TORUN BUSINESS REVIEW (17)3 2018 5-16

MOBILE PAYMENTS USING NFC TECHNOLOGY IN THE LIGHT OF EMPIRICAL RESEARCH

Abstract:
The purpose of this article is to examine the perception of NFC technology used in mobile payments by consumers. The article presents attitudes towards the NFC, from the point of view of specific groups of respondents, i.e. people owning smartphones with an NFC module, people actively using the NFC payments, and people using mobile banking applications. The basis of the article is a questionnaire survey, carried out with the use of the CAWI method in 2018, which was developed on the basis of the TAM technology acceptance model features. The results of the research allow determining the awareness of having and using the NFC technology. The obtained outcome also helps in defining the potential and direction of the NFC payments development on the Polish market.

Keywords: NFC, mobile payments, contactless payments.

JEL Codes: D12, E42, O33
DOI: 10.19197/tbr.v17i3.311

1. Introduction

Over recent years, dynamic technological changes in the entire economy occurred. Technology accompanies each of us at almost every turn, from improving communication through providing various services or offering new products. Thereupon, there are great changes taking place in the payment services market in Poland item, particularly in the area of modern payment methods based on advanced technologies, such as mobile payments. The mobile payment is a payment performed with a mobile device (e.g. a mobile phone) that is used to at least initiate a payment order, and potentially also to transfer cash (Klimontowicz, 2013). A characteristic feature of mobile payments according to J. Sang Un Chae (2015) is the combination of new technologies, i.a. mobile banking, mobile wallets, the QR and NFC codes. It is worth to put emphasis here on the ultra-short-range technology (NFC), which according to many authors (Birch, 2007; Ozcan, Santos, 2014; Pope, Pantages, Enachescu, Dinshaw, Joshlin, Stone, Austria, Seal, 2011) is called "the future of the mobile payments". The NFC technology is an outcome of development of the RFID (Radio Frequency Identification) technology and is an extension of the standard created for contactless cards (Polasik, 2014).

Technological progress and accelerated development of the non-cash payment methods acceptance network, thanks to i.a. the Programme for Non-cash Payments Development, are generating potential for increasing the number of transactions with payment cards as well as the popularity of payments using NFC technology. That is why the question arises whether Polish internet users are familiar with the NFC technology and what is their attitude towards mobile payments using it?

Therefore, the objectives of this article are to verify the knowledge of the aforementioned technology among Polish netizens and to determine its potential on the ground of its perception by the users of mobile applications.

The study employed here is based on the Davis's Technology Acceptance Model while the analysis of perceived usefulness, perceived ease of use, and perceived security is based on a representative survey (CAWI) carried out in December 2018 among Polish netizens.

2. Development of contactless payments in Poland

Contactless payment cards appeared in Poland at the end of 2007. However, they were not ordinary debit cards - they were pre-paid. Until 2009, the popularity of contactless cards was quite low, only 321 thousand cards of this type were issued. The contactless infrastructure has started to grow rapidly after launching of contactless debit cards linked to personal account in 2010 (Polasik & Piotrowska, 2018).

Until this time, the main obstacle for introduction of contactless technology was the fact that it required a different, new standard of terminals and payment cards. The card market was strongly influenced by the so-called network effect, indicating the increase of benefits for existing users of a given network along with increasing number of its new users. Due to the fact that contactless payment cards operate under the two-sided market conditions, the participants of which are payment cards users and merchants that provide a payment card acceptance network, obstacles related to the network effect were difficult to overcome. Therefore, in this case introducing of two new complementary networks, operating on the basis of new contactless technology, was required, which turned out to be a significant difficulty against a well-developed network of contact payment card terminals. The implementation of the contactless standard involved also the necessity of replacing traditional contact smart cards with contactless smart cards as well as transforming the acceptance networks that support this technology. However, the introduction of contactless technology on the Polish market was carried out in a coordinated manner, and the development strategy assumed the establishment of an acceptance network before the mass launching of contactless cards issue (Polasik & Piotrowska, 2018).

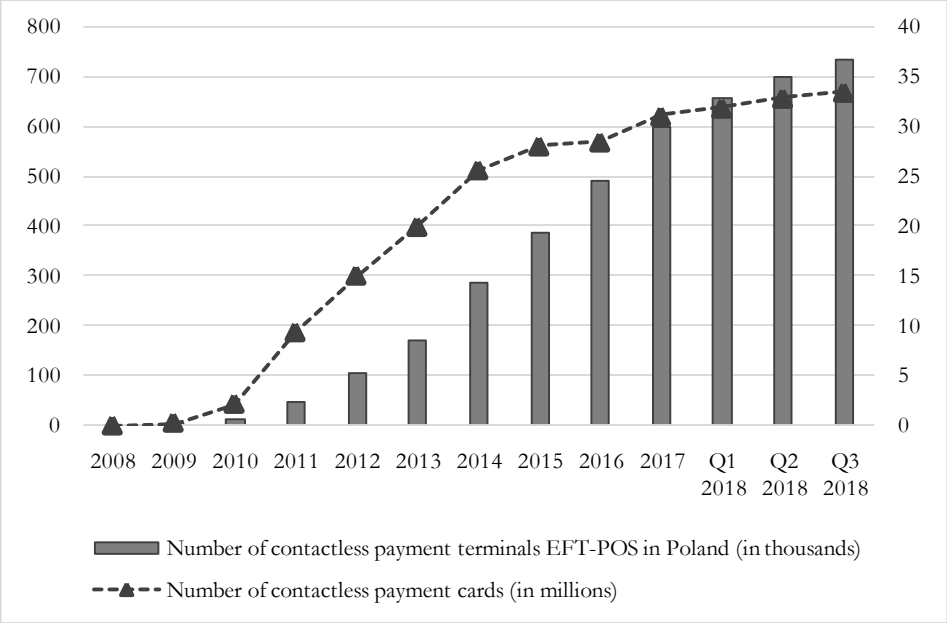

Chart 1. Number of contactless payment cards (in millions) and contactless payment terminals EFT-POS in Poland (in thousands)
Source: own study based on: National Bank of Poland (2019). Payment system.

According to the above chart, the upward trend is still maintained, and the technology of contactless cards and terminals is already well-established among Polish consumers. According to the report of National Bank of Poland for the third quarter of 2018, over 700,000 terminals in Poland are equipped with contactless technology, which is a 99% share in all payment terminals in Poland, while the number of contactless cards is around 33.5 million. (NBP, 2019). J. Kunkowski (2013) draws attention to the synergy effect between payment solutions based on the NFC technology and traditional contactless smart cards. Both solutions use the same infrastructure – EFT-POS payment terminals, which create a great chance for the development of NFC payments.

3. The NFC technology in mobile payments

The NFC technology was created as a result of cooperation of two giants on the electronics market – companies Phillips and Sony. With support from Nokia company, the implementation of NFC technology in mobile payments has begun. The first steps were taken in 2004, when the cooperation of companies was formalized by originating the NFC Forum Organization. Soon after, companies such as MasterCard, Microsoft, Visa, Samsung, and Motorola joined this organization. The first specification of a mobile devices equipped with the

NFC module was presented only in 2006 (Ozcan & Santos, 2014). In NFC data are transferred via radio waves with frequency of 13.56 MHz. Devices equipped with an NFC module can transmit data at a maximum speed of 424 kb per second. There are three modes of NFC devices operation – tag reader/writer mode, card-emulation mode, and peer-to-peer mode. The first of these modes allows passive reading and exchanging of data stored on compatible conveyors, such as NFC tags. In the card-emulation mode, data stored in the device can be read using an external reader, eg. EFT-POS terminal. The last mode – peer-to-peer – consists in connecting two separate devices equipped with this module; two-way communication of these devices allows active exchanging information between them (Leong, Hew, Tan, & Ooi, 2013).

The NFC payment is a special type of mobile payment. In the specialist literature, mobile payments were defined as the type of non-cash payment that can be made using mobile devices such as mobile phones, tablets or laptops. (Hayashi, 2012, Pal, Khethavath, Chen, & Zhang, 2017). M. Kisiel (2013) draws attention to the key importance of mobile devices that initiate, confirm and finalize the payment transaction. M. Polasik (2014) notes that mobile payments of the NFC type are included in the definition of mobile payments, however, they have several different features. One of the key differences is the communication procedures and channels used. In traditional contactless payments, i.e. using a contactless payment card, information is sent via dedicated channels, separately for the MasterCard PayPass and Visa PayWave systems. When making payment in POS (point-of-sale) using an NFC device, information exchange takes place only between the device and the EFT-POS terminal – after sending data from the NFC device, communication in the payment system is performed only by the terminal. According to the author, "NFC mobile payments are an intersection of the mobile and contactless concepts of payment (...), while within each of these terms there are other solutions with prominently distinct characteristics." M. Polasik proposed the classification of NFC mobile payments – due to the fact that NFC payments have the features of both mobile payments and contactless payments, the author has placed NFC payments between these ones.

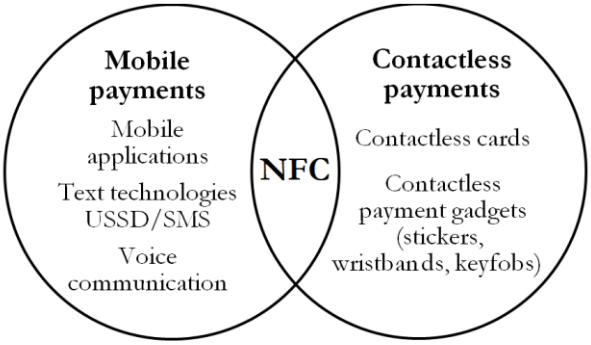

Figure 1. Classification of NFC mobile payments
Source: own study based on: (Polasik 2014)

The combination of mobile payments and contactless payments makes this technology attractive from the point of view of individual users. Thanks to the NFC technology, the payment takes place in a simple way, it does not require initialization before the payment is made – all one has to do is to tap or hover the phone with the NFC module near the terminal. A survey conducted by M. Polasik (2013) showed that NFC mobile payments are competitive against contactless smart cards and cash, while being a much faster solution than traditional payment smart cards with a PIN code. H. Issa (2011) notes that in addition to the functionality of payment cards, this technology offers more possibilities, as there are a number of other solutions based on mentioned technique. First of all, the user of NFC mobile payments has quick access to information such as purchase history or account balance. According to the author, mobile phones with NFC could be defined as a type of electronic wallet that, using the relevant application, can be used as an access card, parking ticket, club card, and a payment solution of course.

4. The NFC technology development in Polish banking system

The NFC technology appeared on the Polish payments market in 2010, when mobile network operators started cooperation with payment organizations and commercial banks. In April 2010, the mobile network operator Plus in cooperation with companies VISA and Bank Zachodni WBK (now Santander Bank Polska) started the pilot implementation of NFC payments. The participants of this pilotage received a Samsung mobile phone equipped with an NFC module and a SIM card with the Visa payWave payment application installed. The survey was attended by 500 respondents, and the management of SIM cards was carried out in OTA (over the air) mode, which means that the client –

participant of survey, did not have to appear at the bank's branch or mobile operator's showroom in order to run the payment application (Kunkowski, 2013). In May 2010, another pilot study began and cooperation of such companies as MasterCard, Inteligo, PKO Bank Polski and Polska Telefonia Cyfrowa (operator of the Era network, currently T-Mobile) was undertaken. This study was attended by 100 participants who received Samsung phones equipped with NFC modules and dedicated SIM cards, cooperating with MasterCard PayPass terminals. (Kunkowski, 2013, Polasik, 2013). In the years 2011-2012, payment organizations, together with four banks and three mobile network operators, conducted five pilot projects on mobile NFC payments. In the fourth quarter of 2012, other mobile networks introduced different solutions to the market. The Orange network offered the mBank MasterCard Orange Cash card based on the prepaid card. Whereas T-Mobile implemented MyWallet, an electronic wallet for NFC mobile payments (Polasik, 2013).

Parallel to the development of NFC payments based on the SIM card, in 2011 the SimplyTapp Texan start-up began works on original HCE (Host Card Emulation) technology. With the end of 2013, the authors of it established cooperation with Google. This IT giant has agreed to support the HCE solution in the emerging version of smartphone software – Android 4.4 KitKat. This event was a turning point in the development of NFC mobile payments in the world. In December 2014, as the first in Poland and one of the first in the world, Bank Pekao in cooperation with MasterCard offered its clients the NFC contactless payments feature that was using a mobile application based on the HCE technology. At the beginning of 2015, the declaration on the planned implementation of HCE was announced by ten more commercial banks in Poland (Braumberger, 2018). At the end of the fourth quarter of 2018, nearly 1.8 million users benefited from virtual HCE payment cards (PRNews.pl, 2019). Concurrently, the popularity of other payment solutions based on NFC also was growing up. In February 2018, the Google Pay system was launched, which has been created as a result of the combination of previously available Android Pay and Google Wallet. In mid-2018, another gaining popularity service – Apple Pay, was introduced to the Polish market.

The increasing availability and universality of NFC technology plays a significant role in the mobile payments market. Currently, the majority of smartphones is equipped with the NFC module, and the number of applications supporting this type of payment is growing. The popularity of NFC payments may also be affected by the development of infrastructure – payment card acceptance networks, i.a. due to the Programme for Non-cash Payments Development. This program assumes doubling the number of EFT-POS terminals in Poland in the next three years (Uryniuk, 2019).

5. Methodology of conducted research

The article has been elaborated on the basis of the subject literature and a quantitative survey, carried out in December 2018. The study was designed with the use of the TAM (Technology Acceptance Model) model assumptions (Davis, 1989), and carried out with the use of the CAWI (Computer-Assisted Web Interview) questionnaire based on a sample of 1012 respondents. The participants of the study were Polish internet users, and a random selection of respondents ensured its representativeness on the basis of sex, age, and size of the place of residence. One of the main research purposes was to assess the levels of usefulness, ease of use, and security of NFC technology perceived by individual consumers.

6. Mobile payments with the NFC technology among Polish internet users

The important aspect of conducted research was to learn about the users' awareness of whether or not they have an NFC module in their smartphones. Only 34% of respondents are aware that this technology is supported by their device, while 21% of all respondents are actively paying with the use of NFC technology. It is worth noting that this makes over 60% of users who own a device with an NFC module. Considering the fact that the popularization and distribution of new solutions in the payment services market is rather slow, this result is surprisingly high. On the other hand, almost a half of smartphone owners do not know whether their device is equipped with NFC (Chart 2), which is probably caused by unfamiliarity with the name of this technology. The high percentage of ignorance may also indicate that the activities related to the transmission of data by means of NFC are not popular among these users.

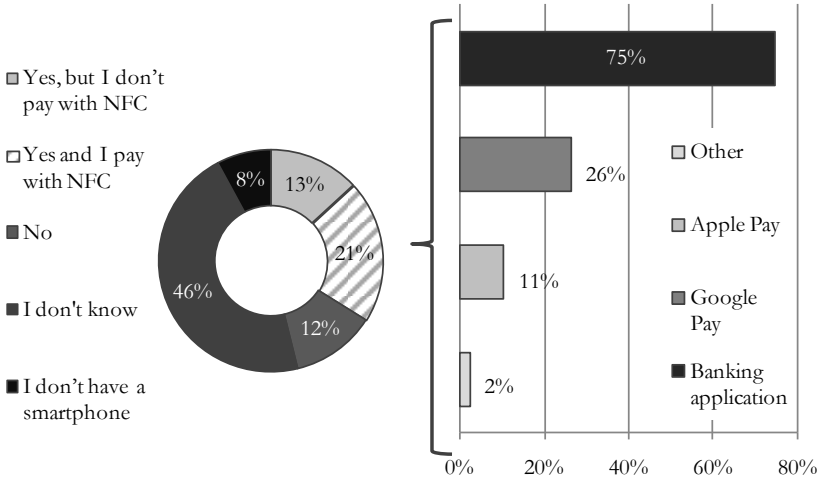

Chart 2. Awareness of having a smartphone with an NFC module and the most popular system used for NFC payments.
Source: own study.

In this study, respondents were also asked to indicate the system used by them to carry out contactless payments. The banking applications (75% of indications) are the most popular among payment systems based on the NFC module (Chart 2). The reason for this popularity may be the fact that it was the banks that took on the burden of popularizing this technology. However, a banking application is not the only system that provides the NFC payments – 11% use Apple Pay, which was introduced to the Polish market last year, and just over ¼ of respondents pay through Google Pay. In addition, it can be assumed that respondents paying with NFC trust non-banking applications as well.

Another part of the research was the perception of payments with NFC among: all respondents, people with a smartphone with an NFC module and people that use the NFC contactless payment. Respondents were asked to rate NFC payments in terms of 5 features: quickness, convenience, ease of handling, financial control, and security. While designing the questionnaire, the authors used the the TAM model assumptions. This model, in classic approach, allows to study the phenomenon of attitude towards using (or rejection) of new technologies by users and was proposed by F. Davis in 1986. It it has been already successfully used as a research tool in the area of payment services. In the TAM model, the perceived usefulness, according to the classic definition, is the prospective user's subjective probability that using a system will enhance his or her job performance. Whereas, the perceived ease of use is defined as "the degree to which the prospective user expects the target system to be free of effort." (Davis, 1989).

In the article, it was assumed by the authors that perceived usefulness is characterized by convenience and control over finances, while the perceived ease of use by the quickness and ease of handling/making payments with NFC. In addition, the perceived security factor was also taken into account (Shin, 2009; Schierz et al., 2010), i.e. the respondent's assessment of the level of security of the potential use of payments with NFC.

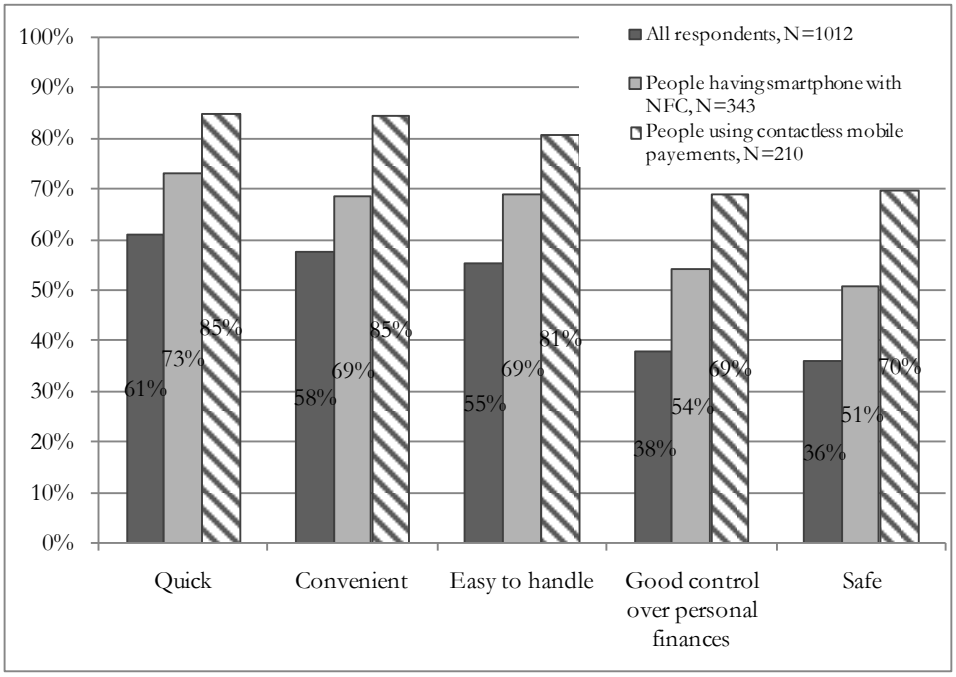

Chart 3. Contactless payments – evaluation of using this method*
Source: own study. *The results present the sum of answers "I definitely agree and" and "I rather agree".

The obtained results indicate that attitude towards payments with NFC is determined by the usage and knowledge of technology itself. Therefore, educational measures in this area may be of key importance for the development of such payment method in Poland. Respondents most often agree that contactless mobile payments are quick (61%) and comfortable (58%) (Chart 3). However, they have strong reservations about their safety – security is assessed negatively by every fifth internet user (21%). Nevertheless, the fact that positive indications are higher among people who have a mobile phone equipped with NFC and are contactless payment users (all aspects examined are better evaluated) is worth paying special attention.

7. Conclusion

The availability of contactless technology infrastructure proves to be the most important factor conducing to the success of mobile payments based on NFC technology, which can benefit from the already existing contactless payment terminal network. Moreover, the positive attitude of the users themselves towards new technologies, in particular to additional services offered by smartphones, may also have a significant impact on the development of NFC mobile payments. For Poland, in comparison to other countries, is much better

at using mobile devices to implement banking transactions (ING Financial Barometer, 2017).

The results of conducted research testify that people familiarized with and actively using the NFC technology perceive it very well, over 80% of respondents commented positively on its quickness, convenience and ease of handling. Albeit, differences in the perceived level of security might prove to be one of the barriers to the development of NFC technology on the Polish payments market. Only 36% of all respondents consider them safe. The owners of smartphones enabled with this technology are also not entirely convinced about the security of NFC payments (51% of indications). But, by proper dissemination of knowledge about NFC payments, this percentage may increase in the near future.

A real opportunity to increase the interest in mobile payments among potential users – owners of smartphones equipped with the NFC module, would certainly be promotional and above all educational activities conducted by banking institutions through, among others, social networks. Equally important is two-way education, which should focus on promoting the beneficial features of the application, addressed both to the people using NFC and those who can potentially become users of this technology. It is crucial to convince and ensure users that this solution is completely safe. Furthermore, M. Polasik (Polasik & Kumkowska, 2015) points at the additional services offered in mobile applications as a stimulus that may affect the popularization of such payment method. Also the mobile banking application allows better controlling of finances – one is able to log in anywhere and anytime, and thanks to dedicated tools, effectively manage one's budget.

Indeed, the further development of mobile payments using NFC technology in Poland is likely to be conditioned not only by improving perceiving of their security, but also by overcoming potential obstacles related to the necessity of finding a compromise between the functionality of the mobile application and the ease of using it, or the emergence of competition from new suppliers admitted to the mobile payments market in accordance with the EU PSD2 directive implementation.

The TAM model used by the authors seems to clearly identify the causes of consumer interest in the NFC payments. However, in order to provide a wider conclusions – examining the impact of individual factors (causation of action), in-depth research, involving quantitative methods, is needed. An important aspect of further research will be biometric solutions, the development of which is going to be accelerated by the PSD2 directive. The implementation of biometric security systems can significantly increase the perceived security of payment services, including payments using NFC.

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This work was supported by the National Science Centre, Poland under Grant No. 2017/26/E/HS4/00858.

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