlberg et al., 2003; Liébana-Cabanillas et al., 2014) and psychological factors, such as trust and security (Dahlberg et al., 2003; Köster et al., 2016), and differ between age groups (Gurtner et al., 2014; Liébana-Cabanillas et al., 2014). To explain the missing acceptance, international researchers investigated a huge number of acceptance factors to analyze their influence on m-payment adoption (e.g. Arvidsson, 2014; Dahlberg and Öörni, 2007; Mallat, 2007). Studies show that behavioristic aspects, such as experience and competence, and demographic factors, such as age, play an important role in the context of mobile payment acceptance (Dahlberg and Öörni 2007; Gurtner et al., 2014; Liébana-Cabanillas et al., 2014). These results indicate a first assumption of possible differences between the generations of “Digital Natives” (DNs) and “Digital Immigrants” (DIs) in technical factors (Prensky, 2001). The cultural concept of DNs and DIs is often used in the analysis of technological issues (Hoffmann et al., 2014; Metallo and Agrifoglio, 2015). The DNs are people born in the digital age and raised on innovative information system technologies. Therefore, one expects high affinity resulting in more acceptance of new technologies. By contrast, the DIs are forced to appropriate the information technology by themselves. Hence, a lower level of technological affinity is expected of this group, which leads to acceptance problems (Vodanovich et al., 2010). Reviewing current m-payment literature, we identified a lack of research by investigating the identity characteristics of consumers (e.g. Liébana-Cabanillas et al., 2014; Slade et al., 2015). Thus, the aim of our investigation was to combine the technical field of m-payment with the generation concept of being a DN or DI. Through this approach, we were able to apply former specific research using the named generation concept concerning the design and marketing activities on m-payment systems (e.g. Gurtner et al., 2014; Holt et al. 2013; Tilvawala et al., 2011). Related to the practice, latest news of paying for withdrawing money from cashpoints in Germany (Reiche, 2017) makes one think of practical alternatives to paying with cash. Therefore, our motivation was to understand attitudinal aspects regarding m-payment to improve the systems for the greatest possible number of customers. We achieved this by the integration of the theory of DNs and DIs to examine the moderating effect of age. Based on this theoretical generation concept, we investigated the technical factors “perceived usefulness” and “perceived ease of use” incorporating Davis’ (1989) “Technology Acceptance Model” (TAM). Additionally, we examined perceived security in our model, because of its enormous relevance in payment transaction processes (Levente and Sandor, 2016). Hence, we conducted a moderated regression analysis to empirically test the impact of the variables mentioned on the attitude towards using m-payment services. The results of the study show significant influences of all variables on the attitude towards using m-payment systems. Thereby, we observe a greater degree of technological affinity over all factors in the group of DNs. Furthermore, we identify security and risk having the highest impact on attitude and being moderated by generational characteristics. Our findings deepen the understanding of consumers’ needs and personal characteristics in the field of m-payment technology. The detailed description of both generations allows a more precise investigation of relevant influence factors on the attitude towards m-payment. This enables us to generate more target-oriented recommendations to all institutions participating. Thus, the relevance of the investigation conducted is justified through the enormous potential of generation-segmented market cultivation. The remainder of our paper is organized as follows: Firstly, we review the current research in the field of m-payment. We then explain the theoretical background and develop our hypotheses. The following two sections deal with the research methodology and the presentation of our results. Finally, we discuss our research findings, create theoretical and practical implications, outline the limitations and show approaches of future research.

2 Current Research

The acceptance of mobile payment methods is a fixed object of international consumer behavior research. The first studies on this topic took place in 2002, whereas the number of publications increased significantly five years later (Slade et al., 2013). Several theories have been proposed as a basis for adoption models of m-payment services: The TAM by Davis (1989), the diffusion of innovation (DOI) postulated by Rogers (1995), and the unified theory of acceptance and use of technology (UTAUT)
proposed by Venkatesh et al. (2003) (Dahlberg et al., 2008, Dahlberg et al., 2015). These models were modified and enhanced for m-payment research through specific factors. In this context, the German researcher Pousshtchi (2005) identified technology-related factors that contribute to the acceptance of m-payment systems. It turned out that consumer-based systems should be essentially secure, easy to use and cost-effective. Bernet (2014) designed a specific acceptance model of m-payment systems based on the TAM. Consequently, perceived risk by users as well as perceived user-friendliness of payment systems are the most important determinants of consumer acceptance. Tan et al. (2014) also extended the TAM with the factor of financial-related risk. In contrast to Bernet (2014), risk was not found to have a significant impact on the behavioral intention. In a qualitative survey, Mallat (2007) as well as Dahlberg and Öörni (2007) identified factors such as security and trust, compatibility, complexity and relative advantage of mobile payment systems as very important variables. Furthermore, Dahlberg and Öörni (2007) combined their qualitative survey with a quantitative approach in order to test the influence of mentioned factors on the willingness to use m-payment methods. In addition to the technical issues, the authors determined three consumer-specific factors: Age, level of education and competence in the handling of mobile devices. The variables of education and competence in the handling of mobile devices influence the user’s willingness to use positively. Age, on the other hand, is negatively related to willingness to use (Dahlberg and Öörni, 2007). Further research concerning the aspects of age was conducted by Gurtner et al. (2014). They identified a lack of research by investigating and evaluating differences in the perception of attitudes like usefulness, perceived ease of use and convenience between age groups regarding mobile business applications. Their results show, that convenience is the dominant factor for DNs. For elderly people, ease of use gains in importance, which should be taken into account when designing applications. In the research area of m-payment Liébana-Cabanillas et al. (2014) examined the influence of age on the acceptance of text message payment systems based on the TAM. Their sample was divided into two groups based on the median age (35 years) and then subjected to a comparison. To summarize, the younger group showed more acceptance towards text message payments than the older group. The confidence in the payment method was comparatively higher (Liébana-Cabanillas et al., 2014). An examination of the concept of DN's and DIs with the focus on technical aspects and proximity m-payment did not take place. Looking at the acceptance factors identified, it is notable that they can be divided into two categories: Both functional aspects of the system, such as ease of use, as well as personal characteristics are relevant. The latter refer to behavioristic and demographic features, which again allow concluding differences in acceptance between generational groups. Explicit generation-specific acceptance studies, however, have not yet taken place in the context of m-payments, as the analysis of the research discovered. Though, the strong presence of the TAM in this research area (Slade et al., 2015) is noteworthy and reinforces the suitability of the model as a basis for this investigation.

3 Theoretical Framework and Hypothesis

3.1 A Modified TAM

Based on the theory of Ajzen and Fishbein (1980), Davis suggested the TAM in 1989. Lee et al. (2003) postulated the TAM to be one of the models most used and empirically verified to analyze customer acceptance of technological systems. Hence, many researchers have used the TAM to examine the adoption of m-payment (Arvidsson, 2014; Bernet, 2014; Dahlberg and Öörni, 2007; Keramati et al., 2012; Liébana-Cabanillas et al., 2014) According to the TAM, two main factors: “perceived usefulness” and “perceived ease of use,” impact the acceptance of new technologies. Davis defines “perceived usefulness” as “the degree, to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989). In contrast to that, Davis understands “perceived ease of use” as “the degree, to which a person believes that using a particular system would be free of effort” (Davis, 1989). In this context, one assumes a system with a high value on “perceived ease of use” to be more useful. Therefore, the aspect “perceived ease of use” is suggested as having a positive influence on “perceived usefulness.” Both factors impact the individual’s attitude towards using a technology. Together with
“perceived usefulness,” these two variables affect the behavioral intention, which finally impacts partially the actual use (Park, 2009). The “acceptance model of mobile payment systems” by Schierz et al. (2010) does not include a separate recording of the variable actual use. This reduction is justified by the fact that it is not possible to monitor the actual use of consumers adequately in view of the early stage of development of m-payment systems at the time of the survey. Consequently, instead of observing the concrete behavior, only the behavioral intention can be examined to draw conclusions about the future acceptance. The authors, however, still refer to the construct “attitude,” as this determines the intention to use new technologies significantly (Davis, 1989; Park, 2009). Furthermore, the researchers enhance the remaining “core TAM” factors through “perceived security,” “perceived compatibility,” “subjective norm” and “individual mobility.” The constructs and items were chosen on the basis of previous research. Their model is proved to be reliable and valid and all independent variables show significant effects on attitude towards using as well as intention to use m-payment services (Schierz et al., 2010). As our investigation approaches the moderating effect of being a DI or DN and technical factors, we were forced to reduce the model named above. Hence, we eliminated the factors “compatibility,” “subjective norm” and “individual mobility.” The former does not show significant influence on an individual’s attitude to adopt m-payment services in the study of Arvidsson (2014). Additionally, Kim et al. (2009) could not support their hypotheses of technological compatibility having a positive influence on “perceived ease of use” and “perceived usefulness”. Focusing on technical factors, “subjective norm” and “individual mobility” are not part of our examination. Instead, we concentrated on the aspects “perceived ease of use” and “perceived usefulness” of the TAM and the factor “perceived security.” The variables of the TAM have proven to be reliable instruments with high quality and measurement properties (Davis, 1989; Pavlou, 2003). As almost all innovations include risks, Antioco and Kleijnen (2010) found functional and performance risk to be negatively related to adoption intention of technological innovations. Perceived risk and security play an important role, especially in the field of sensible transactions, such as the payment process (Henkel, 2001). The fear of fraud in electronic payment transactions also becomes an essential issue (Levente and Sandor, 2016). Thus, we analyzed the “perceived security” of the mobile payment services concerning the fraud and information risks. In contrast to Schierz et al. (2010), we renounced a separate recording of the relationship between the attitude and the behavioral intention to use. This is because a lot of studies have already confirmed this connection and, therefore, no additional examination seems necessary (Meharia, 2012; Schierz et al. 2010). On the other hand, no evidence for generational differences between these relationships could be found, thus, it can be neglected in terms of the investigation to determine generation differences.

3.2 The Generation Concept of Digital Natives and Digital Immigrants

The concept of DNs and DIs is one of the most widespread generational differentiations of today. Originally conceptualized by Marc Prensky in 2001, the dichotomy has been the foundation for most research issues concerning generational gaps in the context of digitalization so far (Jandura and Karnowski, 2015). Prensky defines those who grew up with digital technology, such as computers, video games and the World Wide Web, as DNs. By contrast, DIs refer to the older generation who adapted digital technologies as an integral part of everyday life at some stage in adulthood (Hoffmann et al., 2014; Prensky, 2001). Correspondingly, the generational differences in terms of both the basic way of life and the usage behavior of modern technology are regarded as substantial (e.g. Harris et al., 2016 Prensky, 2001). The DNs have spent their entire lives surrounded by new information and communication technologies and consequently are associated with a higher level of affinity (Palfrey and Gasser, 2008; Prensky, 2001; Süß et al., 2013). Thus, they use modern technology systems intuitively and cope with their everyday practices, such as communication, information provision and consumption, intensively with the help of those innovations (Frielings, 2010; McCormack and Poole, 2009). Their extensive openness and willingness to experiment with modern procedures and information technologies is striking (Tapscott, 1998). They use these information systems typically to explore their environments and identities in the world (Vodanovich et al., 2010). Unlike their DI counterparts, they often act as “early adopters,” applying the newest products and technologies shortly after market release. Along with this, they are more comfortable with taking usage risks, such as the disclosure of personal data, than older consumers (Bitkom,
2011). In this context, DN s are often regarded as relatively ingenious and careless (Hoffmann et al., 2014). The DN s have intertwined the digital world and its numerous technologies as a part of their daily lives more than the DI s. Even though many DI s have become proficient users of technology, their use differs significantly from their DN counterparts. The DI s are believed to oppose the newest technologies or rather have some technology acceptance difficulties (Vodanovich et al., 2010). It is assumed that their use of technology is less common and more cautious compared to younger users (Bitkom, 2011). This behavior is based on the altruistic social and conservative-traditional values of the DI s (Franz, 2010). According to Prensky (2001), DI s are capable of acquiring distinctive skills in the use of modern technologies, but they will always retain traditional usage behavior from the past and do not reach the level of competence of their follow-up generation. Communication via new technology is one such area; DI s prefer to use e-mail for online communication, whereas DN s prefer the more synchronous forms of instant messaging through social media platforms. Regarding phones, DI s favor speaking directly to people, whereas DN s prefer speed texting (Taipale, 2016; Vodanovich et al., 2010). While Prensky (2001) does not provide an unequivocal criterion for the classification of individuals into generational groups, most of the following publications suggest an age limit of 1980 as a year of birth as the differentiation, assuming that from this point onwards, digital technology was so widespread that all those born later were raised in a digital world (Palfrey and Gasser, 2008). We followed this assumption. Prensky’s (2001) approach has been taken up frequently in the context of consumer acceptance of technology. Based on the TAM, Rasalingam et al. (2014) identified, for instance, that DN s have a higher acceptance towards online shopping than older customers. Furthermore, Metallo and Agrifoglio (2015) revealed acceptance disparities between the generations in the usage of social media platforms. In addition, Hoffmann et al. (2014) could demonstrate significant differences between DN s and DI s considering consumer trust in online services. The moderating effect of age was investigated in m-payment research and extensively confirmed by Liébana-Cabanillas et al. (2014). The generation-specific differences identified previously in the context of technology acceptance research substantiate the assumption towards generational differences concerning the acceptance of m-payment methods.

## 3.3 Hypotheses

Various acceptance studies in the context of modern technologies show that the intensities of the respective effect relationships vary within the model construct, partly depending on the demographic and behavioral determinants of the user (e.g. Wang et al., 2009; Yousafzai and Yani-de-Soriano, 2011). Factors such as age, sex and technological affinity can intensify or weaken the effect of the determinants on technology acceptance. Therefore, different intensities of influences should be the focus of this generation-specific study. The construct of “perceived usefulness” in the context of m-payment systems refers to an increase in the efficiency and effectiveness of transaction processes in everyday life (Zmijewska et al., 2004). Previous empirical studies have repeatedly shown a positive correlation between the perceived usefulness of m-payment systems and the attitude towards the use or acceptance (Arvidsson, 2014; Chen, 2008; Kim et al., 2009; Mallat, 2007; Meharia, 2012; Schierz et al., 2010). Lièbana-Cabanillas et al. (2014) point out that the strength of this effect varies depending on the age of the consumers. In their study on user acceptance against text message payments, they compared two age groups, with a division at 35 years. According to their study, the influence of perceived usefulness on attitude towards using m-payment systems among younger consumers is more pronounced (Lièbana-Cabanillas et al., 2014). This result is supported by Yousafzai and Yani-de-Soriano (2011). They show that the relationship between the perceived usefulness and the acceptance of online banking services is most pronounced in younger consumers, who are characterized by optimism and enthusiasm compared to other consumer groups (Yousafzai and Yani-de-Soriano, 2011). Hoffmann et al. (2014) reveal that the DI s focus less on the benefits of new technologies than on the uncertainty about the unknown procedures in the context of online services. The potential effort to learn how to deal with it also tends to be a barrier for them (Hoffmann et al., 2014). Thus, it is assumed for the investigation context of m-payment methods that:

H1: The impact of perceived usefulness on the attitude towards using mobile payment services is higher among the Digital Natives.
In view of the low spread of m-payment systems in Germany, the consumers have hardly any user experience. Consequently, their perception of ease of use is merely a subjective assessment of the potential effort that would be needed to understand or use these applications respectively (Gilaninia et al., 2012). The perceived ease of use in m-payments is mainly due to the number of implementation steps, the duration of the payment process and the complexity of the registration process at the provider (Wiedemann et al., 2008). A simple implementation is central to the consumer’s willingness to use, particularly in daily, purely utilitarian practices, such as in the case of payment transactions (Nysveen et al., 2005). Consequently, a positive influence of this factor could also be demonstrated for m-payment (Arvidsson, 2014; Dahlberg and Öörni, 2007; Keramati et al., 2012; Kim et al., 2009; Mallat, 2007; Meharia, 2012). Various research papers postulate that the importance of the user-friendliness of technological systems for attitude and acceptance varies according to age (Czaja et al., 2006; Niehaves and Plattfaut, 2013). Thus, Morris and Venkantesh (2000) show in the entrepreneurial context, that the ease of use of older employees has a greater impact on the usability of new technologies in the workplace than on younger employees. This factor includes both the perceived control over the system and the ease of use (Morris and Venkantesh, 2000). Wang et al. (2009) proved similar results in their study on the acceptance of mobile learning (M-learning) systems. They compared two age groups, with the age of 30 being chosen as a separation limit. Their analysis showed that the negative effect of the expectation on the effort of using the system on the intended use of the older group is stronger (Wang et al., 2009). In addition to this, a number of studies have shown that a suited, intuitive control of technology systems is one of the most important acceptance drivers from the perspective of elderly consumers (Chin et al., 2009; Mallenius et al., 2007). These results align with the stereotypical characteristics of the DNs and DIs, as elderly users are attributed with certain usability and acceptance difficulties towards new technologies. The DNs, on the other hand, have greater self-efficacy in terms of usage regarding the application of modern technologies (Helsper and Eynon, 2009; Kirk et al., 2015). Consequently, we assumed that the ease of use of technology systems is an essential aid for older people and is, therefore, of higher relevance to them. Thus, the following hypothesis should be assumed in the context of m-payment systems:

H2: The impact of perceived ease of use on the attitude towards using mobile payment systems is higher among the Digital Immigrants.

While the usefulness and ease of use in each case determine the attitude towards m-payment systems positively, the use of such methods always entails inhibitory risks. This is especially true in the field of innovative payment systems, which confront consumers with a new situation where they perceive security risks in particular (Kim et al., 2010; Linck et al., 2006). This is due to the fact that the consequences of the use are usually difficult to calculate. Thus, it is only an estimation of the possible dangers by the customers, therefore, a subjectively perceived risk (Mitchell, 1999). Concerning payment systems, the rise of abuse is the focus of consumerism (Cimioti and Merschen, 2014; Levente and Sandor, 2016). According to a representative study conducted by PwC (2016), 85 percent of German citizens consider this method of payment risky, because data could be hacked and abused by technological manipulation by third parties. An equal share sees a risk in the smartphone being stolen and used for m-payments to the actual owner’s detriment (PwC, 2016). Consumers also see an operational risk in the technical systems involved in the payment process, as they could fail during the transaction process and, thus, prevent data exchange (Bernet, 2014). Experts agree that security risks are the main reason for the low level of usability (EBS Business School, 2012; PwC, 2016). Thus, Bernet (2014) and Khodawandi et al. (2003) identified the perceived risk or the subjective uncertainty, respectively, as the most important acceptance barrier for m-payment systems. Schierz et al. (2010) also demonstrate a highly significant influence of the risk factor on the consumer’s intention of use - both for those who had already made m-payments and for those without experience. However, there are indications that the risk assessment diverges in a generation-specific way from m-payment systems. In line with the widespread assumption that DIs are more skeptical about new technology systems than the younger generation, a study by Bitkom (2011)
showed that elderly people place greater importance on data protection on the Internet than younger ones: Users aged between 50 and 64 years showed the greatest concerns. On the other hand, younger users in social networks and other online platforms are much more likely to display personal information, such as images or status messages, although they are aware of the risks, such as data abuse (Bitkom, 2011). This insight is accompanied by scientific studies of acceptance research. Nyeko et al. (2014) found in the context of mobile banking procedures that the positive impact of the perceived security on the use of the procedures is more pronounced with the increasing age of users. The safety aspect is, therefore, of greater importance for older consumers in terms of acceptance than for younger consumers (Nyeko et al., 2014). This can be due to the fact, among other things, that the general risk profile of people decreases over the course of a lifetime (Josef et al., 2016). Consequently, it is assumed for the perceived security of m-payment procedures that:

H3: The impact of perceived security on the attitude towards using mobile payment systems is higher among the Digital Immigrants.

4 Research Design and Method

4.1 Empirical Design

A linear regression analysis was conducted to prove the hypotheses developed. This method makes it possible to reproduce the stochastic causal relationship between metric variables quantitatively. In relation to the present study, the expression of the dependent variable y ("attitude") is predicted based on the independent variables $x_n$ ("perceived usefulness," "perceived user-friendliness" or "perceived risk"), which means that their interdependency is quantified. Based on the data observed for the variables $x_n$ and $y$, a linear regression equation can be determined which best represents the overall trend of the data (Rasch et al., 2014). In a first step, the independent constructs of the research model were viewed collectively to analyze the overall explanatory power. After that, we subjected the individual parameters to test their singular effect separately. Respectively, individual regression models were constructed, where each contain only one independent variable. In view of the research object, this approach can create graphs with regression lines for each variable, which, in turn, allows a visual analysis of the interdependencies, including generation-specific differences. As can be seen, we expected the generation to be a moderator. A moderator is, in this case, a qualitative dichotomous (age group) variable that affects the relationship between the continuous predictor variables (independent variable) and the criterion variable (dependent variable) (Baron and Kenny, 1986; Hayes, 2013). Therefore, we applied a moderated regression (Aiken and West, 1991). This method is generally used to check how the interrelationships between
variables are affected by another independent variable (the moderator variable \( M \)). The moderator variable can influence the strength, significance or direction of the effect relationship (Urban and Mayerl, 2008). Hence, the statistical analysis has to measure the differential effect of the independent on the dependent variable as a function of the moderator (Baron and Kenny, 1986). The affiliation to the generation of the DNs or DIs describes the moderator variable, whereby only the differences in the intensity of the respective effect relationship are of interest here. To investigate this relationship, each independent variable was initially centered to minimize multicollinearity (Aiken and West, 1991). Then, \( M \) was characterized in terms of interactions which were integrated into the regression models formed previously (Cohen et al., 2003). Our interaction terms are a multiplicative link between the respective independent variable and the affiliation to a generation (Aiken and West, 1991). Due to the present dichotomous shape of the moderator variable, generational affiliation was operationalized using a 0/1 dummy variable. Thus, the term describes the variations of the slopes in the regression lines between the generations (Cohen et al., 2003). A moderator effect occurs when the interaction term results significantly in the regression analysis (Hayes, 2013). In this case, the effect differs between the independent variable and the dependent variable reliant on the state of \( M \) (dummy variable). The impact of the moderator effect can be determined by the change in the amount of variance explained in the dependent variable (\( \Delta R^2 \)) (Aiken and West, 1991; Cohen et al., 2003; Hayes, 2013).

4.2 Structure of the Survey

The results are based on a quantitative online survey. We focused on the general attitude towards m-payments at the stationary POS (dependent variable) and the subjective assessment of “perceived usefulness,” “ease of use” and “security” of the systems (independent variables). Furthermore, we tested the importance of the independent factors mentioned above as control variables. The importance of social acceptance was measured to gain further insight into generation-specific differences. Due to the low popularity of the m-payment systems, we gave a description of a typical m-payment process in the stationary POS at the beginning of the survey. The aim was to provide the subjects with a realistic idea of the procedure. We tried to avoid confusion with other innovative means of payment and brought all probands to a comparable level of knowledge about the subject under investigation. After testing the constructs of the model, we finally requested the sociodemographic data to be able to classify the probands according to generations.

4.3 Data Collection and Sample

The study took place from April 2 to 30, 2016, and was posted mainly on social media, such as “Facebook” and the career network “Xing.” Since we expected predominantly to reach younger people with chosen social media platforms, we also used e-mail lists of various companies and social clubs to recruit our participants. The participation in the questionnaire was voluntary and no incentives were used. As mentioned already, the survey was conducted using an online questionnaire, which was subjected to a pretest prior to implementation. For the pretest, survey data were collected from a sampling of 50 respondents. The results helped to avoid uncertainties concerning the validity of the constructs. The population analyzed was characterized by all German inhabitants who can use mobile devices. At the end of the survey period, 312 persons participated in the survey in total, but only 262 datasets were useable. A total of 59.16 percent of the 16- to 71-year-old participants were female and 40.84 percent were male. The average age was \( \text{M}_{\text{age}} = 32 \). The sample was segmented according to age into the group of DNs (born after 1980) and DIs (born before and in 1980). There were 176 DNs and 86 DIs. The average age of the DNs is \( \text{M}_{\text{age}} = 26 \) and of the DIs is \( \text{M}_{\text{age}} = 51 \). Eight DNs and two DIs had already made an m-payment at the POS.

4.4 Operationalization

As already described, the TAM forms the theoretical basis for our investigation. Therefore, all variables used could verify their goodness of fit in a couple of studies mention below. Above, we exhibited the values of Cronbach’s alpha (\( \alpha \)) for each variable. We used the personal attitude towards m-payment as
the dependent variable (Davis, 1989). This factor is often employed to measure the general acceptance of technology and particularly adoption of m-payment systems. Thus, we applied the following scale to measure the attitude: “I think using mobile payment services is a good idea,” “I think using mobile payment services is wise,” “I think using mobile payment systems is beneficial” and “I think using mobile payment services is interesting” (\( \alpha = .94 \)) (Oh et al., 2003; Van der Heijden, 2003; Yang and Yoo, 2004). The independent variable “perceived usefulness” explains the degree to which a consumer is convinced about the added value of an innovation: “Mobile payment services are a useful mode of payment,” “Using mobile payment services makes the handling of payment easier” and “By using mobile payment services, my choices as a consumer are improved (e.g. flexibility, speed, etc.)” (\( \alpha = .89 \)) (Bhattacherjee, 2001; Devaraj et al., 2002; Koufaris, 2002; Van der Heijden, 2003). Additionally, “ease of use” is a basic element of the TAM and measures the person’s perception of how much effort is required to handle a new technology: “I think it is easy to become skillful at using mobile payment services,” “I think the interaction with mobile payment services is clear and understandable,” “I think it is easy to perform the steps required to use mobile payment services” and “I think it is easy to interact with mobile payment services” (\( \alpha = .95 \)) (Bhattacherjee, 2001; Davis et al., 1989; Taylor and Todd, 1995; Venkatesh and Davis, 2000). Thirdly, we tested the independent variable “perceived security.” The factor focuses on the degree of security a person perceived when using m-payment services. Thereby, the abuse of transaction data was of special interest: “The risk of an unauthorized third party overseeing the payment process is low,” “The risk of abuse of usage information (e.g. names of business partners, payment amount) is low when using mobile payment services,” “The risk of abuse of billing information (e.g. credit card number, bank account data) is low when using mobile payment services” and “I would find mobile payment services secure in conducting my payment transactions” (\( \alpha = .95 \)) (Luarn and Lin, 2005; Parasuraman et al., 2005). All items were measured on a 7-point Likert-type scale (1 = strongly disagree, 7 = strongly agree), because this scale has been shown to reach the upper limits of the scale’s reliability (Allen and Seaman, 2007; Nunnally, 1978) and is also used in most of the reference papers (e.g. Bhattacherjee, 2001; Schierz et al., 2010; Venkatesh and Davis, 2000).

5 Results

5.1 Hypotheses Test

We tested all constructs of our framework through an independent sample t-test in a first step of the data analysis. Therefore, we investigated potential differences between the generations in the extent of “perceived usefulness” (PU), “perceived ease of use” (PEU), “perceived security” (PS) and “attitude towards using m-payment services” (ATT). The aim of conducting the t-test was to get a first hint about possible interdependency among the variables mentioned that builds a basis for following regression analyses. We found that the mean values of both groups differ significantly from each other across all constructs (\( p < .001 \)). Thereby, the younger generation (DNs) assessed m-payment to be more useful, easier to use and safer compared to the older generation (DIs). As expected, the overall attitude towards mobile payment services is much more positive in the group of DNs. The factor of PEU achieved the highest values in both generation groups (M_{DNs} = 4.92 and M_{DI} = 4.10). Therefore, the process of paying with the mobile phone was generally accessed to be simple and easy to learn. Mobile payment was also evaluated as very useful for the DNs (M = 4.35), but noticeably lower for DIs (M = 3.29) (t = 4.752, df = 260, \( p < 0.001 \)). The low trust in the security of this payment system was conspicuous (M_{DNs} = 2.70 and M_{DI} = 1.94). This result aligns with former research which could also find a significant influence of security and risk aspects on m-payment evolution (Arvidsson, 2014; Kim et al., 2010). We detected the biggest difference between the two groups in the construct of attitude towards using m-payment services. While the DNs had a positive attitude concerning this payment method (M = 4.23), the DIs clearly refused it (M = 2.91) (t = 5.956; df = 260; \( p < .001 \)). This finding corresponds to the stereotypical characteristics of the generations observed and the results of Liébana-Cabanillas et al. (2014) concerning age-specific differences in accepting m-payment systems.Before focusing on the hypothesis, a simple linear regression was calculated to examine whether the variables mentioned predicted attitude towards using m-payment services. A significant regression equation was found (F(3,258) = 243.997, \( p < 0.001 \)) (Adjusted
Regression analysis projected that PU predicted attitude most strongly ($\beta = .589, p < .001$), while PEU ($\beta = .199, p < .001$) and PS ($\beta = .251, p < .001$) also predicted the attitude significantly. At this point, however, it is not yet clear whether the influence of the variables on the attitude differs significantly from each other between the generations and how strongly these differences should be assessed. Consequently, we used a moderated regression analysis (Aiken and West, 1991) to examine whether generation-specific differences affect the attitude towards m-payment in various intensities. H1 illustrates the relationship between perceived usefulness and the attitude towards m-payment services. The influence of PU on ATT was expected to be higher in the group of DNs. A significant regression equation was found for both groups (DI: $F(3,82) = 71.148, p < .001$, adjusted $R^2 = .712$; DN: $F(3,172) = 139.330, p < .001$, adjusted $R^2 = .703$). The individual regression analysis for each factor explained that PU (DN: $\beta = .800; p < .001$ and DI: $\beta = .768; p < .001$) predicted the attitude with a high significance. To examine H1, we had to integrate an interaction term as the product of the centered independent variable PU and the dummy variable DN into the regression model. By doing this, we proved a significant difference between the moderating influences of the generation. Through the addition of this term, no significant increment on the amount of variance explained in ATT could be found ($\Delta R^2 = .00, p > .10$), indicating that generation affiliation does not moderate the PU – ATT relationship. Therefore, H1 could not be confirmed.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness (PU)</td>
<td>.771***</td>
<td>.765***</td>
</tr>
<tr>
<td>Generation Group (Dummy/DN)</td>
<td>-.128***</td>
<td>-.120</td>
</tr>
<tr>
<td>PU * Dummy/DN</td>
<td></td>
<td>-.012</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.665***</td>
<td>.664***</td>
</tr>
<tr>
<td>$\Delta R^2$</td>
<td></td>
<td>.001</td>
</tr>
</tbody>
</table>

Table 1. Results of hierarchical regression analysis: Moderating effect of generation on PU – ATT relationship (* $p < .1$; ** $p < .05$; *** $p < .01$).

The connection between PEU and the ATT was investigated in H2. Similar to the results above, a significant and positive relationship between these two variables could be found (DN: $\beta = .541; p < .001$ and DI: $\beta = .622; p < .001$) for both groups. However, H2 posited a greater influence of PEU on ATT in the group of DIs. Again, an interaction term as the product of the centered independent variable PEU and the dummy variable DI was integrated into the regression model. Through the addition of this term, no significant increment on the amount of variance explained in ATT could be found ($\Delta R^2 = .001, p > .10$), indicating that generation affiliation does not moderate the PEU – ATT relationship. Therefore, we found no important differences in the increase of the two regression lines. Thus, H2 could not be confirmed either.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Ease of Use (PEU)</td>
<td>.550***</td>
<td>.575***</td>
</tr>
<tr>
<td>Generation Group (Dummy/DI)</td>
<td>.222***</td>
<td>.155</td>
</tr>
<tr>
<td>PEU * Dummy/DI</td>
<td></td>
<td>.071</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.402***</td>
<td>.400***</td>
</tr>
<tr>
<td>$\Delta R^2$</td>
<td></td>
<td>.002</td>
</tr>
</tbody>
</table>

Table 2. Results of hierarchical regression analysis: Moderating effect of generation on PEU – ATT relationship (* $p < .1$; ** $p < .05$; *** $p < .01$).

It was assumed in H3 that the influence of the PS on the ATT is higher in the group of DIs than in the group of DNs. As expected, we also found a positive and significant influence of PS on ATT in both
groups (DN: $\beta = .507; p < .001$ and DI: $\beta = .619; p < .001$). The high regression coefficient in the group of DIs compared to the group of DNs is conspicuous. Hence, we expected a significantly higher influence of the security perception on attitude for the older age group. Analogous to the investigation method for H1 and H2, we integrated an interaction term as the product of the centered variable examined PS and the dummy variable DI. As one can see in Table 3, the interaction of security and generation has a significant effect on attitude ($\beta = -.164; p < .10$). Through the addition of the interaction term, a significant increment on the amount of variance explained in ATT could be found ($\Delta R^2 = .008, p < .10$). We observed that the effect of perceived security on the ATT is significantly higher in the group of DIs than in the group of DNs. Thus, H3 could not be rejected.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Security (PS)</td>
<td>$\beta = .523^{***}$</td>
<td>$\beta = .465^{***}$</td>
</tr>
<tr>
<td>Generation Group (Dummy/DI)</td>
<td>$\beta = .221^{***}$</td>
<td>$\beta = .359^{***}$</td>
</tr>
<tr>
<td>PS * Dummy/DI</td>
<td>$\beta = -.164^{*}$</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>$=.373^{***}$</td>
<td>$=.379^{***}$</td>
</tr>
<tr>
<td>$\Delta R^2$</td>
<td>$=.008^{*}$</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Results of hierarchical regression analysis: Moderating effect of generation on PS – ATT relationship (* $p < .1$; ** $p < .05$; *** $p < .01$).

Looking at the results, it can be noted that the constant $a$, the intercept, is continuously higher in the group of DNs. This leads to the conclusion that the younger generation has a fundamentally more positive attitude towards m-payment than the elderly generation. These findings were also supported through the t-test conducted.

5.2 Test of Control Variable

An independent sample t-test was conducted to improve validity. Thereby, we examined generation-specific differences in the importance of our variables to pay in a mobile way at the POS. Concerning the importance of PU, we found significant differences between the generation groups ($M_{DNs} = 5.53$ and $M_{DIs} = 4.45$) ($t = 3.803, df = 260, p < .000$). Therefore, the usefulness of using m-payment at the POS is more important for the DN than the DI. These findings support the assumption of H1, which postulates a greater influence of this factor on the attitude for DN s. The other control variables showed no significant differences between both groups. Thus, the importance of the factors PEU ($M_{DNs} = 5.63$ and $M_{DIs} = 5.42$) ($t = .816, df = 260, p = .416, 2-tailed$) and PS ($M_{DNs} = 6.35$ and $M_{DIs} = 6.52$) ($t = -.864, df = 260, p = .388, 2-tailed$) was assessed approximately equally among the age groups. Consequently, none of the variables mentioned influences the results in the form of a disturbance variable. The high relevance of the security aspect further illustrated the enormous influence of risk avoidance in the case of financial transactions.

6 Discussion

6.1 Summary of the Results

Many unsuccessful initiatives of establishing m-payment services in stationary trade have been detected in the past few years. So far, none of the technological solutions could satisfy consumer needs in a holistic way. One essential, but not commensurate condition for using m-payment systems is the security aspect. There are great security worries among the consumers concerning the NFC technology as Zhou (2014) showed. From the technical perspective, there were some vulnerabilities in data modification and the NFC technology did not protect against listening to communications (Monteiro et al., 2014). However, the latest research by ISACA (2015) classified the NFC payment method combined with tokeni-
zation to be very secure. Providers are encouraged to examine and address consumers with special regard to their preferences and perceived security to ensure complete market adaption. Against this background of a meanwhile secure technology, this paper aims to empirically investigate the moderating influence of generation-specific differences between DNs and DIs on the effect of the independent variables on the attitudes towards using m-payment systems. The results of the investigation prove that the attitude towards using m-payment systems differs significantly between generations. The younger group consider m-payment procedures to be more useful, user-friendlier and safer than the older group. Furthermore, they are characterized by a more positive attitude towards using this innovative payment technology than the older generation. Surprisingly, the DIs also evaluate m-payment to be easy to use, which was not be expected. These insights, however, strengthen generation-specific stereotypes. Thus, DIs are affine to technology, whilst DIs reflect a certain reserve towards innovative information systems. Additionally, it becomes apparent that DNs weight ease of use and usefulness of mobile payment systems more heavily when deciding whether to use these systems. We observe a great divergence by the safety factor, i.e. the potential loss of sensitive data. Both generation groups evaluate m-payment methods as risky and both see the safety of the system as the most important criterion for the decision to use this payment innovation. However, the investigation focuses on the analysis of effects resulting from the constructs used on the attitude component considering the age groups as a moderator. The regression analysis reveals that the three acceptance factors chosen influence the attitude strongly in a positive manner. The higher the perceived usefulness, ease of use and security standards of m-payment services are assessed by consumers, the more positive the attitude towards those payment systems develops. The results verify that the negative influence of perceived security and risk has a significantly stronger effect on the attitude of DIs than on DNs. Potential safety risks are, thus, shown to be linked to greater consequences for older consumers than for younger ones. One reason for this finding could be the increasing risk aversion of people over the lifetime (Josef et al., 2016). This effect could be observed especially for sensitive procedures with a huge potential for loss, which is the case for payment transactions (Henkel, 2001). No significant, generation-specific difference regarding the strength of influence on the attitude can be shown for the other constructs. Nonetheless, the continuously higher value of the constant $a$, the intercept, confirms the higher level of attitude described towards using m-payment systems for the younger generation.

6.2 Theoretical and Practical Implications

The examination of the generation concept of DNs and DIs regarding technical aspects of proximity payments widens the scope of current m-payment research and fills one more important research gap. Consequently, the findings extracted allow one to draw relevant theoretical and practical implications. Thus, we suggest reading prior research of attitudes towards proximity m-payment differentially as a theoretical implication. Reviewing the literature, we analyzed differences concerning the influence factors of m-payment acceptance between different authors. Divergent results of risk and security (Bernet, 2014; Tan et al., 2014), as well as compatibility (Arvidsson, 2014; Kim et al., 2009; Schierz et al., 2010) could be explained by regarding generation-specific characteristics. Hence, these samples should be explored and analyzed considering the generations of DNs and DIs. Moreover, the detailed description of both generations allows a more precise investigation of relevant influence factors on the attitude and acceptance of m-payment. These findings can consequently be transferred to other technological research areas to get more valid insights into consumer behavior. Based on the differentiated view of DNs and DIs, we also propose first practical recommendations and strategic actions to reduce the rejection by various stakeholders. We derive two possible strategies for market penetration, including information about the target group-specific design of the mobile application and the marketing communication channel and content. As a first strategy, we suggest focusing on the segment of DIs. Our study shows that the factor “perceived security” is decisive for the attitude of both generations. Elderly consumers particularly consider m-payment systems as risky and, hence, are influenced more strongly in their attitudes. Therefore, it is unavoidable for providers to not only design systems with high safety standards, but also to communicate the security of these systems in the marketing approach towards older consumers. Furthermore, our study results derive that the level of “perceived usefulness” and “perceived ease of use”
is evaluated lower by DIs. However, Gurtner et al. (2014) emphasize the importance of ease of use in the group of best and middle agers. We can totally agree with the authors’ recommendation not to facilitate the mobile application, since usefulness is also decisive, but to simplify the access through educational concepts or special tutorials (Gurtner et al., 2014). The benefits of easy and secure payment transactions should be communicated through target group-specific treatment of DIs. This would lead to an assimilation of the fundamental attitude of this generation to the younger generation. Holt et al. (2013) confirm their hypothesis of elderly citizens using traditional news media, such as television, radio and newspapers, more frequently than DNs. Thus, we recommend using traditional channels for the advertising approach. A further strategic approach of market launch aims to address especially younger consumer groups in the early stage. The results depict that their acceptance towards m-payment is more distinctive from scratch. If this consumer group could be convinced to use innovative payment methods more often, elderly segments could be reached due to effects triggered by the critical mass. Younger users could serve as so-called “early adopters”, which can encourage the diffusion of m-payment systems to the older and rather reserved consumer groups by word of mouth (Bass, 1969; Bass, 2004). This adaption process has been recognized for technological innovations several times in the past, for example, for the market diffusion of smartphones (Lee, 2014). Regarding the design of ubiquitous information systems, multiple functionality is one of the most important components (Tilvawala et al., 2011). Additionally, Gurtner et al. (2014) detected convenience to be the dominant influencing factor for DNs regarding mobile business applications. Transferred to m-payment, the applications should be designed in a multifunctional and convenient manner and serve as a mobile wallet. According to the research of Helsper and Eyon (2009), we propose that companies should use the internet as their prior marketing communication channel to reach the DNs. Our results also identified a low level of security in the group of DIs. As security impacts the attitude towards m-payment, the current secure payment technology could be communicated (ISACA, 2015). Finally, the diverse actors in m-payment systems are challenged to identify the acceptance tendency of consumer groups and react accordingly.

6.3 Limitations and Further Research

Although the results of the experimental design have provided clear insights, some restrictions must be made. On the one hand, the model-theoretic construct is intentionally limited to technical aspects. In its original design, the TAM comprises a further variable being dependent on the attitude, the behavioral intention, which determines the actual system use. The investigation of this relationship has been disregarded deliberately, because no indications of generation-specific differences for this context could be detected. Restricting the different volumes of control groups used for the moderator analysis and a slight imbalance of gender relations in the group of DIs should be mentioned. Additional research requirements can be seen in an extension of the model by further constructs which are suitable for this specific approach of investigation. In the context of mobile bank services, for instance, Yu (2012) could identify the factor “social norm” as the strongest acceptance driver, and that its strength of influence is moderated positively by age. Furthermore, this article is based on the original generation thesis postulated by Prensky (2001). This dichotomous perspective is partially criticized by literature, because the classification of year of birth is not authentic to the complexity of existing generation groups, particularly in times of continuous technological change (Jones and Czerniewicz, 2010; Wang et al., 2013). Jandura and Karnowski (2015), therefore, suggest linking the distinction of generation to a combination of attributes: “age” and “use of internet” (Jandura and Karnowski, 2015). Hoffmann et al. (2014) postulate a more detailed distinction of generation groups by an additional group of middle-aged people (“Naturalized Digitals”). Besides the consideration of additional distinction, features can lead to a more differentiated analysis of preferences concerning the target groups and to specific guidelines.
References


