Association for Information Systems
AIS Electronic Library (AISeL)

2013 International Conference on Mobile Business | International Conference on Mobile Business (ICMB)

2013

Factors Influencing the Slow Rate of Penetration of NFC Mobile Payment in Western Europe

Tatjana Apanasevic
KTH Royal Institute of Technology, tatjanaa@kth.se

Follow this and additional works at: http://aisel.aisnet.org/icmb2013

Recommended Citation
Apanasevic, Tatjana, "Factors Influencing the Slow Rate of Penetration of NFC Mobile Payment in Western Europe" (2013). *2013 International Conference on Mobile Business*. 8.
http://aisel.aisnet.org/icmb2013/8

This material is brought to you by the International Conference on Mobile Business (ICMB) at AIS Electronic Library (AISeL). It has been accepted for inclusion in 2013 International Conference on Mobile Business by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

FACTORS INFLUENCING THE SLOW RATE OF PENETRATION OF NFC MOBILE PAYMENT IN WESTERN EUROPE

Apanasevic, Tatjana, Wireless@KTH, Royal Institute of Technology, Electrum 229, SE-16440, Kista, Sweden, tatjanaa@kth.se

Abstract

The NFC technology implemented on the base of contemporary mobile handsets can provide considerable benefits to end-users. However, despite high level of diffusion of mobile phones in Western Europe, the level of penetration of the NFC based mobile payment is low. A considerable number of trials have been initiated, however, large scale deployment of commercial NFC services cannot be seen. This paper identifies and analyzes different factors that influence the slow rate of penetration of NFC based mobile payment in Western Europe.

This paper presents a qualitative study based on experience of six NFC pilots implemented in Finland, France, Italy, the Netherlands, Norway, and the UK. The research findings confirm that a number of demand and supply barriers negatively affect the rate of the penetration of the NFC payment. The network externalities and the lack of consumer awareness about NFC services were identified as the most important demand side barriers. The most significant supply side barriers are the lack of uniform technological standards, the lack of NFC enabled mobile phones, and the coopetition issue. In addition, the interrelation between mentioned obstacles was identified. This fact means that a delay in the NFC payment's diffusion is affected not by a single factor, but rather by a set of interrelated factors. The sources of these obstacles are related to the consumer acceptance, the specifics of business environment, and the technology.

Keywords: Near Field Communication, NFC Mobile Payment, Supply-side Barriers, Demand-side Barriers, Mobile Payment Adoption.

1 Introduction

The number of smartphones is currently increasing rapidly. In addition to voice and data connectivity services, the mobile phones are used for other services. The Near Field Communication (NFC) is one of the most promising technologies able to extend capabilities of mobile phones and to enrich consumers' experience by simplifying their everyday activities. Application of NFC in mobile payments is highly attractive because of a range of additional services like mobile ticketing, client loyalty applications, smart advertisement, physical and logical access, and mobile wallet. This means a considerable added value for both commercial companies and end users.

The NFC technology is to a large extent developed and standardized. It is based on standardized and tested Radio Frequency Identification (RFID) technology. The main NFC advantages compared to other wireless communication technologies (infrared and Bluetooth) are higher security level, provision of immediate connection between devices, possibility to use NFC with depleted phone battery and switched off phone, and short signal's distance suiting mobile payment specifics (Boer and Boer, 2009). Different organizations (e.g. European Payment Council (EPC), NFC Forum, MobeyForum and GSM Association (GSMA)) continuously work over harmonization and further standardisation of the technology. Furthermore, mentioned organizations propose recommendations on business related aspects in the form of "White papers".

Many pilot projects are being implemented all over the world. The most usual NFC applications are mobile payment and mobile public ticketing. In general, the consumers tend to accept these services positively. However, only a few pilots get continuation as commercially deployed services.

Despite the potential added value services, a big number of pilots, and available technology, the level of NFC mobile service penetration in Western Europe is not very high. The main question that will be investigated in this paper is:

What are the factors influencing the slow rate of penetration of NFC based mobile payment in Western Europe?

The NFC industry is relatively new, and literature related to NFC is mainly fragmented and focused either on specific technical or specific business model issues, or on issues related to technology acceptance by consumers. In addition, many studies are focused on the analysis of successfully implemented NFC cases leaving the analysis of obstacles out of their scope. The major contribution of this study is an attempt to provide a holistic view of the obstacles slowing down the spread of the NFC payment in Western Europe.

The scope of the research is limited to analysis of the six NFC pre-commercial pilots implemented in Western Europe in the period from 2006 to 2011. The research is constrained on NFC technology not extending to any other technology.

Due to explorative nature of the research, qualitative case study approach was selected. Additionally, multiple case study helped to explore specifics and details of each of the analyzed cases. Finally, comparative analysis has been used in order to explore general trends and similarities between the analysed cases and identify critical factors preventing diffusion of the NFC payment.

In the next section of this paper the theoretical background is described and the analysis framework is introduced. The overview of the used methodology is provided in section 3. In section 4 the research findings are presented, the above findings are discussed in section 5, and conclusions provided in section 6.

2 Theoretical Background

Factors which affect the rate of NFC payment penetration have multiple natures derived either from demand or supply side. The demand side of NFC ecosystem encompasses *merchants* and *consumers* (Clark, 2010). The supply side is represented by the *mobile service providers* (i.e. mobile network operators (MNOs) and financial institutions) and *NFC technology and service providers* (i.e. secure element providers, handset manufacturers, trusted service managers, NFC solution developers, service providers, and producers of Point of Sale (POS) terminals) (Clark, 2010).

Several sets of theories and models constitute the theoretic background due to the multidisciplinarity of the research question:

- The theory of network externalities and the Technology Acceptance Model (TAM) were used to uncover major obstacles of the demand side.
- The concepts of business model and business network helped to identify supply-side barriers.

Mentioned theories will be briefly overviewed in this part in order to provide a background for the analysis framework used in this research.

2.1 Background on the demand-side obstacles

Availability of ubiquitous infrastructure is one of the most critical factors for the adoption of an innovative payment solution. In terms of the *theory of network externalities*, NFC payment is an example of "network goods" and deals with an infrastructural dilemma also known as the "chicken and egg" problem (Van Hove, 1999). On one hand, merchants are not willing to invest in the development of infrastructure without critical mass of consumers, however, consumers will not adopt mobile payment substituting currency if it cannot be used everywhere (Mallat, 2007).

Additionally, change of one payment method to another implies *service switching costs*. They affect different aspects of the service like compatibility with existing devices; transaction and economic costs which appear when switching suppliers like new service activation fees; costs of learning to use a new service; uncertainty about the quality of a new service or brand; and psychological costs of switching (Klemperer, 1995). Moreover, it is determined that consumers are not willing to change "their mobile phone model or manufacturer just to gain payment functionality" (Mallat, 2007).

Furthermore, TAM helps to define factors affecting the acceptance of the mobile payment by users. Previous studies (Constantiou and Knutsen, 2006) state that the acceptance of new innovative services by consumers is strongly affected by a general complexity of the service, complexity of user interface, perceived security and risks, and by a perceived value of the mobile payment. Hence, the higher the level of *service complexity*, the less consumers are willing to accept it (Mallat, 2007). Consequently, a need to adapt behaviour due to the complexity of a new service causes discomfort and results in *behavioural barriers* (Boer and Boer, 2009).

A research carried out by Mallat (2007) highlighted the major factors associated with *perceived security* and risks of a new payment method. These factors are following: risks of unauthorised use of the mobile phone; lack of paper documentation resulting in problems with follow-up services; possible errors in transactions; lack of control over mobile payment which makes consumers unsure whether the payment took place or not; and finally, consumer concerns about privacy of their personal information.

Finally, a *value of the NFC mobile payment* remains unclear in comparison to other types of payments (Hayashi, 2012). In Western Europe, the NFC mobile payment meets strong competition from the side of other types of mobile payment and traditional bank services having well-developed infrastructure for credit and debit cards, electronic and mobile banking (Boer and Boer, 2009). So, clearly stated benefits of NFC payments compared to other types of payment can increase the rate of their adoption.

2.2 Background on the supply-side obstacles

New innovative services emerge at the intersection of different industries and bring together parties having different industry traditions and practices, seeking different aims and operating in different environments. Cooperation of all parties within such *networks* or *ecosystems* is a crucial factor in order to ensure the service provision and its success in the market. However, the relationship between multiple parties having different interests can be defined as "*coopetition*", meaning "simultaneous cooperation and competition" (Bengtsson and Wincent, 2010). The major destructive consequences of coopetition are a lack of cooperation, trust, and clear definition of each stakeholder's role and responsibility, tension about dominant position in the ecosystem, and inability to negotiate the essential aspects of a common business model (Ozcan and Santos, in press).

One of the purposes of a *business model* is to define a value provided both to the consumers and to market actors, so, it can be defined as "a blueprint for the way a business creates and captures value from new services or products" (Reuver and Haaker, 2009). Different authors (Bouwman and Haaker, 2008; Mason and Spring, 2011; Pousttchi and Wiedemann, 2008) emphasise various elements of the business model, but all of them agree that a business model should comprise the following components:

- *Value*, which is proposed in the market offering.
- *Architecture of network* defining capabilities, relationships and transactions between involved market parties.
- *Revenue model,* which defines streams of revenue and costs.

Inability of NFC ecosystem actors to solve the questions mentioned results in delay of overall service deployment and, as a consequence, negatively affects its spread.

Theories and concepts overviewed above have been used to build the analysis framework which is presented in the next sub-section of the paper.

2.3 Analysis Framework

In order to provide a holistic analysis of factors which affect slow penetration of NFC payment, the major obstacles arising from consumer, business and technology sides have been identified and classified into two main groups: demand and supply side barriers. Their description is provided below.

Demand-side barriers (mainly related to consumers):

- *Network externalities* are issues related to the "chicken and egg" dilemma.
- *Service switching costs* affect willingness of consumers to start using the NFC service.
- *Customer behavioural barriers* are related to service complexity and a need to change usual behaviour.
- *Perceived service security* are consumers concerns related to various NFC payment risks.
- *Unclear value of NFC mobile payment* is relevant to Western Europe. This obstacle has not included in the analysis of NFC cases, however, it is discussed in the section *5 Discussion*.

Supply-side barriers (related to business aspects):

- *Coopetition issues* are related to inability of NFC ecosystem actors to agree on common solutions.
- *Unclear business model* affects the ability of stakeholders to agree upon the key aspects of a common business model.

Several crucial supply-side barriers related to NFC technology:

- The most considerable technological obstacle which prevents NFC technology from a wider spread is a *lack of agreement on uniform technological standards* (Ok and Aydin, 2011). Consequently, due to the absence of the uniform standardization, it impossible to gain *interoperability* of the service and make it accessible to clients of different banks and mobile operators.

- Another significant technological obstacle is related to a *security* of the NFC system, because all its parts (the reader, the tag, the secure element, the Short Range Communication Channel, the middleware and backend system) can be attacked (Hayashi, 2012).
- Finally, there is a *limited commercial availability of NFC enabled mobile phones* (NFC world, 2012), and ubiquitous infrastructure for NFC service users is lacking.

Methodology used for this research is presented in the next section.

3 Methodology

As it has already been mentioned, a qualitative research method has been used. The multiple case study approach has been chosen, in order to provide a comprehensive overview of the research problem. The flow of the research has been performed in several stages. First of all, literature analysis findings have been used as a background for identification of analysis criteria and development of an analysis framework. Then a number of NFC cases implemented in Western Europe have been selected for analysis:

1. SmartTouch pilot launched in Oulu, Finland.
2. Payez Mobile, a pilot launched in Caen and Strasbourg, France.
3. The NFC pilot launched by Payter B.V. in Rotterdam, the Netherlands.
4. Oyster on Mobile, a pilot launched by Transport for London, O2, and Barclays bank in London, the UK.
5. Mobile Pass, a pilot launched by Telecom Italia and ATM in Milan, Italy.
6. Tap2Pay NFC pilot initiated in Oslo, Norway.

The next step has been the collection of information and evidence. Two types of information – primary and secondary – have been used. The *secondary information* has mainly been used as a background in order to prepare for the execution of the interviews. This has been the information available in the form of previous researches, articles, conference presentations, press releases, newsletters, data published on official web sites of NFC pilots and other corresponding materials.

The *primary information* was gathered through in-depth personal interviews with executives and top-level managers who represent companies participating in the selected NFC pilots. The interviews were carried out in a semi-structured form and consisted of two parts. In the beginning, short general questions about the pilot and company's role in it were asked. The second part consisted of questions covering both demand and supply side barriers faced during NFC pilot's deployment. Overall 11 interviews were executed, the duration of the interviews was distributed in the range from half an hour to one hour.

The primary information was summarized, evaluated, and visualized with the help of the method of value curves. This method was developed by Kim and Mauborgne (2004) (cited in Perez and Pastor-Ferrando, 2010) and could be defined as a tool graphically representing "the relative performance of a firm in terms of the competitiveness variables of its industry". Applied to the current research, the relative importance of each identified obstacle for each case was evaluated using the following grading system:

0 – no impact;
1 – low degree of importance compared to the industry;
2 – moderate degree of importance or average in the industry;
3 – high degree of importance compared to the industry.

The average calculated values were depicted with the help of corresponding value curves. They represent generalized relative importance of one or another obstacle for analyzed pilots. Summary of the research results is presented in the next section of this paper.

4 Results and Summary

Analyzed NFC pilots have covered major NFC application areas, with main focus on mobile payments or public transport ticketing. Brief introduction of cases is provided below.

Smart Touch. The pilot was implemented in Oulu from 2006 to 2008. Its main focus was to explore and evaluate NFC opportunities. The issue of network externalities and lack of infrastructure was critical. Due to novelty of the service idea, consumers had to learn how to use the service, so there were some switching costs. The behavioural barriers from the side of elderly people were noticed. There is no information on consumer perceived service security. This project was carried out under the Eureka/ITEA collaboration framework defining roles of all of the participants, so, there were no coopetition issues. There was no business model developed. Due to the initial stage in NFC technology development, a lack of uniform technological standards was a real challenge (interoperability problems and lots of trials). In addition, some problems with security of NFC tags were defined. A lack of NFC mobile phones was a critical issue and in the beginning prototype phones were used.

Payez Mobile. The pilot was launched in Strasbourg and Caen by seven French banks and main mobile operators in 2007. One of its aims was to test the use of micro-payments. The interviews confirmed that network externalities were limitations of the project. Due to pre-commercial nature of the pilot, there were no switching costs as well as major behavioural barriers. However, consumers were concerned about service security. Not all the parties participated in the pilot at the same pace, so some degree of coopetition issue can be seen. The business model for this pilot was not developed. Due to a lack of uniform technological standards, parties worked together under the development of uniform service standards acceptable for everyone. There were no security issues, but a lack of NFC mobile phones was considered as one of the main obstacles.

Payter. The pilot was launched in Rotterdam by Payter B.V. in August 2007. It aimed at developing a multifunctional electronic wallet including payment, loyalty cards, coupons, tickets and other options (Willemse, 2012). The issue of network externalities and lacking infrastructure proved to be a critical problem. A separate service account and its management can be evaluated as the service switching costs. In addition, consumers expressed a wish to use the service on their favourite smartphones but having to use older models of NFC enabled phones. This situation means the existence of behavioural barrier. The survey implemented before the pilot indicated a high level of consumer concerns about service security, however, it went down during the later stages of the pilot. Coopetition issues were vital for pilot commercialization due to inability of parties to reach an agreement. There was no business model developed for the pilot, but when parties started negotiation of business model related questions for further commercial service deployment they could not agree. A lack of uniform technological standards was one of the major challenges for the pilot. The developed solution had a very high level of security, so there were no security related issues. A lack of NFC mobile phones was a critical issue for this pilot as well.

Oyster on Mobile. Transport for London together with partners initiated the pilot in December 2007. The trial offered a wallet consisting of the following applications: Oyster public transport card, payment, event ticketing and access. There were no network externalities issues for Oyster card, since existing transport infrastructure was used, but infrastructure for payment was insufficient. There were no switching costs as well as behavioural barriers determined. There is no information on consumer perceived service security. Companies participating in the project represented different industries so it took some time to understand each other. There was no business model developed for the pilot. During the pilot, a lack of uniform technological standards was a real challenge in reaching interoperability of the overall solution. There were no security issues, and there was no problem finding needed amount of NFC mobile phones.

Mobile Pass. Telecom Italia and ATM, the public transport operator in Milan, launched the pilot in 2011. The pilot lasted for six months. One of its aims was to test NFC technology applied in the

transport system. The main pilots's problem was a problem of interoperability. So, a need of unified technological standards was still a serious challenge in 2011. Other types of obstacles were not identified in this pilot.

Tap2Pay. The Norwegian bank DNB together with a mobile network operator Telenor initiated the pilot in Oslo, in the summer 2011. One of its aims was to test consumer attitudes. The problem for this pilot was an issue of network externalities. There were no switching costs for consumers; on the contrary the pilot participants received incentives. It is possible to define behavioural barriers, because consumers expressed a wish to use "their favourite" mobile phone for the service instead of older NFC mobile phone models. Surveys indicated consumer concerns about the security of the service. Coopetition issues were indicated to some extent. There was no business model developed, as it was postponed for the next pilot stage. A lack of uniform technological standards and security caused no issues for the pilot deployment. On the contrary, a lack of NFC enabled phones was an issue.

A relative importance of each obstacle for each case was evaluated using the method of value curves. Results of obstacle evaluation and average values are presented in *Table 1*.

	Smart Touch	Payez Mobile	Payter	Oyster on Mobile	Mobile Pass	Tap2Pay	Average
Demand-side barriers							
1. Network externalities	3	2	3	2	0	2	2.00
2. Service switching costs	1	0	2	0	0	0	0.50
3. Customer behavioural barriers	1	0	2	0	0	2	0.83
4. Perceived service security	0	2	2	0	0	2	1.00
Supply-side barriers							
1. Coopetition issues	0	2	3	3	0	1	1.50
2. Unclear business model	0	0	3	0	0	0	0.50
3. Lack of uniform technological standards	3	3	3	3	2	0	2.33
4. Security issues	1	0	0	0	0	0	0.17
5. Lack of NFC mobile phones	3	2	3	0	0	2	1.67

Table 1. Evaluation of defined obstacles.

The accumulated average values depict the generalized relative importance of analyzed obstacles. The information is presented for the demand-side barriers in *Figure 1* and for the supply-side barriers in *Figure 2*.

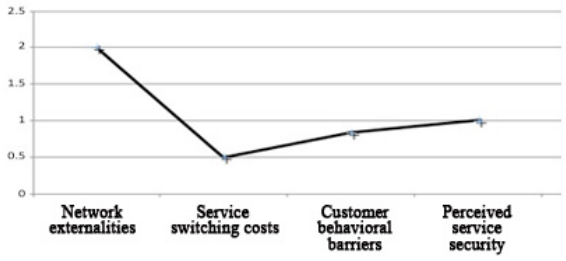


Figure 1. Average values: demand-side.

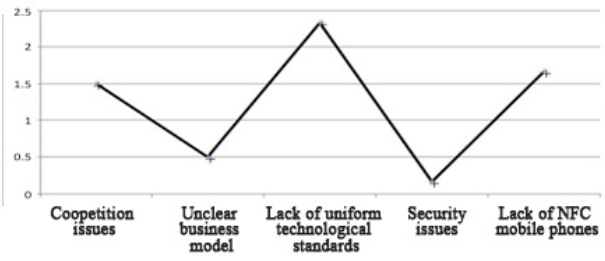


Figure 2. Average values: supply-side.

The *network externalities* could be designated as the most significant obstacle from the perspective of the demand-side barriers. Even though the *perceived service security* accounted for the second rank,

its relative importance is much lower compared with the obstacle number one. The second factor is closely followed by the third, which is the *customer behavioural barrier*. The *service switching costs* were ranked as the fourth important obstacle.

Overall, the *lack of uniform technological standards* caused the biggest supply-side's challenge during the technical implementation of NFC pilots. The *lack of NFC mobile phones* meaning that the commercial availability of NFC handsets still remains a considerable problem is another critical factor for deployment of NFC based solutions. The third important problem is the issues related to *coopetition*. The problem of *unclear business model* accounted for the fourth rank. The *security issues* were relatively less important in the analysed pilots.

The research results are discussed in the next section.

5 Discussion

5.1 Demand-side barriers

Network externalities. From the perspective of the demand-side barriers, the network externalities became one of the critical factors which negatively affect consumer adoption of the NFC payment and the scale of its spread. The "chicken and egg" dilemma which results in insufficient infrastructure and the problem of the critical mass of consumers was especially highlighted during the interviews with NFC industry representatives (Willemse, 2012; Houery, 2012; Suikkanen, 2012; Larsen, 2012). It is possible to specify a common trend: NFC pilot initiators equip a certain number of merchants with NFC enabled POS terminals for the execution of the pilot (like in Payez Mobile, Payter, Tap2Pay pilots), however, consumers evaluate this infrastructure as limited and insufficient (Houery, 2012; Willemse, 2012; Erngard, 2012).

Findings of this research are aligned with the previous studies (Mallat, 2007; Van Hove, 1999) and confirm that NFC payment solutions without ubiquitous infrastructure are not attractive for consumers. Moreover, without a critical mass of consumers, merchants are not motivated to invest in the development of NFC infrastructure which, for instance, was one of the reasons to cease Payter pilot.

In addition, during the interviews, a *lack of awareness among consumers about the NFC service and its capabilities* was specified as another barrier for a wider spread of the NFC payment (Tuikka, 2012; Losq, 2012). Indeed, without consumer demand for handsets, manufacturers will not supply enough quantity of NFC enabled phones. Consequently, consumers in Western Europe will not be attracted by NFC payment without NFC handsets, ubiquitous infrastructure and added value services.

Perceived service security. The current research confirms the findings of the previous studies in the mobile payment (Mallat, 2007) and states that consumer security concerns and perceived risks slow down the rate of NFC payment adoption. The security concerns were usually expressed during the initial stage of a pilot and were related to the security of payment applications; a risk of unauthorised use of a mobile phone in the case of its theft or loss. To exemplify security concerns: a big part of customers selected to set PIN code option even for low-volume payments in Payez Mobile pilot.

Customer behavioural barriers affect the adoption of NFC services. The implementation of the earliest SmartTouch pilot helped to identify the behavioural barriers from the side of elderly people. For other groups of consumers participating in the analysed pilots the usage of NFC services did not cause any problems. Another research finding is reluctance of smartphone users to change the model of device or compromise and use older NFC enabled mobile phones for NFC service (Erngard, 2012; Larsen, 2012; Losq, 2012; Willemse, 2012). Additionally, it is difficult to facilitate NFC payment if additional payment accounts are needed for a service provision (Payter pilot). These findings strongly correspond with the previous study of the mobile payment (Mallat, 2007).

Service switching costs. The importance of service switching costs was highlighted in the previous studies (Mallat, 2007), however, within the current research they should not be considered as a real obstacle for NFC service adoption. In the analysed pilots consumers were getting phones free of charge. Additionally, there were no additional service fees or expenditures. In some cases (like Tap2Pay) consumers who tested the service received an additional incentive.

Unclear value of NFC mobile payment. The research specified one interesting observation. There is a limited number of available commercial NFC based payment solutions mainly provided by mobile operators, banks or transport companies. Moreover, consumers have a wide choice of other available payment methods including cash, bank debit or credit cards, electronic and mobile banking, SMS payments or popular online payment platforms like PayPal and so on. Hence, the challenge is to convince consumers to use NFC payment. In order to speed up its penetration, the benefits should be clearly stated. And the real benefits of NFC are behind the provision of additional value in the form of attractive and convenient services.

5.2 Supply-side barriers

Lack of uniform technological standards is the main supply-side obstacle which prevents the spread of the NFC mobile payment in Western Europe, as the results of the current research show. Indeed, the lack of unified standardization in the NFC field becomes a significant issue causing interoperability problems. This is a reason to refuse the developed NFC solution for mobile phone and consider alternative opportunities (e.g. Oyster card vs. Oyster on Mobile). Different international organisations are currently working on the harmonisation of technology standards, however, a lot still needs to be done.

Lack of NFC mobile phones. Research confirmed that the lack of commercial availability of NFC mobile phones is still a significant hurdle for the adoption of NFC service solutions. It was true for the most of the analysed pilots.

Coopetition issues. The findings of the current research affirmed the negative impact of the coopetition issues to the spread of the NFC payment. This factor is a key obstacle in negotiations between NFC ecosystem parties on essential points of a business model (like in the case of Payter) and, thus, strongly corresponds to business model issues discussed below.

Unclear business model. With respect to the previously conducted studies (Ozcan and Santos, in press), the unclear business model was supposed to be one of the main obstacles to the NFC service spread. However, in the current research this factor was evaluated as relatively not important. This could be explained by the fact, that the analysis was focused on the NFC pilots, which were primarily used to test the technology and consumer acceptance before actual commercial deployment. In this case, the negotiation of business model questions was postponed for further stages. Nevertheless, the parties of several pilots (Payter and Payez Mobile) worked over commercial deployment of the service and their experience was the most relevant regarding the factor analysed.

The research findings affirm that the coopetition issues and the inability of partners to find a relevant business model behind the new service cause significant problems. So, parties cannot evaluate value brought by other stakeholders, disagree on fees, revenue and cost sharing schemes, fail to share roles, responsibilities and "ownership" of consumers. In some cases this leads to withdrawal of the pilot (e.g. Payter pilot) or switching to alternative payment solutions (e.g. Oyster on Mobile) (Losq, 2012; Tuikka 2012; Willemse, 2012).

These results highly correspond to the findings of research carried out by P. Ozcan and F. Santos (in press) stating that the inability of parties to negotiate business model and share responsibilities becomes a reason of delay in the emergence of a new industry.

Security issues. Despite the fact, that literature sources (Boer and Boer, 2009; Ok and Aydin, 2011) defined NFC system security as an important technical obstacle, the findings of this research could not confirm it. The analyzed NFC solutions proved to be secure.

6 Conclusions

The purpose of this paper was to define, analyse and generalize factors, which slow down the spread of NFC mobile payment solutions in Western Europe. So, the most significant demand-side obstacles are the *network externalities*, the *perceived service security*, the *customer behavioural barriers*, and the *unclear value of NFC mobile payment*. Additionally, the demand-side obstacles can be extended by the *lack of consumer awareness* about NFC services, their functionality and added value. The major supply-side obstacles are the *lack of uniform technological standards*, the *lack of NFC mobile phones*, and the *coopetition issues* together with the *unclear business model*.

In addition, it is possible to find the interrelation between the most important supply and demand side barriers. Hence, due to the *lack of the uniform technological standards*, it impossible to gain interoperability of the service and make it accessible to clients of different banks and mobile operators (the issue of *network externalities)*. In their turn, due to the *coopetition*, payment service providers cannot agree on essential *business model* questions and delay to offer NFC payment solutions. Moreover, the lack of interoperability between different NFC services provided by different providers sets additional limits in reaching the critical mass of consumers and solving the "chicken and egg" problem (issues of *network externalities)*. The *lack of NFC mobile phones* additionally limits the number of consumers using the NFC payment. Furthermore, *consumers are not aware* about the opportunities of the NFC technology and do not demand for NFC enabled mobile phones on a mass scale. So, all these facts together limit the development of the NFC infrastructure and negatively affect the rate of penetration of the NFC payment.

Finally, the research results point up the gap existing between real security of NFC payment and service security perceived by consumers. The practical evidence shows that the consumer concerns about the NFC payment risks are not aligned with the real security measures.

Many studies implemented in the area of NFC do not focus on the analysis of barriers and obstacles for service commercial deployment. The major theoretical contribution of this study is an attempt to provide an overview of the main obstacles negatively affecting the penetration of NFC payment in Western Europe. The research question was addressed by analysis of demand and supply factors. Another theoretical implication is identification of interrelation between the most important obstacles. Indeed, the main reason of the slow rate of NFC payment penetration is defined by a complex set of interrelated supply- and demand-side barriers. The sources of these obstacles are the consumer acceptance, the specifics of business environment, and the technology.

Due to a relative lack of investigations dedicated to the research question, the results of this research provide useful guidance for NFC industry actors by highlighting the overall picture. Furthermore, the identified gap between the real and perceived security of the NFC payment can practically be addressed to improve the existing consumer perception. In addition, payment service providers should pay attention to education of consumers, providing more information about NFC functionality, increasing consumer awareness about NFC services and their value.

This research was limited to analysis of only six NFC pilots implemented in Western Europe. This limitation could influence the estimation of common trends and generalization of the research results. Another limitation is related to the fact that the estimation of the importance of the different factors is based on the opinions and perceptions of managers and researchers. It was not possible to contact and interview consumers participating in the analysed pilots. Additionally, few industry specialists were interviewed.

A quantitative study of NFC payment adoption by consumers and provision of generalizable results would be seen as a logical continuation of this research. In addition, interviews with industry representatives exhibited their concerns about lack of attractive services provided by NFC. Hence, one of the possible future study area could be the analysis and development of recommendations about additional NFC services that could be provided along with the payment.

In summary, this research is a step to unveil the key factors preventing NFC mobile payment from a wider penetration in Western Europe. Major barriers could be categorised into two domains related to the supply and demand side. The results of the executed research refined the main factors which affect slow adoption of the NFC payment: the *lack of uniform technological standards*, the *lack of NFC enabled mobile phones, coopetition issues* from the supply side; and the *network externalities* and the *lack of consumer awareness* about NFC services from the demand side. In addition, the research results highlighted the interdependence existing among the barriers mentioned. This means that the spread of the NFC payment is affected by a complex set of interrelated obstacles.

Acknowledgements

I am very grateful to Professor Per Andersson, Associate Professor Jan Markendahl, Associate Professor Niklas Arvidsson and Ph.D student Riikka Murto for valuable and useful comments on the draft of this report. I would also like to thank all the participants of this research for interesting and valuable comments expressed during the interviews.

References

Bouwman, H., H. De Vos, and T. Haaker (eds.) (2008). Mobile Service Innovation and Business Models. Springer.

Bengtsson, M., J. Eriksson and J. Wincent (2010). "Co-opetition dynamics – an outline for further inquiry." Competitiveness Review: An International Business Journal, (20) 2, pp.194-214.

Boer, R. and T. de Boer (2009). "Mobile Payments 2010. Market analysis and overview." Innopay BV and Telecompaper BV, https://www.ebaportal.eu/_Download/Research%20and%20Analysis/2010/Mobile_payments_2010_Innopay.pdf (current Jan. 25, 2012).

Clark, S. (2010). NFC Business Models. SJB Research: Monmouth.

Constantiou, I.D., J. Damsgaard and L. Knutsen (2006). "Exploring perceptions and use of mobile services: user differences in an advancing market." International Journal of Mobile Communications (4) 3, pp. 231-247.

Erngard, V. (April, 2012), Personal Communication. "Tap2Pay" pilot in Oslo: obstacles and barriers in its implementation."

Hayashi, F. (2012). "Mobile payments: What's in it for consumers?" Federal Reserve Bank of Kansas City, http://www.kc.frb.org/publicat/econrev/pdf/12q1Hayashi.pdf (current Jan. 3, 2013).

Houery, N. (May, 2012), Personal Communication. "Caen and Strasbourg NFC pilots: obstacles and barriers in their implementation."

Klemperer, P. (1995). "Competition when consumers have switching costs: an overview with applications to industrial organization, macroeconomics, and international trade." The Review of Economic Studies, (62)4, 515-539.

Larsen, T. (April, 2012), Personal Communication. "Tap2Pay" pilot in Oslo: obstacles and barriers in its implementation."

Losq, S. (May, 2012), Personal Communication. "NFC pilot "Oyster on Mobile": obstacles and barriers in its implementation."

Mallat, N. (2007). "Exploring consumer adoption of mobile payments – A qualitative study." Journal of Strategic Information Systems, (16) pp. 413-432.

Mason, K. and M. Spring (2011). "The sites and practices of business models." Industrial Marketing Management, (40), pp. 1032-1041.
Meli, D. (April, 2012), Personal Communication. "NFC pilot of Telecom Italia and ATM: obstacles and barriers in its implementation."
Miali, M. (April, 2012), Personal Communication. "NFC pilot of Telecom Italia and ATM: obstacles and barriers in its implementation."
NFC world. (2012). "A definitive list of NFC phones." NFC world, http://www.nfcworld.com/nfc-phones-list/ (current Feb. 27, 2012).
Ok, K., V. Coskun, B. Ozdenizci and M. N. Aydin (2011). "A Role-Based Service Level NFC Ecosystem Model." Wireless Personal Communications, pp. 1–31.
Ozcan, P. (April, 2012), Personal Communication. "Obstacles and barriers to commercial deployment of NFC pilots."
Ozcan, P. and F. Santos (in press). "The market that never was: Turf wars and failed alliances in mobile payments." Strategic Management Journal.
Perez, P.B., M.C. Gonzalez-Cruz and J. P. Pastor-Ferrando (2010). "Analysis of construction projects by means of value curves." International Journal of Project Management, (28), pp. 719-731.
Pousttchi, K., M. Schiessler and D. G. Wiedemann (2008). "Proposing a comprehensive framework for analysis and engineering of mobile payment business models." Information Systems and e-Business Management (7) 3, pp. 363–393.
Reuver, M. de, H. Bouwman, and T. Haaker (2009). "Mobile business models: organizational and financial design issues that matter." Model. Electron Markets (19), pp. 3-13.
Rouru-Kuivala, O. (May, 2012), Personal Communication. "SmartTouch" pilot in Oulu: obstacles and barriers in its implementation."
Suikkanen, J. (April, 2012), Personal Communication. "SmartTouch" pilot in Oulu: obstacles and barriers in its implementation."
Tuikka, T. (April, 2012), Personal Communication. "SmartTouch" pilot in Oulu: obstacles and barriers in its implementation."
Van Hove, L. (1999). "Electronic money and the network externalities theory: lessons for real life." Netnomics (1), pp. 137-171.
Willemse, R. (May, 2012), Personal Communication. "Payter pilot in Rotterdam: obstacles and barriers in its implementation."