

# The Implementation on NFC-based mobile payment in Norway

A case study of the emerging NFC business ecosystem in Norway

**Jarl Erik Ulvedal**

**Supervisor**

Harald Knudsen

*This Master's Thesis is carried out as a part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.*

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## Abstract – Executive summary

This master thesis looks at the emergence of mobile payment in Norway with a focus on NFC technology. NFC based mobile payments represent a relative new technology that can be used in a relative new business area, which is that of mobile payments. The move towards mobile payment can be the beginning of a shift from traditional payment forms, such as cash and payment cards, to a new and modern way of conducting payments, using your own personal mobile phone. For the unobservant eye, the idea can seem like a scenario taken out of a Hollywood movie. The reality is that the technology already surrounds us in our everyday life. Many of us already use the technology in the form of a public transportation ticket or as an access card to the local gym. Now, there is an increasing attention around the world towards NFC technology as a way of conducting payments. In Norway it is no different.

In this paper, I explore the emergence of NFC based mobile payment in Norway based on seven interviews with industry expert in seven different stakeholder companies. Each of the interviewed subjects was selected specifically based on their company position, knowledge and expertise in the field of mobile payment technology. The companies represented in the interviews were DNB, Telenor, Teller, OfficeLink, NorgesGruppen, WyWallet and TrustNordics. The empirical investigation gave a tremendous amount of data that could be analyzed in conjunction with textbook literature, scientific articles and other related sources of information.

In this study, I find that NFC technology infrastructure is well on its way into the Norwegian market in various forms. The most progress seems to be related to NFC based contactless payment terminals, both hardware and software, which represent one of the most critical infrastructure necessities. On the other side, providers of NFC services have yet to fully launch their products to the customers. Investigation shows that there are still some challenges that need to be dealt with before NFC mobile payment becomes a mainstream service. First of all of these challenges relates to the collaboration and competition amongst stakeholders in the NFC ecosystem. Accordingly, some of the challenges are the current number of participating stakeholders, type of business models, Secure Element (SE) location and distribution, NFC payment transaction costs, security and the role of the Trusted Service Manager (TSM). A second set of challenges is relates to the customer adoption of the NFC based mobile payment service. Currently, the amount of customer compatible mobile phones is not sufficient. A different problem is how to get the customer to use the service, once they

have a compatible device, which relates to factors such as customers perceived usefulness, perceived ease of use, utility, security and other customer related behavior attitudes.

The questions identified are considered highly relevant for the emergence of NFC mobile payment. Although this thesis does not intend to answer these questions, both the theoretical and empirical research should guide involved stakeholders and managers to deal with the economic aspect of NFC based mobile payment. This can help to identify important directions for participants of the NFC ecosystem.

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## List of key Acronyms

CMP	– Contactless Mobile Payment
FSP	– Financial Service Provider
GSM	– Global System for Mobil Communication
MNO	– Mobile Network Operator
NFC	– Near Field Communication
OTA	– Over The Air
PIN	– Personal Identification Number
PoS	– Point of Sale
PSP	– Payment Service Provider
PSO	– Payment Scheme Owner
RFID	– Radio Frequency
SE	– Secure Element
SIM	– Subscriber Identity Module
SMS	– Short Message Service
TAM	– Technology Acceptance Model
TAMMS	– Technology Acceptance Model for Mobile Services
TRA	– Theory of Reasoned Action
TSM	– Trusted Service Provider
UTAUT	– The Unified Theory of Acceptance and Use of Technology
WAP	– Wireless Application Protocol
Wi-Fi	– Wireless Fidelity



## **1.0 Introduction**

*This chapter will provide an introduction and the background of the master thesis, and why I have chosen to write about this topic. This includes the objective and the purpose of the study, as well as the research questions. Finally, an outline of the thesis structure will be presented.*

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### **1.1 Introduction**

The purpose of this master thesis is to evaluate how key stakeholders in Norway are working to implement NFC based mobile payment to the Norwegian market. The NFC technology is considered one of the most prominent technologies for use in mobile payment services, and it can potentially revolutionize the payment transaction industry.

Mobile phone technology has already changed the way we communicate with one another in more than one way. The mobile phone each one of us carry around is not any longer just a mobile phone in which we can call and text. Nowadays, we use our mobile phones to browse the web, play games and to eternize memories by taking photos or video. With new technology built in to the mobile phone, it is possible to develop new ways to perform mobile authentication and payment transactions, making the mobile phone even more convenient for the consumer.

There are several technologies that have previously been tried out for use in mobile payment services around the world. In the Norwegian market, no single technology has so far succeeded considerably. One of the most promising mobile technologies, which also have received considerable media attention worldwide, is the Near Field Communication technology (NFC). In other words, mobile payments based on Near Field Communication. The NFC technology allows users to buy goods and services by touching (or waiving) their NFC mobile phone at the point of sales (PoS) locations. NFC is an already existing technology that is ready to be implemented in payment terminals and mobile phones. NFC is anticipated to be the leading technology within the mobile payment segment.

The aim of this paper is to look at this technology in the lights of implementing NFC based mobile payments in Norway. This will be done through an extensive literature review regarding mobile payment and NFC technology, in addition to a collection of empirical data

from mobile payments experts. The findings will create the fundament for an analysis on the emergence of NFC based mobile payment in Norway and how promising the evolvement looks at the current point of time.

The empirical evidence from the research shows that the Norwegian market is still in an early phase in terms of adopting and using NFC technology for mobile payments. This can partly be explained by a number of relevant factors necessary for a successful NFC ecosystem. First of all, the lack in the widespread of NFC enabled mobile phones is a huge challenge to overcoming in order to reach a critical mass of users. Another crucial factor is the absence of infrastructure related to NFC enabled payment terminals, or so-called point of sale (POS). A third factor is the deficiency in cooperation and a shared vision between key stakeholders within the NFC ecosystem, which hinders different actors to implement the technology. Even though there are efforts made towards NFC based mobile payments, it seems companies are awaiting further development, before they decide on how they want to invest in the emerging NFC technology.

I hope this study will provide insightful information to key stakeholders and decision makers in the NFC ecosystem. It can potentially assist managers to implement appropriate measures for a successful collaboration amongst actors involved in the NFC ecosystem. I also hope to expose faulty assumptions and possible organizational traps, in order to reduce the risk involved a NFC mobile payment investment.

## **1.2 Background**

News media often write articles on what the future might look like, by for example by giving the reader a vision on how a unique invention can cause evolution in one or more areas, if everything goes as anticipated. An online newspaper is largely what caused my initial interest in mobile payment and NFC technology. The vision of a world without the wallet, as we know it today, and moving forward with a technological innovation which is all we need to conduct our everyday payments. An alluring vision that seems very far away, but at the same time might be right around the corner.

The vision of a consumer mobile phone wallet, providing a seamless customer experience has already become a hot topic in many newspapers, in social media, in academic research, and in

political forums. Already we can see pilot projects all over the world, testing out different technologies related to mobile payments. Japan was amongst the first countries to introduce a service that allowed the user to pay with their mobile phones. It was the leading Japanese mobile network operator, DoCoMo, who in 2004 initially launched its mobile FeliCa – A service that allowed users to use their mobile phone for payment transactions similar to a traditional payment card. The introduction soon proved to be a huge success, and it was arguably the start on a new era in payment instruments. Other companies and researchers where soon to shifted their attention from payment solutions based on SMS, WAP and billing payments, into technologies that allowed for contactless payments such as NFC, Bluetooth, Infrared, ZigBee, RFID technology (Dahlberg et al., 2008).

Because of the wide spread of mobile phones today, the potential for the mobile phone as wallet is huge and can create a substantial revenue source for any succeeding companies. If mobile payment becomes a mainstream, it can potentially mean a society without cash and cards in a few years. In the Scandinavian countries, in addition to some countries Europe, the percentages of advanced mobile phones are considered to be very high. These mobile phones, also known as Smartphones, are predicted to play a key role in the evolvment towards the contactless mobile payment era, particularly with the NFC technology in mind. Since NFC technology allows for contactless transfer of data from a distance up to 10 cm, it is possible to use the technology for contactless mobile payments. If this evolvment takes place it could mean that we in the future have debit and credit card information stored on our mobile phones. When a payment needs to be performed, the user can simply wave their mobile phone over the payment terminal and the purchase is executed. The agreed amount will be deducted from the customer's account and sent to the merchant account, the same principle as when using a normal debit or credit card today. The features of contactless payment can increase transaction speed, facilitate easier payments, and ideally reduce the cost of payments for both the consumer and the merchant. All in which are great arguments for the implementation of NFC based mobile payment.

Debit and credit card are already accepted in most point of sale (POS) locations in Norway, and is used in majority payment transactions. The underlying infrastructure in traditional payment services gives the user great convenience. For a similar adoption of the NFC contactless payment technology, the customer needs to find the technology even more appealing, for example by offering additional value. The term customer in this scenario refers

to users who are *both* the merchant who receives the payment, *and* the end user who purchases from the merchant. In order to get acceptance for the technology it is important to give the right incentives for both parties in order for them to start using the NFC technology, especially since they are considered key stakeholders for a successful implementation. Opposite to the users, there are the providers of the service. These key stakeholders include mobile handsets manufacturers, payment terminals manufacturers, software developers, mobile network operators, financial facilitators and financial service providers. This indicates a span across different heterogeneous industries with little previous experience in cooperation with each other. The traditional financial service providers are often considered cautious in terms of adoption new technology, while mobile network operators are considered more innovation and open-minded to new technology. In order to create a viable and sustainable contactless mobile payment development, it is necessary to get a deeper understanding on emerging collaborations, business models and market challenges.

However, not all skeptics are equally convinced that contactless mobile payment is a real and life worthy alternative, or threat, to existing payment options. The wide spread of the technology is still very limited. Currently few markets have adopted the technology. Most are still researching and running pilot tests on the technology.

Recently there has been an important shift in the evolvement of the NFC contactless payment technology, making the technology more promising than ever. More and more mobile handset manufacturers, the key stakeholders in the NFC ecosystem, have started to implement the NFC technology into their devices. Based on current estimates on NFC enabled mobile phones, they are soon to surpass 500 million handset worldwide. In addition, over half of these are expected to come in the next couple of months(The Integrated Retailer, 2013). With NFC enabled phones becoming mainstream, a fundamental factor for successful implementation can be fulfilled. Other stakeholders are also showing signs of preparation targeted for NFC technology, like for examples by enabling NFC technology in point of sale payment terminals. All of these strategic movements might be due to a unified belief that the technology has come to stay, and therefore everyone is preparing for the “storm”.

Norway is one of the markets where the technology is still in its early stages. Larger stakeholders like Telenor and DNB have just finished some pilot test, and are proceeding further with the technology. Stakeholders are still working out ground rules on how to

cooperate together. Seen in relation to our otherwise highly technical society, the evolvement of the NFC technology in Norway is rather poor. Currently, older technologies like SMS payments are still in the forefront when speaking of mobile payments.

The use of efficient electronic payment systems is a key element in the Norwegian economy for several reasons. Firstly it reduces the burden of handling large amount of cash, it reduces the risk for money laundering, and it adds value by increasing the speed of transactions. Humphrey et al. (2001) found that the cost of making payments can account for as much as 3 per cent of a country GDP, and concluded that switch from cash based to electronic based payments will result in a substantial cost savings(Humphrey, Kim, & Vale, 2001). Even if mobile payments transactions have proved very successful in some regions, like for example SMS payments in developing countries, mobile transactions accounts for only a very small portion of all financial transaction in Norway today. This is likely to change if NFC technology gets fully implemented into our society, and the coherent infrastructure is in place.

The implementation of NFC-based mobile payment in Norway depends on how key stakeholders amongst mobile network operators and financial institutions view in the opportunity of the technology. The decision on whether to invest in the technology is a matter of belief in whether they can succeed or not. There is always a substantial risk involved in the introduction of a new and unknown product or service to a company portfolio. Research has shown that new products have a very high failure rate. Many companies tend to be very cautious before an implementation, often to see whether others succeed first.

This master thesis will only consider the NFC based mobile payment service. However, the most notable differences between NFC technologies and other mobile payment technologies will be mentioned slightly for informational purposes. This also means that this master does not intend to join the discussion on which technology is the most suited in terms of mobile payments. Based on the topic chosen NFC technology seems especially promising in the setting as a mobile payment technology.

### **1.3 Problem formulation**

Given the direction the mobile payments are moving in other parts of the world, it can eventually become a large industry that will govern the future within the financial payment services. It is in fact creating a new industry, where the role of mobile network operators and

financials service providers closes the distance from each other to becoming more of a unified service. On the other side there might be more challenges than we can imagine. Already there are questions being raised on how the roles should be shared between participating stakeholders. Mobile network operators are businesses who often fall under the category of being innovative and experimental, while the traditional banking and financial services is often seen as a conservative business. Instead of creating cooperation between actors, they might find the mobile payment to become a conflict of interests. This is the subject of vast speculation in contemporary research, newspapers, web-forum and other publications. There are many stakeholders involved in the NFC ecosystem, but these can largely be divided into two categories. On one side there are the mobile network operators, financial service providers, mobile handset manufacturers and the software developers. On the other side there are the visual merchants and end-consumer that will be using the service. They are vital components in the NFC business ecosystem. If the merchant or the consumer does not adapt the NFC technology, it does not matter if the service is great. Therefore, the merchant and consumers value proposition cannot be ignored. Mobile payment might seem a promising soon-to-be future, but there are still several social, organizational, market and industry challenges that remain unsolved. There are a few examples of countries or markets that have managed to solve the puzzle. In Japan, South Korea, and some of the developing countries have proven the livelihood of mobile payments. They have had successful results on both implementation and adoption. However, the strategies used for the implementation varies from market to market. Markets for mobile payments are not homogeneous. This means that individual markets have different challenges, which further makes that it is hard to draw parallels the Norwegian market. Based on the complexity of NFC based mobile payment, it is necessary to take a multi-stakeholder perspective approach to find the key challenges for the implementation in Norwegian market.

#### **1.4 Object and purpose**

With the given the background and problem formulation, the purpose of this research is to provide an understanding of important issues relating to an implementation of NFC based mobile payments in the Norwegian market. The research will be closely related to different stakeholders within the NFC ecosystem, based on a dynamic multi-stakeholders perspective approach. This can help potential stakeholders to evaluate the opportunity for NFC based mobile payment technology in Norway. The research can further help to highlight and analyze

key issues that are crucial for a successful implementation and adoption in Norway. Consequently, the research aims to answering the following research questions.

### **1.5 Research Question:**

In order to provide an answer to the thesis the following research questions have been formulated:

*“Which key issues are most important to solve in order to achieve a sustainable NFC ecosystem that can successfully implement NFC based mobile payment in Norway?”*

### **1.6 Definitions and clarifications**

This section is intended to clarify and explain some terms that will be frequently used throughout this these. Hopefully, enabling the reader a better understanding of some new terms regarding NFC based mobile payment, and further to reduce the probability for any misunderstanding.

A more often occurring expression is *contactless mobile payment*, or *proximity mobile payments*. This payment method refers to using a mobile device in close proximity to a point of sale terminal. Contactless or proximity mobile payments are often used with the same meaning, as both expressions refer to a transaction where there is no need for physical contact between the mobile device and the point of sale. In other words the transaction can be performed by bringing the two devices into close proximity.

NFC based mobile payments refers to mobile payment with the use of NFC technology. This indicates that *NFC technology* is the primary technology in use when conduction a payment transaction. Mobile payment will be further explained in chapter 2.2 – Mobile payment. NFC technology is a technology based on contactless or close proximity interaction. This means all NFC mobile payments are contactless or proximity payments. However, not all contactless or proximity payments are with the use of NFC technology. Other technologies can also be used. In this thesis, no other technologies than NFC technology will be discussed. When the term contactless of proximity payments are used, it simply indicates that NFC technology is one of several options.

The term *merchant* is often used in this thesis with an extended meaning. It refers to the merchant, a store, a retailer or any location where a purchase of a physical good by the customer can be made. A point of sale (PoS) refers the actual place where a payment is done. For example, if a customer uses a credit card to pay, the point of sale will be the payment terminal which accepts the payment. Hence, a merchant can actually have several point of sale in one store.

## 1.7 Delimitations

This thesis focuses on the NFC contactless mobile payment and the business ecosystem surrounding the NFC technology. It is difficult to frame the research into categories such as mobile payments, technologies, stakeholders or organizational structure, due to the scope and complexity of NFC ecosystem - which is also yet to be precisely defined.

The research touches in on several different topics considered relevant for the development and direction of evolvement of the NFC based contactless payment. Not all relevant theories or areas of importance can be covered, due to the nature of this as a master thesis. Limitations are necessary. In order to limit the extent of the research, only obvious and fundamental parts of the NFC business ecosystem related to NFC contactless mobile payment will be addressed.

First of all the focus will be on the in-store mobile payments at the point of sale (POS), traditionally seen as the transaction between the merchant and the customer – also known as the business to consumer (B2C) transaction. The technology in focus will be NFC technology. This will be further defined in Chapter 2 - Near Field Communication. Although this is only one part of what NFC contactless payment technology can be used for, it is considered one of the most fundamental step-stones for a major large scale deployment and adoption of the technology. With this limitation in place, a second limitation will be to look at only stakeholders closely related to the users' side and to the provider side in the NFC business ecosystem. For further description of providers and users in the NFC ecosystem see chapter 2.5 – Key stakeholders in the NFC ecosystem. Another important stakeholder is regulatory agencies and governmental influence. Although highly important and not to be ignored, this thesis will not aim to answer questions directly related to juridical or regulatory implications.

The NFC technology has both advantages and disadvantages, whereas the most important for



contactless mobile payments will be mentioned. However, the focus of this research will not be to give a comprehensive and in-depth evaluation of highly technical aspects of the technology. Neither will the thesis enter the debate related to security features and comparison to other technologies. Security is obviously of important for the users interest in adopting the technology, and it should be taken seriously by the providers.

Hardware specifications are another matter that will not be addressed extensively in this thesis. The aim of this research is to write an easily readable style paper to describe and explain the role of various stakeholders in the NFC business ecosystem. In addition to examining which issues that affects the development of the business potential for NFC based mobile payments. Based on the theoretical insights and empirical research, this paper seeks to analyze the *current* issues for NFC based mobile payments in Norway.

### 1.8 Outline of the thesis

The first chapter presents a short insight in the world of NFC based mobile payments. The introduction will further address what problem this thesis aims to answer, and why this is important, followed by the “defined” research questions and delimitations of this paper.

The second chapter seeks to explain the NFC technology sufficiently enough for the reader to understand the technology and the NFC business ecosystem. The information used is gathered from subject literature, web resources, white papers, academic papers, and from work of the standardization bodies and so on.

The third chapter constitutes the theoretical framework including complied descriptions of the theories based on relevant literature. In order to increase the theory relevancy and visualize the connections to NFC mobile payment, key aspects from several scientific journals and academic work will be introduced to each theory. The theories in use are those of consumer choice and demand, diffusion and adoption, network externalities, switching costs, complementary goods and business ecosystem.

The fourth chapter explains the chosen research methodology and why this method has been chosen to answer the research questions. The section includes an explanation of the research paradigm and data collection approaches, as well as addressing the validity and reliability of this work.

The fifth chapter will present the empirical data gathered from in-depth interviews of seven industry experts, representing key stakeholder in the NFC ecosystem. The empirical data provides an important insight to the Norwegian NFC based mobile payment market. All interviewed subject were in one way or another involved in ongoing NFC related work.

The sixth chapter presents the analysis of the theoretical and empirical data gathered in the thesis. It includes an analysis of each of the theoretical concepts in light of the empirical findings in a theory concept by concept structure.

The final three chapters present a discussion, the conclusion and suggestions for further research. The discussion will shed light on the key issues necessary to solve by the NFC ecosystem, on the basis of both theoretical and empirical data. This will be followed by the conclusion which will summarize the findings the thesis. Finally, there will be some suggestions for future research related to NFC based mobile payment.

## **2.0 Near Field Communication (NFC)**

*This chapter is intended to explain some of the basics of NFC technology, its origin, and how it can be used for mobile payment services. The chapter further seeks to explain the involved stakeholders in a NFC ecosystem and industry-specific business models.*

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NFC is a short range wireless technology that simplifies and secures interaction with other technologies surrounding us in our everyday life. The NFC technology can be implemented in common electronic devices such as a mobile phone. When touches against another NFC device it automatically initiates communication with that device. The idea behind the NFC technology is closely related to ubiquitous computing, sometimes referred to as the highest level of interaction between humans and computing. Ubiquitous computing is a model where humans do not need to design their activities according to the machines they use, but instead machines adjust to human needs. In doing so, the computer becomes autonomous agents that take on our goals (Weiser, 1993).

NFC technology is considered especially interesting in the area of contactless payments. When the technology is applied to a traditional payment card or a mobile phone it can be used for payment transactions, simply by touching the NFC device into a payment terminal. The features of the NFC technology could have potential to revolutionize how we perform payment transaction. Especially when combined with other technologies such as our own mobile phone.

### **2.1 Mobile phones**

A Mobile phone is an electronic device which is primary used to make voice calls when the user is mobile. It has largely taken over the market for phone calls, from the traditional hard-line phone. It has become a mobile device that most people carry around all the time. Even in the developing world the mobile phone is starting to become a more common sight. In Norway the amount of mobile phone subscriptions have exceeded the population, as there in 2011 was registers approximately 5,7 million subscriptions (Medienorge, 2013; Post og Teletilsynet, 2013)

To use a mobile phone, the owner has to be registered to a mobile network operator to gain access to the mobile network. When the user has access he can use the mobile phone to make

or receive calls from others people on the network. It is also possible to communicate in other ways like for example using Short Messaging Service (SMS), or through internet access on the phone. Based on the specification on the mobile phone, the user is likely to have a range of other technological features on the phone, enabling the user to perform even more tasks.

In relation for this paper the interesting thing about a mobile phone is how it can be used as a form of wallet, by that using the mobile phone to conduct payments. This is often referred to as mobile payment or m-payment. In order to perform mobile payments, a Smartphone is in most circumstances necessary.

### 2.1.1 Smartphones

The most advanced phones today is often referred to as smartphones, and are recognized by being mobile phones that provide advanced capabilities beyond a typical mobile phone. They normally have a vast amount of integrated features. A smartphone runs on an operating system (OS) software that provides a standardized interface and platform for application developers. A Smartphones is often equipped with additional technologies that are not directly linked to communication, like for example a hard drive, a camera, a compass and GPS. With the proper application on the phone, a user can also use the smartphone as a music player, video players, and a calculator and so on. Depending on the model, a smartphone it can be equipped with other communication technologies than the traditional GSM technology. Today, additional technologies are Wi-Fi, Infrared, Bluetooth and NFC.

A smartphone can be defined as:

*“A mobile phone that is able to perform many of the functions of a computer, typically having a relatively large screen and an operating system capable of running general-purpose applications.”* (Oxford Dictionaries, 2013)

The function of a smartphone is to eliminate the necessity for other devices by integrate all devices into one smart phone. One example is the Global Positioning System (GPS) which is a wireless service that allows for navigation and tracking of location, and replaces traditional mobile GPS devices. Another example is Wi-Fi which is a service that allows for wireless access to the internet or a network through an access points such as a router. This can replace

the need for a computer for hi-speed internet access.

Infrared, Bluetooth and NFC are technologies that allows for wireless transfers of data on shorter distances between devices with similar technology, but with some important differences. These differences are especially importance in terms of using the technology for mobile payment purposes. Infrared requires line of sight to function properly. For Bluetooth to function it requires communication within a short distance, normally no longer than 20-30 meters away. NFC requires very close proximity for interaction, normally no longer than a few centimeters away (Coskun, Ok, & Ozdenizci, 2012).

The differences in these technologies will not be discussed further in this paper. The main point of mentioning is that these are all technologies that they are not necessary to perform a phone call. They are additional features that enable easy transfer of data for other purposes.

A survey conducted by Ipsos MediaCT in May 2012 showed a marked share of smartphones at 54% in Norway, which was an increase up from 33% the previous year. This indicates a rapid increase in the market of smartphones. On a worldwide basis, Garter estimates that the compounded annual growth rate of smartphones for the period of 2012 -2016 will be at 12,65%, and that every one-in-three mobile phones sold globally will be a smartphone by 2016 (Gartner, 2013; Forbes, 2013).

## **2.2 Mobile Payment**

The mobile payment services are currently undergoing some exciting changes that can affect the whole payment industry. New technologies are now enabling users to make payments with their mobile phone. Mobile payments can be defined in many different ways. A simple and understandable definition is used by Dahlberg et al. (2008) :

*“Mobile payments are payments for goods, services, and bills with a mobile device”.*

Another way of describing mobile payments is following definition:

*“Mobile payment or M-payment is any payment where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return for goods and services.”*

(Karnouskos, 2004)

According to Herzberg (Herzberg, 2003) the term *mobile device* is referred to as mobile

phones, PDA, wireless tablets or any other device that can connect to a mobile telecommunication network in order to conduct a payment.

Mobile payment is not a new phenomenon. In some parts of the world mobile payment is already a common phenomenon, and it is estimated to grow substantially over the next decade. There have been a number of different technologies tried out for payment transactions, where some have had success and others have failed. Diffusion and success of mobile payment is further dependent on marked location and demographics. Some areas have adapted mobile payment due to lack in the banking infrastructure while others because of a more acceptance towards new technology. There are also areas that barely use mobile payments. *“Depending on where an observer looks in the world, the extent of interest and the degree of development and diffusion of m-payments systems and alternative electronic cash systems will differ dramatically.”*(Au & Kauffman, 2008, p. 142)

Mobile payment literature tends to split the technology in use in two categories, remote payments and proximity payments (Goeke & Pousttchi, 2010; Lai & Chuah, 2010). There are two technology standards in particular that are helping to achieve the needed devices and platform interoperability, which is resulting in the current projections of high future growth. These technologies are SMS based payments (remote payments) and NFC based payments (proximity payments) (Au & Kauffman, 2008). This thesis aims to look at NFC mobile payment, which falls into the category of proximity payments or also known as contactless payment. Firstly, SMS payments are explained in short.

In terms of remote payments, SMS technology has proved successful in several markets. SMS payments are sometimes referred to as micropayment due to it usually involves a very small sum of money. SMS payment takes advantage of the mobile network, which means a transaction can be performed as long as mobile signal coverage is present. In developing countries a lack in banking infrastructure has resulted in the popularity of SMS transactions, primarily because of its convenience for individuals without access to a personal bank account. One of the early successes for SMS payments was in Kenya in 2007 with the service M-Pesa. The huge success in Kenya is normally explained with the high number of mobile users, combined with the inadequate banking structure ("The Economist," 2007). SMS transaction is also present in the developed world. In the US, SMS payment initiatives have been provided by PayPal. In the UK, ZayPay provides an alternative to traditional

payments method by offering SMS payment. Both PayPal and ZayPay targets mainly micropayments in the person to person transactions market and the person to business transactions (PayPal, 2013; ZayPay, 2013). We also have similar services in the Nordic countries. WyWallet in Sweden has created a niche where they offer businesses the opportunity to accept SMS payments from 97% of all mobile phone users in the country. This enables customers to pay for purchases or to transfer money to other persons (WyWallet, 2013). In Norway, Telenor has offered SMS payments for a couple of years for small transactions related to online services and small purchases, like for example paying for parking (Telenor, 2013).

Proximity payment or contactless payment refers to payments where the sender (customer) and receiver (merchant) devices are in close proximity to each other. This normally means that both devices need to be on the same location to perform a transaction. One of the most promising technologies for proximity payments are with the use of NFC technology. Proximity payments are still considered being at an early stage in most markets. However, there are tendencies from several stakeholders that indicates a move towards NFC based mobile payment as a viable solution for the future. In 2011, there were 1,5 billion NFC transactions globally representing a market share of 17,6% for all mobile payment transactions. IE Market Research Corp (2011) have estimated that NFC transactions will grow to 55,3 billion transactions, and to represent a 37,2% market share by 2015.

As mentioned earlier, this thesis aims to take a closer look at the progress in NFC based mobile payments in Norway. NFC technology has a wide range of capabilities and can be used in different settings. This thesis will however focus on the customer who pays the merchant for the purchase or in other word business to consumer (B2C) transaction. This can also be referred to as contactless payment at the point of sale (PoS). The B2C perspective will give a clear perspective of the challenges in the market for proximity payment. For the rest of this chapter the focus will be on the NFC mobile payment, NFC technology and the NFC ecosystem

It is important to make a distinction between mobile payment and mobile banking. Mobile banking is an increasingly common and popular service, particularly in Norway. Mobile banking has roots from the internet banking, a service in which gives access to customer account via internet. It enables customers to access their account to view transactions and pay bills without physically going to the bank. Most major banks now also provide mobile phone

applications to perform the same service. In general, this means access to banking functionality through the mobile phone (Zhou, 2012). With the given definition of mobile payments, mobile banking would arguably be a way of performing mobile payments. However, mobile payments and mobile banking should not be confused with each other. Both can be used to perform financial transactions, and is therefore closely related. A financial transaction through a mobile banking will normally mean a payment *ex post* purchase. This could for example be to pay a bill for a travel insurance purchased online. Mobile payment generally refers to payment of goods and services instantly as the purchase is conducted, equivalent to purchases with cash or payment cards.

### **2.3 About NFC technology**

Near Field Communication (NFC) is a technology that has emerged in the last decade. It involves a set of standard for smartphones and similar devices that allow for radio communication between each other simply by touching them together or bringing them into close proximity of each other. NFC technology can be categorized as a short range, high frequency, low bandwidth and wireless communication technology that can be used to communicate between two NFC enabled devices. The communication between the NFC devices occurs at 13,56 MHz high frequency which was originally used by Radio Frequency identification (RFID)(Coskun et al., 2012). The main reason for why the NFC technology uses the same frequency is because of its roots from RFID. To understand how NFC works one should have some basic knowledge about RFID.

#### **2.3.1 Radio Frequency Identification**

The RFID is a technology patented in 1983 by Charles Walton and the patent is based on a system that allows for contactless transfer of data with the usage of radiofrequency and magnetic fields (Coskun et al., 2012). The RFID technology was originally derived from an invention from 1945 by Leon Theremin, nick-named “The thing”, which initially served as an espionage tool for the Soviet Union. However, the first application of the RFID technology was invented in 1973 by Mario Cardullo (ISECOM, 2008). This invention was early on showcased to investors as a technology with the potential for use as identification of transportation vehicles, banking transactions, security, and medical patient tracking.

Radio frequency identification (RFID) is a technology that communicates using radio waves



to exchange data between an RFID reader and an electronic RFID tag or label. These tags were traditionally attached to an object as a tool to identify and track each object individually. The RFID tags are small integrated circuits which can hold small applications as well as a tiny amount of data. There are mainly two different types of RFID tags, *passive* and *active*. The passive tag does not have an internal power supply, but has the integrated circuit and an embedded antenna. That means the tag has to be powered by incoming radio frequency, sent by the RFID reader. Passive tags can be read between the distances of 10 centimeter to a few meters, depending on the chosen RF, antenna design and size. Unlike the passive RFID Tags, active RFID tags have an embedded power source. This makes the tag readable at a much longer distance than the passive tags. This means that active tags can be considered more reliable (Coskun et al., 2012).

### 2.3.2 NFC previous evolvement

With a basis from RFID technology, NFC technology was jointly developed by Phillips and Sony in late 2002 for contactless communications. The ECMA International (European Computer Manufacturers Association) adopted the technology as a standard in December 2002. A year later, The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) adopted NFC technology in December 2003 (Coskun et al., 2012). One of the first organizations that worked to implement Near Field Communication (NFC) into mobile devices was the Near Field Communication forum. The forum was established in March 2004 by well-known mobile manufacturer Nokia, Philips Electronics and Sony. The purpose of the organization was to enable the use of touch-based interactions in consumer electronics, mobile devices, PC's and smart objects. As mobile phones became more and more common, the main motivation for NFC technology was the integration of personal and private information. When information such as credit card or debit card data are stored on mobile phones it could enable the phone to serve as a wallet, in addition to a mobile phone (NFC Forum, 2013).

One of the main differences between the NFC and the RFID technology is the range in which they operate. RFID is capable of reception and transmission beyond a few meters while the NFC technology operates in very close proximity on a distance not longer than a few centimeters away from the receiver. The close proximity feature of the NFC technology was

one of the reasons why the NFC Forum considered the technology interesting for mobile payments.

### 2.3.3 NFC essentials

NFC operates between two devices over a very short communication range, at the same frequency as the RFID technology. There are three operations modes, reader/writer, peer-to-peer, and card emulation where interaction occurs between a NFC device on one side and a NFC reader on the other. Currently the operational speed is 102, 212 or 423 kbps (Coskun et al., 2012). An important property is the automated pairing capability of the NFC devices when in close proximity of another NFC device, which automatically will launch an installed application when it finds a matching pair. When the NFC technology is used for mobile payment, the automated pairing facilitates a fast and efficient communication. The customer's phone automatically pairs with the merchant's payment terminal where payment is instantly received. In terms of security, NFC major property is the short communication range. The necessity of close proximity between NFC devices makes the data signal very hard to intercept by other sources or devices. The short signal range is one of the most important arguments for NFC as a secure technology in mobile payments. The fact that the NFC signal range is only a few centimeters, makes it very secure compared to other wireless and contactless technologies.

### 2.3.4 NFC devices

For the NFC technology to function and to operate, the basic necessity is to have NFC device. NFC devices are the acting components of the NFC technology. These devices come in three different forms; *NFC enabled mobile phone*, *NFC Tags* and *NFC Readers*.

The NFC mobile is a mobile phone or smartphone with embedded NFC technology. The mobile is considered the most important NFC device, largely due to the widespread of mobile phones. For NFC based mobile payments a NFC enabled mobile phone represents an important element in the payment infrastructure. When a customer owns a NFC enabled mobile phone it can potentially help the adoption rate and further increases the acceptance towards the NFC technology.

The NFC tag is actually a RFID tag without an integrated power source. It comes in various

forms and models, which are all compatible with other NFC devices. In order for the tag to work it has to be preprogrammed with data in which the NFC reader then can receive (Coskun et al., 2012).

The NFC reader is a device that is capable of data transfer with a NFC component. The most common NFC reader is the contactless NFC payment terminals at the point of sale (POS). At these terminals a payment will be initiated when an NFC device is touched against the NFC reader.

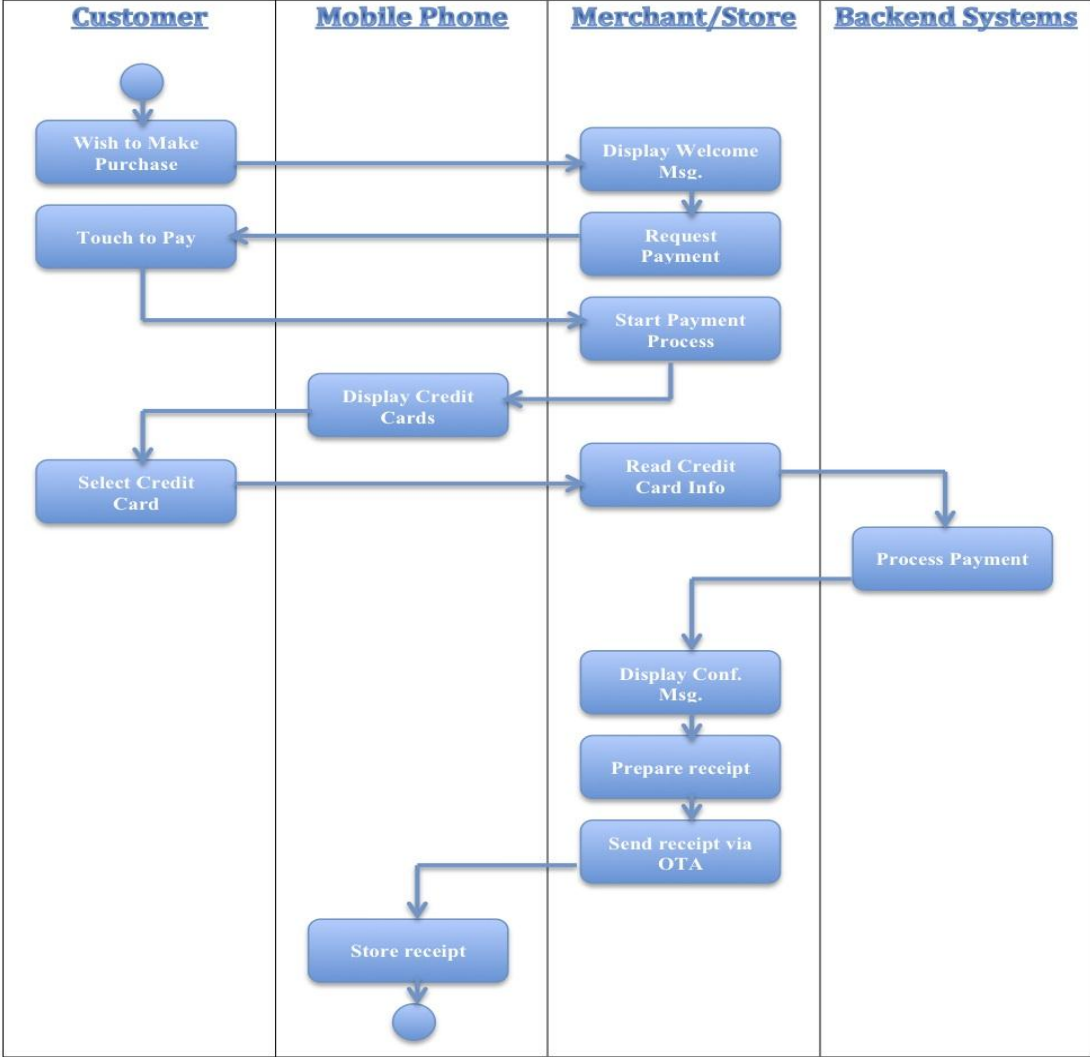
To start communication between two NFC devices all they have to do is to touch. Touching is the action that triggers the communication between the devices. As mentioned earlier, this is one of the most important features of the technology. This means that the user does not need to start any application or interact with the process other than bringing his or hers NFC mobile in contact or close proximity with the tag, reader or another NFC Mobile (Coskun et al., 2012).

Each NFC communication process involves an initiator and a target. The initiator is the party that starts or initiates the communication, while the respondent is called the target. This is analogous to the well-known client- server architecture, where the client initiates the communication and the server responds.

When using NFC technology the initiator always has to be an active NFC device in order to start or initiate communication. An active NFC device has an internal power source. This means that a passive NFC tag can never initiate communication as the passive tag can only stores data readable for an active device. An active device however can be both initiator and respondent.

In the case of NFC based mobile payment, both the payment terminal and the customers mobile phones is an active device. In addition, both parties act as both initiators and respondents. Figure 1 shows a simplified activity diagram of how a payment transaction takes place.

Figure 1: NFC Payment activity diagram (modified) as illustrated by Coskun et al. (2012. p. 142)



The activity diagram shows a customer who wish to make a purchase. The NFC payment terminal represents an initiator by requiring payment (request payment) for the goods purchased. The NFC mobile phone receives the request, and automatically starts up the payment application which will display the credit cards. The customer can now make a choice of credit card. The opened application then serves as an initiator by initiating the payment. The payment terminal then receives the payment, processes it, and automatically replies with a confirmation to the mobile phone (a receipt).

**2.3.5 Operational modes.**

NFC has three different operational modes; *reader/writer*, *peer-to-peer* and *card emulation mode*. Each operating mode has a different technical infrastructure with different benefits. According to Coskun et al. (2012), card emulation mode is best suited for payment services as

allows the mobile phone to serve as a contactless smartcard. A smartcard is an item that contains an embedded IC that has integrated memory. Today, most credit and debit card in Norway has a so-called “chip”, which indicates that the card contains a secure microcontroller or an equivalent intelligent device. This means that the payment card is a smartcard. A *Contactless* smartcard has an additional feature. It is a smartcard with embedded contactless technology, for example NFC technology. Given the topic of this thesis, card emulation mode will be explained more extensively than reader/writer mode and-Peer to-Peer.

In a reader/writer mode an active NFC enabled mobile phone initiate the wireless communication, and can read and alter stored data on an NFC tag. The tag is normally a sticker that can be attached to an object. In this operating mode, an NFC enabled mobile phone is capable of reading NFC Forum mandated tags. In doing so the mobile user can retrieve the data stored in the tag and take appropriate actions afterwards. An application operation in reader/writer mode normally does not need a secure area in the NFC enabled phone as is only read or alter data by writing to the tag (Coskun et al., 2012).

Peer-to-Peer allows two NFC enabled phones to be linked together in a bidirectional connection to exchange information, with the same data format as in reader/writer mode. This can be used to exchange virtual business cards or other digital information. The mode is not considered to be suited for mobile payment transactions (Coskun et al., 2012).

In card emulation mode an NFC enabled phone act as a smartcard. To do this an NFC enabled phone needs to emulate a smart card, or a smartcard chip has to be integrated in the NFC phone and connected to the antenna of the NFC module. When the user touches the mobile phone to a NFC reader, the NFC reader initiates the communication. This is an operational mode that is useful for secure transactions like for example contactless payments, ticketing applications and access control. It is only in card emulation mode that a secure element (SE) is used efficiently and functions are performed securely. In a payment transaction the NFC mobile act as a standard smartcard and the NFC reader interacts with the payment application on the SE on the mobile phone (Coskun et al., 2012).

### 2.3.5.1 Secure Element

NFC enabled services must reassure users and service providers that the transaction takes place in a protected environment. In order to have a secure storage and execution of NFC enabled applications, a secure element (SE) is essential. The secure element is a combination of hardware, software, interfaces and protocols that work together to protect the communication flow from unauthorized interference. Protection from unauthorized interference is considered being of high importance in mobile payments, because the security of the overall process affects the reliability and trustworthiness of the payment service. At the moment there are several alternatives to type of SE that can be used, and with the most popular being embedded hardware, Secure Memory Card (SMC) and Universal Integrated Circuit Card (UICC - or also known as SIM Card)(Coskun et al., 2012).

Embedded hardware - is a non-removable component that is implemented in for example a NFC mobile phone. This means that every mobile phone has to be personalized for the user. Since the hardware cannot be transferred to a new phone, the hardware has to be personalized whenever the user buys a new phone.

SMC card - is a combination of memory, an embedded smart card element and a smart card controller. It is both removable and has a large memory capacity. This allows the card to be transferred to a new phone without being re-issued.

UICC - also known as the SIM card (Subscriber Identity Module), and is a physical card that is personalized and implemented in all GSM and UMTS mobile phones. When the SIM card is used as a SE, it is considered an ideal environment for NCF enabled applications. It is personal, portable, secure, and can be easily managed remotely via over the air (OTA) technology. This allows for secure transactions as well as the personal information of the user is protected.

The choice of SE is dependent on stakeholders in the NFC ecosystem. During the Mobile World Conference in Barcelona 2013, Samsung and Visa announced cooperation in relating to embedded secure element on Samsung produced mobile phone (Read New Tech, 2013). Visa and Samsung are considered key stakeholders in the NFC ecosystem. The step is taken to accelerate and to promote NFC mobile payment. This will initially only involved Samsung

branded mobile phones, but can potentially lead to a change others manufacturers will follow. In Norway, Telenor is a MNO that has taken initiatives to implement a SE based SIM card. One of the advantages for a SIM based SE is that all mobile phones in the Norwegian market can potentially be equipped with a SE, hence enabling all mobile phones with NFC technology for NFC based mobile payments.

### **2.3.6 NFC Application Development**

In order to use the NFC technology as a tool for mobile payments, the NFC applications is an important part. The developers of the applications need to have a complete understanding for NFC technology and operating modes. In general there are two sides of an application in NFC services. The first one is the Graphical User Interface (GUI), which provides an interface for the user to interact with the mobile device. It works in all operational modes and allows for reading and writing from and to an NFC component. The second is the Secure Element (SE) which is needed to provide a safe, secure and trusted environment for security required applications (Coskun et al., 2012).

Form a security perspective, looking at a mobile payment application, the data that need protection would for example be credit card information and protection against unauthorized use. A mobile phone is technically almost identical to a personal computer, but is a much more personal item. Users carry them around in their everyday life, using them to call, text, take pictures and so on. This ties the mobile phone closer to the user, and it is often considered being an important part of their lives. As a reaction to this, users often have their mobile phone under physical surveillance. However, this does not prevent mobile phones from being stolen or attacked wirelessly using Bluetooth or Wi-Fi communication technologies. In order for NFC to function and to be adapted successfully, security issues are very important. A user initially cares about the functionality, and only subsequently notices the importance of security. This can potentially create a pitfall for any developer who does not take the security features seriously. If a service has a label of being insecure, users will soon stop to use the service (Coskun et al., 2012).

### **2.4 NFC Business ecosystem**

NFC technology relies on a range of different stakeholders in order to succeed in the market. In terms of NFC and its business environment, the different stakeholders are often referred to

as the NFC business ecosystem of NFC ecosystem - A concept that was popularized by James F. Moore (J. F. Moore, 1996). The term ecosystem is normally used in a biological context, representing a sustainable community of living organisms in a particular area (Molles & Cahill, 1999). In an industrial setting a business ecosystem is used metaphorically to emphasize a sustainable development of business activities within that particular area. Each stakeholder is a fully participating party which both influence and is influenced by the business ecosystem, an ecosystem made up of all related companies as well as economic, cultural and legal institution. Moore (1996) and Iansiti & Levien (2004) point out that the key entities in a business ecosystem are the leadership companies who are “keystone species” and have a strong influence over the co-evolution processes. This will be further explained in chapter 3.6, Business Ecosystem.

In most technological devices there are several companies involved both in development, marketing and distribution. Technological advancement often requires a vast amount of investments in order to bring the product to the market. Success is defined in different ways. From a user point of view it is whether the product makes everyday life a little bit easier, while from the investing companies perspective success is often measured in return on investments. Participating companies naturally seeks to maximize their profit. In a NFC ecosystem the focus on return on investments can potentially be a danger for the evolution of NFC technology. If profit is the main focus, the large amount of stakeholders involved can potentially lead to collapse the business environment. For a technological innovation to succeed, technical success is the primary requirement. When the technical success is achieved, a public acceptance is the second requirement. If a service proves useful for the customer they are more willing pay for the service. As more adapters start using the service, development and operating cost per user will be reduced. This cycle eventually drives the price down to a reasonable level so that the technology becomes successful. *“NFC technology is no different. A success story will be written only when the players agree on how to share the profit, which is not settled yet”* (Coskun et al., 2012, p. 26).

A successful implantation of the NFC technology as a mobile payment platform requires cooperation between several companies. The ecosystem contains everything from manufacturers to infrastructure developers and operators, software producers, service providers, financial service providers. All these different stakeholders demand a return on their investment, or a payment for their service. That underlines the importance of why all



players should agree on how to share the profit, before they deliver a service to the users. NFC technology exposes an inviting financial share to related partner, especially in financial services such as mobile payment. NFC mobile payment it is considered an exciting opportunity for involved companies, as it creates a completely new business environment with a large value chain. This has created considerable excitement and optimism in many organizations. The potential for a share of the cake is considered to be a very rewarding investment.

**2.5 Key Stakeholders in the NFC ecosystem.**

A stakeholder is a widely used term in economic theory, and refers to an organization or any group that might affect or be affected by the actions of the business environment (Freeman, 1994). In the evolving NFC ecosystem there is potentially a wide range of stakeholders involved. The Mobey Forum (2011) has developed a good overview of potential stakeholders in the NFC ecosystem, which was further developed by Coskun et al. (2012). Which stakeholder and to what extent they are involved can vary depending on the type of NFC enabled service. For NFC based mobile payment there are many stakeholders involved as it requires knowledge and experience from several different industries.

**Figure 2: Stakeholders in NFC Ecosystem as illustrated by Coskun et al. (2012)**

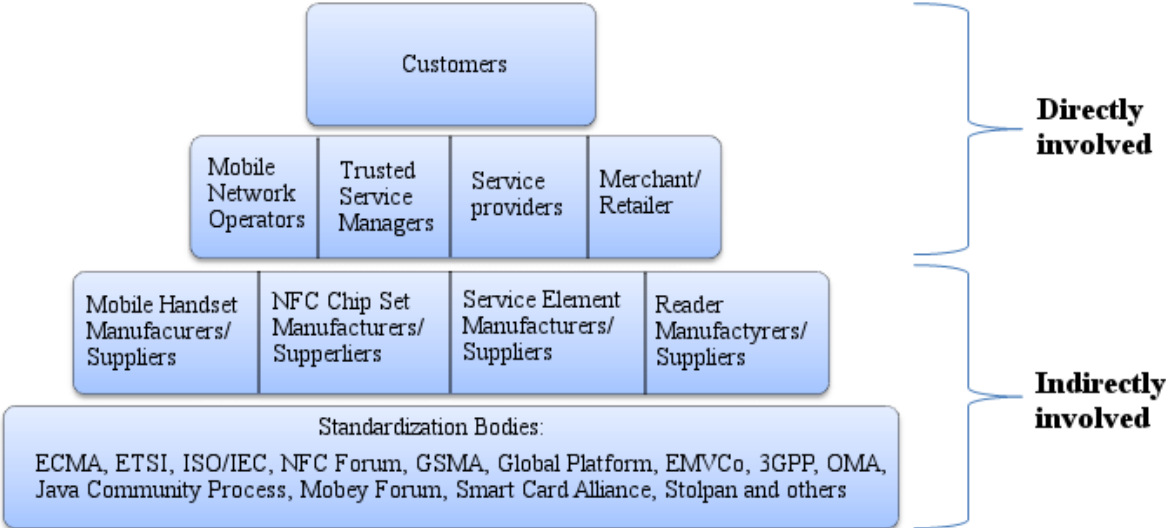


Figure 2 is influenced by the illustration from Coskun et al. (2012), but with some minor modifications. It displays a list of participating stakeholders in a NFC mobile payment service, participating at four different levels in the NFC ecosystem. Due to this papers focus

on the implementation of NFC mobile payment in Norway, these four levels have been modified into “directly involved” and “indirectly involved”. Stakeholder who is considered indirectly will only be described in brief.

By looking at the “indirectly involved”, and at the lowest level are the standardization bodies. Their role is work related to developing global, interoperable standards for NFC. They provide a fundament for the NFC technology to develop. At the next level are hardware manufacturers and suppliers of mobile phone handsets, NFC chips, Secure Element and NFC readers. They play an important role in the NFC infrastructure as they produce and delivers equipment customized to the NFC standards. Since this level mainly involves international world-wide suppliers, they are not directly involved in the implementation of NFC technology services in local markets.

The mentioned two bottom levels are definitely of importance for the NFC mobile payment initiative. Unfortunately, due to the limitations of this paper the roles of these stakeholders will not be discussed any further. Instead the focus will be on top two levels categorized as “directly involved”, which is considered more relevant in relation to the research questions.

The third level from the bottom consists of *mobile network operators, trusted service managers, service providers* and *merchant/retailers*. These are considered the major players in the NFC ecosystem, as they effectuate the NFC enabled applications and services in a secure, trusted environment. Each of these stakeholders will be describes more in-depth. It is important to underline the fact that even if these stakeholder roles are described individually, a particular stakeholder can be involved in more than one role at the same time. For example, a stakeholder can both perform the role as a mobile network operator and at the same time be a service provider (Coskun et al., 2012).

### **2.5.1. Mobile Network Operator (MNO)**

MNO's are the enablers of communication and data network to the mobile phones with secure over the air (OTA) solutions. They provide and maintain the necessary network infrastructure that allows for data and telecommunication. The MNO's have an important role in the NFC ecosystem because of their close connection to mobile phone users, and their role in the secure element (SE). Their customer base alone is an interesting aspect in terms of adoption of NFC technology. If a SIM based SE is used to enable NFC mobile payment, the MNO is

potentially both the issuer of SE as well as a provider of an OTA platform. Both in which can create additional revenue for the MNO's. The OTA technology allows for a remotely managed SE in the mobile phone, which can increase the security for NFC mobile payment. The largest mobile network operator in Norway is Telenor, followed by Netcom and Network Norway/Tele2 (Post og Teletilsynet, 2012).

### **2.5.2. Trusted Service Manager**

A TSM is necessary to create a trusted environment for the NFC ecosystem, mainly as a bridge between the MNO's and service providers. The TSM stakeholder role was initially introduced in 2007 by the Global System for Mobile Communication Association (GSMA), and functions to create a secure communication and interest protection for each entity involved. The role of the TSM is especially important in mobile payments, as financial service providers normally have strict requirements for organizations handling payments. The TSM offers a single point of contact with the MNO for the different service providers, which further helps to reduce the complexity of a NFC business model. In a sense, the TSM serves as a central authority role in the NFC ecosystem, with knowledge about both banking and the mobile phone application. The TSM operate the customer interface towards the NCF ecosystem, and further ensures that the NFC application and payment credentials are completely secure. (Coskun et al., 2012)

Telenor and DNB have established a joint venture under the name TSM Nordic, which aims to become a central TSM in Norway (TSM Nordic, 2013). VALYOU is currently the brand name of the application that will serve as a TSM and will enable NFC mobile payments. The application is planned to launch in 2013 (Valyou, 2013). TrustNordics is an independent trusted service manager, who provides mobile wallet framework for service providers. They are currently launching their V2.00 version of the mobile wallet framework (TrustNordics, 2013).

### **2.5.3. Service Providers**

According to Coskun et al. (2012) a service provider is the entity that wishes to deploy a service to the customers' mobile phone as well as to manage the service. In mobile payment the core service provider are the banks and financial institutions. The role of a service provider can be that of an application developer, owner and/or a provider. Due to of the complexity of mobile payments, service providers can be further categorized as banks and

financial institutions, payment service providers, payment scheme owner and third party technology/service provider,

*Banks and financial institutions* handle the customers' financial services such as issuing payment card and access to personal bank accounts. They have a long tradition providing financial management tools, and have over the years become highly trusted and respectable intuitions. Their involvement in money handling ties them closely to payment transactions, and is therefore considered a key stakeholder in the NFC ecosystem. Banks and financial institutions are often considered being conservative in terms of adapting and implementing new technology, and have at times been accused of being too passive in term of developing mobile payment solutions.

*Payment service providers* offer the technical platform and service for accepting payments to the merchant and retailers. This service normally involved a wide range of payment methods from traditional payment cards to mobile payments. The Payment service provider deploys the actual payment terminals as well as software to handle payment transactions. They enable the essential link between the merchant and the customer account, as an independent service provider.

*Payment scheme owner* is the owners of the payment card infrastructure. Examples are Visa and MasterCard who has a wide acceptance around the world. Both of which are devoted to providing mobile payment solutions. They are responsible for setting fees, establishing technical functionally and further handling the agreements, branding and certifications policies for payment scheme participants,

*Third party service provider* consists of entities involved in the infrastructure and/or application development in the name of their client. This involved application programmers engaged on behalf of a financial institution, MNO or TSM. It can also be an infrastructure developer engaged by a payment service provider, or a promoter of the TSM application.

#### **2.5.4. Merchant/ Retailers**

Merchants and retailers play a significant role in the NFC ecosystem as they are accepting the NFC-based contactless payment services. Without a general accept for the mobile payment

service amongst merchant and retailers, the NFC mobile payment are facing the danger of failure in terms of a successful and widely adapted service. A merchant has the opportunity to speed up the transaction at the point of sale (PoS). This means a more effective and easier purchasing process. In that sense the merchant is considered to be a user of the service, much like the customer. Today, most merchants and retailers already accept traditional payment cards. To enabling NFC mobile payments would an upgrade of the payment terminal at PoS normally be necessary.

There can also be other incentives for the merchant be engaged in the NFC ecosystem. Through the TSM a merchant has the opportunity to create value adding services to their customers, for example through special offers and loyalty programs provided by the TSM application. This can have a positive influence on the customer.

#### **2.5.5. Customers**

The customer is always the principal stakeholder in any business, and they are also the main focus of the service providers. The customer initiates the mobile payment transaction by touching their mobile phone on the payment terminal. They are the most important stakeholder for the NFC ecosystem to develop into a sustainable payment alternative. By using NFC mobile payment they generate value for other stakeholders involved in the NFC ecosystem.

#### **2.6 Business model**

The NFC ecosystem is a complex environment. It involved a new and disruptive technology with potential to change the future for payment transactions. A unified and suitable business model will help to promote the new service, and that create value for all participating stakeholders. Many business models do not encourage cooperation between organizations involved, but in the NFC ecosystem it is considered particularly important for the overall wellbeing of the ecosystem. There are many issues that need to be handled and problem to be solved. Of these issues, most are related to relatively few technological and infrastructure challenges.

“Currently, there is a vast amount of uncertainty in which business model is the best. The question that arises is which firm will perform exactly which activity, and who will pay whom for which service, and further how much profit to be earned or shared by any stakeholder” (Coskun et al., 2012, p. 294)

In order to find a sustainable business model for the NFC technology, it is important to harmonize the interests of all participants. Otherwise one could face challenges that prevent the technology and service to evolve and improve further. This could damage the overall reputation of the technology, and could eventually lead to a failure. Within the NFC community there is currently not a common agreement on the optimal business model that sufficiently satisfies all participating stakeholder. There are several examples of business models that have been tried out, and it is probably too early to see which one is the best one. Standardization bodies such as the Mobey Forum, NFC Forum, Global platform, GSMA, and EMVCo are organizations that intensively works on the NFC ecosystem and its business models, as well as underlying technological infrastructure.

In the NFC Business model the secure element (SE) has an essential part and it is often considered a key element when organizing the NFC ecosystem. With a basis in the SE it is possible to define different business models. The important strategic decisions that have to be settled can be summed up in three different tasks, which can be that of the *SE issuer*, *Platform manager* and *OTA provider* (Coskun et al., 2012, p. 295).

The SE issuer is the stakeholder that will issue and own the control over the SE. This will in most cases be either the MNO or a bank. If a SIM card is used as the SE element, the MNO who normally provides the SIM card will naturally also be the SE issuer.

The platform is the manager of the life circle of the SE platform. This task would involve the control and management of the SE platform. The platform manager owns the cryptographic keys that are used to control the SE in its lifecycle, and it can allow authorized service providers to install its applications.

The OTA Provider relates to the mobile network and on whose OTA platform will be used for management of the SE platform. This task is about the provision for the OTA platform. Providing a flexible and interoperable OTA solution is a key requirement for the NFC Ecosystem to function. The OTA solution enables secure and wireless communication between two parties as well as providing transmission and reception of application related information in a wireless communication system. OTA enables remote download, installation, and management of applications such as updating activating or deactivating an application

stored on SE.

The different task can also be referred to as functional roles and responsibilities that can be handled by single entities or multiple entities in a NFC business model. How this is sorted out play an important role on the approach to different business models. One can have a *MNO centric business model*, a *Distributed model* or a *TSM centric alternative*.(Coskun et al., 2012, p. 297)

A MNO centric model it is the MNO that issues the SE and at the same are the platform manager and the OTA provider. That means there are no other trusted independent entities. In this model the MNO acts as the TSM as well as owns and manages the SE by using its own OTA platform. This means that any service providers have to pay the MNO for gaining access to their NFC network, allowing for the usage and running of the service provider applications on the SE.

In the Distributed business model the platform management services are distributed between the SE issuer and the service provider. In this model the TSM can be a separate infrastructure provided by a third party or provided by the SE issuer and/or service provider. If a third party TSM provider is used, this will have to be done in cooperating with the SE issuer and service provider.

In the TSM centric business model the trusted service manager (TSM) acts as the platform manager on behalf of the service providers. The TSM centric model is considered least complicated and a best suited for an NFC service. The role of the TSM is to realize loading, installation, and personalization processes via its own OTA platform. In order for this business model to be sustainable it is important to create a win-win situation for all stakeholders. This requires an establishment of trust at all levels in the ecosystem.

### 3.0 Theoretical Framework

*This chapter will introduce a set of six theoretical concepts and perspectives that will be used as a foundation for the research on stakeholders in the NFC ecosystem. These theoretic concepts are Consumer Choice and Demand, Adoption and Diffusion, Network Externalities, Switching Cost, Complementary Goods, and Business Ecosystem. These six theoretical concepts create a foundation for the research, as well as these concepts will be used in conjunction with the empirical data for the purpose of analysis.*

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The theoretical foundation used in this thesis is inspired by previous work on mobile payment by Au & Kauffman (2008), Dahlberg et al. (2008). In their research they use multiple theoretical concepts to create a framework for the purpose of analyzing the state of mobile payments from different perspectives. The reason they have used a multi-perspective approach were to explain the mobile payment evolvement as correctly as possible. This makes it easier to visualize which obstacles and challenges a stakeholder face when participating in the mobile payment process. Several researchers on mobile payment have been inspired by the multiple theoretical approach to mobile payments, like for instance Kim et al. (2010), Ondrus & Pigneur (2009), Shin (2009) and Englund & Turesson (2012).

Previous research on mobile payment has the tendency to compare and evaluate different technologies for mobile payment. In this thesis the aim is to analyze mobile payment based on NFC technology. The theoretical framework has been selected after relevancy to the NFC mobile payment, and will be further supplemented with relevant concepts and research. In total six basic theories have been chosen. Of these, *Consumer Choice and Demand* have been chosen because of the theories ability describe consumer behavior towards new technologies such as the NFC technology. *Adoption and Diffusion* is a closely related to the previously mentioned theory, but looks primarily at the process and rate of which adoption takes place. The theory is often used in research due to its characteristics of explaining consumer adoption, particularly when it comes to new technology. *Network Externalities* have been chosen because it explains how a consumer might become more willing to pay for a good as the adoption increased. The theory shows how direct and indirect network effects increase the value of the good, hence increases the customers willingness to pay. *Switching cost* theory deal with the obstacles a customer might face because of his or her engagement with another



company or product. This theory have been chosen to help identify possible reason why a customer might not adopt NFC mobile payment. The theory of *Complementary Goods* explains how a product's value might be affected by another product. Complementary goods and substitute goods are often seen as two opposites. In NFC mobile payment, other NFC technology and NFC devices are believed to complement one another, hence increasing the value of both. The final theory, Business Ecosystems, looks at how a company in a business ecosystem can have different function and roles. Maybe more important, the theory describes how a business ecosystem evolves over time, to become a healthy and sustainable system. This is particularly interesting in relation to the complex NFC business ecosystem. Business ecosystem theory was chosen because it explains collaboration amongst participating stakeholders takes place. For stakeholders it can be beneficial to develop a healthy and sustainable NFC ecosystem.

The sum of these theories should build a good foundation for understanding the total complexity of NFC mobile payment and the implementation of such in Norway. The theories will further be supplemented with relevant research in order underline the theory's relevancy to this thesis, eventually building a good foundation for the purpose of analysis. The theoretical framework created in this chapter will be analyzed together with the empirical research for this thesis found in chapter 5 – Empirical Investigation. Each theoretical concept will be analyzed separately together with the relevant empirical findings. All of which will be presented in Chapter 6 - Analysis.

### **3.1 Theory of consumer choice and demand.**

There are several theories that seek to describe consumer choice and demand. In this thesis the theory of multi-attribute models and the technology acceptance models have been chosen. Both theories describe consumer choice and demand differently

#### **3.1.1 Multi-attribute Models**

In the center of the consumer choice and demand theory is the customer, who always seeks to choose the best option for him or herself. In traditional microeconomic theory the main object of the consumer is to get the maximum possible utility based on the consumer preferences. The maximum possible utility is commonly displayed in a model where the world is

simplified by assuming it only contains two goods. The consumer chooses the best option from a set of feasible options, hence giving the consumer the most possible satisfaction and enjoyment in that given situation (Estrin, Laidler, & Dietrich, 2012). The model is favorable because of its ease of use, but at the same time limits how well a phenomenon can be explained. Modern consumer behavior research tends to go deeper into the consumers mind in order to understand their actions. This involves quantifying, explaining and eventually predicting the customers' decision-making process. One way of trying to explain consumer behavior is with multi-attribute utility models. Compared to other behavior models, multi-attribute models are shown to predict consumer decisions more accurately than some of its counterparts (Bettman, Capon, & Lutz, 1975; Currim & Sarin, 1984). This has been shown in several marketing areas such as consumer information environments (Johnson & Katrichis, 1988), attitude modeling (Wilkie & Pessemier, 1973), and choice modeling (Danes & Cattin, 1980). The focus in multi-attribute is to investigate attributes of a brand which can be improved in order to influence consumer behavior in the purchasing process.

Multi-attribute models were developed because traditional economic theories did not explain consumer behavior questions satisfactorily (Lancaster, 1966). An example of a question is why some prefer Coke and others Pepsi. Multi-attributes models seeks to explain how a customer are attracted by the characteristics of the brand, not by the brand itself (Nelson, 1999). The characteristics are called attributes, and are relevant physical and psychological factors inherent in the brand. Consumer behavior eventually depends on the attributes of the brand. The multi attribute models focuses mainly on the attributes that make a difference in the decision making. These are referred to as *determinant*, *salient* or *important* (Mittal, Katrichis, Forkin, & Konkel, 1994). These three models differ in how they deal implicitly with the fact that it is costly for the consumer to collect and process information about brands. They attempt to explain decision making process based on different kinds of relations between attributes, information and attitude (Nelson, 1999).

The simplest type of model refers to an attitude that is formed on the ground of reasonable heuristics or "rule of thumb", and is associated with low-cost/effort, ordinary purchase decisions (Nelson, 1999). Many of these rules can be interpreted as a variant of Simon's (1959) idea of satisfactory. These rules are often associated with low-involvement purchase situations. The nature of the ordinary purchase simply does not justify the time and effort of

comparing all attributes for every possible option available. Typically the price and quantity is considered, without taking into account details such as a brand and product characteristics.

Non-compensatory preference and choice models constitute the second set of multi-attribute models (Nelson, 1999). It proposes that a customer may favor a particular attribute, with no possible tradeoff between sets of attributes. Whether the attribute is satisfactory or non-satisfactory, it will not be compensated. Two common examples are conjunctive and priority based models, both in which the customer sets a cutoff level for each attribute. Conjunctive models indicate that consumers use a predefined checklist of attributes with a certain acceptance level. If a product fails to meet the desired requirement, it will not be purchased. A consumer with a priority based model will range attributes in a priority list from top to bottom. Products that do not meet the top priority will be instantly dismissed. Remaining products will be dismissed as the customer moves down the priority list, eventually leaving one product left to purchase (Tversky, 1972). Non-compensatory utilize a simple evaluation process were limited brand information is required. Shugan (1980) argues that the model is economically rational as expected benefit versus cost allows the consumer to ignore certain available information, hence making the cost of collection and processing information optimal.

The third and final model is a multi-attribute utility model that suggests attributes are compensatory. This allows attributes to be traded off with other attributes. For a tradeoff to take place, it is necessary with an extensive information gathering and processing. Since information gathering is costly the consumer, they must perform a *tradeoff* between the amount and quality of the information to collect about each brand, *and* the number of brands to collect information about (Nelson, 1999). It is assumed that the customer prefer to have in depth information about a few brands, rather than superficial information about many. Consumers tend to limit the number of brands to analyze and choose from, instead of analyzing all brands. In multi attribute utility modeling a *linear* or *parts worth* is generally used. The difference in these models is on how consumers assess the weight of the attributes (Nelson, 1999)..

Understanding how consumer evaluates attributes and how these affect consumer behavior is considered highly relevant in product development. This knowledge is further valuable in strategic marketing efforts for the product. To increase the usefulness of the attitude construct,

marketers have to develop a clear understanding of the causal determinants of attitude formation and change (Lutz & Bettman, 1977; Olson & Mitchell, 1975). A better understanding of the consumer behavior will help to guide company decisions, and help managers to develop a more effective brand strategy.

### 3.1.2 Technology Acceptance Model (TAM)

The Technology acceptance model is a theoretical model that describes how users come to accept the use of technology (Davis, 1989). The TAM was developed by Davis (1986) and is a model that is often used in information system (IS) research, and has become one of the most used models for studying individual intentions to adopt technology (Shin, 2009). Several researchers have replicated the original study to provide empirical evidence on the existing relationships between usefulness, ease of use and system use (Adams, Nelson, & Todd, 1992; Hendrickson, Massey, & Cronan, 1993; Subramanian, 1994). The model assumes that perceived usefulness and perceived ease of use, with the influence of pre-existing external variables, are the primary determinants for adoption of a new technology (Lu, Yu, Liu, & Yao, 2003).

The TAM is one of the most influential extensions of the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which is a theory applied to predict and explain volitional behavior. Volitional behavior is any behavior that takes place during a conscious decision process, where the person voluntarily makes a choice. The theory suggests that behavioral intention is the best predictor for behavioral engagement (Hale, Householder, & Greene, 2002). In the construct of the TRA there are three general constructs: *Behavioral intention*, *attitude* and *subjective norm* ( $BI = A + SN$ ) (Fishbein & Ajzen, 1975).

Behavioral (BI) intention measures a person's relative strength of intention to perform a behavior. Attitude (A) is a belief about the sum of consequences of performing the behavior multiplied by the person's evaluation of these consequences. Subjective norm (SN) is the combination of perceived expectation from relevant individuals or groups along with intentions to comply with these expectations (Fishbein & Ajzen, 1975). Based on the logic of the TRA, the TAM explores the factors that affect behavioral intention to use information or computer systems. Davis et al. (1989) suggest a causal linkage between the two key variables, perceived usefulness and perceived ease of use (TAM), and users attitude, behavioral intention and actual system adoption and use (TRA).

Perceived usefulness is described as “*the degree to which a person believes that using a particular system would enhance his or her job performance*” (Davis, 1989, p. 320), while perceived ease of use refers to “*the degree to which a person believes that using a particular system would be free of effort*” (Davis, 1989, p. 320)

As figure 3 illustrates, the TAM is a path model that identifies the impact of external factors on perceived usefulness and perceived ease of use. These external factors can be system design-, user- or task characteristics, nature of the development or implementation process, political influence, organizational structure, and so on (Ajzen & Fishbein, 1980).

**Figure 3: The Technology Acceptance Model (TAM) as illustrated by Davis (1989)**

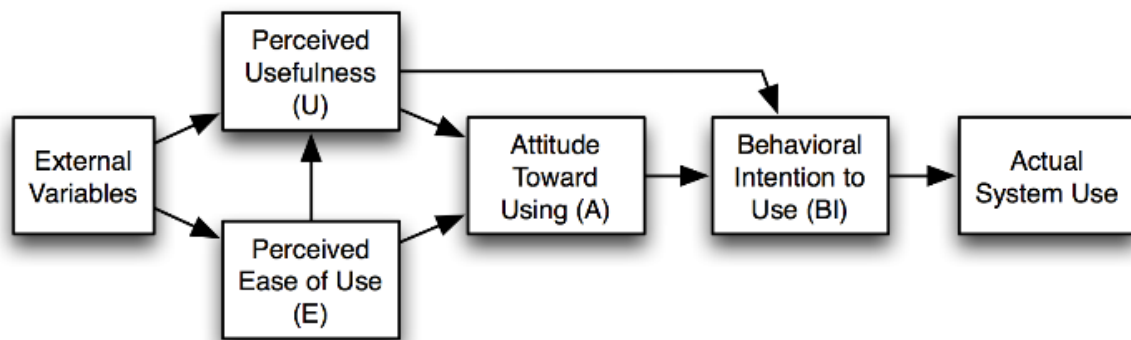
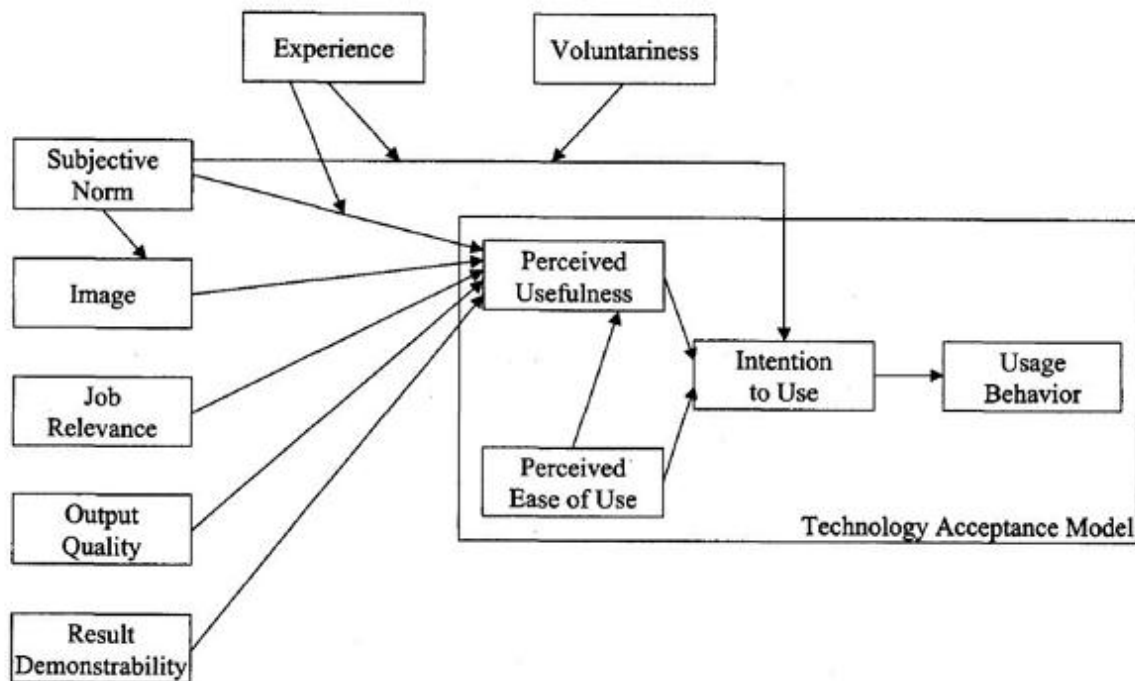


Figure 3 shows that perceived ease of use has a direct effect on perceived usefulness and both determine the consumer’s attitude towards use. This will again lead to behavioral intention to use the system and finally to actual use the system.

Previous research has demonstrated the validity of the TAM across a wide range of IT (Shin, 2009). There has also been made progress in order to improve the TAM by implementing various other motivational factors. This has led to a revised model of TAM, like TAM 2, (Venkatesh, 2000; Venkatesh & Davis, 2000), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), TAMMS (Kaasinen, 2005) and TAM 3 (Venkatesh & Bala, 2008). All which can be considered extensions of the original TAM.

Displayed in figure 4, TAM 2 provides a detailed account of the underlying forces of perceived usefulness by reflecting three interrelated social forces; Subjective Norm, Voluntariness, and image (Venkatesh & Davis, 2000). The model showed that both social influence process and cognitive instrumental process significantly influence user acceptance (Kaasinen, 2005).

**Figure 4: TAM 2 model as illustrated by (Venkatesh & Davis, 2000)**



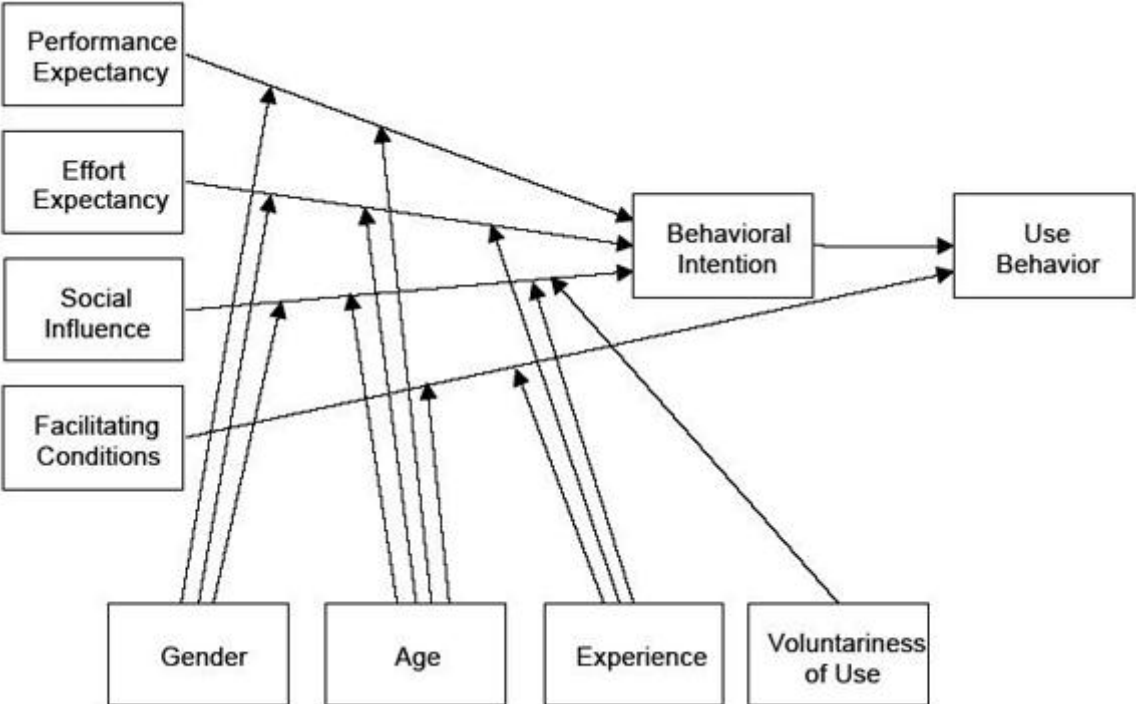
Mathieson et al (2001) extended the TAM by analyzing the influence of perceived user resources. The reason was that many users want to use technology, but was prevented by lack of time, money and expertise and so on. The resource related attributes were classified into four groups; user attributes, support from others, system attributes and control related attributes. This extension modeled these external factors affected the perceived resources, which further affected perceived ease of use and behavioral intent to use (Kaasinen, 2005).

Shin (2009) argues that TAM only has a limited ability to explain mobile services, such as mobile wallet adoption. There are important factors that TAM neglects. For instance the social influence in adoption of new technologies (Malhotra & Galletta, 1999), or that it assumes that there is only one single technology available to the user. Mathieson et al (2001)

further points out that the TAM presumes that there are no barriers to prevent an individual from using a particular system if he or she has chosen to do so. A mobile payment services all of these factors can affect a consumer’s acceptance, in particular social influence and the option to choose from different available technologies. In addition, elements such as trust and perceived security are believed to be of immense importance. The UTAUT enables incorporation of all these additional variables in a structured and better combined construct (Shin, 2009; Venkatesh et al., 2003).

Venkatesh et al. (2003) developed UTAUT, which is the Unified Theory of Acceptance and Use of Technology Model, where they combined the original TAM with seven other user acceptance research approaches (Kaasinen, 2005). The UTAUT model focuses on explaining the users’ intention to use information systems and their subsequent usage behavior. The theory states that there are four key constructs: Performance expectancy, effort expectancy, social influence, and facilitating conditions. These are direct determinant of usage intention and behavior. In addition the model proposes moderator effects such as gender, sex, experience, and voluntariness on usage to influence the four key constructs on usage intention and behavior(Venkatesh et al., 2003). The model displayed in the Figure 5 shows how the different factors influence behavioral intention and use behavior.

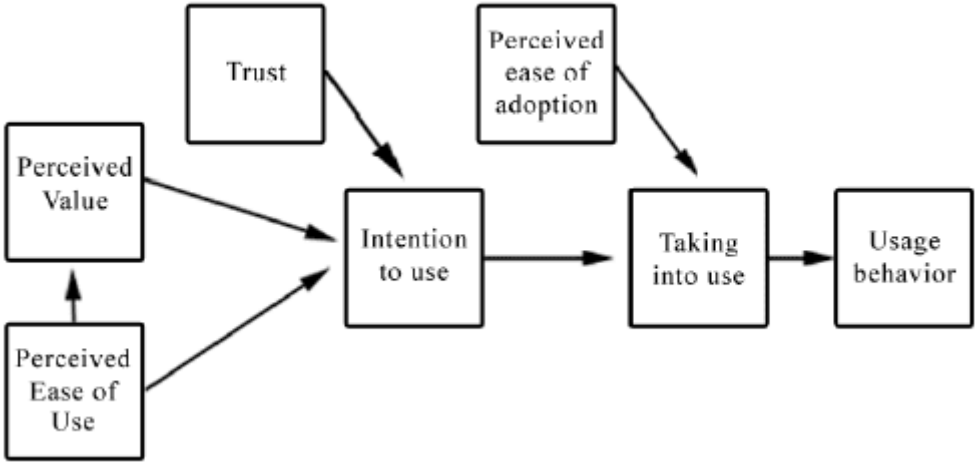
**Figure 5: The UTAUT model as illustrated by (Venkatesh et al., 2003)**



UTAUT related models have been applied in several different research papers relating to consumer acceptance of mobile devices and services. In a study of a handheld internet device, Bruner and Kumar (2005) introduced “perceived risk and cost” in a revised TAM model. Teo and Pok (2003) used a decomposed theory of planned behavior to study adoption of WAP-enabled mobile phones. Carlsson et al. (2006) used the UTAUT to explain the acceptance of mobile devices and services. Wang et al (2006) re-specified the original TAM and validated an integrated model for predicting consumers’ acceptance of mobile payments. This was done by adding a trust related construct called perceived credibility, and two other resource related constructs which was self-efficiency and perceived financial resource. In relation to NFC technology, Chen and Chang (2011) combined the UTAUT with the TAM to investigate user acceptance of NFC mobile phone services. Based on the studies mentioned about, the UTAUT is widely applied in research related to mobile devices and services.

Another relevant TAM extension for NFC based mobile payment is the Technology Acceptance Model for Mobile Services (TAMMS). According to Kaasinen (2005) a mobile service provider should focus on value creation, rather than a wide range of features. As an extension from TAM the model replaces perceived usefulness with *perceived value*. In addition two new perceived product characteristics were implemented; *trust* and *ease of adoption*. The model is displayed in figure 6.

**Figure 5: Technology Acceptance Model for Mobile Services (TAMMS) as illustrated by Kaasinen (2005)**





The TAMMS argues that perceived usefulness may not indicate adequate motivation to acquire the mobile services (Kaasinen, 2005). This is explained by the key attributes of a product, which are appreciated and create user interest, are defined by value. Value not only includes rational utility, but also defines the key features of the product. In particular those appreciated by the users, which are the main reason why the users are interested in the product. When knowing the perceived value of the mobile service a provider can differentiate features by importance, and focus on improving features that add to the user experience.

Perceived ease of use was included in the original TAM, and refers to usability and user experience of the mobile service - equal to the earlier model by Davis (1986). Trust is a new element covers the perceived reliability of the service or technology. Because mobile services are delivered over a complex mobile service network, trust to the provider becomes essential. This relates to stability and reliability of the mobile service delivered by the service provider. This also involves control over personal data.

Perceived ease of adoption relates to taking the service into use. Kaasinen (2005) found barriers in adopting a mobile service by users that were unaware of where to find the mobile service, or unknowing about how to take them into use.

### **3.2 Diffusion and Adaption**

The diffusion process is considered to be the cumulative process where foremost technical innovations are spread and adopted amongst individuals and firms. The diffusion of technology usually appears as a continuous and rather slow process, unlike the invention of a new technology, which often appears to occur as a single event. The diffusion of technology is ultimately determining the pace of economic growth and the rate of change in productivity (Hall & Khan, 2003). One of the most prominent figures related to Diffusion of Innovations (DOI) is Everett Rogers, who popularized the theory when publishing his book Diffusion of innovations in 1962. In his book he defines diffusion with the following word (Rogers, 2010): *“Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system”*

Based on the definition there are four main elements in the diffusion of new ideas; (1) an Innovation, (2) which is Communicated through certain channels, (3) over time, and (4) among the members of a social system (Rogers, 2010).

The innovation is an idea, practice or object perceived as new by an individual or the unit of adoption. Most innovations discussed in Rogers (2010) are technical innovations, which is defined as “... *a design for instrumental action that reduces the uncertainty in the cause-effect relationship involved in achieving a desired outcome*” (Rogers, 2010). Typically these technological innovations consist of two components, one being the hardware and the other being the software.

The communication channel is where the message is sent from one individual to another. Examples of these can be mass media, which are more effective in creating knowledge about innovation, or interpersonal channels, which are more effective in forming and changing the attitude towards a new innovation (Rogers, 2010).

Time is involved in the diffusion process in three ways. First is through the innovation-decision process, a mental process through which an individual passes from first knowledge to forming an attitude about the innovation. Second is innovativeness, which is the degree to which an individual or unit of adoption is relative early in adopting new ideas compared to other members of a social system. In general there are five adopter categories; (1) Innovators, (2) early adopters, (3) early majority, (4) late majority and (5) laggards. Third is the innovation's rate of adoption, which is the relative speed with which an innovation is adopted by members of a social system (Rogers, 2010).

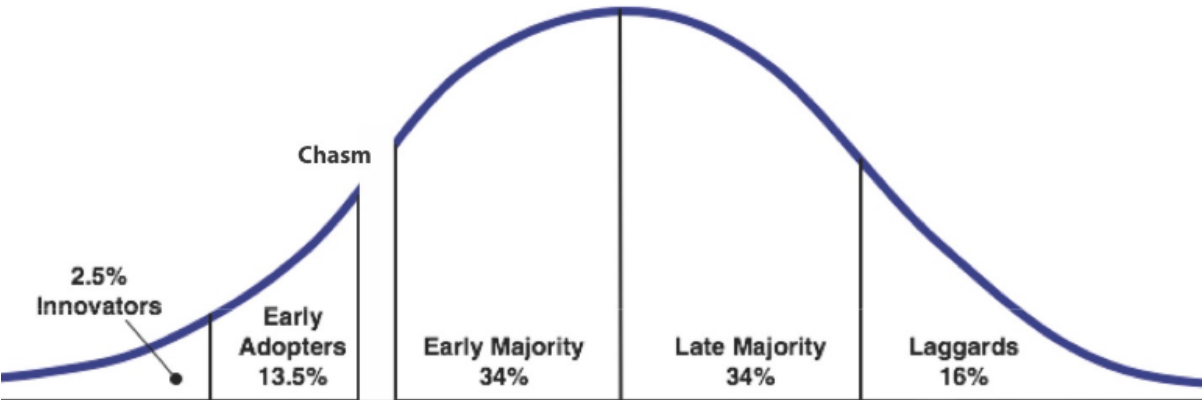
The final element is the social system which is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. It has a system that is defined by the patterned arrangements of the units in a system, which gives stability and regularity to individual behavior in a system. The social and communication structure of a system facilitates the diffusion of innovations in the system. (Rogers, 2010)

Even if diffusion and adoption are very closely related, there are some important differences that separate the diffusion from adaptation. The adoption process deals with a series of stages that the individual undergoes from first hearing about a product to finally adopting it. The diffusion process on the other hand signifies a group of phenomena which suggest how an innovation spreads among individuals (or unit of measure). In essence, this means that the diffusion process overlooks the adoption process of several individuals over time.

As briefly mentioned earlier, Rogers (2010) have developed a standardization model for categorizing different types of adaptors. The adoption of an innovation normally starts off with a few individuals in the first time period, namely the group categorized as Innovator. As more and more innovators take part and adapts the innovation, it eventually creates a growing curve. After a while the curve starts to level off with fewer of the remaining population who have not yet adopted the innovation, and by that creating the S-shapes rate of adoption. Finally it reaches its asymptote, and the diffusion process if finished (Rogers, 2010).

Many researchers have shown how most innovations can be plotted into an S-shaped cumulative adoption curve. The S- slope can vary a lot from innovation to innovation. Some innovations can have a rapid adoption that creates a steep s-curve while other might have a slower adoption rate giving a more gradual curve (Hall & Khan, 2003). Rogers took this notion a step further by developing a lifecycle for adoption of innovations, which can be illustrated as a normal distribution or a “bell curve”. In this model he defined the five different adoption groups; Innovators, Early Adaptors, Early Majority, Late Majority and Laggards, displayed in figure (X)

**Figure 7: The lifecycle for adoption of innovations as illustrated by Rogers (2010)**



The innovativeness is the pillar that is used to define each adapter category. The different adopter categories are ideal types, in which are conceptualizations based on observations from reality, and further designed to make comparisons possible. In that sense it can be used as a framework for the synthesis of research findings. This means that there are no actual breaks in the innovativeness continuum between each of the categories.

The adoption curve is normally measured by the length of time required, for a certain percentage of the members of a system to adopt the innovation. This means that the adoption rate is actually measuring an innovation or a system, rather than individuals (as the unit of analysis). The innovations that are perceived as possessing a greater relative advantage, compatibility and the like, tends to have a more rapid rate of adoption. However, there are also other factors that influence the adoption, such as demographics and psychological characteristics of the group. This means that there can also be a difference in the rate of adoption for the same innovation, but in a different social system (Rogers, 2010).

“The innovators” are often seen as venturesome, and almost obsessed with new ideas and innovations. In which also means that they have to cope with the high degree of uncertainty and risk related to the new innovation. In essence one can say that the innovator serves as gatekeeper in the flow of new ideas into a social system. “Early Adaptors” are normally a more integrated part of the local social system. They are respectable and often have the largest number of opinion leaders compared to other categories. The early adapters adopt innovations based on the experience of the innovators. They further influence and give advice to other potential adaptors of the innovation. In that sense their role is to decrease uncertainty about a new idea by adopting them (Rogers, 2010).

“The Early Majority” may deliberate for some time before they completely adopt a new idea, but adopts the new ideas just before the average member of a social system. This point is also considered the “tipping point” in which was popularized by Gladwell (2006), where rate of adoption rapidly increases as a critical mass is reached. At this point the innovations further adoption rate is considered self-sustainable. There is a variety of suggestions on which point a critical mass is reached, normally ranging somewhere in between an adoption rate of 10-20% (Rogers, 2010; Valente, 1995) .

“The Late Majority” is considered to be the skeptical adopters, were adoption often is related to economic necessity and the answer to an increasing network pressure. Even if the utility of the new idea is clear, pressure from peers in generally needed to motivate adoption, as well as all uncertainty have to be removed the late majority feels that it is safe to adopt (Rogers, 2010).

The last in a social system to adopt a new idea is the “Laggards”. They are considered relatively traditional and possess almost no opinion leadership. Decisions are often made based on experience from previous generations and these individuals interact primarily with others within the same category. Their traditional orientation practically slows adaptation down to a crawl, and it may already have been superseded by another new idea (Rogers, 2010)

According to Rogers (2010) the critical mass occurs at the time when enough individuals in a system have adopted the innovation, so that the innovation itself becomes self-sustainable. The critical mass is especially important in the diffusion of interactive where additional adopters increase the utility of adopting the innovation for all adopters (Kaasinen, 2005). A typical example is the use of email service. Another example can be the NFC mobile payment. When more adopters use NFC mobile, the value of accepting NFC mobile payment increases for the merchant.

Moore (2002) build further on the bell shaped diffusion curve, by addressing the “cracks in the bell curve”. His research shows that even if an innovation survives the innovator or early adaptor stage might fail in the early majority or late majority stage, if the innovation lacks the characteristics that appeal to these groups. For an innovation to succeed in the mass market, the gap between early majority and late majority need to be bridged. The gap referred to as “the chasm”, and it represent the different needs between the groups. In Figure 7 “The chasm” is illustrated as a gap.

According to Norman (1998) all new technologies take a long time to affect the lives of ordinary people. Especially when it comes to disruptive technologies, the adoption takes a long time since it often involves a complicated process. Norman considers disruptive technologies as not just incremental changes to current technology, but technologies that cause revolutionary change in people’s lives. A disruptive technology can change the entire course of an industry, by creating new companies and killing of existing ones. Normally, these new technology approaches start small, simple and weak. This is typically when they are adopted at the stages which Rogers defines as “innovators” or “early adopters”. The technology has to bridge the chasm in order to succeed in reaching the mass market (G. A. Moore, 2002; Norman, 1999). To cross the chasm is not an easy step. According to Norman, the whole products have to be different. That is because both early majority and late majority

value new solutions and convenience. This means that a new finish or fine-tune of the product or marketing is not sufficient. In order to cross the chasm, Norman suggested that a whole new product development process has to be carried (Norman, 1999). When developing new technology, Kaasinen (2005) underlines the importance of considering the point made by Norman (1999) that a totally new product is necessary for the early majority to adopt.

In the diffusion of innovation theory, the speed of adoption depends on several variables. Typical socioeconomic and demographic factors are characteristics that influence adaptor groups. In addition, the environmental contexts like the ease of access, economic development, geography and culture also influence the adoption of a new technology (Hall & Khan, 2003; Wejnert, 2002). There are various ways the diffusion process can be affected. Mass media are one example of a factor, which has considerable importance in earlier stages of the diffusion process. In later stages, word of mouth can be considered a valuable source of influence (Hornik, 2004; Rogers, 2010). In terms of characteristics of the innovation itself, Rogers (2010) states five attributes for innovations as perceived by the members in a social group for determining the rate of adoption. These are *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*.

*Relative advantage* relates to the degree an innovation can be perceived better than the idea it supersedes. *Compatibility* is whether the innovation is consistent with the existing values, past experiences and need of potential adopters of the innovation. *Complexity* is the degree of which the innovation can be perceived difficult to use. *Trialability* and *observability* refer to the degree which an innovation may be experimented with on a limited basis, and that the results of an innovation are visible to others. Individuals will adopt innovations faster than other innovations, when they are perceived to have *greater* relative advantage, compatibility, trialability and *less* complexity (Rogers, 2010). Other research has consistently found compatibility, complexity and relative advantage as the most influential characteristics for continuous use and the adoption of innovations (Bradford & Florin, 2003; G. C. Moore & Benbasat, 1996). Several researchers have used the diffusion of innovation theory combined with the technology acceptance model (TAM), for a more complete and better understanding of user adoption. In particular, the unified theory of acceptance and use of technology (UTAUT), one of the extensions of TAM, has implemented elements from the diffusion of innovation theory (Au & Kauffman, 2008; Kaasinen, 2005; Shin, 2009; Venkatesh et al., 2003).

### 3.3 Network externalities.

The theory of network externalities has often been used to explain value creation in a network economy (Economides, 1996; Shapiro, 1998; Varian & Shapiro, 1999). Network externalities exist when the utility derived from the use of a product, increases with the number of people using the product (Farrell & Saloner, 1985). Katz and Shapiro (1985) define network externalities as “*the value or effect that users obtain from a product or service will bring about more values to consumers with the increase of users, complementary product, or service.*”

It reflects the customers increased willingness to obtain a good as the number of users’ increases, due to the increase of external benefits as a result of a growing network.

Economides (1996) suggests that the key reason for the appearance of network externalities is complimentary between the components of a network. This is also supported by Farrell & Saloner (1985) who suggests that consumer’s value for a good can increase when another consumer has a compatible good . Katz and Shapiro (1985) developed an oligopoly model which they used to describe how consumers value a product more highly when it is compatible with another consumer product. A typical example is the mobile phone. The value of a mobile phone increases as more people adopt mobile phones, generating a relative benefit, providing subsequent users increased opportunity on whom to call. In addition, it attracts third party businesses to join, which in turn will bring in more users. This will allow third party users to make mobile phones even more convenient and easy to use.

Economides (1996) uses another visual example of network externalities, which can be seen in the financial markets. An increase in the amount of trades in an exchange market will increase the expected utility of all participants. The more participating traders on both sides of the market will reduce the market price variance, and by that increase the expected utility of risk-averse traders (Economides, 1996). Similarly, the utility derived from the use of a particular electronic payment instrument depends on how many consumers are using the same instrument (Kauffman & Wang, 2002). The more consumers that use the same instrument, the more merchants will accept the instrument – and vice versa. This increases the utility for consumers since the payment instrument becomes more practical.

Authors in the area of network externalities often distinguish between *direct network* benefits and *indirect network* benefits. Direct effects exist when adoption by different users is complementary by increasing payoff and incentives to adopt, as others adopt the good. It

relates to the increased benefit for users, due to the demand side of the network (Lin & Lu, 2011). An indirect network effect arises through improved opportunities in the trade with the other side of a market, eventually creating a more efficient market for the good. A buyer likes when a product attracts more sellers, making the good more available, eventually forcing sellers to lower prices. A seller also prefers increased customer demand for the product, hence increasing the value of being able to sell the good. Loss in profit per product is outweighed by an increase in total sales (Farrell & Klemperer, 2007).

There are several evidences of network externalities in different industries today. In Norway, the network of ATM machines and payment terminals provide a good example. Because most payment cards are accepted in ATM machines and at stores, customers experience a greater value in payment card. Kauffman and Wang (2002) found that banks who shared ATM networks led to a beneficial impact for the growth of the banks individual networks. The value of the shared electronic banking network will increase as the network grows, providing benefit for both the banks and its cardholders.

Varian and Shapiro (1999) point out that the key ingredients for network externalities are standards and compatibility. They suggest that standards enhance compatibility, also known as interoperability. Tirole (1988) argues that one advantage of standardization is that it avoid excess inertia, which occurs when users wait to adopt a new technology or to choose among several technologies. Standardization will also reduce the users' search and coordination costs. Katz & Shapiro (1985) describes that large existing networks dominated by a few entities, with a good reputation, tend to be against compatibility, even though the value and utility of the network objectively would increase. Shapiro & Varian (1999) argues that setting a standard normally requires different players to unite in an alliance. A dominant stakeholder like a large company or government can play a large role in steering an industry towards a common standard.

In NFC mobile payment standardization and compatibility can help the network grow larger and increase network externalities, hence creating value for the users. This demands cooperation across several industries, which might be a challenging task. Mobile payment is a typical example of how network externalities play an important role for the success of the service. Goldenberg et al (2010) points at the number of adopters' drives the utility directly, because increased numbers of consumer adopters' increases utility of the mobile payment



service. As consumer adoption picks up, merchant adaptors will soon follow by accepting mobile payment at their stores, hence enhancing the utility even further.

### 3.4 Switching costs

The theory of switching cost describes how the buyer reacts to the cost of switching to a different competitor or product. It arises when a buyer finds it expensive or too much of an effort to switch to another product or supplier when it has already bought a product or bought from a supplier (Au & Kauffman, 2008; Porter, 2008). Burnham et al (2003) defines switching cost as;

*“the onetime cost that consumers associates with the process of switching from one provider to another”* (Burnham et al., 2003, p. 110).

The switching cost must be associated with the switching process, but it does not have to arise immediately upon the switch. The cost itself is not exclusively tied to financial cost or other measurable costs (Burnham et al., 2003; Morgan & Hunt, 1994). According to Klemperer (1987), ex ante homogeneous products may, after purchase of one of them, be post differentiated by switching cost. He further describes that there are three types of switching cost; *Continuity cost, learning costs and sunk costs*.

Continuity cost includes the extent and likelihood of lost performance benefits and perquisites secured with continues patronage with a provider. Learning cost involves time and effort expended on information gathering, exchange and evaluation. Sunk cost involved the irrelevancy, but psychological importance of prior investments in the exchange of a relationship (Jones, Mothersbaugh, & Beatty, 2002).

Klemperer (1987) underlines the important role of switching cost in economics. If two identical suppliers offer the same goods or services, traditional market theory states that the supplier with the lowest price will be chosen. However, switching cost theory helps to undermine this basic principle, by stating that there might be other cost involved in the decision making than just the price of the product itself. These can be seen as switching cost or switching barriers. When a customer states that “it is simply not worth it” to switch provider, it may be because the customer has a switching barrier built up. The barrier can be related to *“search costs, transactions costs, learning costs, loyal customer discounts, customer habit, emotional cost and cognitive effort, coupled with financial, social and*

*psychological risk on the part of the buyer*” . The factors that influences can vary in accordance to product, business and customers.

If switching costs exist when choosing between functional identical products, a rational consumer usually stays loyal to a known brand name. This occurs because switching cost provides the consumer with a strong incentive to continue to buy from the same firm.

Switching cost can further lead to network effects, which again can lead to a lock-in of adapters and users. The more consumers that buy the product, the more likely it will be to survive and attract other consumers. According to Molina-Castillo et al (2011) empirical studies prove that the presence of network externalities can be more important than quality. They prove that indirect network externalities plays a major role in creating switching cost in the short term, while direct network externalities play a larger role in the long term.

If we exclude the possibility of price differentiation on a product or service, Beggs (1989) argues that for a consumer to experience a credible incentive (experience a switching cost), would be easier achieved by a larger firm, which may wish to preserve its reputation in other markets, than for a small specialized one, which may simply plead for bankruptcy.

For companies to manage the switching costs effectively, they must distinguish and understand the various types of cost that consumers perceive. However, there are lack in consistency and clarity regarding the appropriate conceptualization and measurement of switching costs. No good switching cost frameworks or measurements exist that have been proved empirically. This creates challenges for researchers and practitioners (e.g. Porter 2008, Jackson 1985, Klemperer 1995). Fornell (1992) stated; “*a direct measure of switching cost is difficult to obtain*” as “*all cost associated with deserting one supplier in favor of another constitute switching barriers*”(Fornell, 1992, p. 11)

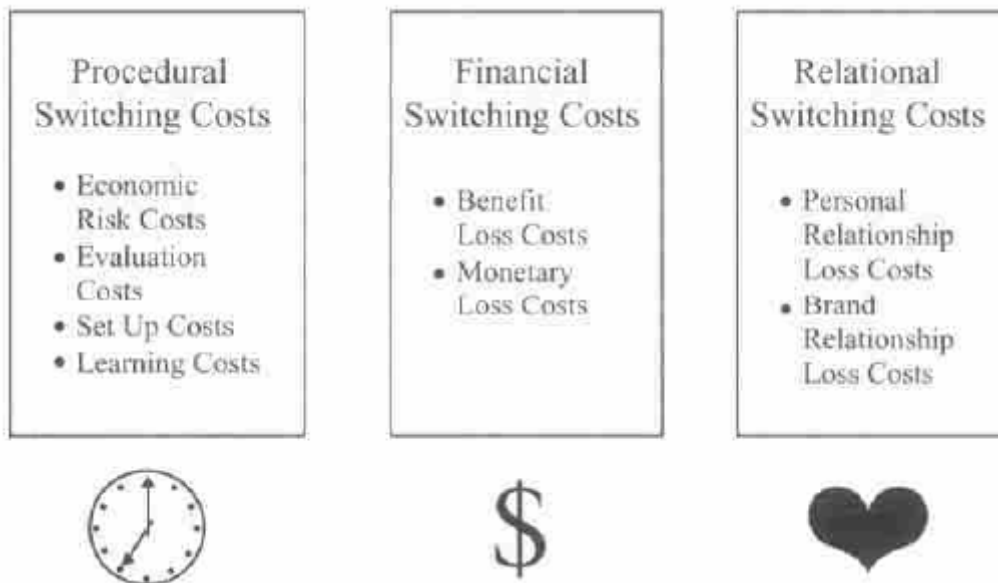
Gourville (2003) lists several rules of thumb to help understand why many consumers do not immediately switch from a product they currently use to the latest innovative improved product, even if the cost difference is minimal. First of all, people are sensitive to the relative advantages and disadvantages of any change from the status quo. This means that a new improved product must be significantly better than what the consumer is currently using before a switch takes place. Second, different people have different preferences. This will affect how they see a possible switch of products or service. Thirdly, people exhibit loss aversion. This means people experience the pain of a giving up a benefit to supersede the

pleasure of gaining a new benefit.

The switching cost typology proposed by Klemperer (1987) has been extended in several well-renowned studies. In a study by Jones et al (2002), two service industries were compared, whereas one was of the banking industry, they found support for six dimensions of switching cost. These are extensions of the broadly grouped continuity cost, learning cost, and sunk cost, and are defined as; lost performance cost, uncertainty cost, pre-switching search and evaluation cost, post-switching behavioral and cognitive costs, setup cost and sunk cost.

Burnham et al (2003) redefines Klemperer's original typology of switching cost by defining "three higher order switching costs types"; *procedural*, *financial* and *relational*.

**Figure 8: A typology of consumer perception of switching costs as illustrated by Burnham et al. (2003, p. 112)**



As seen in figure 8 Procedural switching cost primarily involving loss of time and effort. It relates to economic risk cost, evaluation cost, set up costs and learning cost. Financial switching is loss of financial quantifiable resources and involves benefit loss cost and monetary loss costs. Relational switching costs involving psychological or emotional discomfort due to loss of identity and the breaking of bonds. It involves personal relationship and brand relationship loss cost (Burnham et al., 2003).

It is evident that switching cost can be present in various forms. The typology provided by Burnham (2003) should give a good foundation for conceptualizing the nature of switching cost, also in relation to NFC based mobile payments. It incorporates most types of switching cost identified in the literature.

### 3.5 Complimentary goods

The theory of complementary goods describes that an increase in demand for one leads to increase in demand for the other, and vice versa (Au & Kauffman, 2008; Viard & Economides, 2006). This gives a complementary good a negative cross elasticity of demand, in contrast to substitute goods, where the demand for one good drops if the price of another good reduces (Sullivan & Sheffrin, 2003, p. 88). Complementary goods and substitute goods are often seen opposites. For instance, when measuring complementary, Samuelson (1974) implicitly uses the notion that all goods are either complementary or substitutes.

A perfect complement is a good that has to be consumed with another good. There are not many perfect complementary goods, but shoes provide a good example. Normally they are sold in pair, one left and one right. For every left shoe sold, a right shoe will normally be sold. The more complementary goods created for a product, the more people will buy the product (Viard & Economides, 2006).

Samuelson (1974) states that a good is complementary when;

*“the marginal utility of an extra unit of each should be greater than the sum of the marginal utility of an extra unit of either.”*

In other words the marginal utility of the consumption of either good will increase in the consumption of the other good, because demand for one good generates demand for the other.

Complementary goods are closely related to switching cost and network externalities mentioned earlier in this paper. It is often considered a strategic marketing tactic to have complementary goods in the company's goods portfolio, because it helps to build up the switching cost for the buyer. A typical example of complementary goods is gaming consoles like PlayStation or Nintendo, which both have games that only work on their own gaming console. To increase the market share for gaming consoles, the producer lowers the price of the gaming console, which again increases the demand for compatible games. This indicates

that the goods are complementary. Based on the theory of switching cost, any buyer who has either one of the gaming console will be reluctant to change console due to his or her previous investments in games compatible with the existing console. Because of the joint consumption characteristics there is often quality interdependence among the goods produces. This means that the utility consumers derive for a product depends not only on that product, but also on the product of the complementary good (Yalcin, Ofek, Koenigsberg, & Biyalogorsky, 2012).

Economides (2005) evidently shows that the greater number of complementary goods created for a product, the more people will want to buy the product. However, when it comes to new technical achievements, complementarities often means compatibility standard. Chakravorti (2003) and Calem et al (2006) found evidence of complementarities to work favorable between components in the credit card system. Today most credit cards are based on the same smart card technology. Due to system computability standards, some credit card can only be used on certain terminals. As consumers carry these credit cards, merchants are encouraged to have compatible credit card readers, hence increasing value for both consumers and merchants. This is a similar effect as to that of network externalities, where widespread of infrastructure is likely to increase adoption of a product. McAndrews (1997) found that as more consumers carry credit cards more merchants are encouraged to add credit card readers. In return, more customers will carry a credit card as they will perceive more value associated with a credit card.

The theory of complementary good might be present in NFC mobile payment. For instance the widespread of contactless payment cards and contactless payment terminals can increase the value of NFC based mobile payment services. Understanding the role of NFC mobile payment in lights of complementary good can visualize how the new technology creates value across the NFC ecosystem.

### **3.6 Business Ecosystem**

A business is a dynamic structure consisting of an interconnected population of organizations where both competition and cooperation are simultaneously present (Adner & Kapoor, 2010; Peltoniemi & Vuori, 2004). The term ecosystem is primarily used in the context of a biological ecosystem, where it represents a strong interconnectedness between all involved organisms. It is a natural system where the members have coevolved mutual dependencies that work to their benefit(Iansiti & Levien, 2004; Molles & Cahill, 1999). The concept of

applying biological ecosystems into a business context is a relatively new concept. One of the pioneers in the field is James F. Moore who originated the strategic planning concept of a business ecosystem (Iansiti & Levien, 2004; J. F. Moore, 1996)

Moore (1996) defined business ecosystem as:

*“An economic community supported by a foundation of interacting organizations and individuals—the organisms of the business world. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward with shared visions to align their investments, and to find mutually supportive roles.”*

Moore (1993) explains that the business ecosystem can be divided into four different stages; *The birth stage* - Where the business ecosystem needs to show signs of giving the customer more than just satisfying the customers need.

*The expansion stage* – The potential of scale-up of the business concept is being tested.

*The leadership stage* – The business ecosystem reaches stability and high profitability.

*The self-renewal or death stage* – Where renewal or improvements of the business ecosystem takes place in order to counter a threat from rising new ecosystems. (J. F. Moore, 1993, p. 76)

Moore (1996) uses the ecological ecosystem as a metaphor when explaining the business ecosystem, but underlines that there are some important differences. Animals have a choice when choosing their habitats, mates and behavior, but in the economical world policy makers, investors, and managers spend a lot of time understanding and considering the possible outcomes of different choices. Similarly, Iansiti and Levien (2004) point out three key differences between a natural and a business ecosystem. Firstly, the business ecosystem actors are intelligent and able to plan and foresee the future. Second, the business ecosystem competes over possible members. Third, business ecosystems are focused on delivering innovations, while the natural ecosystem is purely focused on survival (Iansiti & Levien,

2004).

Moore (2006) points out that in a business ecosystem a firm is embedded in a business environment that needs to coevolve with other companies by being proactive in the development of mutually beneficial relationships with both customers', suppliers, and even competitors in a modern market. Ecosystems are increasingly central to modern business, as innovations rarely stands alone, but depends on accompanying changes in the environment of a firm. New products and innovations often depend on different contributors from different industries. Few, if any firms have all the capabilities and resources necessary for managing a whole business ecosystem (Adner & Kapoor, 2010) (Moore, 2006). A company who takes a part in an ecosystem should understand their role in the ecosystem, as well as to how the ecosystem works. Despite the fact that ecosystem are easy to create, they are often poorly understood and even more frequently badly managed (Iansiti & Levien, 2004).

According to Iansiti and Levien (2004), a business ecosystem includes fragmentation, interconnectedness, cooperation and competition. They were influenced by Moore's analog on the business ecosystem, to help explain and understand certain issues.

*"We found that perhaps more than any other type of network, a biological ecosystem provides a powerful analogy for understanding a business network. Like business networks, biological ecosystems are characterized by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival. Like business network participants, biological species in ecosystems share their fate with each other. If the ecosystem is healthy, individual species thrive. If the ecosystem is unhealthy, individual species suffer deeply. And as with business ecosystems, reversals in overall ecosystem health can happen very quickly."* (Iansiti & Levien, 2004, p. 8)

Iansiti & Levien (2004, p. 40) argue that; "because the health of individual firms and the utility of individual products in such highly interconnected networks, depend so much on the health of other firms and products in the network, it is especially important to develop ways to characterize the collective health of the entire business ecosystems and to understand the ways in which firms can influence and respond to this collective health."

For a business ecosystem to succeed, Iansiti and Levien (2004) points at three critical success factors. The first is *productivity*, a very basic necessity in any kind of business. The second is

*a robust ecosystem*, which means to have survival capabilities when faced with difficulties that threaten to destroy the ecosystem, whether it comes from inside or outside of the system. In business this means developing a competitive advantage and the ability to transform alongside with a changing environment. The final factor is that the business ecosystem is able to *create niches and opportunities for new firms*. This however requires a shift in attitude from protectionism to becoming more cooperative (Peltoniemi & Vuori, 2004).

There are different actors in a business ecosystem can be categorized after what role they play in the network. Iansiti and Levien (2004) points out three roles of particular significance in a business ecosystem; ***Keystone, Dominator, Niche players***.

Keystone organizations play a fundamental role in a healthy ecosystem by providing the needed robustness of the system. They have a general low physical presence, but serve as enablers with great impact on the whole system. They are focused on creating platforms and sharing solutions to problems throughout the network, meaning they create value and share value for the greater welfare of the community. Without any of the keystone organizations, the whole ecosystem would eventually collapse. The individual members of the ecosystem may change, but the system as a whole, along with keystones, will persist. This underlines the importance of these companies, which can be everything from an individual company to several different companies, depending on the actual business ecosystem. *“Because they have the ability to persist over significant turnover in an ecosystem, and because diversity and responsiveness to change preserves the ecosystem against encroachment, keystones improve the chances of survival by either directly or indirectly encouraging change”*(Iansiti & Levien, 2004, p. 81). Keystone organizations may also displace or hold in check other organizations that would otherwise dominate the system (Iansiti & Levien, 2004).

Dominators are easily recognized with a high physical presence. They focus is on control and ownership or defining, owning and directing most of what the network does. They are easily distinguished form keystones due to obvious metrics of physical size and abundance. Dominators work to eliminate other functions or organizations in the ecosystem by integrating both vertically and horizontally in order to manage and control large parts of the network. This might in fact harm the diversity and at the same time be harmful to the greater good in the ecosystem, and might lead to an unstable ecosystem that is vulnerable to disruption (Iansiti & Levien, 2004).



Niche players develop specialized capabilities that differentiate themselves from other companies in the network. They have a very low physical presence individually, but collectively constitute the bulk of ecosystems where they are allowed to thrive. Their role is to function in the shadow of the keystone organizations that tie the niches together, and at the same time be of critical importance for the shaping of the ecosystem. Niches often have to adapt to factors beyond their control, due to their dependency on the keystone organizations. And they sometimes have to react to what are sometimes highly idiosyncratic moves from a keystone organization (Iansiti & Levien, 2004).

Research has shown that the dynamics of business networks have important operational implications for business practitioners. By identifying an organization's position within the ecosystem, whether it is being a niche player, keystone or dominator, the organization can pursue strategies appropriate to their role. This will enable companies to set more realistic expectations for both themselves and their investors. A business ecosystem should benefit from the health, productivity and innovation achieved collectively, and is further hurt by their fragility and stagnation. This generally implies that a central firm should pursue a strategy that fosters broad ecosystem health and stay away from any dominating behavior (Iansiti & Levien, 2004).

Moore (1996) raised an interesting issue concerning business ecosystems, regarding how actors tend to have different images and understandings of the ecosystem, which creates shattered visions. An involved organization can undermine the greater good of the ecosystem, in pursuit of its own interests and visions, due to the inherent competition, both within and outside of the ecosystem. Such behavior is a constant threat to the co-evolution and the shared vision of the business ecosystem as a whole (J. F. Moore, 1996). This underlines the important role of the manager; to think carefully about their role in the business ecosystem, and focus on fostering a practice that promotes a keystone behavior. This means that they should monitor the health of the ecosystem, promote reasonable business models and relationships, and invest in platforms, technology components, and tools that enable third-party productivity, innovation and diversification (Adner, 2006). Adner (2006) further claims that a common mistake managers make is to plan out the full ecosystem right away, and then take actions to position their own organization as best as possible to defend their position. This

limits the co-emergence in the ecosystem over time, and can further cause vulnerability and instability.

Actors involved in the ecosystem often tend to overestimate the potential for value creation within the ecosystem, and by that overestimating the possible profitability. In addition, actors tend to underestimate challenges involved with the ecosystem. If a problem occurs, it is often referred to as someone else's problem, not the individual organization(Adner, 2006).

Operating an ecosystem takes issues of roles and boundaries to a whole new level of complexity. Different activities have to be identified, and a decision has to be taken on whether the activity should be done in the firm, with a partner or in the open market. In addition to define the relationship between incentives and capabilities, the question of ecosystem leadership also has to be settled. In the business ecosystem an organization always can choose between taking a passive or active role in guiding ecosystem development. Obviously, a leader or an active member is much more likely to have a chance to tailor development to favor own strengths. However, being a leader also involves risks. It often involves large resource investments over a long period of time without having any guarantees for achieving the company goal. When taking a passive role, an organization has to choose from whom to follow in the ecosystem, and how aggressively to commit, as well as how to defend the position. (Adner 2006)

A business ecosystem is built explicitly on volunteers, and is constructed to put in place a network of companies in which the contributions all can be coordinated. Companies in a business ecosystem tend to have differing images and understandings of the ecosystem, even in a highly aligned situation. They have profoundly overlapping interests. On the other hand, they constantly struggle over elements of the vision that each deems critical, and on which they have divergent perceived interests (J. F. Moore, 2006). In an evolving ecosystem both factors of the competition over standards and design, the shared perceptions and understanding the vision among ecosystem members, affects the establishment of roles and responsibility in the ecosystem. In order for companies to co-evolve their goods and services they must find ways to align their visions so that research and development investments are mutually supportive, and that capital investments and operating processes are synergistic. Companies have to establish interfaces and protocols for putting together their contributions. Most important, they must have a close dialog with customers, so what is created is what the customer wants and is willing to pay for.(J. F. Moore, 2006)

Customer is the most essential part of the ecosystem and a key element for success in any type of business. The customers are the ones that eventually buy the final product, and are therefore the key element to the existence of the business ecosystem. In order to succeed with new inventions, contrarily to existing product, the business ecosystem tends to demand more of participating stakeholders. “*Successful innovation requires tracking of your partners and potential adopters as closely as you track your own development process*” (Adner, 2006, p. 1). The more intermediaries that must adopt an innovation before the end users can adopt it – the more risk it carries. Getting to the market first, only matters if your partners are ready when you arrive (Adner, 2006).

The theory of business ecosystem provides examples of basic challenges and issues that need to be addressed to achieve a good business ecosystem. These examples are also considered highly relevant for the NFC business ecosystem. The conventional hierarchical firm does not effectively address the breadth and importance of inter-firm relationships. The unaided market is not able to achieve inter-firm coordination sufficiently to justify players aligning their strategies and visions (J. F. Moore, 2006). Companies participating in a cooperating for NFC mobile payment can gain on understand the dynamics of a business ecosystem, due to the complexity of the NFC ecosystem. Cooperation amongst different stakeholders can be seen as essential for the success of NFC based mobile payment (Coskun et al., 2012).

## 4.0 Research Methodology

This chapter will explain the research methodology and choice of methods used for this master thesis. First, an explanation of research design, followed by a description of the data collection method, which aims to help answer the research questions. Following, there will naturally be a discussion about the validity and reliability for the chosen method. I will then go on to explain the data analysis, and how this is conducted, followed by a justification of the methods chosen.

### 4.1 The design

In this master thesis I have used a qualitative approach with an exploratory research design. I have chosen to base the thesis on grounded theory, which is an inductive type of research which is based on observations and data gathered by the researcher. The data gathered will be impressions gathered from in-depth interviews and other on field observations. Before I elaborate on why this method was the choice, I present some general theory on research methodology.

Qualitative research design can be classified in three different categories; exploratory, descriptive and causal. Research design provides the basic directions for carrying out the project. In exploratory design the objective of the research is to explore a problem that has not been clearly identified, in order to get a better understanding of the problem. The researcher often relies on secondary and/or qualitative approaches when there is little information about the problem or research objective. Descriptive method can be used to describe data and characteristics about a population or phenomenon of the study, and is a method that generally precedes exploratory research. Causal research can be used to explore the effect of one variable on another variable.

When conducting a research, a researcher has the option of using qualitative or quantitative research methods. A qualitative method focuses on getting an in-depth understanding of the unique and the particular. It can typically be recognized from the extensive data gathered from a few observations or respondents. The most common way of collecting qualitative data is through observer impressions. (Zikmund, Carr, & Griffin, 2012)

Qualitative research can be defined as.

*“Analyzing and interpreting texts and interviews in order to discover meaningful patterns*

*descriptive of a particular phenomenon”* (Auerbach & Silverstein, 2003, p. 18)

Quantitative research focuses more on systematic empirical investigation of data from a larger population, often retrieved from statistics, mathematical or computational techniques.

Quantitative data is any numerical form, and is often used to provide a fundamental connection between empirical observations and mathematical expression of quantitative relationships. (Given, 2008)

While exploratory design both can be quantitative and qualitative, descriptive and causal design is quantitative. Qualitative data are descriptions of observations that can be made without assigning numbers directly. Quantitative data are measurements where numbers can be directly used to represent the properties of the investigated issue. (Zikmund et al., 2012)

When explanatory research design is used, there are several possible techniques that can be used. In this study an informal, conversational interview was appropriate. No predetermined questions are asked in order to remain as open and flexible as possible towards the interviewee nature and priorities. The point of this procedure is for the interviewer to go with the flow so the interview subject steers the conversation within the boundaries of the study.

#### **4.2 Grounded theory**

Grounded theory was developed by B. Glaser and A. Strauss in 1967, and is a systematic methodology in the social science involving the discovery of theory through the data analysis (Glaser & Strauss, 1967; Martin & Turner, 1986). Grounded theory is one of several options if doing a qualitative research, but opposite to traditional research, which starts with a hypothesis, grounded theory starts with a data collection through a variety of methods. The goal is not to find a “truth”, but to conceptualize what is going on by using empirical data. This eventually will build the foundation for a new theory. During this process of data collection, the data coding, analysis and reformulations should be done simultaneously, so the researcher has the opportunity to move back and forth along the way to readjust the hypothesis to eventually reach a new theory.

Eisenhardt (1989) developed a roadmap to building theories from a case study, based upon the grounded theory. In total the map consists of eight different stages in the research process. Each of the step will we described in short separately below. (Eisenhardt, 1989)

1. Getting started – is where the researcher starts to formulate a research question. The researcher does not need to be too specific at this point, but it is important to find a focus for the study. If not, the researcher might be overwhelmed with the volume of the data. It can also be valuable to have a prior specification of construct, although this is not common in theory building studies. However, it might help the initial design of theory building research, as well as it permits researchers to measure constructs more accurately, giving a firmer empirical grounding. The focus of the research question is to get started, without thinking about specific relationships between variables or theory. In fact, most importantly is that theory building is begun as close as possible to the ideal of no theory under consideration and no hypothesis to test.
2. Selecting Cases – Is an important aspect of building theory from case studies. In traditional hypothesis sampling a random selection can often be used, but when building theory from a case study, random sampling is neither necessary nor even preferable. Instead, theoretical sampling is often used. This is because cases are chosen for theoretical reasons, not statistical. Therefore it makes sense to choose cases where the process of interest is transparently observable, even if this sometimes means in cases of extreme situations or polar types.
3. Crafting Instruments and Protocols – Theory-building researchers typically use multiple data collection methods (Interviews, observations, archival resources etc.), inductive researchers only employ some of these data collection methods. For example, observations can be the only method used in a study. Qualitative data is most common in case study research, but a case study can also involve quantitative data only or a combination of both. To enhance the creativity potential of the case study, multiple investigators can be used. In fact, this can have two advantages for the case study. One is that team members can have complementary insight that enriches the data collection, and second, any convergence of observation from team members enhances confidence in the findings.
4. Entering the field – One of the main features of research to build theory from a case study is the frequent overlap of data analysis with data collection. An important tool in case studies can be field notes, in which whatever impressions and observations can be

noted. The goal in theory building theory is try to understand each case individually, and in as much depth as possible. It is further allowed to alter a data collection if a new data collection opportunity arises or if a new line of thinking emerges during the research, if this gives a better ground for the theory or provides new theoretical insight. However, this flexibility should not be unsystematic, but a controlled opportunism in which the researcher can take advantage of the uniqueness of a specific case to improve the resulting theory.

5. A) Analyzing Within-case Data – Analyzing data is the heart of building theory from case studies, but also the most difficult and least codified part of the process. One key step is within-case analysis, which typically involves detailed case study write-ups for each site. Even if these are often are simply pure description, they are central to the generation of insight (Gersick, 1988; Pettigrew, 1990) for example by helping the researcher to cope with often enormous volume of data. The overall idea is that the researcher becomes familiar with each case as a stand-alone entity. This way the researcher can see the emergence of the unique patterns in each case, before investigators push to generalize patterns across cases. When the researchers are familiar with each case, a cross-case comparison can accelerate.

B) Searching for Cross-Case Patterns – Coupled with within-case analysis is cross-case search for patterns. It involves the search for patterns from one case to another. This can be done due to the reality that people are notoriously poor processors of information. On top of that, the fact that a researcher searches for patterns also involves a danger for a premature or false conclusion as a result of information-processing bias. To counteract this, a researcher has to look at the gathered data in divergent ways. There is a variety of tactics that can use to prevent such wrong impressions of cross case patterns. The idea behind the cross-case searches tactics is to force the investigator to go beyond initial impressions, by being structured and critical to the data.

6. Shaping hypothesis – is done by a systematic comparison of the evidence put forward by the within-case analyses and the cross-site tactics as well as the overall impression, to develop a theory that fits the data. The idea is that the researcher constantly should compare theory and data, to get a close fit in order to build a good theory.

The first step of shaping a hypothesis is the sharpening of construct, which involves

redefining the definition of construct and building evidence that measures the construct in each case. The second step is verifying that the emergent relationships between constructs fit with the evidence in each case. This is a verification process that is similar to traditional hypothesis testing research, with the key difference being that each hypothesis is tested against each case, not for the aggregate case. If there is an emergent relationship, this also enhances confidence in the validity of the relationship. Furthermore, the quantitative data serves particular useful for understanding why or why not emergent relationships hold. When a relationship is supported, the quantitative data often provide a good understanding of the underlying dynamics in the relationship, which is a crucial factor for establishing internal validity. In short, shaping hypothesis in theory building research involves measuring construct and verifying relationships.

7. **Enfolding Literature** – Involves a comparison of emergent concepts, theory, or hypothesis with the existing literature. This is considered an essential feature of the theory building research. The focus is to find similarities, contradictions, and why. A key to this process is to consider and review a broad range of literature. This includes literature conflicting with the emergent theory. Conflicting theory is considered particularly important since it increases the confidence in findings, in addition to force researcher into a more creative and frame breaking mode of thinking. This actually represents an opportunity for the researcher to get at deeper insight into the emergent theory and the conflicting literature, as well as sharpening the limits to generalizability of the focal research. Literature discussing similar findings also represents crucial importance as it ties together underlying similarities in phenomena normally not associated with each other. It is particularly important since theory building research often rests on a limited number of cases. Therefore it can result in a theory with a stronger internal validity, wider generalizability, and higher conceptual level.
8. **Reaching closure** – There are two issues that are important in reaching closure in the theory building research. That is when to stop adding cases, and when to stop iterating between theory and data. Ideally, researcher should stop adding cases when theoretical saturation is reached (when incremental learning is at minimal because the researcher has previously observed the phenomenon) (Glazer and Strauss, 1967). In practice, time constraints and money are often a reason why the research stops. There is further



no ideal number of cases that should be studied, but anything between 4 to 10 cases often works well. When it comes to the iteration process, it should equally stop when the incremental improvements to theory is minimal. The final product of building theories from case studies may be concepts, a conceptual framework, or propositions or possibly midrange theory. On the other hand, another scenario can be disappointing one, only to replicate prior theory, and maybe with no clear pattern within the data.

The process of creating a theory through grounded theory is strikingly iterative, and intimately tied to empirical evidence. Though the researcher might focus on one part at the time, the process itself involves a constant state of back and forward between different steps. In a sense, this means an “alive” environment with tension between divergence into new ways of understanding the data and convergence onto a single theoretical framework. This requires the researcher to view the evidence from a diverse perspective, but also in a process that involves converging on construct definitions, measures, and a framework for structuring the findings. (Kathleen Eisenhardt)

Kathleen Eisenhardt (1989) mentions some strengths and weaknesses with the grounded theory. The first strength is first of all the likelihood of generating a novel theory. This was also supported by Cameron and Quinn, (Cameron & Quinn, 1988) who found that juxtapositions of contradictory or paradoxical evidence often arises creative insight. A second strength is that the emergent theory might be testable with constructs that can be readily measured and the hypothesis that can be proven false. This is because they have already been measured during the theory building process. Therefore, the resulting hypotheses are likely to be verifiable for the same reason. Finally, the third strength is that resultant theory is likely to be empirically valid. This is because the theory building process is so intimately tied with evidence that it is likely to be consistent with empirical observations.

### **4.3 Validity and Reliability**

In research there are always the question about the validity and reliability of the research. Validity refers to the accuracy. If the issues of reliability, validity, trustworthiness, quality and rigor are meant to differentiate a “good” from a “bad” researcher, then testing and increasing the reliability, validity, trustworthiness, quality and rigor will be important to the research in

any paradigm.(Golafshani, 2003)

Reliability refers to consistency. This is a concept most known for testing and evaluating quantitative data. However, it is also viable in qualitative data. Reliability refers to the concept of good quality research, whereas in qualitative research, the reliability has the purpose of generating understanding (Golafshani, 2003). “To widen the spectrum of conceptualization of reliability, and revealing the congruence of reliability and validity in qualitative research, Lincoln & Guba (1985) states that: “since there can be no validity without reliability, a demonstration of the former [validity ] is sufficient to establish the latter [reliability; ]” (p.316)” (Golafshani, 2003, p. 601). According to Patton (2005) the researcher’s ability and skill in any qualitative research also states that reliability is a consequence of validity in a study.

Taken this into consideration, the focus in this research will be on establishing a good validity by following the steps provided by Eisenhardt (1989). This will In turn yield a good reliability for the research.

## 5.0 Empirical Investigation

*This chapter will present the empirical qualitative data gathered from (several) in depth interviews with key stakeholders related to NFC based mobile payment implementation. The data gathered is based upon observations and the interpretation of these observations in relation to the objective of the thesis. The chapter is divided into a section for each stakeholder, with a presentation of key outcomes from the interviews.*

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The empirical investigation in this chapter focuses on observations in relation to the theoretical framework presented in the previous chapter. The aim of the investigation highlight different stakeholder's attitudes and opinions related to the implementation of NFC mobile payment in Norway. In order to get a clear understanding of the topic, a variety of different stakeholders were interviewed. The interviewed candidates represent different actors in the NFC ecosystem, all of which has a different role related to the Norwegian market. The empirical data was gathered in individual sessions with a representative from each particular stakeholder. The interview process took place during the months of April and May 2013. The method used for the data collection was mentioned in chapter 4 - Methodology.

In NFC mobile payment the consumer can be considered a key stakeholder. It may be worth noting that the consumer has not been interviewed for this thesis. The reason is the nature of NFC mobile payment still is a new and innovative product. Few customers have actually tried the service. The final product is currently under development by other stakeholders in the NFC ecosystem. Based on the qualitative research approach for this thesis, a few consumer interviews are not likely to be aligned with an unbiased interpretation of the Norwegian market for NFC mobile payments.

To include consumer opinion, interpretations were extracted from key stakeholder's insight in the topic. In particular, a merchants' perspective as a key stakeholder on the user-side is believed to have similar attitudes as to the consumers. Both can be considered end-users of NFC mobile payments, but with two different roles.

The seven in depth interviews includes a financial service provider; DNB, a mobile network Operator; Telenor, payment service provider; Teller, A third party service provider; OfficeLink, a merchant; NorgesGruppen, a trusted service provider; TrustNordics and a

service provider; WyWallet.

The data gathered will be presented in structure for each particular stakeholder, including a company description, information about the interviewee and a summary of key outcomes. Key outcomes will be tied to the relevant theoretical concepts in use, namely theories as diffusion and adoption, consumer choice and demand, switching cost, complementary goods and network externalities. Despite the structure presented, all interviews were mainly unstructured and as an informal conversation. The intention was not to ask to specific questions, but rather to allow the respondent guide course of the conversation based on his or hers opinion of what is important, within the boundaries of the topic.

As explained, the NFC ecosystem has a variety of stakeholder roles. An actor can actually represent more than one of the defined stakeholder roles. However, in the categorization below, the company's core business is used to define its stakeholder role. As to the role of trusted service manager (TSM), it is currently a joint venture between DNB and Telenor. Therefore, it will not be categorized individually as the key outcomes would be the same as those of representatives from DNB and Telenor.

## **5.1 Financial institution**

### ***Company description:***

DNB is Norway's largest bank and one of the largest financial institutions in the Nordic countries, measures in market value. DNB are currently involved in an ongoing project related to NFC mobile payments. As a large financial institution they can be considered a potential key stakeholder as a financial service provider (FSP) in the NFC ecosystem. In addition, DNB are also involved in a joint venture with Telenor to develop a trusted service manager (TSM) for the NFC ecosystem (DNB, 2013).

### ***Interviewed:***

Bjørn Skjelbred is program manager for mobile payments in DNB, board member of TSM Nordic, and manager of Doorstep AS. He has extensive knowledge about mobile payment and several years of experience with RFID technology. I met with Skjelbred on the 17 of April at DNB headquarters at Bjørvika, Oslo. The interview lasted for one hour.

### ***A short insight of DNB's involvement in NFC based contactless payment***

DNB entered into a joint venture with Telenor formed the company Doorstep. Doorstep intends business development at the interface between banking and telecommunication. The joint venture also established TSM Nordic AS, a daughter company of Doorstep, intended to serve as an independent trusted service manager (TSM) for contactless technology like NFC. . The TSM will be an open platform under the name VALYOU – which is a mobile wallet software. As an open platform mobile wallet other financial institutions will be able to provide their services through the same platform. This means VALYOU will be mobile wallet with a solution for multiple financial service providers (FSP). DNB intends to be one of the FSP's through the VALYOU platform. This means DNB actually takes part in both the TSM and as a FSP.

### ***Key outcomes from interview***

I started the conversation with Skjelbred by asking about the progress in the NFC network, and how different stakeholders contribute to the adoption of the technology. *“The customer in the NFC ecosystem needs relate to a reliable TSM. This can be provided by TSM Nordic”*. He explained that the mobile network operator (MNO) will provide secure element (SE) SIM cards, and that financial service providers (FSP) will provide access to user accounts. *“There is still a lot of progress needed amongst the cooperating companies in order to get a well-functioning ecosystem. In that sense, it is not yet a real NFC ecosystem. An ecosystem represent to some extent represent a well-balanced system. We are not quite there yet.”* Skjelbred pointed out that DNB has the funds to invest in NFC technology, but they were also dependent on other stakeholders to take part in the NFC ecosystem. When more players participate in the development, the adaptation of the NFC technology will speed up. *“We plan to launch VALYOU during the summer of 2013. Hopefully the market will endorse the service”* In terms of adoption the aim was to reach “the chasm” between Q3 -2013 and Q2 -2014.

I further asked questions related to consumer choice and demand. Skjelbred underlined the importance of continuing the progress with NFC mobile payment technology. *“A big challenge would be if we were to stop the development, and wait for the market to grow.”* The development in NFC technology is happening today, and it is important to be prepared for the demand with a solution that works. A solution tailored for the Norwegian market. He further mentioned that one of the essentials in the NFC ecosystem is to have a set of standardized

rules or terms that counts for every stakeholder participating, or who wants to participate. There are several important stakeholders in the ecosystem. *“If a stakeholder chooses to raise their price, it can affect the whole ecosystem”*. In the worst case scenario, price increase could potentially ruin the whole NFC ecosystem. The focus should be on a sustainable ecosystem with established ground rules for all participants. *“An ecosystem, not ego-system”*.

Skjelbred pointed out an important movement in terms of switching cost. *“The current development shows us that NFC enabled payment terminals are being deployed all over the country. We see a new trend of smartphones with an embedded chip solutions, which might affect both the market development and the business models. But as it seems right now, the SIM based NFC solutions are the most mature ones. However, the development is going fast, and we need to be agile and take the required actions”* This is an important evolvement in terms of NFC infrastructure. If the customer already have the technology, it becomes easier to use it. A challenge is the transaction price which can be considered expensive. *“In Norway we have a domestic payment scheme BankAxept which is almost free in terms of transaction cost. Merchants are somewhat spoiled in terms of paying little in transaction fees, due to BankAxept.”*

In relation to complementary goods, Skjelbred explained that over time mobile payment can become a substitute product for both cash and traditional payment cards. *“If you think about the typical payment card itself, it is not a good reason for why we should need a plastic card to perform a payment transaction”*. Technology makes it possible to use the mobile phone instead of a plastic card. The goal is not only small transaction, but every payment transaction. *“Low value purchases are too small of a market. We want mobile payment to be possible for all payment transactions”*.

On questions related to network externalities, Skjelbred pointed out the development of NFC enabled phones that are entering the market, and the deployment of NFC payment terminals as two steps in the right direction. He also pointed out that other actors who are working to develop the NFC technology contribute to the widespread of knowledge and usage of the technology. *“I think competition in the market is a good thing. It can help spread knowledge about the service, as well as stimulate service providers to improve their products.”*

In terms of business ecosystem, Skjelbred pointed out that collaboration amongst key stakeholders are essential in order to create a sustainable NFC ecosystem. That was one of the reasons why DNB entered into a joint venture with Telenor.

## **5.2 Mobile Network Operator**

### ***Company Description:***

Telenor is Norway's largest mobile and data service provider and has leading Nordic position on mobile, broadband and TV services. Telenor is also a recognized international mobile operator with a total of 148 million subscribers worldwide<sup>1</sup>. NFC mobile payment technology is currently an ongoing project at Telenor, who is both involved in the Secure Element (SE) – SIM card, and as a Trusted Service Manager in cooperation with DNB.

### ***Interviewed:***

Mona Berbusmel is Project Manager for market and customer relations in Tap2Pay. Berbusmel has extensive knowledge about the company's involvement in mobile payment services. I met with Berbusmel on the 23 of April 2013. The interview took place at Telenor headquarters at Fornebu, Oslo. The interview lasted for one hour.

### ***A brief introduction to Telenor's involvement in NFC based contactless payments.***

Telenor is involved in a joint venture with DNB through the companies Doorstep AS and TSM Nordic. As a mobile network operator (MNO) Telenor provides the Secure Element (SE) in the NFC transaction by embedding the SE into their SIM cards. In addition to their role as MNO, Telenor indirectly has a role as trusted service manager (TSM) through TSM Nordic.

### ***Key outcome from interview***

I started the interview by asking about Telenor's initiative in contactless payments, and whether they had any anticipation for the market adoption of mobile payments. *"We have conducted a couple of pilot tests on mobile payment. The candidates involved were positive towards the new technology"*. She also points out experiences from mobile payment services from other countries. *"We have learned from others that the hardest part is the registration*

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<sup>1</sup> Telenor.com

*process in order to get users ready to use the service.*” Experience from other markets is important to keep in mind. She also pointed out challenges related payment terminals. *“I think that to see all NFC terminals installed will be one of the biggest challenges”*. That NFC payment terminals are available at POS are important so consumers can start using the mobile wallet. The mobile wallet should further have value adding services.

Berbusmel was also asked questions related to consumer choice and demand. Her answers reflected the importance of a good customer experience of the mobile wallet. Telenor had conducted studies to determine what consumers wanted in a mobile wallet. *“I don’t think payment features alone is sufficient. It should be open for other widgets as well”*. She pointed out features such as digital storage of customer cards, transport ticket and access cards. It is the extra features that make the app good. Another point is the function of a TSM. *“If a NFC transaction goes wrong, it is important for the customer to have one contact point. If the application malfunctions it is important to have one contact point for the customer. It is important because there is no way the customer knows if it was the MNO, FSP or the TSM that causes a transaction problem”*.

In relation to complementary goods Berbusmel mentioned that mobile payment would probably be for payments below 200 NOK. She further points out that the value adding services on *VALYOU* can be a great feature for the user.

On question related to switching cost, Berbusmel explained that there is a cost related to the secure element. *“SE SIM card are more expensive than traditional SIM cards.”* The SE will be rented out to the TSM. The new SIM cards will be distributed when *VALYOU* is launched during the summer *“Mobile phone retailers have a bunch of old SIM cards stored that needs to be distributed. Optionally, these have to be replaced with the more expensive NFC- SIM card”*.

In terms of business ecosystem, Berbusmel explains that Norway is a unique country in many ways. The fact that Norway is a small country makes it easier to cooperate with other stakeholders in the NFC ecosystem. *“I think trust is a key factor for cooperation”*. There is more trust between companies and stakeholders in Norway compared to other countries. People who work with NFC know each other in one way or another. In terms of network externalities, she underlines the importance of additional contributor to the network. *“It is*



*important to get more actors involved in the NFC project for a successful development. We want at least one more MNO and one more FSP to join in on VALYOU".* She mentions that they are currently in a dialog with other companies, and hopes to an agreement by Q1 or Q2 2014. Additional members of the NFC network are likely to improve the likelihood for success for the NFC initiative.

### **5.3 Payment Service provider**

#### ***Company description***

Teller is the largest acquirer of international payments cards in the Nordic region. They offer acquiring for all the major, familiar card brands such as MasterCard, Visa, American Express, JCB and UnionPay. Teller is also a subsidiary of Nets, a Nordic provider of payments, cards and information services (Teller, 2013).

#### ***Interviewed:***

Nina Natalia Hasleengen is Product Manager at Teller with a special expertise in contactless payments. I met with Hasleengen on the 19th of April at Teller headquarters in Skøyen, Oslo. The meeting lasted for 2 hours.

#### ***Key outcomes from interview:***

I started the interview by asking Hasleengen on how Teller is currently are involved in NFC contactless payments, and formulated my questions to target the diffusion and adoption of NFC payments.

*"We are currently distributing NFC contactless payment terminals to merchants all over the country. We are also ready to accept NFC payments through these terminals once the merchant updates their terminal software. The terminals and software is approved to accept contactless payments by both Visa and MasterCard".*

She further explains how NFC payments targets transactions below NOK 175 for Visa, and below 200 for MasterCard transactions. *"These are guidelines set by Visa and MasterCard".*  
*"Since Norway has a higher cost level compared to other markets, I think the limit needs to be raised to get a more widespread adaption of NFC payments in the Norwegian market".*

Another relevant topic is questions related to consumer choice and demand of NFC payments.

She pointed out that contactless payment has come to stay, but how the market reacts towards the service is the question. *“We are preparing to accept contactless payments whether it will be with payments card or by mobile phone”. “Approximately 27% of all transactions today are cash transactions. We want these transactions to occur with contactless technology in the future”*. To get there most merchants need to accept NFC payment. However, using NFC payments currently involves using a credit transaction. *“Today all NFC transactions run as a credit transaction. Norwegians are not used to pay with credit, opposite to many European countries”*. A credit also transaction has a higher cost than a debit transaction. *“I think NFC payment has to be a debit card solution in Norway”*. A debit solution can be particularly interesting for merchants and might result in an increased demand for NFC payment service. This is because the merchant pays for the cost of the transaction. Indirectly the consumers might pay the cost in terms of higher prices on the goods purchased. *“I think the NFC payments will be the preferred choice of payment for smaller payment transactions in the future”*

In my questions related to switching cost by enabling NFC payments, Hasleengen pointed out that the highest cost is tied to the actual transaction, not the changing of equipment. *“For some there might be an actual one-time switching cost depending on whether the merchant has rented or bought their POS. Only the buyer that has an old POS needs to buy an upgrade in order to enable NFC payments.”* The challenge today is that NFC transaction cost is more expensive than traditional debit card payments with BankAxept. *“NFC contactless payments costs approximately NOK 1,05 + 0,95% per transaction, while BankAxept cost approximately NOK 0,12-0,17 per transaction for the merchant.”* Another issue can be integrating the new payment system to the merchants register. *“We have experienced some problems with the integration at one particular restaurant chain, but we are currently working to solve this issue”*. Merchants use different register systems and it is hard to predict whether the integration will be problem.

In relation to complementary goods, she said; *“I don’t think NFC mobile payment will replace traditional payment card, but rather be a supplement to traditional payment card”*. She also mentioned that banks should give their customers contactless payment cards. *“I think NFC contactless payments card will speed up the adaption of NFC mobile payments, because it will help to increase the knowledge and make people feel more secure (safe) about using the technology”*. *“When the customer see the benefit of contactless payments, they are likely to*

*adapt it both in card form and with their mobile phone”.*

Network externalities can affect how a technology is spread. Hasleengen underlined that for the market to start using NFC payment it has to be accepted by most merchants and shops around the country. *“I think the suppliers of register and payment solutions towards the merchants are the most passive link. They need to market the service to the merchant so he gets the NFC payment solutions up and working”.* As mentioned earlier, banks should also start deploying NFC enabled payment cards. *“Norway is unique when it comes to the wide spread of traditional payment card, and our tendency to use them for payment transactions”.* In terms mobile payments, a mobile wallet needs to be installed on the users’ mobile phone. For a NFC mobile payment to work, a NFC enabled phone is essential. This might be a reason why the Norwegian market is ready for NFC payments. *“When it comes to mobile technology, most Norwegians already have a smart phone. Most smart phones will soon have implemented NFC technology”.*

#### **5.4 Service Provider**

##### ***Company description***

WyWallet is a Swedish mobile payment platform company that was established by a group of mobile network operators. The company was started in 2011 as a joint venture between Telia, Tele2, Telenor and 3. The role of the company was combine mobile network operators’ efforts on mobile payments in Sweden. The company offers mobile payment to 97% of all Swedish mobile phone owners (WyWallet, 2013).

##### ***Interviewed:***

Johan Ragnevad is a business developer at WyWallet who also managed the set-up of WyWallet. He has extensive knowledge in telecommunication and mobile payments in the Swedish market. As Ragnevad is located at WyWallet office in Stockholm, the interview was conducted as email conversations, between 10<sup>th</sup> of April to 6<sup>th</sup> of May.

##### ***Key outcomes from interview:***

Ragnevad mentioned that the current Swedish market for NFC based mobile payments are relatively small and unpredictable, mainly because banks and financial institutions have yet to

adopt the technology. From a user perspective, NFC compatible phones are rapidly increasing, but as Apple has not announced a NFC mobile phone yet prognosis are uncertain.

In terms of adoption and critical mass; *“we estimate that the addressable mass must be more than half the user base and that this must be achieved within five years for the technology to be viable”*. According to Ragnevad for consumers to adapt to NFC services, value adding services are a key element. This can be services such as loyalty cards, special offerings and a good economic overview, which are features that can be implemented in mobile wallet. The fact that the NFC transaction is fast easy and secure is not enough.

In terms of switching cost the neither the cost of the technology is any huge obstacles today. The way that NFC transactions are performed are fairly similar to traditional payments today, but with the use of a different technology. *“Changing customer behavior takes time but really are no major obstacles from the customer perspective if only the payment process is quick enough and like the established short process.”* He further points out that one challenge is that no company wants to be first out on the market with the technology.

Network externalities can benefit several actors in the NFC ecosystem. *“It helps if other players give out NFC-enabled cards and NFC services that can be handled by phone.”* According to Ragnevad, one of the most important things is that the whole value chain in the NFC ecosystem works properly. Standardizations can complement the NFC service and *“reduces entry barriers for stakeholders and enables the widespread use of NFC”*.

Ragnevad points out the NFC ecosystem as a key to success with NFC-based mobile payment. *“It is important for the NFC market success that major stakeholders such as mobile operators, banks and government agencies are working together.”* Mobile network operators play an important role in reaching the masses in the market fast. Cooperation should be built on healthy economic business model.

## **5.5 Trusted Service Provider**

### ***Company description***

TrustNordics is a Norwegian based vendor of Trusted Service Manager as a service. Their business model focuses on an open, independent and flexible integration between services

providers, financial institutions and mobile network operators, in an integrated mobile wallet framework (TrustNordics, 2013).

***Interviewed:***

Lars Sandtorv is the CEO of TrustNordics and has in-depth knowledge about the company's involvement in the mobile payment framework. In also has 20 years of experience with RFID/NFC technology. I met with Sandtorv on the 28th of May at TrustNordics headquarters in Sandvika, Oslo. Present at the meeting was also Geir Norlund, CTO at TrustNordics, and Thomas Normann, technical pre-sales employee at TrustNordics. The conversation lasted approximately for one and a half hour.

***Key outcomes from interview:***

Sandtorv explained that TrustNordics provides an independent turnkey TSM solution with state of the art technology. Their focus is to provide the necessary platform for NFC stakeholders to enable a digital wallet solution for mobile phones.

According to Sandtorv, the NFC technology is already present all around us in Norway, but not everybody knows and understands it *“We use NFC technology to enter training gyms, as transport tickets and to access to our hotel rooms”*. He explains adoption is already happening all around us, but NFC payments have yet to be properly introduces in the Norwegian market. The way to get customers to adapt NFC based mobile services is to integrate more features into a mobile wallet, such access cards, loyalty cards and other NFC based services. *“Within five years everyone will have adopted NFC technology. With everyone I mean 70% of the population”*.

In Norway market there is already a lot of infrastructure for NFC technology, like for example payment terminals. In addition other major companies are also moving forward with NFC technology. According to Sandtorv this will give positive synergy effect for the rest of the NFC industry. These networks effects are important to get a faster adoption by customers. When it comes to complementary goods, the fact that it is possible to integrate several NFC services into the mobile wallet increases the value of the digital wallet for the customer. *“It is not necessary to carry several different payment cards and loyalty cards in a wallet, when you can have them all in the mobile phone wallet”*.

There are many different companies involved in the NFC ecosystem. *“We think the key to a well-functioning NFC ecosystem is an independent TSM. The role of the TSM is essential in the NFC ecosystem, and should be an independent actor.”* Sandtorv mentions that the TSM play a fundamental important role in defining the business model of a NFC ecosystem. An independent TSM creates a less complex organization, and allows for all stakeholders to participate on equal conditions. A dependent TSM can potentially create barriers in terms of stakeholders’ interest in participating.

## **5.6 Third Party Service Provider**

### ***Company description***

OfficeLink is a Norwegian distributor of communications solutions to business customers in the Norwegian market. They offer telecommunication and data solution from leading suppliers, as well equipment within the area of cash and payment terminals. They supply payment terminals from market leader suppliers such Elavon, Nets and Point, in which several of these are ready to accept contactless payments (OfficeLink, 2013).

### ***Interviewed:***

Ørjan Hansen is a business consultant at OfficeLink AS with special expertise and enthusiasm for NFC contactless payments. He has experience from being a pioneer in testing new mobile wallet solutions in Norway. I had two phone conversations with Hansen on the 23th and 24th of April. Each session lasted for approximately 30 minutes.

### ***Key outcomes from interview:***

I started the interview by asking Hansen how OfficeLink is involved in the NFC contactless payment, and focused my questions towards their progress in distribution of NFC enabled payment terminals.

*“We provide the customer with a complete package with cash and payment terminals. Most of our payment terminals today already have NFC capabilities, except a few older models + a few wireless terminals”* Hansen further explained that it will probably take some time before all POS have NFC capabilities. Terminals are both sold and rented out. Merchants who buy terminals will probably be slower to adapt NFC terminals, because they would have to invest in a new terminal. There are still a large percentage of merchants that purchase their terminals. *“The NFC transaction price is more expensive than traditional transaction prices.*

*I think that will be a challenge in order to get everyone to use NFC payments”.*

In terms of consumer choice and demand Hansen points out the service VALYOU, the project DNB and Telenor are currently working on. *“I think the key to get end-consumers to use the new technology is to point out the value-adding features of the VALYOU application”.*

VALYOU gives the customer more than just an efficient method of payment. By marketing these features the app can become popular and further increase popularity of NFC payments. In addition, a lower transaction price will probably increase the demand for NFC payments. *“It is preferred to go from a credit solution towards a debit solution for NFC payments”.* A debit solution is likely to have a less expensive transaction price.

When I asked Hansen questions related to theory about the complimentary good he pointed out the following. *“I think NFC payment primarily will become a by-product to traditional payment methods”.* His thought were that traditional payment methods still would be the dominant form of payments, but that NFC payments could increase the amount of digital payments.

When we talked about switching cost for the merchant or the consumer, Hansen mentioned as noted earlier that the higher transaction price for NFC payments might be the most obvious cost for the merchant. For the buyers of payment terminals there can be an additional cost for new equipment. *“All payment terminals have just been changed out due to the introduction of the chip to traditional payment cards”.* The merchant might not be willing to invest to change terminals again to enable NFC payments. He pointed out the same for NFC contactless payment cards. *“All banks have just issued new payments cards with chip to their customer. To replace all cards again to enable contactless payments can become very expensive”.*

In relation to network externalities Hansen mentioned that he has experienced that merchants who get a new terminal installed today, more often than before, ask about whether or not the terminal has NFC capabilities. *“I have noted that more customers have questions on contactless payment terminals compared to last year. The level of knowledge for the product has defiantly increased amongst merchants”.* In relation to mobile technology, *“Soon all smartphones will have NFC technology. Norwegians are quick to buy a new mobile phone once it enters the market”.* With a widespread of NFC technology in the hands of the consumers, the usage of NFC payments is likely to increase.

## 5.7 Merchant

### ***Company description***

NorgesGruppen AS is Norway's largest grocery wholesaling group, and has an estimated 38,5% market share of the Norwegian grocery retail market. They operate over 1750 grocery stores and 500 convenient stores around the country, and has an estimated 30 000 employees (NorgesGruppen, 2013). With the market share of NorgesGruppen they are also considered a significant user of payment terminals, and therefore a potential large stakeholder in the NFC ecosystem.

### ***Interviewed:***

Jørgen Grüner-Hagen is IT director at NorgesGruppen Data. Grüner-Hagen has an extensive insight and knowledge about the NFC payment initiative at retail and convenient stores in NorgesGruppen. I had a phone conversation with Grüner-Hagen on the 24<sup>th</sup> of April. The conversation lasted for approximately 45 minutes.

### ***Key outcomes from interview:***

I started the session by asking Grüner-Hagen how NorgesGruppen is adapting to the new NFC technology, and how far the progress is on its way. *"We see the new NFC payment technology as a relative undramatic change. We have in total approximately 6500 payment terminals distributed around in our grocery and convenient stores. Many of these are already in need of replacement. These new replacement terminals will have NFC technology implemented. In addition will all new stores have NFC enabled terminals"*. NFC terminals will be part of the infrastructure, but NFC payment has not yet been activated. *"We will not active NFC payment in a large scale before we know what it will cost both us and the customer"*.

When I asked questions related to consumer choice and demand, Grüner-Hagen also points out that the solution they have today works satisfactory. *"The solution we use today works fine both for us and for the consumer. We are not in need of a new transaction method at this point. However, we are always interested what the customer demands. If NFC payment is a service the customer wants, we want to provide the customer with this option"*. He further underlines that NorgesGruppen will always be interested in accepting the most common way of payment in their stores.



In terms of switching costs Grüner-Hagen mentioned that the replacing the terminals itself is not considered to be a cost. The transactions cost can however be a barrier. *“We are in a unique position in Norway because of BankAxept. BankAxept barely cost anything. Other countries don't are not in this situation. They are more used to pay higher transaction fees”*. He explains that NorgesGruppen don't want to retain the development of the NFC technology. *“We are genuinely interested in the NFC solution. However, customers don't pay to use their payment card today. -and NFC transactions are expensive. We need to find out who are to pay for the transaction. Is it us, the customer or a medium?”*

In questions on NFC payment in relation to theory of complimentary goods, Grüner-Hagen had some thoughts on how he saw the evolvement. He emphasizes that NFC technology can be a complementary to traditional payment cards. *“I think NFC technology primarily will be used via a payment card. At first, not necessarily digitally through the mobile phone”*.

When I asked questions related to network externalities, Grüner-Hagen mentioned an issue that probably needed to be improved. Mobile network coverage in NorgesGruppen stores was often poor. If any NFC services were to use OTA communication, the in-store signals would probably be insufficient, and might cause problems with the service. He exemplified this by illustrating a mobile wallet with value adding services such as a store voucher. *“If you were to download a voucher to your phone while you are in the store, it would probably take several minutes to download it”*. Another issue he raised was related to NFC technology in smartphones. *“Apple has a large market share in Norway. Their market share alone is probably sufficient to reach the needed user share in terms of adapting NFC technology. However, so far they have not implemented NFC technology into their phones”*. It would be a positive signal for NFC development if Apple implemented NFC in their future phones.

## 6.0 Analysis

*This chapter is an analysis of the theoretical framework in light of the empirical research conducted in this master thesis. With the information gathered the goal is to break down complex questions related to the industry development, in order to clarify issues and actions related to the implementation of NFC mobile payment in Norway.*

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The analysis in this chapter will be a sequence of merging theoretical concepts from in the theoretical framework in chapter 3, with related empirical observations from chapter 5. The comprised theoretical framework pointed out an interesting direction for the thesis. The theoretical concepts were further supplemented with elements from several scientific articles for a better understanding of the theoretical relevance, due to the unique characteristics of the NFC ecosystem.

The observations from the empirical investigation were organized in a step by step procedure, from one stakeholder to the next. In addition the structure was according to relevancy to the theoretical concepts from chapter 3. All of the participants in the investigation had special knowledge and expertise about NFC mobile payment in Norway.

In this chapter, both theory and empiric data merges for the purpose of an analysis. The analysis aims to break down and filter the information to consider whether these factors are relevant for the implementation of NFC mobile payment in Norway. The break-down of the structure can help to explain the complex environment and potentially build a fundament for the creation of a new theory.

This chapter will consist of five sub chapters, one devoted for each of the theoretical concepts. The sub chapters will start with a short recapitulation of the theoretical concept, followed by a discussion involving elements from scientific articles and key outcomes from empirical investigations. Each of the sub chapters will further have a conclusive summary of the section, which are discussed more extensively in the chapter 7, Discussion.

## 6.1. Consumer Choice and Demand

When a product is not fully developed and implemented in a market, an analysis of consumer choice and demand can be based on assumptions from industry experts and theoretical models. Industry experts are likely to have a good knowledge about customer behavior related to their working field. Additionally, theoretical concept should provide a good foundation to analyze consumer choice and demand.

The theory on consumer choice and demand was presented in chapter 3.1. It involved Multi-attribute models and the Technology Acceptance Model with related extensions. The essentials of these theories are it to look at attributes and characteristic of a product, in order to get acceptance from the users. In NFC mobile payment, the customer and the merchant are the actual users of the technology. The theory applies primarily to the stakeholders how is responsible for the development and marketing of the product for the customers. However, all stakeholders involved in the NFC ecosystem are in one way or another affected by the consumer demand for the product. This means that all participants should be interested in features that increase the consumer choice and demand for NFC Mobile payment.

Because NFC mobile payment is a new product for the Norwegian market, it is challenging to know which attributes play the most important role. The multi attribute model identified three attributes that make a difference in the decision making process; determinant, salient or important. Each of these can be evaluated in accordance to two different decision related to NFC mobile payment. Firstly, the actual decision of adapting the NFC mobile payment service, so that the user has the opportunity to use the service for payment transactions. Secondly, to use the service to pay once the user has enabled the service on the mobile phone. Mona Berbusmel in Telenor pointed out that the actual process of registering customer, so they could use mobile payment had proved to be the most challenging task in other markets. This might indicate that the adoption process can be considered “costly” for the customer. Cost can be financial or effort to adopt in relation to what the consumer expect to get in return from the adoption. This could further indicate that the consumer, in relation to NFC mobile payment, follows a non-compensatory model. This can be either a conjunctive or a priority based model. This would indicate a predefined checklist of attributes with a certain acceptance level. If these attribute specifics are not met, the product will not be acquired. An example is if the consumer finds security or safety to be inadequate for NFC mobile payment. This attribute can by itself be sufficient to dismiss the product. If the customer prioritize

security as an attribute, based on the non-compensatory model, other attributes will not compensate for the lack in security. Coskun et al. (2012) points out that security is one of the most important features of NFC mobile payment, in order to get a consumer acceptance of the products. This was also confirmed by several interviewees during the empirical investigation.

Once the NFC service has been adapted, the question arises whether it will be used to perform payment transactions. When a customer has a choice to pay with, cash, card or mobile phone, it is likely that the most convenient method will be used. For the consumer, the decision on how to pay once all options available are not considered to be an important choice. Therefore this qualifies for the simplest attribute models, related to ordinary everyday purchases. Option of payment does not have any huge impacts on the customer, given that the price of the purchase is equal, independently of payment method. Jørgen Grüner-Hagen in NorgesGruppen pointed out that transaction price for NFC payments is yet to be fully settled. If a NFC transaction is more expensive than other transaction, the merchant might not be as willing to accept that payment form. As merchants play a large role in the NFC ecosystem, they also affect how the development goes. Compensatory attribute models suggest that attributes can be compensated with other attributes. A lower transaction price could be an important attribute for the merchant, hence might choose to accept other payments than NFC payments.

Central in the Technology Acceptance Model is the *Perceived usefulness* and *Perceived ease of use*. Together they form the customers' attitude towards the products, behavior intent to use the product, and actual usage of the product. Since NFC mobile payment is a new technology, the model should fit well. NFC mobile payment promises to perform payment transactions in faster, simpler and more convenient way. The perceived usefulness by the customer will affect attitude towards the product. Equally, whether using the product is believed to be free of effort also affects customer attitude. Grüner-Hagen underlines that the payment options that exist today work satisfactory both for the customer and merchant. On the other side, Bjørn Skjelbred in DNB argues that NFC payment can be a valuable technology for many people in Norway because Norwegians tend to value queue free and effortless transactions. Both of these arguments relates to the perceived usefulness, but in slightly opposite directions. Nina Natalia Hasleengen in Teller argues that the key to increased usefulness for the customers, are through value adding services on the payment application that supports NFC payments. This argument were supported by Skjelbred (DNB), Ragnevad (WyWallet) and Berbusmel

(Telenor). Kaasinen (2005) shows in his study of mobile services that value creation is more important than a whole range of features. This indicates that value creation for the customer is not necessarily to add features to the initial service, but to add features that are valuable for the customer.

The perceived ease of use is one of the key features of NFC mobile payment, and can be considered one of the main arguments development of NFC payments. Given the automated features of NFC technology described by Coskun et al. (2012), the service should be very convenient and easy to use. Users experience and usability of the software related to NFC mobile payment are very important in the development process. Skjelbred underlines that the customer is the main focus for DNB when developing a product for NFC mobile payment.

Shin (2009) argues that the TAM model only has a limited ability to describe mobile wallets adoption. It presuming that the customer has only one technology to choose from, and it neglects social influence. Further, elements such as trust and security are also not included in the TAM. Social influence of using NFC mobile payment can be related to the “cool” feature of the technology. Namely by simply touching the phone to a payment terminal, and the payment can be performed. Hasleengen (Teller) described how she had experienced curious people approached her when she paid with contactless technology. Paying with a mobile phone is likely to raise some eyebrows, at least in the beginning. I can further potentially become a symbol for modern and cool technology, and in becoming so contribute to a social influence on surrounding people. Wang et al (2006) built on the TAM model and found that credibility of the service provider for mobile payment was important for potential adopter. Berbusmel (Telenor) also underlined the importance for the customer of relating to one trusted service provider. When a problem is experienced, more than one contact point for the customer increases the customer effort. Skjelbred (DNB), Hasleengen (Teller), Sandtorv (TrustNordics), and Coskun et al. (2012) pointed out the importance of one trusted service provider. If the network of providers in the NFC ecosystem becomes to complicate, a customer might be more reluctant to use the service.

Both the Unified theory of acceptance and use of technology (UTAUT) and the technology acceptance model for mobile services (TAMMS) explain additional conditions not mentioned in the TAM. UTAUT particularly looks at performance expectancy, effort expectancy, social influence and facilitation conditions. For NFC mobile payment, Chen and Chang (2011)

found that effort expectancy had a positive effect on performance expectancy and that both performance expectancy and social influence have a positive effect on attitude toward the use of technology. Ørjan Hansen at OfficeLink explained how different merchants recently had heard about the NFC technology, and that they now were asking more questions about NFC than previous. It was obvious that the attitude towards the technology was changing. Both Hasleengen (Teller) and Hansen (OfficeLink) confirmed an immense ongoing progress in deploying NFC terminals, in order to facilitate for NFC payment transactions at PoS. According to the UTATU, facilitation conditions have a direct effect on user behavior. In other words, as the infrastructure development improves, customer behavior towards using NFC technology is likely to improve.

Skjelbred (DNB) pointed out that cooperation amongst the stakeholders in the NFC ecosystem is very important to facilitate for consumer adoption and demand of NFC mobile payment. Currently, the NFC ecosystem is still in at an early stage, were additional participating stakeholders can be considered to strengthen the effort of implementing the technology. Hasleengen (Teller) believed all efforts towards NFC technology will increase the consumer demand for the product. Whether it is NFC contactless payment card or NFC mobile phones, they are both providing positive synergy effects to one another.

### **Conclusive summary of section**

As NFC mobile payment is yet a new and unproven technology in Norway, consumer choice and demand is highly dependent on the effort made by facilitating contributors to develop the technology for the Norwegian market. The theory provides underlying importance of creating value for the customer. In NFC based mobile payment, value creation for the customer can be tied to several aspects of NFC mobile payment. Davis (1989) indicates that perceived usefulness and perceived ease of use are essential values for a customer to adopt the technology. Both the UTAUT and TAMMS build further on this notion. Coskun et al. (2012) indicates that the service should be considered safe and secure by the customer, where a trusted service manager plays a key role for the customers. The empirical investigation indicates that customer choice and demand are dependent on the joint effort of the NFC ecosystem to create a service that the customer values. What the customer actually demands of a NFC based mobile payment service is not clear. However, basic features related to payment transactions such as trust and security are probably basic necessities. In addition,

usability, convenience, social influence and functionality are all elements pointed out by both theory and empirical research.

## **6.2. Adoption and diffusion**

The theory of diffusion of innovations by Rogers (2010) explains the diffusion process as a cumulative process where technological innovations are spread and adopted amongst individuals and firms. As mentioned previously, the NFC mobile payment service is yet not at fully developed product available for the Norwegian market. Meaning that both the diffusion process and the adoption process will be analyzed based on theoretical models, related scientific research and empirical observation from interviewing industry experts.

Rogers (2010) states that for the diffusion process to take place it has to be an invention which is communicated through certain channels over time, amongst members of a social system. Coskun et al. (2012) writes that the NFC technology is a relative new technology that can be used for contactless communication. One of the first organizations who started to work with the technology for use in payment transactions was the NFC forum. Using the mobile phone as a wallet is new to most people, as it is not yet a common sight. Some markets have adopted mobile payments more than others, but the NFC technology is still considered being at a young state of development. However, recently more and more researchers have started to take a look at the NFC technology for mobile payments (Au & Kauffman, 2008; Benyo, Vilmos, Kovacs, & Kutor, 2007; Chen & Chang, 2011; Ondrus & Pigneur, 2009). In addition, media are now also becoming more interested in NFC mobile payment. A simple search online shows a growing number of article for NFC mobile payment. At the Barcelona World Mobile Congress there was a special focus at the NFC experience, where participant could try out the NFC technology in various settings (Mobile World Congress, 2013). During the interview with Hansen (OfficeLink), he explained how their merchant customers are becoming more aware of the technology. All of these examples indicate that the NFC technology is being communicated, which is considered a basic necessity for the diffusion process to take place, according to Rogers (2010).

The growing interest of NFC technology has also influenced both the payment industry and the mobile phone industry in particular. In addition, other key stakeholders in what can be considered the NFC ecosystem, is also paying closer attention. Hasleengen (Teller) explained

how both Visa and MasterCard are currently working to implement contactless payment cards based on the NFC technology. Teller has already positioned themselves to be able to accept contactless payments by deploying NFC enabled payment terminals. Berbusmel (Telenor) and Skjelbred (DNB) both explained how they are positioning their companies through a joint venture, in order to create a NFC payment solution for their customers. As these industries move forward with the NFC technology and communicate this to their customers, it can be considered a step in the right direction in relation to the diffusion process.

In the diffusion process the time perspective involved three elements; the innovation-decision process, innovativeness and the innovation rate of adoption. The innovation-decision process would involve the time it takes from a customer's first experience with NFC mobile payment, until an attitude to the product is formed. The innovativeness categorizes the individuals, in terms of being innovators, early adopters, early majority, late majority or laggards. Grüner-Hagen (NorgesGruppen), Skjelbred (DNB) and Hasleengen (Teller) mentioned that the first adopters of NFC mobile payment will probably be the younger generations and especially interested individuals. Experience from the banking industry shows the adoption of traditional payment cards was slower for older generations than for younger. The last element, the innovation rate of adoption, reflects the amount of time for a certain percentage to adopt the innovation. Moore (2002) suggests "the chasm" as a turning point for both the innovation and the adoption. According to Moore (2002) this would be the point at which the further path of the innovation can be defined. Whether it will be sustainable or fail to reach additional adoption. Skjelbred (DNB) mentioned that DNB works with an estimation of "the chasm" to be reached between Q3 – 2013 and Q2 – 2014. He also further underlined the importance of the cooperation amongst stakeholders for a successful adoption of NFC mobile payment. According to Skjelbred, one of the major focuses should be on defining a standardized set of rules for all participants, allowing the NFC ecosystem to evolve further. Berbusmel (Telenor) pointed out the importance of additional stakeholders to join in on the NFC ecosystem. She mentioned that Telenor are currently working with additional MNO's and financial institutions in order to expand the NFC network. Other key stakeholders would benefit the entire NFC ecosystem in order for NFC mobile payment to be widely adopted.

Companies like Telenor and DNB already have a large customer base, and can potentially provide the necessary basis for the deployment of the NFC mobile payment, with regard to Rogers (2010) "members of a social system". Additional key stakeholders can potentially



provide an even larger customer base. On the other hand, members of a social system would in this case also relate to the merchant, who are the other acting part of an adoption of NFC mobile payment. In that sense, both merchants and customer adoption should ideally occur at the same time. They are both dependent on each other for the NFC mobile payment service to work. For a successful market adoption of NFC mobile payment, all providers depend on the merchant and the customer to adopt. According to Hasleengen (Teller), they are already targeting merchants to install NFC enabled terminal. Many have already been installed and are ready to start accepting NFC payments with a simple upgrade of the merchant terminal software. Hansen (OfficeLink) confirms the deployment of NFC terminals at several merchant locations. In addition, he mentions that merchants' who own their own payment terminals might have a financial switching cost related to acquiring a NFC terminal. This potentially leads to a bottleneck in the distribution of NFC enabled terminals. Grüner-Hagen (NorgesGruppen) also confirms that all new terminal they install, already have NFC capabilities. The oldest terminals are already replaced, and the remaining terminal will be replaced gradually. Grüner-Hagen further underlines that even if they have the terminals in place, they will not be opened for NFC transactions before NorgesGruppen knows the costs of NFC transaction. Currently, the cost of NFC transactions is much higher than ordinary transaction cost, which means someone has to pay the additional cost. NorgesGruppen is potentially a huge stakeholder, representing the merchant interests in the NFC ecosystem.

Grüner-Hagen (NorgesGruppen) mentions a possible drawback for NFC mobile payment adoption. Currently, all mobile phones produced by Apple do not have embedded NFC technology. There are also great uncertainties about if they will ever implement the technology. Because Apple has such a large market share in Norway, a large group of individuals automatically can be excluded from the NFC service, unless the change to mobile phones with NFC technology. Berbusmel (Telenor) pointed out that during Telenor's pilot test of NFC payments, customers who tried it out had a very positive attitude towards the technology. However, if they were to use the service it has to function with their personal phones. Skjelbred (DNB) explained that they now see a trend where many new mobile phones come with NFC technology, except Apple and their mobile phones.

Norman (1998) states that all new technology takes time before they affect people lives. This can probably also count for NFC mobile payment. Most people are used to a wallet, and most are used to a mobile phone, but few people are used to the mobile phones as a wallet. One

could argue that the combination of those two qualifies as disruptive technology, but that will eventually be determined by customers who adopt it. According to Moore (2002) “the chasm” can pose difficult challenges for a new innovation. In that sense larger companies or larger networks of companies are more likely to manage to cross “the chasm”, because of their resources and position in the market. Interviews with key industry stakeholders showed that there were different views on what role NFC mobile payment technology will have in the future. Hansen (OfficeLink) believed that the product primarily will serve as a supplement or a by-product to a traditional payment method, but with a growing market share in payment transactions over time. Hasleengen (Teller) believed that NFC transactions would dominate the market for low-value payments (amounts below 200NOK). Skjelbred (DNB) saw NFC mobile payment as a fully worthy contestant to traditional payments, for all transaction amounts, not only low value transactions. Over time, he visualized NFC mobile payment to replace traditional payment cards and cash.

How the various stakeholders in the NFC ecosystem visual the future of NFC payment might affect their effort and engagement in the cooperation, which again can affect the adoption of the NFC mobile payment service. A dilutive vision in the NFC ecosystem can cause confusion amongst both adaptors and other stakeholders, eventually posing a challenge to influence adopters to adopt NFC mobile payment.

### **Conclusive summary of section**

The diffusion process describes the phenomenon on how an innovation spreads amongst a group of individuals over time. The theory is relevant in relation to NFC mobile payment in order to understand how adoption might take its course. Moore (2002) explanation of “the chasm” is particularly important since it explains how a NFC mobile payment as a service might need to change as more users adopt the service. What type of change that might be is hard to predict at the current moment. For example, it can be related to the transaction amount limit, security features or widespread of infrastructure. Because NFC mobile payment involves a complex ecosystem with many stakeholders, adoption is dependent on the joint effort of the cooperation amongst participants. Both consumers and merchants come in different forms. Some are “innovators” and some are “early adaptors”. These play an important role in the further evolvement of NFC mobile payment. Another key element of adoption is the infrastructure technology it requires. As Hasleengen (Teller) and Hansen (OfficeLink) mentioned, the deployment of NFC terminals to the market is already in

progress. On the other hand, technology requirements for the adaptor might not be equally far on its way. As Grüner-Hagen (NorgesGruppen) and Skjelbred (DNB) noted, not all customer has a NFC enabled phone yet. There might be obstacles related to customer mobile phones, which eventually delay the adoption of NFC mobile payment in Norway.

### 6.3 Network externalities

The theory of network externalities suggests that a good increases in value when more people use the good (Economides, 1996; Shapiro, 1998; Varian & Shapiro, 1999). The phenomenon can typically be explained by the use of mobile phone. If only one person has a mobile phone, it is not much worth. As more and more people get a mobile phone, it becomes increasingly valuable. A parallel can be drawn towards NFC mobile payment, in terms of customer and merchants who can pay and accept payment using NFC technology. Goldenberg et al (2010) point at the numbers of adapters of NFC mobile payment drives the utility directly. If a customer has a NFC mobile payment service on his phone, it becomes increasingly valuable for the customers when more merchant accept such payment. Equally the opposite way around, having a NFC payment terminal becomes more valuable for the merchants as more customers use NFC technology to pay for goods. NFC mobile phones, and NFC payment terminals relate more to compatible goods, but as Farrell & Saloner (1985) states, positive network externalities can be achieved through compatible goods. Varian and Shapiro (1999) noted that standards and compatibility are the key elements in network externalities. . Skjelbred (DNB) points out the value of a large network of NFC compatible payment terminals and mobile phone. The technology becomes more widespread, the more valuable it will become for both customer and merchants. If all merchants accept NFC payments, the customer no longer needs a wallet or a plastic payment card. Hence, network effects increases customer value for NFC mobile payment.

Another way of seeing the value of network externalities is through the transaction price.

Currently, NFC transaction can be considered expensive (high transaction price) compared to other transactions, which also were confirmed by several of the interviewees. As the network of NFC payments grows, operational cost per user can be expected to fall. If that is the case, transaction price might be reduces to a level equivalent to other payment transaction.

Economides (1996) used a similar illustration on network externalities, but uses it in relation to the financial market. As more traders' trade, the expected utility of all participants increases. In Economides (1996) example, it is worth pointing out that the point is the reduced price variance in a trade. In NFC payment transaction, the price variance is not present

directly. However, it still might be present indirectly due to the merchant price adjustment of goods sold due to high or low transaction costs. Hasleengen (Teller) mentioned that the high transaction price today are mainly because of all transactions pass through VISA (payment scheme owner). She further mentioned that for NFC transaction to become less expensive, it should probably have to be through a debit card solution. Most debit card transaction runs through BankAxept, which has an exceptionally low transaction price.

When compatibility of goods increased value for the customer, incompatibility might lower the value of a good. For example, the incompatibility of a NFC service on a mobile phone that does not have NFC technology, like Apple's iPhone. Technically, a NFC service will have no value for an Apple user. Hence, it cannot reduce the value additionally. On the other hand, incompatibility can lower value for all other users in the network. A NFC payment terminal will not be as valuable for a merchant if he cannot receive payment for all Apple iPhone users, opposite to if he could receive payment. Grüner-Hagen (NorgesGruppen) pointed out Apples market share for mobile phones especially as a challenge for NFC mobile payment in Norway. Because NFC technology is not available in Apple products, a large part of the population will not be able to use the NFC payment service. At least not until Apple introduces NFC technology to their mobile phones, or another solution solves the problem. For a merchant who accepts NFC payments, or consider installing NFC payment terminal, might find the reach of NFC technology to be too narrow. The incompatibility might lead to a lower value of the NFC payment terminal.

Hasleengen (Teller) pointed out a different NFC product that might help to increase Network externalities also for NFC mobile payment. She explained that NFC enabled contactless payment cards might lead to positive network externalities in more than one way. Even though NFC based contactless payment cards are not the focus of this thesis they still bring in relevant (potentially positive) synergies for NFC based mobile payments. NFC contactless payment card works similarly as NFC based mobile payments. When NFC contactless payment cards get introduced to the market, also people without a NFC enabled card can also see the benefits of NFC payments. In doing so, possibly also removing some of the fear people have surrounded security of the new technology. This can potentially increase the value of NFC mobile payment. In addition, merchants will see more customers that are able to pay using NFC technology, which increases the value of having the ability to accept NFC payment. Kauffman & Wang (2002) found evidence of banks who shared ATM network

increased value for customers. Given their findings, NFC payment terminals which are compatible with both NFC mobile phones and payment card, is also likely to increase customer value. This would fit with the finding of Varian and Shapiro (1998), who found that standards and compatibility was the key ingredients in network externalities.

### **Conclusive summary of section**

Products with network externalities can experience an advantage compared to other products because the presence of one will increase the value of the other. It increases the value for the customer using the product, as well as participating members of the network. According to Varian and Shapiro (1998), standards and compatibility are the most important elements for networks externalities. For NFC based mobile payments, it would involve a common standard for the NFC technology itself, and compatibility between NFC devices. Varian and Shapiro (1998) argued that in order to achieve standards and compatibility it requires key stakeholders to unite in an alliance. This statement indicates that participants of the NFC ecosystem could gain on a good cooperation in several areas of NFC mobile payment. Skjelbred (DNB) underlined the importance of uniting with other stakeholders in NFC ecosystem. Berbusmel (Telenor) pointed out that the Norwegian market is smaller than other markets because Norway is a small country. The advantage of that is the close relationship between stakeholders because stakeholders in Norway already know one another. Grüner-Hagen's (NorgesGruppen) argument regarding incompatible mobile phones poses a different challenge. For the Norwegian market, participants "directly involved" might have a limited influence on the "indirectly involved" stakeholder in the NFC ecosystem. A challenge can be mobile phone manufacturers with a large market share in Norway, who chose not to implement NFC technology into their phones, like for instance Apple.

### **6.4 Switching Cost**

The theory of switching cost describes how the buyer reacts to the cost of switching to a different competitor or product. In NFC based mobile payment, the switching cost would primarily relate to change in related technology and systems, but also a change in behavior on how to conduct and receive payment for goods. The most visual switching cost is those of financial value. If a payment terminal or a mobile phone needs to be replaced, this normally involves a cost, either for the providers, merchant or customers. Hasleengen (Teller) and Hansen (OfficeLink) confirmed that the switch to NFC enabled terminal does not imply a onetime financial investment for the merchants. The installation cost can be covered by the

providers, which mean there is no instant financial disadvantage. The exception is for those who owned their own payment terminal. The number of merchants who owned the terminal was unknown, but apparently represented the minority group. The uncertainty around the percentage in which payment terminals can be rented out or owned by merchants creates some uncertainty about the actual involved financial switching cost. If there is a large portion of merchants who own their own payment terminals, they can potentially delay adoption due to inherent switching cost.

In the eyes of the customers', a financial switching cost is present if he, or she need to upgrade their mobile phone to a NFC enabled mobile phone. This would be a onetime cost, but not necessarily tied to acquiring NFC based mobile payment services. It is probably fair to say most people upgrade their phone because of reasons other than the NFC technology itself. If that is the case, the NFC technology, which already is present in many new phones today, a financial switching cost in relation to NFC based mobile payment does not exist. A switching cost can be present if a customer buys phone just because of the NFC technology.

According to the empirical investigation, one of the most prominent financial switching costs can be related to the increased transaction cost of the NFC transactions. For example, compared to debit card payments, the NFC transaction price is significantly higher. Whether or not this could be considered a switching cost is not certain. Burnham (2003) refers to switching cost as a *onetime cost* associated with the switch. A higher transaction price is not a onetime cost, but a continuous cost of using the NFC payment transactions. Either way, the cost is relevant, but it will probably not hinder the merchant in acquiring the actual NFC payment terminal. Instead, the merchant might be reluctant to accept NFC payment transactions over debit card transactions.

Currently, Telenor and DNB are working on a SIM based secure element for the NFC mobile phones. Berbusmel (Telenor) highlighted the importance of SIM card distribution for a working NFC mobile payment service. The SIM card itself represents a typical onetime switching cost. The financial cost can be taken by either the issuer or the consumer. If the consumer has to bear the cost, it might be an additional switching cost. The financial cost itself is probably not high, but the consumers will probably also experiencing additional switching costs.

Burnham et al (2003) and Morgan & Hunt (1994) explained that switching cost does not only represent financial cost, but also other cost related to the switch, such as procedural cost or

relational cost. Procedural cost relates to economic risk, evaluation, set up and learning cost. Berbusmel (Telenor) mentioned experiences from the US market were some of the challenge relates to the set up process. The actual registration process of customers to NFC based mobile payment. This can indicate that the learning and set up cost involved in NFC based payment can be considered too much of an effort for the customer. Hasleengen (Teller) mentioned that they had experienced some issues with the software installation related to the merchant's cash register or point of sale. Issues like this probably qualify as procedural switching cost, but it will depend on which part who is installing the software. The customer, who in this case would be the merchant, should only experience these types of cost if he installs the software himself. If the provider is the installer, the merchant cost can be limited to learning cost of using the system.

Coskun et al (2012) points out security as a key element, and that the customer needs to feel safe about using the service. This can be related to the economic risk and evaluation costs. Customers who experience the NFC technology as insecure will be reluctant to start using the service. Especially, since it involves payment services and access to personal accounts.

Relational cost, on the other hand, relates to a personal relationship or a brand relationship. As mentioned by Coskun et al. (2012), the mobile phone can be considered a highly personal item for the consumer. Changing mobile phone in order to enable NFC based mobile payment might be too much of a cost. Someone's personal phone might mean more than the ability to pay with a mobile phone. Berbusmel (Telenor) experienced similar feedbacks from Telenor's pilot project on NFC mobile payment. The customers liked the service, but would prefer to use it on their own mobile phone, rather than test phones. Grüner-Hagen's (NorgesGruppen) argument on Apple can be related to brand relationship. Apple users have one of the most loyal customer base related to consumer electronics. Many Apple users' are known to be brand loyal to most Apple products. If NFC technology do not get implemented in future Apple products, there is a risk of apple users not adapting to NFC-based mobile payment. NFC payment transaction can be both supplementary to existing products, and replace traditional payment methods. Consumer and merchant might start using the service, but at the same time use traditional services such as payment cards and cash. This will affect how a consumer experience switching cost. According to Burnham (2003) switching cost must be associated with the switch, but it does not have to occur immediately upon the switch. If a customer switches the NFC based mobile payment too early, when the infrastructure is inadequate, several merchant will not be able to accept payments. The consumer will then

experience delayed switching cost, in terms of having an unusable service. If a strong infrastructure is not in place, it would mean that the switch would have to happen gradually. Or maybe that NFC based mobile payment will be better off simply as a supplement to traditional methods.

### **Conclusive summary of section**

A switching costs are not always visible immediately, but can become apparent when analyzed further. In order to get NFC mobile payment implemented in the Norwegian market both providers, merchant and customers can experience related switching cost. Switching cost theory states that there has to be a switch from one product to another. If possible, providers of the NFC based mobile payment should focus on reducing switching cost to an absolute minimum for both merchants and consumer. That is because switching cost poses as a barrier for a successful adoption of the technology. When there is no switching cost, there are no real barriers for why a customer should not adopt NFC based mobile payment. Currently, the most prominent switching cost can be the absence of necessary technology and infrastructure. Empirical evidence further indicates that the financial cost related to the NFC transaction can be a switching cost.

### **6.5 Complementary goods**

The theory of complementary goods suggests that an increase on one good leads to an increase in the other good, which is opposite of a supplementary good (Sullivan & Sheffrin, 2003). In NFC based mobile payment, the NFC enabled mobile phone is a can be a complement good to the merchant NFC payment terminal. If there is an increase in the demand for NFC enabled mobile phones, there will most likely be an increased demand for NFC enabled payment terminals. Obviously, it is not a perfect complement as the number of NFC mobile phones will supersede NFC payment terminals by far, but the increase in number of NFC mobile phones will increase the utility of the NFC payment terminal. This is a similar situation as McAndrews (1997) experienced with credit cards. As more customer carried credit card, more merchant added credit card readers, which in turn increases the value of carrying a credit card. This could represent a complementary good.

Economides (2005) showed that the more compliments a product has, user are more likely to buy the product. For NFC technology, this effect might be present for merchants when the NFC payment terminal can accept traditional payment forms, NFC mobile payment, and NFC



contactless payment card. Hasleengen (Teller) mentioned that NFC payment terminals can accept both traditional payment cards and NFC technology payments. For NFC technology, both mobile payment and contactless cards will accept. With Economides (2005) arguments in mind, more merchants will acquire the NFC payment terminal. The synergy effect of this is that demand for NFC contactless payment cards and NFC mobile phones will increase.

Yalcin et al (2012) points out that complementary goods often has quality interdependence. This indicates that a lack in quality in one good will affect the other good. This is worth noting especially in terms of security of the technology. A Coskun et al. (2012) point out the security in NFC technology is generally very good. However, if a user experiences a lack in security this could be perceived as a lack in quality of service, and in turn also affect all complementary goods. If users become hesitant to the quality of technology, the demand for NFC devices and complementary goods can be reduced.

Grüner-Hagen (NorgesGruppen) saw the NFC technology as an interesting technology with could replace cash handling. Cash is still a common way of payment, but for the merchant cash handling can be expensive. Hasleengen (Teller) explained that the storage and transportation of cash involved a lot of work. NFC based mobile payment can serve as a complementary payment instrument to credit and debit payments. In this scenario that the user will carry both credit and debit cards, in addition to, their NFC mobile phones. Any payment not suitable for a NFC mobile payment, a credit or debit card can be used. This creates a complementary good effect. This fits into what Hansen (OfficeLink) pointed out regarding the role of NFC mobile payment. He primarily saw NFC technology as a by-product that would complement traditional payment method. Hasleengen (Teller) predicted that NFC payment will be the preferred transactions form for lower amounts. Amount above 200 NOK would still be conducted with payment cards.

The arguments above suggest that the NFC mobile payment can serve as both a supplement to cash, and as a complement to payment cards. Skjelbred (DNB) saw potential for the technology to substitute also traditional payment cards in the future. There is no good reason why someone should need a plastic card to pay, as technology can replace the plastic card.

### **Conclusive summary of section**

The theory of complementary goods explains how some goods can benefit from other goods by increasing the utility of both goods. The infrastructure necessary for NFC based mobile

payment is likely to provide and received utility due to complementary goods. In particular, the NFC contactless payment card creates complementary effects both for NFC based mobile payment, and for NFC payment terminals. In addition, the service provided by NFC technology can potentially cause complementary effects for electronic payments, such as traditional credit and debit card transactions. Economides (2005) argues that in order to experience increased usage of a good due to complementary effect, more complements for the goods should be provided. This can indicate that more users will adopt NFC technology as additional complements get provided.

## 6.6 Business ecosystem

Moore (1996) used ecosystem as a metaphor to explain an interconnected population of organizations where both competition and cooperation was present simultaneously. The theory of business ecosystem is increasingly important in modern businesses. Coskun et al. (2012) argues that the NFC ecosystem consists of key stakeholder for the enabling of NFC based services. He pointed out four main groups of key stakeholders for NFC mobile payment which was the standardization body, the manufacturers and suppliers, providers and customers. In relation to the Norwegian market, the stakeholder categories got labeled as directly involved and indirectly involved. This thesis focused on the stakeholders directly involved in the implementation of the NFC based mobile payment in the Norwegian market, as they are the most influential contributors to the Norwegian market. Coskun et al. (2012) model on NFC ecosystem is considered to represent a good foundation for a business ecosystem. In terms of business model Coskun et al. (2012) suggest three types; MNO centric, distributed or a TSM centric business model. Empirical evidence suggests that a Telenor and DNB have chosen to use a distributed business model, where the platform management services are distributed among SE issuers and service providers, but with a separate TSM actor. TrustNordics has chosen to use a TSM centric approach, which involved having a trusted third party provider as a TSM. In particular, there are two very different approaches which has an effect on how the TSM serves as an actor. Coskun et al. (2012) argues that a TSM centric business model reduces the complexity of the environment compared to other models. The nature of the TSM as an independent provider versus a TSM as a distributed role will probably affect how additional stakeholders chose to participate in the NFC ecosystem. How the NFC ecosystem will look eventually, is yet to be seen. It is possible that each of these two business models can operate side by side in a market, as two different working NFC

ecosystems. However, the structure of the NFC ecosystem, and participating stakeholders are likely to be different from one another.

Moore (2006) points out that a company embedded in a business ecosystem need to coevolve with other companies involved by being proactive in the development of mutually beneficial relationships with both customers', suppliers and even competitors. Skjelbred (DNB) and Berbusmel (Telenor) explained the joint venture that both DNB and Telenor is involved in, aims to create a working NFC solution for the Norwegian market. They two companies already represent a major financial institution and a major mobile network operator, but this is not considered sufficient for a full market reach of NFC mobile payment. According to Coskun et al. (2012) a NFC ecosystem consists of several different actors with different roles. A company can potentially have more than one role in the NFC ecosystem, so that the ecosystem consists less members. However, Adner & Kapoor (2010) states that few if any firms have all capabilities and resources necessary for managing the entire business ecosystem. This indicates that the focus should not necessarily be on having few participants, but the enough stakeholders to fill in all essential roles in the ecosystem. Berbusmel (Telenor) pointed out that they are currently working to expand the network by involving additional key stakeholders. If they are successful in uniting additional stakeholders, their combined effort can improve the emergence of NFC based mobile payment.

Iansiti & Levien (2004) argues that although ecosystems are easy to create, they are often poorly understood. A business ecosystem includes fragmentations, interconnectedness, cooperation and competition. Skjelbred (DNB) points out that in order to have a well-functioning ecosystem there need to be a set of standardized rules for all participating stakeholders in the NFC ecosystem. The NFC ecosystem is complex and dependent on their stakeholders. If a stakeholder chooses to increase their prices, the whole ecosystem gets affect by it. If not agreed upon initially, it can lead to a disproportionally distributed power structure in the ecosystem, eventually leading to a dysfunctional and unsustainable ecosystem. Iansiti & Levien (2004) underlines the importance of a healthy business ecosystem. Because business ecosystem consists of highly interconnected businesses, it is beneficial to develop ways to characterize the collective health of the business ecosystem. This allows stakeholders to influence and respond to the collective health.

According to Iansiti and Levien (2004), the three success factors for business ecosystems are

productivity, a robust ecosystem and that it is able to create niches and opportunities for new firms. Productivity reflects the ability to produce. It is already possible to see some results of production, like for instance the deployment of infrastructure, software development and the making of preparations for the introduction of the NFC service. Since NFC based mobile payments yet has to be launched, it is still early to draw any grounded conclusions on the NFC ecosystem as a healthy and sustainable ecosystem

The industry experts interviewed all emphasized the important of cooperation amongst stakeholder in the ecosystem. When more stakeholders pull in the same direction, it is more likely that it will create consumer awareness. Sandtorv (TrustNordics) pointed out that the effort made by Telenor and DNB on NFC based mobile payment will help increase the consumer knowledge of the NFC technology. Equally, Telenor and DNB will benefit from the work done by TrustNordics in the same field. Hence, both can provide mutually benefit by increasing the customer knowledge. Skjelbred (DNB) mentioned that competition in NFC technology is considered a good thing for the NFC ecosystem as long as it does not lead to consumer confusion. Confusion can be destructive for the adoption of the service.

Iansiti and Levien (2004) point out three main roles a stakeholder can have, which where keystone organizations, dominators and niche players. The keystone organizations serve as enablers with great impact on the whole system. Given how the NFC ecosystem is in Norway today, these organizations would be larger stakeholders such as Telenor, DNB and Teller. They have all different roles as they represent a mobile network operator, payment service provider and a financial institution. Without of these organizations, a NFC network would be difficult to establish. Berbusmel (Telenor) mentioned that they were currently in a dialog with other financial institutions and mobile network operators in order to grow the ecosystem further. Both MNO and financial institutions can provide additional keystone organizations to the NFC ecosystem.

The niche players have very low physical present individually, but collectively constitute the largest group in the ecosystem. This role is typically the role of a third party supplier, the merchant or any smaller organizations working towards the merchant. These are already present in the ecosystem, and some of them have already adopted NFC enabled terminals. This is naturally a stakeholder group that needs to grow in order for NFC mobile payment to develop fully.

In relation to the dominator role, no real dominators are currently present. Potential dominators are likely to be more present as the ecosystem gets established and the NFC based

payment service gets more popular. Moore (2006) argues that the success of the ecosystem depends on the shared vision of participants of the ecosystem. As the described ecosystem above is an emerging ecosystem, it is not certain that all participants have shared vision. There might be different motivational factors that bring the ecosystem together, and the same might count for participants who do not want to participate in the ecosystem. Moore (1996) raised an interesting issue concerning actors that have different images and understandings to the ecosystem, which creates shattered visions. Involved organization can undermine the greater good of the ecosystem, in pursuit of own interest and visions due to the inherent competition in the NFC ecosystem. To counteract such destructive attitude, managers of participating organization should focus on promoting a keystone behavior.

If a NFC ecosystem gets successfully implemented in a market, it can potentially generate huge revenue streams for participation actors. Coskun et al. (2012) explains that the NFC technology is a step towards an entirely new industry, with a whole new value chain. That is the reason why many different stakeholder wants to join the ecosystem. Adner (2006) states that participating stakeholders often tend to overestimate the potential for value creation within the ecosystem. Wrong interpretation of profitability can potentially be devastating for a company who takes the lead the ecosystem. Skjelbred (DNB) explained that DNB have the resources to invest in NFC mobile payment, but want more participants to join the cooperation. This will reduce the financial risk involved. He further mentions that any investment in the new service and the technology will be worthwhile even if the service does not become a success. That is because the experience gained can be used in other projects. Hasleengen (Teller) said that the deployment of NFC terminals in not considered a risky infrastructure investment because the NFC technology will be in use in the future, either if it is with contactless cards or NFC enabled mobile phones. Sandtorv (TrustNordics) mentioned that doubt about the NFC technology tend to be a bit shallow. According to him it is obvious that the current progress in NFC technology is only advancing.

An important part of the NFC technology, especially when used in NFC based mobile payment, is the Secure Element (SE). Coskun et al. (2012) argues that the SE is essential to provide users and service providers with assurance about the security and the overall process. According to Coskun et al. (2012), embedded SE chip, SE SIM card and SE Smart card are the most common variants of secure elements. Skjelbred (DNB) point out that there is a new trend of embedded SE elements in new mobile phones, but that the SIM based SE is the most

mature for the Norwegian market. Sandtorv (TrustNordics) explains that they are currently working with a cloud based SE, which is an alternative to the standard secure elements. According to Coskun et al. (2012), the SE in use is relevant because it can affect both the business model and the structure of the NFC ecosystem. In particular, the TSM has to be compatible with the SE in the market.

A key element in a business ecosystem is customer acceptance of the product or service provided. The customer is always the key focus of all businesses. For a new innovation, the customer feedback can be a valuable resource for improvement. Customers not only experience the service, but also the surrounding network. Adner (2006) points out that successful innovation requires tracking of partners and potential adopters as closely as the company's own development process. The complex nature of the NFC ecosystem might delay the process of adoption more than stakeholders anticipate. Adner (2006) argues that the more intermediaries that have to adopt an innovation before it reaches the end user increases the carried risk for the solution.

### **Conclusive summary of section**

The complex network of participating stakeholders in the NFC based mobile payment is likely to be part of what Moore (1996) considered a business ecosystem. However, the early stage of early stages of development in NFC based mobile payments limits how well the ecosystem can be identified. For the technology to become widely adopted, both theoretical and empirical evidence suggests the presence of one or more larger contributors to the ecosystem, which should be companies that can serve as keystone organizations in the NFC ecosystem. Another key element for the evolution of the NFC ecosystem, evident in both theoretical and empirical data, is the presence of a trusted service manager (TSM). The TSM function is a key role of uniting the diverse services of both mobile operators, financial institutions and other service providers. Based on empirical research, the key role of the TSM in the NFC ecosystem seems to be a key issue for the organization of the NFC ecosystem. The path chosen for the role of the TSM can potentially guide how the emergence of NFC mobile payment will proceed. The Secure Element (SE) provides an additional challenge for the NFC ecosystem. It is a key element of the technology in use for NFC based mobile payment. Moore (2006) points out the co-evolution and cooperation as the key elements in an emerging ecosystem. This creates the basis for a healthy and sustainable network of

participating stakeholders. In order to succeed with an innovation, a common and unified vision amongst stakeholders is necessary. In the end, it is the customer who will decide the future of the NFC ecosystem.

## 7.0 Discussion

*This chapter will discuss the most critical challenges for the implementation of NFC based mobile payment in Norway. The discussion will use challenges in the analysis from the previous chapter and discuss these in light of theoretical and empirical research.*

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This thesis has not focused on data from consumer of NFC based mobile payment, but rather on different industry experts from various types of businesses. In order to study the consumer choice and demand, the customer should ideally be the focus of the study. This creates a classic challenge for the researcher when it comes to innovations. The theory tells us that the customer values attributes of a product, but not which attributes that is most important for NFC based mobile payments. Empirical evidence suggests that security, convenience, effectiveness is key attributes for NFC based mobile payment. On the contrary, these are attributes arguably present on existing technology, such as payment cards. Consumers might need additional persuasion for NFC based mobile payments. The technology acceptance model suggests perceived usability and perceived ease of use as key elements for a consumer use the service. For the consumer to experience these effects to its full extent, the NFC mobile payment infrastructure plays a crucial role. The infrastructure consists of both hardware and software, at both the customer and the merchant side, in addition to service supporting facilities. Although progress is happening, the combined development for NFC based mobile payments still has to be considered to be at a very early state. Empirical findings indicate an optimistic attitude towards the emerging technology. The reader should take into account a possible industry bias as all interviews experts represent key stakeholders positions in the NFC ecosystem. A similar enthusiasm might not have been as present if the target audience is the consumers.

Success with NFC mobile payment requires adoption of the technology by both customers and merchants. The theory of diffusion and adoption proposes how adaption to a new innovation occurs. Given that the NFC based mobile payment service has yet to be properly introduced to the Norwegian market, the theory serve only as a guide to the future adoption process. “The chasm” further argues that an innovation needs to change over time in order to get adopted by all adapters. The empirical investigation cannot predict future adoption, but indicates how stakeholders view NFC mobile payment over time. The result of the



investigation shows a diverse prediction for the diffusion and adoption process. Each stakeholder has a different view on how the technology will pick up. These views can often be tied to dependencies outside of the stakeholders control. The importance might not be tied to predicting the process correctly, but to understand the actual process. All interviewed stakeholder representatives to some extent realizes that the joint effort of the NFC ecosystem will define the emergence of NFC based mobile payment in Norway. This indicates that a unified NFC ecosystem is essential to influence adoption the service. With an increased focus on building a healthy and sustainable NFC ecosystem, the adoption of NFC mobile payment is also likely to increase.

Network externalities, switching cost and complementary goods all represent interrelated theories that each provides elements that are relevant for NFC based mobile payment. Empirical evidence indicates that network externalities is present the deployment of NFC related infrastructure. As the NFC ecosystem expands, the increased reach of the network is likely to provide additional value for both participant and users. This is a relative obvious effect which can be used as an argument for increased investments in the NFC technology. On the other side, developing a network infrastructure for NFC based mobile payment takes time and is synonymous with increased cost. Berbusmel (Telenor) suggested a gradual development of infrastructure based on geographical areas, which would spread the investments over a longer time limit and reduce the inherent risk. This strategy can allow the NFC ecosystem to adjust to any change in development for the NFC based payment service. Complementary goods theory indicates that compatibility and standard between NFC technologies can increase the value of the service. The empirical investigation confirms that the stakeholders work towards a unified solution where compatibility and standards are key ingredients. For example, that NFC enabled payment terminals as compatible with NFC based mobile payment and payment cards. In that sense, empirical investigation shows that stakeholder attitudes is consistent with the theory. NFC payment cards and other NFC based services are also likely to complement NFC based payment services, so companies involved in the NFC ecosystem should pay attention to complementary effect from other NFC services. This includes potential negative effects customers might have regarded similar services as this might create negative synergies for NFC based mobile payments. Switching cost potentially serves as an obstacle to the adaptation of NFC based mobile payment. If they are present, adaptors can become hesitant. Empirical evidence shows signs of switching cost on several occasions. Most of the interviewed industry expert points out

transactions price of NFC based mobile payment as one of the most prominent challenges. Switching cost theory states that the NFC ecosystem should target those switching costs that hinder or delay the adoption. This emphasizes a focus on lowering, removing or compensate this cost for potential adopters.

The heart to the emergence of NFC based mobile payment in Norway seems to be the NFC ecosystem. NFC mobile payment is in many ways unique compared to other businesses. It involves combining and uniting different types of industries traditionally not used to work together. The banking industries can be considered a traditional and conservative branch of business while telecommunication industries can be seen as a new and innovative. This can result in unexpected challenges for the NFC ecosystem. Empirical investigation shows that all stakeholders consider cooperation between stakeholders as essential for the widespread of NFC mobile payment. Naturally, all stakeholders want their voice to be heard in the ecosystem. As Iansiti & Levien (2004) suggests about business ecosystem theory, keystone organizations are necessary for a sustainable and well-functioning ecosystem. In an NFC ecosystem based on the Norwegian market, these keystone organizations are likely to be the major mobile network operators and major banking institutions. These are the core service providers in the NFC ecosystem. The Norwegian market consists of both multiple larger MNO's and multiple larger banks. In their respective branches of business, these actors are natural competitors. In the NFC mobile payment, they can potentially gain on joining their forces, at least in terms of increasing the adoption the NFC technology. However, to unite all these stakeholders into one NFC ecosystem can be challenging. This includes agreeing upon both business model and structure of the ecosystem. Both Coskun et al. (2012) and empirical investigation show that the TSM is a key element of the NFC ecosystem and its business model. How the TSM should be organized, and whom should be in control of that role is likely to be a good basis for a new master thesis.

## 8.0 Conclusion

Going into this study, I thought NFC based mobile payment progress in Norway was virtually nonexistent. To my surprise I found that several actors and stakeholders in the Norwegian market are already making moves forward with the technology. I discovered a network of businesses with an optimistic attitude toward NFC based mobile payment. I also learned that the NFC community in Norway is still relatively small, which meant that the management personnel working with the NFC technology in a stakeholder organization often knew about their counterparts at other stakeholder companies. Several managers even worked closely together cross-company wise.

This thesis shows a small picture of the whole complexity of implementing NFC based mobile payment in the Norwegian market. I have only been able to touch slightly upon some of the most important questions related the NFC business ecosystem, due to the limitations of the master thesis. There are still many unanswered questions surrounding NFC based mobile payment. This thesis indicates that questions such as NFC ecosystem structure and cooperation, organization of the TSM, place and fabricate of the SE, NFC transaction price and customers security assumptions still need to be properly addressed. This thesis does not give a complete answer to any of these questions, other than highlighting the need to solve these issues. Both the theoretical and empirical work presented in this thesis can further provide a fundament for further work in any of these areas of interest.

Given the early stages of development in the Norwegian market, the future is uncertain for NFC based mobile payment. Which paths key stakeholders take in the NFC ecosystem, will decide how the implementation and the emergence of NFC based mobile payment turns out. The inherent complexity of the full NFC ecosystem indicates that implementation can be more challenging than one would image.

## 9.0 Further Research

*This chapter will give suggestion to further research in the field of NFC based mobile payment. The suggestions are for related topics that can be considered not fully addressed in this thesis due to the nature of this as a master thesis.*

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This master thesis has provided the author with some good assumptions on what could be interesting future research for the topic. First of all, the NFC ecosystem can be considered a unusually complex network of stakeholder, with various key roles. Any further research should consider an in-depth study of parts of the NFC network, rather than addressing the whole network at ones.

In this thesis, I have identified some key elements which according to empirical evidence, is of importance for the NFC ecosystem. The role of the TSM in a NFC ecosystem can be an interesting topic to study further. Currently there is remarkably little research targeted at the TSM role. This role can be organized in many different ways, which will also affect what business model that can be used. Such a study is likely to be of interest to NFC stakeholders both in the domestic and international market. In addition to the role of a TSM, any study of key stakeholder roles can be the theme for a future study.

A second research suggestion is research related to the transaction price on NFC transactions. Empirical evidence shows that stakeholders in Norway see the transaction price as a significant factor for NFC adoption. A study in this area can potentially clarify what effect price might have on adoption in Norway.

A third suggestion is a study of organizational models and roles in the NFC ecosystem, and what effect these give the NFC ecosystem. A closely related study would be on various business models for the NFC ecosystem. This could be an interesting research both for the domestic and international market. Since these markets arguably are heterogeneous, a researcher should evaluate whether to choose a given market, or compare different markets. Finally, I would suggest further studies on consumer adoption and behavior. Consumers are they key to the success of NFC mobile payment. Because the final customer products is still under development, a customer study should preferably be conducted went the product enters the market. Theory and empirical evidence suggest that areas such as perceived usability and perceived ease of use are important for consumers to consider adoption. Security features and perceived security are also highly relevant topics.

In addition to these suggestions, I further hope that this thesis can be inspirational for anyone interested in the topic. The work done in relation to this study has only increased my interest in the topic of NFC based mobile payment, and I would encourage anyone interested in the topic to do further research.

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