Exploring retailer perspectives on Near Field Communication mobile payment adoption using Q-methodology

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## EXPLORING RETAILER PERSPECTIVES ON NEAR FIELD COMMUNICATION MOBILE PAYMENT ADOPTION USING Q-METHODOLOGY

Ву

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## PREFACE

Upon completion of this thesis I would like to express my gratitude to my graduation committee. First and foremost I would like to thank my first supervisor Prof Dr. Harry Bouwman for showing interest in the research topic and taking time and effort to provide guidance during the project, while still allowing sufficient buffer for me to think critically during each phase of the project. Aside from this form of support, I would also like to thank him for the opportunities he has presented to me, some of which were seized upon. I would also like to thank my second supervisor Dr. Patrick van der Duin with whom I had interacted on a less regular basis, but who provided me with valuable insights and positive support on the occasions that we did interact. Gratitude also goes out to my additional supervisor Dr. Ir. Mark De Reuver whose relatively higher attention to detail encouraged me to form well-reasoned arguments throughout this thesis project. My appreciation goes out for the different kind of support given by each member of the graduation committee, and for putting up with a less than ideal speed of work. I can only hope that the content of this document merits putting your names on the cover of it, and hope it will be of some use in the near future.

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## ABSTRACT

This research study employed Q-methodology to explore retailer perspectives on the adoption of Near Field Communication. Near Field Communication m-payment has emerged as a promising payment alternative for retailers in the Netherlands, offering attractive technological advantages over existing payment methods. However, the multi-stakeholder nature of m-payment ecosystems means that a comprehensive understanding of the adoption factors and incentives for each stakeholder is needed in order to go past the adoption tipping point and reach critical mass. Limited adoption of previous m-payment systems coupled with an existing body of knowledge that has overlooked the adoption factors for retailers have instigated the need for this research study.

This study identified 4 retailer perspective on NFC m-payment adoption. The first perspective represents retailers that rely heavily on customer demand before being enticed to consider adoption. This represents the typical wait-and-see behavior shown by the majority of retailers in the past when it comes to mobile payment adoption, and this is supported by the fact that the majority of participants loaded on this perspective. The second perspective represents retailers that are concerned with the financial consequences of adoption and rely less on the completeness of the mobile payment ecosystem. The characteristics of this perspective represent a group that may be enticed to adopt by offering extrinsic motivation such as financial support. The third perspective represents retailers that are less concerned with financial consequences, but instead focusses on the technical competence of mobile payment. The fourth and final perspective represents retailers that are satisfied with current payment alternatives and will only adopt if mobile payment can improve the efficiency of payment.

The use of Q methodology enabled a deeper insight into adoption factors that other common techniques such as surveys may not have provided. The identification of retailer groups extends on conventional adopter groups such as "early adopters" and "laggards", thus providing a wider breadth of views and responses towards NFC m-payment adoption. These findings inform NFC m-payment providers as to who are willing and capable of adoption, thus possibly accelerating adoption by creating a strong ecosystem. In addition, it also informs providers on the factors they need to improve on in order to attract those who are not yet ready for adoption. For the retailer this leads to an m-payment system that better fits their needs so that they can take advantage of the technological benefits of NFC m-payment.

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# 1

## **INTRODUCTION**

The opportunity to introduce innovative ways to pay at retailer point-of-sales is driven by a changing payment behavior of the customer and enabled by new technologies. This change in payment behavior is reflected in the diminishing use of cash and an increase in use of electronic payment cards. This trend towards more card and less cash at point-of-sales is also present in the Netherlands. Between 2002 and 2012 the use of debit cards at point-of-sales more than doubled, whereas cash usage decreased considerably (Jonker, 2013). For retailers, the shift from cash to card-based payments resulted in faster transaction time and reduced transaction costs, while providing the customer the convenience of use (Smartcard Alliance, 2014). This prevalence of electronic payment cards and advances in technology have led to the emergence of mobile payment as the new means towards a cashless and potentially cheaper payment alternative offered to the customer. The smartphone is considered as the suitable carrier of m-payment due to its high use by the customer and the important role it has taken in their daily activities. Despite its potential, the development and use of m-payment as an alternative way to pay has been limited to niche markets worldwide and in the Netherlands.

#### 1.1 BACKGROUND INFORMATION

In order to understand the context regarding retailer adoption of mobile payment, it is important to first define a retailer, briefly discuss the payment industry and discuss how mobile payment relates to the two previously mentioned topics.

To illustrate and define the concept of a retailer it is useful to explain the concept of a supply chain. A supply chain is a system of entities and resources involved in the process of transforming a raw material or natural resource into a finished product or service that is to be consumed by the end-customer. A supply chain applies to businesses such as grocery stores, where the primary purpose is to sell a finished tangible product, but also applies to restaurants where the primary purpose is to sell a service, experience or set of skills to the customer. Figure 1 illustrates a simplified supply chain of a product that is sold as a finished article to the customer. The two entities involved in this illustration right before it reaches the end-customer are businesses referred to as merchants. A merchant is generally defined as an

organization that buys and sells products or services for a profit. Two main type of merchants exist: whole-sale merchants and retail merchants. As illustrated in Figure 1, whole-sale merchants typically buy large quantities of products from manufacturers or suppliers and sell them to retailer merchants. A retail merchant consequently trades in relatively smaller quantities and sells to the end customer; this may be an individual, but also another businesses. In this study we are interested in the retail merchant (from hereinafter simply referred to as a "retailer", and the end-customer in the form of an individual user (from hereinafter referred to as the "customer").



It is possible to further classify the types of retailers. One of the ways to do this is by looking at the ratio of product-service that they provide. An airline company, for example, classifies as a retailer based on the definition of a retailer given above, but has its core business value centered on the provision of service, rather than a product. The same goes for a bank, a university, a restaurant, an optician; they can be seen as retailers, but with a much stronger focus on a service or set of skills being provided. Advances in the retail industry have created some grey areas such as hybrids of restaurants that also have storefront, i.e. restaurant-retail hybrid. Figure 2 illustrates a continuum of retailers based on the product-service ratio. The product-service ratio can also be an indication of the variety (breadth) and assortment (depth) of the product offering. Variety refers to the different number of product categories, while assortment refers to number of different items within a product category. A comparison between a supermarket and a specialty is a good illustration of this difference; a supermarket has a wide variety of products with a limited assortment, while a specialty store, e.g. footwear retailer, has a smaller variety of products but with a wider assortment. This difference is reflected in the customer service offered to the customer; a footwear retailer offers much more customer service in terms of personnel intervention compared to a supermarket.



Each time a product progresses through the supply chain, there is a process of interaction between the selling and buying entity, also called the process of commerce. As discussed earlier in this study the selling entity is the retailer, and the buying entity is the customer. From the eyes of the customer the process of commerce can be divided into the following steps(Shopping2020, 2013):

- 1. Orientation (evaluate alternatives),
- 2. Selection (select desired alternative),
- 3. Payment (offer product or service in exchange for selected alternative),
- 4. Delivery (receive selected alternative),
- 5. Support (receive relevant information on product or service).

The payment industry revolves around the third step of this process, and this step is the focus of this study. The value of placing payment within the context of commerce helps in distinguishing ambiguous terms and give a better understanding of new channels of commerce and payment that have emerged as the result of change in payment behavior and technological advances.

#### 1.1.1 Payment industry

Arguably the most central aspect when discussing the payment industry is the point-of-sale. As the name suggests, the point-of-sale is the location at the retailer store where the customer pays the retailer for the products or services. The following section briefly discusses developments that have transformed the point-of-sale.

Before the development of the Electronic Data Interchange (EDI) in the 1990's, each of the commerce steps described in section 1.1 had to be conducted using personal interaction between customer and retailer, and payment was conducted at the point-of-sale using cash or non-cash alternatives such as paper banknotes or credits. The point-of-sale consisted often of nothing more than a cash register. The development of the EDI enabled the electronic

transmission of data in a structured and formatted manner. For commerce this marked the beginning of electronic commerce (hereinafter referred to as 'e-commerce'). E-commerce refers to the buying, selling and exchanging of products and/or services using electronic systems. Breaking it down into the previously discussed steps, this means that the orientation, selection, payment, delivery and support can all be done electronically.

While nor e-commerce is not limited to the use of internet as the enabling technology, the widespread use of the internet makes it the most adequate and accepted electronic system to enable e-commerce. Therefore when reference is made to e-commerce in general literature, it is often assumed to be commerce conducted on/through the internet, although from a strict technical point of view this does not necessarily need to be the case. For simplicity, in this study e-commerce is defined as commerce conducted through the internet.

While electronic payment (e-payment) can also be defined as payment conducted exclusively through the internet (as part of e-commerce), in this study it is defined more broadly as payment conducted through electronic systems (not necessarily internet). The choice for a broader definition of e-payment is taken to give a more fitting resemblance of how, where and when e-payment is used in practice. Besides being used to describe the act of payment through the internet during e-commerce, e-payment can also refer to payment conducted using Electronic Funds Transfer (EFT) at retailers. EFT is the electronic exchange or transfer of monetary value from one bank account to the other through electronic system. EFT enabled a new non-cash alternative at point-of-sales: the e-payment cards. These plastic cards are issued to customers by financial institutions, providing the customer with electronic access to their bank account containing electronic funds. Example of such cards are debit cards and credit cards. The introduction of these cards have resulted in the payment industry being divided into two categories: the online and offline channel. The online channel is e-commerce through the internet, with the payment being initiated on the internet. The offline channel on the other hand is "traditional" commerce where each step of the commerce (orientation, selection, payment, delivery, support) is conducted through personal interaction between retailer and customer. In this scenario the point-of-sale is a physical location at the retailer store and the payment is initiated in this 'offline' or physical environment. These e-payment cards have been well received by customers, prompting retailers worldwide to upgrade their point-of-sales into electronic ones- Electronic Funds Transfer at Point of Sale (EFTPOS).

In the Netherlands the debit card in particular was well received. Between 2002 and 2012 the use of debit cards at point-of-sales more than doubled, whereas cash usage decreased considerably (Jonker, 2013). Retailers experienced faster transaction times and reduced transaction costs compared to cash, while providing the customer the convenience of use (Smartcard Alliance, 2014). This prevalence of the debit card and a high penetration rate of smartphones have led to the emergence of m-payment as the promising means towards a cashless and potentially cheaper payment alternative offered to the customer.

#### 1.2 MOBILE PAYMENT

Mobile payment is defined according to (Mallat, 2007) as: "the use of a mobile device to conduct a payment transaction in which money or funds are transferred from payer to receiver via an intermediary, or directly, without an intermediary". This definition is broad, as it tries to cover all the different contexts to which m-payment can be applied. Mobile payment (hereinafter referred to as m-payment) in fact is an extension of e-payment, thus meaning that it carries most of the characteristics and properties of e-payment. One of which is the fact that it can be used in an online environment and offline environment. The following section scopes down the specific context and environment that is the focus of this study.

Each m-payment context is defined according to the type of actors involved and the location and distance between these actors. Using Mallat's definition discussed above as reference, there are three broad types of actors in m-payment: the payer, receiver, and the intermediary. As illustrated in Table 1, the payer is always the costumer, while the receiver can be a customer or a retailer. The location of these actors can be in proximity (offline channel) or remotely (online channel). The location also determines what kind of technology can enable m-payment. For this study the focus lies on proximity m-payment between a customer and a retailer. As illustrated in Table 1 this context entails contactless payment and mobile card payment.

Table 1: Contexts of m-payment			
	Customer to Customer	Customer to Retailer	
Proximity	Contactless transfer	Contactless payment	
		Mobile card payment	
Remote	Mobile Money transfer	Mobile online payment	

Source: (Longoni & Gâza, 2013)

The difference between the two is the role that the mobile device takes during the transaction. In contactless payment the mobile device is the transaction medium that initiates the transaction and communication with a reader at the point of sale. In mobile card payments the mobile device takes the role of the reader that processes the payment initiated by card-based payments systems. For this study the focus is on contactless payment, as this type of proximity customer to retailer payment aims to benefit from the widespread use of the mobile phone by the customer.

It should be noted that the discussion so far has kept from mentioning the smartphone in particular as the transaction medium, but rather refers to the transaction medium as a mobile device. This is because other mobile devices such as tablet PC's, Personal Digital Assistants, or any other 'mobile', i.e. freely movable device capable of initiating, activating or confirming a payment can also be used for m-payment (Karnouskos, 2004). However developments of the mobile phone has transformed it from a device with basic features for making a receiving calls, to what is now known as a smartphone. A smartphone is essentially a mobile phone

with more advanced computing capabilities. These advanced capabilities allows a smartphone to have features that previously were exclusive to (tablet) PC's or Personal Digital Assistants, while maintaining the small size and comfort of use. The wider profile of features on a smartphone coincides with its widespread use by customers as it is allows them to conduct various daily activities that would otherwise require more than one device. This is makes the smartphone the ideal mobile device to conduct m-payment. The following section briefly discusses the technologies that could enable proximity m-payment.

#### 1.2.1 Enabling technologies Proximity Contactless payment

As discussed in the previous section this study focuses on proximity contactless payment. Table 2 illustrates the various technologies that can enable this context of m-payment.

Table 2: Enabling technologies		
Technology	How it works	
Near Field Communication	Uses radio communication to establish a connection between two devices in close proximity.	
Bluetooth Low Energy	Uses radio frequencies to passively connect BLEenabled devices to beacons.	
QR Code	A Quick Response (QR) code is a 2d readable bar-code containing data that can be read by any imaging device.	
Sound Wave	White noise (transaction specific and valid for a few minutes) generated by a Smartphone carrying digital information	
Magstripe emulation	A key fob generates a magnetic field that can be read by an existing POS terminal	
Hotknot	The technology involves data transmission between devices through signal transmission between the touch panels which get coupled. It uses low transmission power but the data transmission rate is far lower than NFC technology	

Source: (Let's Talk Payments & Knowledgefaber, 2014)

The first three technologies listed in are comparatively older thus more developed than the last three mentioned technologies. SoundWave, the Magstripe emulation and Hotknot are all technologies that have not yet been fully developed and are thus not readily available in smartphones. This leaves Near Field Communication (NFC), Bluetooth Low Energy (BLE), or QR Code as the 3 potential technologies that can enable proximity m-payment at this present moment. The next section discusses these 3 technologies and scopes the choice of technology for this study.

#### 1.2.2 NFC vs. BLE vs. QR

In this section a description is given of three of the most viable technologies that can enable proximity m-payment. The aim is to provide a brief overview of how each operates, and then use scenarios to illustrate the process at the retailer store.

Near Field Communication (NFC) is a protocol for ultra-short range (max 10 cm) contactless communication between two devices. NFC is based on the technology used for RFID(Radio

Frequency Identification) and is standardized in ISO/IEC 18092(Curran, Millar, & Garvey, 2012). It is designed to support on-to-one communications between two NFC-enabled entities. (One person to another person or one person to one thing). Every NFC communication session is composed of an initiator and a target. The initiator is typically an individual with an NFC-enabled smartphone but can be any mobile device that can contain an NFC chip. The target is typically an NFC tag or other NFC-enabled device. The individual will position their device near the target which automatically actives the target device and a communications sessions will be established.

The Quick Response (QR) code is a two-dimensional (2-D) matrix code belonging to a larger set of machine-readable codes, all of which are often referred to as barcodes. The first generation of barcodes were one-dimensional (1-D) barcodes, known as Universal Product Code (UPC) commonly seen on price tags in retail stores. Unlike 1-D barcodes, the QR Code is a 2-D matrix code that transmits and reads information not by the size and position of bars and spaces in a single (horizontal) dimension, but by the arrangement of its dark and light elements, called "modules," in columns and rows. Each dark or light module of a QR Code symbol represents a 0 or 1, thus making it machine intelligible and readable by imaging devices.

Bluetooth Low Energy (BLE) is a wireless communication protocol that dictates the function of a Bluetooth 4.0 wireless transceiver. BLE support various transmission ranges (max 100m). One function of a BLE transceiver is to repeatedly broadcast its device ID and small packets of information. When a Bluetooth 4.0 equipped device, such as a smartphone, is in range it will receive this information and pass it on to an appropriate app on the smartphone. This app will then process this information and execute a pre-programmed action such displaying information, issuing a notification, processing data etc.

#### 1.2.2.1 Scenario 1: Payment using NFC

After selecting his desired products at the retailer store, the customer arrives at the POS and informs the checkout clerk that he wishes to pay using his NFC. The customers holds his mobile device (smartphone or otherwise) close to the retailer's payment terminal, verifies the transaction and checks out.

#### 1.2.2.2 Scenario 2: Payment using QR

After selecting his desired products at the retailer store, the customer arrives at the POS and informs the checkout clerk that he wishes to pay using his QR code. The customer unlocks their smartphone, selects the appropriate QR app, and either scans a code on the cashier's screen or has the cashier scan a QR code from the phone's screen. If a QR code cannot be generated, a numeric code may be manually entered. Once one of these actions have been undertaken the payment is verified and the customer checks out.

#### 1.2.2.3 Scenario 3: Payment using BLE

Upon entering the retailer store, the customer's payment app on his smartphone senses a BLE Beacon in the vicinity. The app responds by "checking-in" to alert the retailer's POS of the

customer's presence. Once the customer is finished shopping and arrives at the POS, he requests the checkout clerk to post the sale to their m-payment account. The clerk verifies the customer's identity and completes the transaction.

Scenario 3 suggest that the customer goes through two different type of shopping experiences compared to the other two scenarios. One major advantage of BLE is its ability to make use of its location services and constant engaged communication (transmitter continuously sending out packages, receiver continuously listening) to track what a customer is doing while in the retailer store. The level of interaction required by the customer is very low, as all interaction is done by the BLE enabled mobile app on the smartphone. This level of shopping experience however requires far more comprehensive changes to their technological framework compared to NFC or QR enabled m-payment as it requires several beacons / transmitters to be placed in the store in order to keep track of customer's activities. In NFC or QR enabled m-payment the shopping experience stays relatively the same, up to the point of sale where instead of pulling out a wallet containing several electronic plastic payment cards, the customer pulls out a mobile device that can initiate and verify the payment.

Therefore despite BLE's advantages in store interactivity with the customer, it comes with considerably higher costs related to an overhaul of technical infrastructure and disruption of the customer experience. NFC or QR m-payment on the other hand however does not require major changes to existing technical infrastructure as all changes required are only applied at the POS. In the Netherlands NFC also has a head start over BLE due to the use of the OV chip card for transportation which is based on a similar technology. Customers are therefore more used to the idea of waving a device in front of a receiver in order to complete a payment.

This leads to a comparison between scenario 1 and 2, i.e. NFC and QR. Scenario 1 with NFC is clearly a faster and thus more convenient process for the customer; NFC is technologically superior to QR in that regard. Because of this technological superiority and the fact that the Dutch public is used to the concept of payment through waving, is NFC m-payment perceived as the most viable and feasible proximity m-payment system for in the Netherlands.

#### 1.3 NFC ECOSYSTEM

In order to make NFC m-payment a possibility, cooperation between several stakeholders is required. These stakeholders constitute what is known as an ecosystem. Various configurations involving different stakeholders can enable NFC m-payment, but in Figure 3 a basic configuration is illustrated. Which stakeholders involved in an ecosystem determine what options are available at the point-of-sale. For example, if handset manufacturer A is not involved in an ecosystem then customers that own a handset manufactured by A will not be able to pay using NFC m-payment. This illustrates the importance of having stakeholders with a strong customer-base and partners involved in an ecosystem in order to increase the chance of wide adoption.



#### 1.4 **PROBLEM DESCRIPTION**

Mobile payment appears to be viable and feasible payment alternative in the Netherlands. The country has one of the highest penetration rate of smartphones in Europe, has customers that have shown a favorable change in payment behavior in the past (from cash to debit), and has stakeholders that are keen on and have shown incentive to push through new payment alternatives. Despite ticking these boxes, previous attempts to introduce mobile payment systems have not managed to establish themselves as long-term payment alternatives.

One of the latest technology that can enable mobile payment is Near Field Communication (NFC). NFC enables contactless proximity or mobile payment, i.e. mobile payment in the offline environment. Enthusiasm for this mobile payment is high, not least due to customers' indication that they are readier to make the transition to mobile payment compared to previous timings of mobile payment systems. The Dutch population is also used to the concept, with contactless ticketing in the public transport now widely used for the past four years.

Despite these desirable market conditions there are still some aspects to take into account when it comes to the wide adoption of mobile payment. Mobile payment is a multi-sided platform, meaning that it has distinct user groups that each need to have sufficient reason or incentive to become part of a platform, in this case the mobile payment system. For NFC mobile payment these user groups are discussed in section 1.3 and more extensively in section 2.2. Literature on past mobile payment adoption have shown a preference towards studying incentives for the customer to adopt mobile payment, possibly under the assumption that retailers will automatically follow, as the result of critical mass and network effects.

#### **Critical mass**

Critical mass refers to the amount of adopters required to make the rate of m-payment adoption self-sustained. Theories on innovation diffusion and adoption have various jargon that help illustrate the critical mass.



Figure 4 illustrates an upside down bell shaped curve that indicates groups of potential adopters of m-payment but also any innovation in general. Potential adopters of m-payment can be categorized based on how quickly they adopt m-payment, i.e. their adoption rate(Rogers, 1995). In the beginning the adoption rate is slow and typically only adopted by innovators and early adopters. These are constitute the early market of an innovation. The critical mass constitutes this group and a small percentage of the next adopter group, the early majority. However as Figure 4 illustrates there is a between these two groups; commonly referred to by marketers as "the chasm". For most innovations this is their Achilles heel as they fail to reach the early majority. Once an innovation manages to "cross the chasm" it reaches the "tipping point" (illustrated in Figure 4 with a light blue dot). Once it reaches this point it is up to network effects to further accelerate the adoption rate and let m-payment be adopted by the mainstream market containing early majority, late majority and laggards.

#### **Network effects**

The concept of network effects relates to the impact that each stakeholder has on the overall value of a mobile payment system. This impact can be positive and negative. Positive network effects increase the overall value of mobile payment while negative decreases the overall value. Network effects can also be classified into same-side network effects and cross-side network effects. As the names suggest, same-side network effects are network effects (positive or negative) caused and experienced by the same stakeholder. Cross side network effects (positive or negative) occurs when one distinct stakeholder's action affects the value of the platform for another distinct stakeholder. A combination of these type of network effects will determine whether NFC m-payment will establish itself as a long-term payment alternative in the Netherlands. Figure 5 provides a concise illustration of the two concepts discussed so far.



The challenge in reaching critical mass comes from the fact that all stakeholders need to perceive NFC m-payment as valuable enough to adopt NFC m-payment, without the benefits of network effects. This value comes from their own intrinsic valuation of whether NFC m-payment is an answer to their current demand/requirements, or can come from the providers or marketers of NFC m-payment who can employ various marketing strategies to cross what for them is known as "the chasm". As described earlier customers seem to have found this value in the form of speed and ease of use of NFC m-payment (Emerce, 2014). For retailers however the reasons for adopting NFC m-payment are not yet clear. A sustained change in customer payment behavior might be the source of potential incentives.



Figure 6 illustrates a sustained increase of online retail as the percentage of total retail turnover in the Netherlands. The online retail market of the Netherlands is amongst one of the most developed in Europe, with the percentage of online shoppers in the Netherlands well above the average. The increase in online retail is fuelled by high internet penetration rate. It is predicted that at this rate the online retail industry will account for 30 percent of total retail, at the expense of offline retail. While the declining turnover of offline retail is not strongly reflected in the number or presence of offline retailers, the effects have been seen in increase of prices as a consequence of the decrease in volume. These developments mean that offline retailers need to think forward and consider if NFC m-payment is something that can provide value for them.

This chapter has discussed the problem(s) that have instigated the need for this study. The problem is a two-fold problem: on the one hand providers of NFC m-payment need an insight into factors that affect the adoption decision of retailers in order to make sure that what they are offering is enticing to the retailer in order to give the system a better chance of "crossing the chasm" and reaching critical mass. The problem can also be described from the perspective of the retailer: offline retail is under pressure from online retail and offline

retailers need to start considering options as to how to adjust to the changing payment behavior of the customer.

#### 1.5 **Research Aim, Objectives & Questions**

The primary aim of this study is to complement existing literature by exploring the perspectives among retailers on NFC m-payment. 'Perspective' describes the views and opinion of retailers regarding the adoption of NFC m-payment. This in order to provide insight into what factors affect retailer's decision to adopt NFC m-payment. Examining the retailer's perspective on NFC m-payment and the underlying factors could serve to inform NFC m-payment providers as to what factors to pay attention to when developing and marketing such system, in order to increase the likelihood of the system reaching critical mass.

The above described research aim be broken down into the following distinct but related objectives:

- 1. To identify the retailer adopter groups that have a shared perspective of factors that influence NFC m-payment adoption.
- 2. To examine the underlying factors for each perspective

The exploration of the following research question serve to meet the research objectives listed above.

#### "Which perspectives represent the different groups of retailers when it comes to NFC m-payment adoption? "

Answering this question helps reach the objectives as it implies looking for factors in the literature, and evaluating them quantitatively using Q-methodology. This question can be subdivided in categories and consequently in sub questions. Sub questions mainly help in making assumptions explicit.

#### Concepts

- What are m-payment systems?
- How can NFC enable m-payment?

#### Domain in the Netherlands

- What are the current offline retail payment methods in the Netherlands?
- What are the POS options for a retailer if it wants to adopt NFC m-payment?

#### Methodology

- What is Q-methodology?
- Which retailers can offer well-informed perspectives on NFC m-payment?
- Which statements adequately cover the concourse on m-payment?

#### 1.6 JUSTIFICATION OF THE STUDY

Dahlberg et al.(2008) conducted a literature review on studies concerning m-payment systems. The result of the study indicate that there is a strong focus on the customer perspective and technological aspects when adopting m-payment systems, whilst very little attention is given to retailers. Table 3 supports this argument by categorizing the amount of publications on m-payment according to the research framework of the publication. From this table it is clear that the focus is on consumers and m-payment service market and providers (financial institutions and mobile carriers).

Table 3: Number of papers according to research framework categories			
Categories in the research framework	Papers published		
Technological	48		
Consumers	22		
M-payment service market and providers	21		
Commercial	6		
Standardization	6		
Retailers	4		
Traditional payment services	5		
Social / Cultural	0		
New e-payment services	0		

Adapted from: (Dahlberg et al., 2008)

As discussed in section 1.4, each stakeholder has their own factors that trigger them to make an adoption decision. It is therefore imperative that m-payment providers have a holistic understanding of the adoption factors for each stakeholder. Stakeholders that make the adoption decision before critical mass is reached are typically referred to as innovators, early adopters, and sometimes early majority. Once critical mass is reached, late majority and laggards also make an adoption decision. These traditional adopter categories are grouped based on their social status, financial power and risk tolerance and other background characteristics. This study aims to extend on these adopter categories by grouping retailers based on their perspective on NFC m-payment. This differs from the traditional adopter grouping in the fact that it groups adopters based on content-rich information instead of demographical characteristics. An insight into the perspective, view, and attitude of retailers towards NFC m-payment gives providers a better understanding of the retailer market segments with their underlying factors. This in turn can lead to an improvement of the design of NFC m-payment and a better marketing approach to accelerate the rate of adoption.

#### 1.6.1 Research approach: A case for Q-methodology

Determining the appropriateness of a methodology for any study starts with a revision of the problem description and the consequent research question. Section 1.4 has described the problem as one where NFC m-payment may fail to reach mainstream market if its providers cannot convince certain retailers to adopt their system. This problem description raises the question: what are the perspective of retailers regarding NFC m-payment adoption? This question is explorative of nature as it aims to gather an understanding of underlying reasons and motivations. Questions that are exploratory of nature are associated with a subjective/qualitative research paradigm as they aim to develop an initial understanding of a phenomena and are not concerned with testing theories or making generalization claims. Within this qualitative research paradigm there is one group of techniques that are often used to identify patterns or perspectives among respondents, called the Content or Discourse Analysis. These techniques identify perspective through text and literature analysis. The nature of this approach however means that there is a strong reliance on the researcher's literate and linguistic capabilities, with little transparency or structure to the manner in which perspectives have been elicited. As a consequence there is no guarantee of the same perspectives being elicited if the study was to be done by another researcher. This can be a problem in cases such as the one in this study where investments are made to target specific market segments with certain perspectives. One methodology that offers a systematic and transparent manner to exploring perspectives is Q- methodology.

Q-methodology (hereafter referred to as 'Q') is a research method with origins in psychology, designed to study subjectivity. It is most often used when researchers want to study attitudes towards a phenomena, and does this through a process known as the 'Q-sort' (Cross, 2005). This process requires participants to give a number of statements a position on a quasi-normal grid. By ranking statements in relation to one another the participant is forced to think about issues in a holistic manner instead of individually(Akhtar-Danesh, Baumann, & Cordingley, 2008). These rankings are then subject to correlational and factor-analytical techniques. Factorization reveals patterns of perspectives by identifying groups of participants that have similar Q-sorts, i.e. have expressed similar opinions. The focus of Q is its emphasis on subjectivity as it seeks to gain insight into the dimensions of phenomena from a personal/intrinsic perspective to the participant, while using statistics to identify differences and similarities among participants(Dennis, 1986). The use of statistics is the main aspect that distinguishes Q from other qualitative methods as it provides transparency and structure.

Q is adjudged to be an appropriate methodology for this study as it is capable of answering the research question and achieve the research objectives as laid out in section 1.5. Compared to traditional qualitative methodologies it has the advantage of statistical transparency and structure, which allows it to achieve research validity in the form of replicability. Q-methodology has two distinctive characteristics: it concerns with viewpoint of a certain groups of people and it uses the statistical technique of factor analysis to determine the range of discourses of the particular group (Barry and Proops, 2000). A more comprehensive discussion of the inner workings of Q is provided in chapter 5.

#### 1.7 EXPECTED CONTRIBUTIONS

#### 1.7.1 Academic – adoption literature gaps

As there is a scarcity of literature on adoption factors for retailers, this study contributes to the body of knowledge of adoption factors of m-payment. Furthermore, this study goes beyond dichotomous "adoption versus non-adoption" decisions and takes a holistic view of the diffusion process as adoption-implementation-use and effects.

#### 1.7.2 Academic – ecosystems and network effects

This study also sheds light onto the workings of ecosystems and the importance of recognizing differences between requirements of stakeholders. More specifically it contributes to the knowledge of how NFC ecosystem is configured and the retailer's position within this ecosystem.

#### 1.7.3 Academic- a case for Q

Upon completion this study also highlights the usefulness of Q across various research domains and as a tool to study subjectivity. Studies in which Q has been employed to study adoption is scarce, and this study will aid in proving the versatility of the methodology.

#### 1.7.4 Practical contributions

From a practical standpoint this study is valuable to NFC m-payment providers as it offers them insights to retailer perspectives on the NFC m-payment. This information aids in the development of better systems and more concise marketing strategies that can target specific market segments of retailers.

#### 1.8 TERMS CLARIFICATION AND RESEARCH SCOPE

As previously noted, there are some terms that are used loosely or with ambiguous meaning that can cause confusion. Section 1.1.1 has already scoped a majority of concepts. This section aims to clarify and scope remaining terms that will be used throughout this thesis.

The focus of this research is on the adoption of m-payment by retailers situated in the Netherlands. As discussed in Section 1.1.1, retailers can operate both physical and online transaction channels. However, as NFC is a technology that enables proximity m-payment, the focus of this study is on physical point of sales, i.e. offline retailers. Within this context there are other further classifications such as brick-and-mortar, clicks-and-bricks, e-tailers etc. This study will not distinguish between these types; any retailer with the minimum of a physical point-of-sale is the focus of this study. The term "factor" merits clarification in this study as it can be used in several different ways. In Q and other forms of factor analysis the term "factor" refers to the outcome of statistical calculations. However the term "factor" is also used in general when referring to an issue or phenomenon that affects behavior. To avoid confusion, the outcome of Q's statistical analysis is denoted by a capitalized "Factor", while the lower case "factor" describes an issue or phenomenon.

#### 1.9 **ORGANIZATION OF THESIS**

This thesis consists of seven chapters and is structured as follows:

**Chapter one** provides an introduction to the thesis. It describes the background of the study, defines the research proposition including problem description, research objective and questions, justification of the study, expected contribution and research scope.

**Chapter two** discusses the research domain specifically for in the Netherlands. It provides an overview of payment methods in the Netherlands, discusses NFC in more depth, and discusses developments of m-payment systems in the Netherlands.

**Chapter three** reviews past literature on retailer-centric mobile payment adoption. It discusses each study, summarizes their conclusions and discusses how the conclusions of each study is linked to one another. The chapter is concluded with an extensive overview and grouping of all adoption factors mentioned in the retailer-centric m-payment literature and their links to their respective studies.

**Chapter four** discusses theories that form the basis for the theoretical framework that will be used in the following chapter on Q.

**Chapter five** deliberates in detail Q methodology and how it differs from other methodologies. Its origins and thinking behind its design are discussed before explaining the steps required to conduct Q. Arguments are provided for the methodological choices of the researcher during this study.

**Chapter six** discusses the findings of the steps conducted as explained in the previous chapter, chapter 5. Each perspective is discussed through a narrative, followed by similarities and differences between the perspectives.

**Chapter seven** concludes the thesis by evaluating the attainment of the research objectives and provides critique for the research design and methodological choices. The chapter concludes with suggestions for follow up studies, and a finally closing word.

# 2

### DOMAIN

Section 1.4 has already discussed the developments of online retail and how it is affecting offline retail. In this chapter the payment methods used in offline retail are discussed in order to understand the market that NFC m-payment is aiming to enter and the competition it faces.

#### 2.1 OFFLINE RETAIL PAYMENT METHODS IN THE NETHERLANDS

De Nederlandsche Bank (DNB) is the central bank of the Netherlands, responsible for the supervision of banks in the Netherlands. A study conducted in 2013 concerning the use of cash in the Netherlands provided some valuable insight into the use of payment methods. This study identifies four main payment methods: Cash, credit card, debit card and Chipknip. These are common payment methods used outside of the Netherlands, with the exception of the Chipknip. The Chipknip is issued in combination with a debit card. A Chipknip has to be loaded at a terminal with a minimum amount of EUR 5. A four-digit code (PIN) is required when loading a Chipknip which debits from the customer's bank account. The account balance on a Chipknip cannot exceed EUR 500. The use of Chipknip is concentrated in parking, vending and, commonly abbreviated as 'parvenca'. Payments are initiated offline with a press of "the green button", and does not require the PIN code(CPSS, 2004).

Figure 7 illustrate the results of the study, indicating that both the total amount of transactions as the size of the transaction have increased when it comes to debit cards, also commonly referred to as "pinnen" in the Netherlands. The growth of pinnen has coincided with the decrease of the use of cash over the three-year period under study. Whilst payment with cash still accounts for two-third of the of amount transactions in 2012, when it comes



to the total value of pinnen is the dominant payment method. The pinnen payment system has benefitted from campaigns such as "Klein bedrag? Pinnen mag!" encouraging customers to use it to pay for small value transactions. Motives behind this campaign is the perceived risks of fraud and theft associated with cash payments. Retailers embraced the campaign and the pinnen system because of lower risk of fraud, favorable transaction costs and the ease of use for customers. As a result pinnen has since been used increasingly all transaction value categories, as illustrated by Figure 8 on the following page.



What is significant of this figure is the increase of debit cards or "pinnen" for transaction sizes within the range of micro-payment (max Euro 30). This change in customer in customer payment behavior highlights the ease of use and convenience that the Dutch population currently has with the pinnen payment system. The popularity of pinnen however had detrimental consequences for the Chipknip payment system.

As illustrated in Figure 9 Chipknip transactions volume have decreased drastically over the past three years, eventually leading to providers of the payment system opting for discontinuation starting 1<sup>st</sup> from the of January 2015(Currence, 2013). The cited reasons for the discontinuation of Chipknip are the growing use of the debit card for smaller value transactions. Providers no longer see value in maintaining the infrastructure of Chipknip, and



believe that mobile payment enabled by NFC will be the payment system is capable of serving the parvenca industry and more. However as discussed and illustrated by Figure 7 and Figure 8, the pinnen system is well established and accepted by the Dutch population and promises to be the biggest alternative to NFC m-payment targeting micro-payments. The following section discusses Near Field Communication in more depth and how it can be used to enable proximity m-payment.

#### 2.1 NEAR FIELD COMMUNICATION

Near Field Communication (NFC) is a protocol for contactless communication between two devices. NFC is based on the technology used for RFID(Radio Frequency Identification) and is standardized in ISO/IEC 18092(Curran et al., 2012). Communication between two devices using NFC can occur at a maximum distance of 10cm. This communication between devices involves an initiator and a target. The initiator starts the communication by making a request, and generates RFID signals that are captured and processed by the target. Two modes exist in NFC- passive and active. The passive mode is the common one in which the only the initiator generates RFID signal, which is then processed by a passive target. In active mode, both the initiator as the target can generate RFID signals.

#### 2.1.1 The initiating device

Recalling the definition of m-payment given in section 1.2, this reads(Mallat, 2007): "the use of a mobile device to conduct a payment transaction in which money or funds are transferred from payer to receiver via an intermediary, or directly, without an intermediary". It has been discussed that the term "mobile device" in this definition does not exclusively imply a mobile phone or smartphone, but mobile in the sense that the device can move freely. With this in mind, there are two main devices that can be used to initiate and verify an NFC m-payment:

- 1. the contactless EMV smartcard
- 2. the smartphone

The contactless EMV smartcard is an upgrade to the contact EMV smartcard, which in itself is an upgrade on electronic plastic payment cards using the magnetic stripe. EMV stands for Europay MasterCard and Visa, and stems from an initiative to streamline electronic payment cards across Europe. The chip placed on the plastic payment card has security advantages over the magnetic ones which were prone to skimming fraud. Contactless EMV's are contact EMV smartcard with the additional benefit that it is compliant with NFC technology, i.e. the card can contain an NFC chip and can therefore be used to conduct a NFC m-payment.

NFC m-payment using a smartphone is essentially the simulation of an electronic payment card and its credentials, also referred as the "card emulation" operating mode of NFC. The secure element plays an important part in this simulation, and is discussed in the next section

#### 2.1.1.1 The Secure Element"

The secure element is an environment in which application code and application data can be securely stored and administered and in which secure execution of applications can occur. There are several ways to implement the secure element in order to enable NFC m-payment using the smartphone:

- separate secure smart card
- in the SIM card
- in an SD card that can be inserted in the mobile phone

Which type of secure element is selected is an important consideration as it determines which stakeholder takes the central role in the NFC ecosystem. With this comes a power struggle as concrete agreements need to be established over rights and obligations. As a consequence many ecosystems became cumbersome or have to employ an independent party that intervenes and controls partnerships. This led to stakeholders being reluctant to become part of an ecosystem with the prospect of complex partner relationships not attractive.

Host Card Emulation offers an alternative to the need for a physical secure element on the smartphone as all payment data are stored in the cloud. This bypasses most of the complex ecosystem relationships, and by using tokenization offers a securer environment for the processing of payments.

Regardless of which type of initiating device is used, smartcard or smartphone, the retailer wanting to provide NFC m-payment at his store location will need to acquire the target NFC which will communicate with the initiating device, i.e. he needs to make changes to his point-of-sale.

#### 2.1.2 The target device

The retailer has several options to choose from when deciding on changes to his terminal or point-of-sale. The point-of-sale is considered as the complete configuration (with possible connections to inventory, printing of receipt etc.), while a terminal is the separate piece of equipment (with connection to the point-of-sale) in which a payment card can be inserted/swiped or waved in front of. Retailers need to consider whether their existing terminal can already accept NFC or if it is upgradeable in any way to accept NFC. In the Netherlands the majority of the 300.000+ terminals are of the brand 'VeriFone'. No VeriFone terminal bought before 2013 is NFC-ready nor can they be adjust or upgraded to support NFC(Checkout.nl, 2013). A retailer with this type of terminal will therefore need to buy a new terminal if they wish to provide customers with the opportunity of paying using NFC. Another common brand of terminal in the Netherlands are the "Ingenico" terminals. These terminals have different suppliers, and whether they can be upgraded to support NFC depends on their supplier. Those that are upgradeable need to be send to their suppliers, with the costs of upgrading to be paid by the retailer. Another brand of terminals, which are very popular in supermarkets, are the Xenta terminals. These also have different suppliers and whether they are upgradeable depends on their supplier, with any costs again to be paid by the retailer. Prices for new terminals of any of the brands discussed above vary between Euro 550 and Euro 900 (Checkout.nl, 2013). Retailers also have the option of acquiring terminals on a lease contract, or by acquiring "Slimpin-pakket" which are a service-contract bundle offered by bank which also includes an NFC-ready terminal. These type of bundles may be more attractive to new retailers who do not yet have existing service contracts with other banks. Whichever solution a retailer chooses, it is clear that there are significant costs involved; be it up front costs, ongoing lease contact costs, or costs of not having a terminal for the duration of the period that a terminal is send to the supplier for upgrading.

#### 2.2 NFC M-PAYMENT ECOSYSTEM

An NFC-enabled m-payment system requires several stakeholders to be part of an ecosystem. However, traditional payment ecosystems form the basis of an NFC-enabled ecosystem. Figure 10 illustrates the ecosystem of a traditional/generic payment ecosystem.



#### 2.2.1 Retailer

As this thesis has the retailer as the stakeholder under the scope, it is only appropriate to discuss the retailer first. The typology of retailers has already been discussed in section 1.1.1. The retailer sells goods and/or services to a customer and decides which payment alternatives to offer to the customer. Which payment alternatives are offered depends which agreements or service contracts a retailer has with acquirers and POS providers.

#### 2.2.2 POS provider

POS (Point-of-sale) has been discussed briefly in section 1.1.1. A POS terminal holds the software used at the checkout. As the name already suggests, POS providers are those that manufacturer or otherwise sell POS terminals to retailers. Figure 11 therefore also illustrates a direct relationship between retailers and POS providers. Although not illustrated in Figure 11, POS providers sometimes also have a direct service contract with acquirers. Some markets also require POS terminals to be certified for payment schemes, another stakeholder which will also be discussed below.

#### 2.2.3 Acquirer

Acquirers are responsible for handling financial acquisitions in the payment ecosystem. Different acquirers have different ways in which they authorize and clear payments for the retailers. Main tasks of the acquirer include the initiation, the clearing and settlement of payment transactions through payment schemes and banks.

#### 2.2.1 Payment scheme

The payment scheme/brand or card scheme handles agreements with scheme participants, sets fees and determines technical, functional, branding and certification policies for scheme participants. As discussed in section 2.2.2, payment schemes often work with POS providers in order to ensure that POS terminals are certified and comply to their security regulations in order to accept the payment scheme. Popular examples of payment schemes include MasterCard, VISA, American Express and Discover.

For mobile contactless payments using NFC, some actors are added to the ecosystem. There are various ways to structure a NFC-enabled m-payment system, but below a possible setup is illustrated. There are four new stakeholders that are added to a traditional or generic payment ecosystem; these are illustrated in Figure 11 in the highlighted area. A short description of each stakeholder follows.



#### 2.2.2 MCPA Service Provider

Besides the four added stakeholders in the accentuated rectangle, another difference from Figure 11 compared to Figure 10 is the MCPA Service Provider, previously simply referred to as the Payment Service Provider. MCPA stands for Mobile Contactless Payment Application and is an application on the Secure Element, another concept discussed in section 2.1.1.1. As discussed in that section, how the Secure Element is implemented affects the dynamics of the ecosystem. Figure 11 should therefore be seen as a generic representation of the NFC ecosystem, solely for the purpose of explaining which stakeholders may be involved. The MCPA Service Provider issues the payment application which will be performing the payment functions for the customer.

#### 2.2.3 Trusted Service Manager

The Trusted Service Manager is an optional player that can play an essential role, tasked with mitigating the cost, complexity and inefficiency of multiple service agreements. The Trusted Manager was introduced after acknowledging conflicting interests of other stakeholders and a power struggle, for example as the result of how the Secure Element is implemented. In essence it takes the position of an independent third-party which fulfills technical or commercial roles.

#### 2.2.4 Mobile Operator

The mobile operator, or otherwise referred to as the Mobile Network Operator (MNO) or mobile phone carrier, offers wireless communications and owns or controls elements required to allow the customer make use of a mobile phone. In the context of NFC m-payment it can take an important role in the ecosystem because it can provide communication between the MCPA residing on the customer's mobile phone and the MCPA provider. In cases where the SE is implemented on the SIM card, MNO's with large market shares can become powerful stakeholders in the ecosystem.

#### 2.2.5 Secure Element provider

The Secure Element provider manufactures the secure element. This role is different from the Secure Element issuer, which in Figure 11 can be any of stakeholders.

#### 2.2.6 Handset provider

The handset provider can have a two-fold role in the ecosystem. Firstly it manufactures the handsets which means that it determines whether a handset is NFC enabled. Secondly it can also be the issuer of the secure element, in which case the secure element is embedded in the device. Before the introduction of Host Card Emulation, discussed in section 2.1.1.1, handset provider and platform provider were grouped together as one stakeholder in the context of NFC m-payment ecosystem. However with the introduction of HCE it is possible to find a setup where handset provider and platform provider grouped fulfill different roles, as HCE no longer depends on a SE but relies on processing capabilities of the platform provider (e.g. Android, Blackberry).
#### 2.3 **DEVELOPMENT OF THE POINT OF SALE**

As part of the introduction to this thesis, Section 1.1.1 already briefly discussed the development of the POS systems, brushing on concepts such as the Electronic Data Interchange and Electronic Funds Transfer which were key contributions to the point-of-sale we now encounter in the retailer store. However as section 2.2 and in particular Figure 11 illustrates, retailers are in direct relationship with POS providers which means that they merit a more comprehensive discussion if we were to fully comprehend retailer decisions on payment alternatives. This section goes through developments of the POS in the context of the Dutch market.

The location in the retailer store where a customer pays for a product is the point-of-sale (POS). For years this location is occupied by a cash register operated by a store clerk or cashier. Originally mechanical cash register containing cash and opened by hand, these later became digital cash register which were capable of printing out proof of transactions. Mechanical cash registers are no longer in use, while digital cash registers are still in use globally. Retailers using digital cash registers benefitted from the ability to preprogram certain functions such as the addition of the price of a product to the total price, an easier and faster calculation of advanced formulas such a taxes, and the ability to print receipts.

The 1980's saw the introduction of "point-of-sale systems". These are essentially Personal Computers connected to a cash register. These were introduced by IBM Retail Store Solutions in line with the anticipated growth of popularity of Personal Computers. Retailers using these systems were better able to keep track of their sale activities thanks to extended features of resource planning (ERP), customer relationships (CRM) and management reports. These systems also paved the way for further developments such as the product scanning using barcodes and electronic payment cards, and the payment terminal that reads the electronic payment card. The majority of brick and mortar retailers are at this point with regards to their point of sale systems. A central point of sale systems with or without extended features such as CRM and ERP, and with a connected terminal that accepts electronic payment cards. The next couple of paragraphs discuss further developments in the point of sale industry and what are the alternatives a retailer could face when considering an upgrade.

#### 2.3.1 Mobile Point of Sale

Developments in of the internet, mobile technology and cloud computing caused a shift from usage of desktop and personal computers to more mobile devices such as smartphones and tablets. This change has been reflected in the POS industry and the year 2009 has seen the introduction of mPOS systems, i.e. mobile point of sale systems. As the name suggests, mPOS systems are typically smartphones or tablets that function as a point-of-sale and accept electronic payment cards from customers. Examples of mPOS providers in the Netherlands include Adyen Shuttle, Monitise, Payleven, Payworks, Payplaza and Sumup. In order to accept electronic payment cards, attachments are provided that need to be connected to the smartphone or tablet that allow the customer to insert their EMV electronic card and type in

their pin code on the attachment or on the smartphone/tablet itself. A retailer may be enticed to acquire an mPOS due to lower acquisition costs of the mPOS attachment compared to a traditional POS terminal, and typically free download of the software required for the smartphone or tablet. The implementation of a traditional POS terminal is also far more complex and time consuming than an mPOS. Downsides to mPOS is that the smartphone or tablet must always be available for use, with battery life of such devices becoming an important factor. Other considerations are the costs per transaction which are far lower with traditional POS terminal providers. Due to its reliance on mobile connectivity, transaction speed with mPOS are also lower in comparison with traditional POS terminals which use the faster wired connection. Lastly due to its higher maturity, POS terminals have the added layer of assurance in the form of certifications, with mPOS systems considerably behind in this regard.

#### 2.3.2 Cloud-based Point of Sale

Cloud based POS extend on traditional POS systems and/o mPOS. These systems make use of cloud computing; in essence this implies that all data processing and storage takes place in the cloud. This makes these systems platform and hardware independent. As these are relatively new systems, they often come (NFC) m-payment ready. Besides being platform and hardware independent, these systems offer the opportunity to have access to the POS regardless of location. Large retailers may resist switching over to cloud-based systems due to the years of investments in their own in-house ICT department or because traditional POS systems providers offer tight-fitting solutions to their industry specific needs. However some cloud-based systems are open platforms that offer app-store-like functionality for developers to develop custom modules that can be integrated in cloud based systems. A major attraction for retailers in using these systems is the ability to go cross-channel and integrate activities in the offline channel with the online channel. Examples of cloud based systems in the Netherlands include ASPOS, Cashr, CloverTwo and Sweebr Kassa.

#### 2.4 NFC IMPLEMENTATIONS IN THE NETHERLANDS

The Netherlands have seen various NFC pilots, with mixed reviews and experiences. This section discusses some of the solutions, both in a non-payment as payment context to give an illustration of the degree of maturity of NFC in the Dutch market and the stakeholders that have been active in it thus far.

#### 2.4.1 NFC in non-m-payment contexts

The Dutch healthcare industry was one of the first to experience NFC implementations. Security and identification specialist Nedap announced in 2011 that more than 50,000 nurses that provide home healthcare use their NFC trial. The service was launched in 2005 and was used to track and manage home healthcare visits of nurses to patients. Nurses would tap their NFC-enabled phone to a sticker when arriving, and tap again when leaving; Nedap managed the administration, thereby reducing administrative errors and hassle the previous system permitted(S. Clark, 2011a).

Dutch startup company Tag N Tap used NFC tags on posters to provide movie-goers with information on upcoming screenings and locations at the G Short film festival. By tapping or scanning the tags on the posters, users were directed to a mobile website with details of timings and venues(Dyker, 2013). High-end fashion retailer VIC used NFC tags and QR codes in a pilot at their store, which allowed customers to access product information, vouchers and promotional videos by tapping the tags. The pilot showed that NFC tags are more popular than QR codes because consumers found it very easy to use, compared to QR codes which requires scanning(Boden, 2013).

Phone manufacturer Samsung has also been active in the Netherlands. They have teamed with Dutch ecommerce retailer JeansOnline and technology provider SalesWindow to promote the use of NFC functionality in their Samsung Galaxy S III, Galaxy S III Mini and Galaxy Note II. Customers at JeansOnline could receive coupons entitling them to receive a second item with every purchase by using their Samsung phone to scan a NFC sticker in the shop window (S. Clark, 2013a). Dutch Imax theatre Omniversum used NFC posters to inform visitors on upcoming screenings and directing them to its Facebook page(Dyer, 2013a). Two-hundred-and-fifty advertising panels in crowded shopping areas, railway stations and car parks in major Dutch cities are equipped with NFC and QR code functionality(M. Clark, 2013).

Dutch restaurant Popolare uses Nexus tablets in combination with NFC tags to reduce waiting lines and automate the process of ordering food. Customers of the restaurant are handed a tablet when they arrive at the restaurant, and after choosing their menu on the tablet, tap a NFC tag located at their table, which then sends the table number and order to the restaurant staff. The tags used in this context are the so called "NFC disc tags", which are water-resistant and made of plastic (NFC Support, 2014).

#### 2.4.2 NFC in M-payment

The NFC m-payment pilot in 2013 by Mobiel Nederland Betalen is regarded as a key milestone in the development of m-payment in the Netherlands. Developments before, during and after the pilot are of interest because they offer some explanation to the decisions taken by stakeholders before, during and after the pilot. For this reason, this subsection is divided into pre-Mobiel Nederland Betalen, Mobiel Nederland pilot, and post-Mobiel Nederland Betalen.

#### 2.4.2.1 Pre-Mobiel Nederland Betalen

Payter became the first NFC m-payment service launched in the Netherlands. . Launched in 2007, Payter was a mobile wallet that allowed customers to pay using NFC. The goal was to launch the service on a national level in 2008, after a live pilot in Rotterdam, one of Netherlands' largest cities. However, plans to roll out on a national level were put on hold after failing to gather the required and desired scale. An in-depth study in 2008 by Rathenau Institute has raised concerns on the Payter pilot. The authors recognized the possibilities of NFC m-payment but raise concerns on liability for user data when things go wrong (van 't Hof & Schilpzand, 2008). The report is one of the earliest that identified the dilemma about where to place the Secure Element, recognizing the power shift that can occur depending on where the Secure Element is placed. The specific role of the Trusted Service Manager is also among the key issues they have identified. In 2009, Payter announced that they were ceasing their operations, citing insufficient scale to develop existing services further as the main reason for doing so(S. Clark, 2009).

The Netherlands have been on the front foot in Europe concerning collaboration between major banks and mobile operators to introduce a NFC m-payment system. In 2010 T-Mobile, Vodafone, KPN, Rabobank, ABN Amro and ING signed a letter of intent specifying that they would set up a joint venture company responsible for introducing and managing a NFC m-payment system. Initial areas of application of the system were announced as payments, admission tickets, coupons, customer loyalty and membership cards.(S. Clark, 2010).

In 2011, security identification specialist, Multicard, announced that it was to provide Rabobank with NFC-compatible stickers to allow non-NFC enabled phones to use Rabobank's Minitix virtual mobile wallet service. In addition it would provide applications that could transfer money, check balances, top-up and manage all transactions of the mobile wallet(C. Brown, 2011).

Rabobank followed up their announcement by collaborating with Dutch technology provider Chess later in 2011 to roll out a trial at an Amsterdam outlet of Albert Heijn, the Netherlands' largest supermarket chain. Using NFC stickers attached to their phones, customers could pay in the convenience store. The NFC sticker was linked to customers' existing Minitix wallet. The authentication and authorization of transactions between cash registers, NFC reader and the Minitix virtual wallet was managed by Chess' Point of Sale cloud-based server(S. Clark, 2011b).This pilot marked the beginning of Rabobank's Cashless Betalen. In 2011 the cooperation agreement between mobile network operators KPN and Vodafone, and bankers ABN AMRO, ING and Rabobank was signed. Notably, T-Mobile pulled out of the joint venture, instead opting to follow its own route to NFC m-payment. Entitled "Six pack", the joint venture announced that its aim was to develop a user-friendly and secure m-payment in the Netherlands, with the rollout expected in early 2013(S. Clark, 2011c).

In the second quarter of 2012, Vodafone announced a collaboration with VISA to introduce a global Vodafone Mobile wallet, with the Netherlands among the select few countries to benefit first from the service. The service would be based on the VISA prepaid account and will be offered to consumers in partnership with VISA issuers. The service would be a platform open to all financial institutions, retailers, transport and utility companies. Besides making purchases using the service at a point-of-sale, customers will be able to store loyalty scheme points and gift voucher credits, as well as stored value accounts and other services(S. Clark, 2012).

Regulatory hurdles have led to the announcement of Six Pack that plans to form the joint venture have been abandoned. Although no joint venture will be formed, the five remaining members are still committed to working together in alternative ways to develop the m-payment system. A poll among 15-65 year old Dutch consumers has revealed that 55% would prefer to make m-payments through an app rather than NFC either embedded or in the form of stickers. Respondents also indicated that they would prefer the payment to be handled by banks, followed by phone manufacturers and mobile network operators(Telecompaper, 2012).

Four members of the original Six Pack initiative have announced plans to run a NFC pilot in the city of Leiden in the summer of 2013. **ABN Amro**, **ING**, **Rabobank** and **KPN** have teamed up again, this time joining MasterCard to launch the pilot initiative. Apart from T-Mobile, the other notable absentee from the original joint venture is Vodafone. As discussed earlier, its recent partnership with VISA might offer some explanation to this, as VISA and Master Card are two distinct payment-processing networks. One thousand select customer will be able to use an NFC phone to make payments in shops and restaurants. The initiative is ran by Mobiel Betalen Nederland, a new group established by the three banks. The group is to remain intact until the end of 2013, when the pilot is scheduled to be completed(S. Clark, 2013b).

#### 2.4.2.2 Mobiel Nederland Betalen pilot

The m-payment pilot began on September 2 2013, in Leiden. Selected participants are provided with a Samsung Galaxy Express smartphone preloaded with their bank's payment app. The group announce that the selection of retailers that will take part in the pilot are to be as varied as possible. These retailers include smaller shop, large retail chains, including department stores, retail outlets, department stores, bars, and restaurants. The Dutch railway company Nederlandse Spoorwegen (NS) is also part of the study, including all shops located

in the railway stations. It is announced that after the pilot each member of the initiative are free to form their own conclusions and choose their own path to follow (Dyer, 2013b)

#### Transactions

During the pilot, the amount transactions with the NFC phones average at 2.000 per week. The average total of transaction reach 20.000 per week. The amount per transaction averages at 10.51, with 92% of the transactions conducted being below 25. Of all customers, 84% conducted more than 25 transaction during the pilot. The top three type of transaction were(Emerce, 2014):

- At 62%: Daily groceries (supermarkets, bakery, drugstore etc.)
- At 18%: Specific shopping (clothes, books, etc.)
- At 12%: Catering and fast-food

#### **Retailer experience**

One hundred and eighty retailers took part in this pilot. 38% percent of them described the experience of m-payment as above expectations, with forty-seven percent experiencing it as expected. 40% percent agreed that the biggest advantage offered by the pilot was a faster transaction time by 7 seconds and shorter queue's, for transactions below 25. Other benefits listed was that it could let customers perceive their business as client-friendly and innovative. The five type of retailers most suited to the pilot were(Emerce, 2014):

- Major supermarkets
- Convenience stores in railway stations
- Large department stores
- Small shops such as drugstores
- Parking meters

#### 2.4.2.3 Post Mobiel Nederland Betalen

The Mobiel Nederland Betalen made it clear in no uncertain terms that each bank and mobile network operator that was part of the venture were totally free to do as they wish once the pilot was completed; and the decisions of each member of the venture are very interesting to observe once the pilot was completed. For this reason this section is divided per stakeholder and discusses how each of them has followed up the pilot in Leiden.

#### Rabobank

Rabobank was involved in m-payment from the very beginning. Their Minitix mobile wallet was introduced back in 2003 and although it has seen major changes over the years, it remains at the core of their m-payment ideas. Following the pilot in Leiden, Rabobank has decided that the results were positive enough to push through developments of an NFC m-payment

service. Their initiative is two-fold: A "Rabo Wallet" for Rabobank customers and a new version of their "My Order" app for everyone.

Besides allowing NFC m-payment at terminals, the Rabo Wallet is expected to add other value-added services to Rabobank customers such as scanning of receipts, display of account balance, and adding of other bonus and customer cards. Although it is known to be an app, it is yet uncertain for which mobile platforms it will be developed. Customers of other banks can use Rabobank's Mobile Order Cashless betalen app. This app is essentially an integration of the previous My Order app and the Cashless betalen service. With either an NFC-enabled phone or NFC-sticker, the app allows NFC m-payment at various locations that previously supported Mobile Order or Cashless betalen(Rabobank, 2014).

#### Vodafone

As mentioned earlier, Vodafone pulled out of the Mobiel Nederland Betalen before the pilot started. They collaborated with VISA and explored NFC m-payment separately with the payment-processing network. In March 2014 they announced their SmartPass app in the Netherlands, available for customers and non-customers. Available on Android and iOS, Smartpass allows users to pay at a Point of Sale, online, or peer-to-peer, thus covering three of the previously discussed context of m-payment. As with the Rabobank app, since iPhones do not have NFC technology integrated, iPhone users will have to buy a sticker that can be attached to the phone. Users are able to pay at any terminal that supports V-Pay, including those outside the Netherlands (Boden, 2014).

#### ABN AMRO and ING

Banks ABN AMRO and ING have opted against using a mobile device or app for contactless payment. They saw more value in keeping the tried and tested card, and add the NFC chip to it. Adhering strictly to the definition of m-payment given earlier, this means that the two banks have not chosen for m-payment, yet contactless card payment. Customers will be able to pay by "tapping" the card to point-of-sale, without having to type in their PIN number when it comes to transactions below 25.(WebWereld, 2014)

#### **KPN and T-Mobile**

The two remaining members of the original "SixPack" venture are KPN and T-Mobile. As of the time of writing, neither KPN nor T-Mobile has given clear indications how they will continue with NFC m-payment in the Netherlands.

#### 2.5 **SUMMARY**

This chapter has discussed the market share of payment alternatives in the Netherlands. The pinnen payment system seems to be the preferred the offline retail industry, overtaking other payment systems such as the Chipknip in the micropayment niche. The discontinuation of Chipknip presents an opportunity for NFC m-payment in micropayment, with pinnen however possibly providing stern resistance. The chapter also briefly discusses the operating modes of NFC and uses a generic NFC m-payment ecosystem to discuss the stakeholder possibly involved. Being one of the stakeholders with which the retailer has a direct service contract with, attention was then given to POS providers and developments in the POS landscape. Should they decide to adopt NFC m-payment, retailers have the option to choose between upgrading existing POS infrastructure, acquiring an NFC enabled payment terminal, acquiring mPOS systems or acquiring cloud based POS.

The chapter concludes with an overview of NFC implementations in the Netherlands. The Netherlands have had non-payment NFC implementations, also known as NFC in the reader/writer operating mode, in the form of NFC tags in the health, transport, and horeca industry. While this does not directly relate to NFC m-payment, it does suggest a possible familiarity of the Dutch population with the concept of contactless communication or the "tap-n-go". As for NFC m-payment itself, the Mobiel Betalen Nederland represented the biggest pilot held under retailers. Retailer adoption of NFC m-payment is crucial for the mpayment ecosystem. However, as results from the Mobiel Betalen Nederland has shown, retailers are not as excited by m-payment systems as customers. Retailers that have taken part in the pilot have indicated that a faster transaction time is the biggest advantage, and even so only 40% of the percentage of participating retailers agree with this statement. The different paths that members of the original Sixpack convention have chosen also indicates that there still is a division concerning what is perceived as the best manner to provide a mpayment system. This means that retailers have alternatives when it comes to the adoption of m-payment systems. The following chapter explores and discusses factors that can influence retailer decision on m-payment adoption.

# 3

### LITERATURE REVIEW

This chapter reviews existing literature on retailer m-payment adoption. Section 3.1 briefly discusses these studies and presents the findings and conclusion for each study. An extensive overview of all factors linked to their respective studies follows. The chapter is concluded with a brief summary and indication of the by now identified research that this study aims to bridge.

#### 3.1 RELATED STUDIES ON MOBILE PAYMENT

As of 2014, m-payment is a relatively new topic and remains a topic of interest for many, especially in the retail industry. However, research on m-payment adoption has often overlooked the retailer's perspective in m-payment adoption. Prior research mostly focusses on technological and consumer-related aspects of m-payment (Dahlberg et al., 2008). A literature review on m-payment by (Guo, Nikou, & Bouwman, 2013) has yielded 142 studies on m-payment, published between 2002 and 2013. Significantly, only four out of these 142 studies study m-payment adoption from the retailer's perspective. A summary of the six studies is found in Table 4, followed by discussions of each study.

Table 4: Retailer-centric m-payment literature					
Authors	Methodology	Objective			
Van der Heijden(2002)	Qualitative Interview	Examine factors that affect early implementation of m- payment systems in Sweden and the Netherlands.			
Teo et al (2005)	Qualitative interview	Explore factors that inhibit and facilitate m-payment adoption in Australia. Focus was on micro-payments services.			
Mallat& Tuunainen(2005) Mallat & Tuunainen(2008)	Mixed-method (quantitative followed by qualitative)	Propose a conceptual framework that maps factors that drive and inhibit the adoption of m-payment systems by retailers. Increasing sales or reducing costs of payment processing entail the main adoption drivers, while complexity of systems, lack of critical mass and business models entail the main barriers.			

Lai &	Semi-	Used semi-structured interviews with experts in the field to
Chuah(2010)	structured	propose an analytical framework for understanding the
	survey	possible impacts of the market drivers and organizational
		enablers on m-payment adoption in Hong Kong.

(Van Der Heijden, 2002) empirically investigated factors that affect the adoption rate of mobile payment systems by conducting interviews in Sweden and in the Netherlands. The author found that the three most important factors were 1) cost compared to alternative payment systems such as debit card systems, 2) security, and 3) the perceived ease of use the system, specifically at the side of the retailer. The author also concluded that technological feasibility (integration effort) with current POS and user support were considered as hygiene factors by the interviewed retailers. Hygiene factors are factors that are taken for granted and are assumed to just be there, as prerequisites. On themselves they do not necessarily drive or motivate adoption, but the absence of them will lower drive and motivation to adopt. The author also concluded that merchant acceptance and customer acceptance are positively interrelated. Two implications were extracted from his findings: 1) retailer and customer acceptance have different requirements and therefore need to be addressed separately. 2) Relative cost and benefit compared to alternative payment systems weigh heavily for both retailer and customer, the suggestion is to target industries where the relative advantage is the highest, e.g. car parking.

	Retailer and customer acceptance are positively interrelated
Conclusions	Retailer and customer's different set of requirements need to be addressed separately
	Target industries where the relative advantage is highest

Teo, Fraunholz, & Unnithan(2005) used semi structured interviews to study mobile payment adoption in Australia. Interestingly, in accordance with (Van Der Heijden, 2002) conclusions three years prior to their study, two trials were deemed as successful in Australia; in the vending machine and parking scheme industries. The authors classified retailers that took part in their study as unaware/uninterested, trialed/abandoned, and successful/continuing. The first group stated viable business opportunity (transaction costs) and customer demand as potential triggers to make them consider m-payment. However lack of budget maneuverability meant they could not afford to absorb the costs without sharing some cost with the customers, which could lead to loss of customers. The second group stated increasing usage of mobile phones and the potential to increase impulse purchases as the two main incentives that made them to trial m-payment. However high implementation and transactions costs meant that they abandoned trials and decided against adoption. The third group of respondents successfully adopted and implemented m-payment using customer feedback. They targeted young generation that perceived m-payment as innovative and were also impulse buyers. However so far these business were not able to achieve high revenue from these purchases as a resulted of an Australian m-payment ecosystem dominated by only one telecom provider. Their desire to be perceived as an innovative company and a belief that at some point they will start making a reasonable return on investment have kept them from abandoning m-payment as others in the third group of respondents have done.

ConclusionsRetailers are put off by uncertainty about required time for return on investment<br/>An ecosystem free of monopoly and with variety of stakeholders might lower costs

Mallat & Tuunainen(2008, 2005) used a mixed-method research approach to propose an analytical framework which categorizes retailer adoption factors as prerequisites, drivers and barriers. The author reasons that a factor is a prerequisite when it precedes the adoption decision but does not determine it. This type of factor is what (Van Der Heijden, 2002) described as hygiene factors. Factors described as drivers are factors that are benefits and effects of mobile adoption that entice or motivate retailers to adopt m-payment. And finally factors described as barriers are factors that either prevent adoption or impede the use of m-payment. The findings of the study lead the author to conclude that barriers to adoption are evident for retailers, but drivers or benefits are not, as they are vary per retailer. The author further comments that the industries that are more likely to embrace m-payment are electronic ticketing, vending, and self-service at unmanned service station (e.g. car wash). This is in accordance with previous discussion on (Teo et al., 2005; Van Der Heijden, 2002). Mallat reasons that this reflects retailer's needs for cost effective ways to charge for small value payments, more so in the light of the diminishing use of cash.

	Retailers active in small value industries are more likely to consider mobile payment
Conclusions	Retailers associate the increase in use of smartphones with increased impulse purchases which then becomes a driver for adoption
	A profounder understanding of retailer adoption decision may be achieved by evaluating the market in terms of prerequisites and then comparing drivers with barriers in order to predict or explain retailer adoption decision

Lai & Chuah(2010) employed semi-structured surveys in an industry-wide study in Hong Kong with the objective to propose an analytical framework for mobile payment adoption in retailing, using a supply-side perspective. The author categorizes the forces that could influence retailer adoption as: Provider forces, Organizational Enablers, Consumer attitudes and Market enablers. The author bases the study on the reasoning that the decision to adopt is not an instantaneous decision but consists of two critical decision stages: willingness to adopt and capability to implement.

Conclusions	Actual	use	and	potential	implementation	also	determine	retailer	adoption
conclusions	decisio	n.							

## Mobile payments adoption behavior exhibits the form of a complex ecosystem subject to multi-actor forces and multi-dimensional influences

This brief chronological overview of studies on retail-centric m-payment adoption illustrates how research on m-payment have developed over the years. There is a cohesion between conclusions and implications of each study, which indicates that there is an increasing understanding of retailer m-payment adoption decisions. To further illustrate how the four studies relate to one another, an extensive overview of all factors identified in each study is provided in Table 5 on the next page.

Table 5: Overview of retailer adoption factors according to literature				
where	e B = barrie	er; D = dr	iver; P = pre	erequisite
Factors	Van der	Тео	Mallet &	Lai &
	Heijden	et al.,	Tuunain	Chuah,
	, 2002	2005	en, 2008	2010
Transaction costs	В	В		В
Expected reduction of payment processing			D	
Lack of suitable charging model			В	
Charging methods seem not flexible	-			В
Ease of use for retailer	D			
More convenient than cash		D		
Complexity for retailer			D	
Ease of use for customer	D			
Facilitating payment			D	
Improvement of POS efficiency				D
Perceived risk / security	В			
Loss of sensitive customer data				В
Lack of perceived security and trust			В	
Mobile screen provides instant proof of transaction				D
Risk of fraud				В
Retailer and customer are positively interrelated	D			
Customer demand		D		D
Critical mass			В	В
Technical feasibility	Р			
Viable technical infrastructure			Р	
Budget for implementation		В		
High costs of implementation			В	
Cost of switching & implementation are high				D
Dedicated budget				В
Increased usage of mobile phones		D		
Proliferation of mobile technologies			Р	
Required mobile technologies are ready				D
Impulse purchases		D	D	D
Cooperation between and variety of stakeholders in		В		
ecosystem				
Lack of standardization			В	
Innovative public image		D		
Positive effects on company image			D	
Better company innovation image				D
Retailer's knowledge(M)			Р	D

Enhanced customer service			D	
Plurality of applications like loyalty CRM and mobile				D
advertising				
Possibility to offer new services			D	
Ability to expand markets beyond physical to online retail				D
or vice versa				2
		D		
Viable business opportunity		D	D	
Alternative to each and eards for processing micro			В	D
Alternative to cash and cards for processing micro-				U
New customers			D	
Higher appeal to young generation				D
Complementarities with other mobile services				D
Competitors and peers in the market start to imitate and				D
follow the act				
Market leaders have adopted m-payment				D
				-
Efforts to boost the awareness				D
Top management commitment				D
Strategie exignation				D
				D
Absorptive capacity				D
User support	Р			
Existence of skilled manpower resources with ongoing				D
training support				
Capability to sense & respond likely effects of new				D
technology changes				

Table 5 gives a comprehensive overview of factors and statements that the authors have listed as influential on the adoption decision of the retailer. The factors have been grouped using the researcher's judgment based on the similarity of the factors. For each factor it is indicated what the author of the respective article believed the effect of the factor was on the adoption decision (prerequisites, barrier or driver). There are several factors that are indicated as barriers and drivers, but this is the result of a negative or positive connotation of the description that the author have used, but with the underlying factor being the same. It should be noted that the focus is on factors that the authors have proposed as part of their theoretical framework or have rated as influential, not factors that are listed in their respective work merely as the result of literature review.

#### 3.2 **SUMMARY**

This chapter has reviewed existing literature on retailer-centric m-payment adoption in chronological order in order to understand the direction that the research area is heading towards. A cohesion between findings and suggestions for future research is identified. While these similarities may stem from general innovation adoption principles or the multisided nature of ecosystems, the consistent indication theoretically and practically that retailers active in small value industries are more inclined to adopt m-payment illustrates that there are some m-payment specific consistencies. Other consistencies are the indication that retailer and customers have different requirements that need to be addressed separately, which further justifies the need for this study. This study also follows up on one of the more recent suggestions by (Lai & Chuah, 2010) that in order to understand retailer adoption decision better it is imperative to also include post adoption phases such as implementation and actual use, and to do so from a multi-dimensional manner. The next chapter discusses the theoretical concepts that will be used in this study.

# 4

### **THEORETICAL BACKGROUND**

The previous chapter has discussed the literature on retailer-centric m-payment adoption to familiarize the reader with the direction that the research area is going into. One of the conclusions of the chapter was that the adoption decision of m-payment by retailer is also affected by post-adoption phase which the literature has typically overlooked. This chapter aims to discuss theories and concepts that will be used in order to come to the research model of this study.

#### 4.1 **DIFFUSION OF INNOVATIONS**

Everett Rogers is arguably the researcher who has contributed the most to diffusion research. In his book "Diffusion of Innovation", he has combined various previous studies on diffusion research. In this book Rogers defines diffusion as *"the process by which an innovation is communicated through certain channels over time among the members of a social system*'(Rogers, 1995). It is important to denote the difference between the terms diffusion and adoption, which unless explicitly defined can be confused or used ambiguously. Diffusion refers to the overall process, while adoption is at a more microscopic and individual level. Using this distinction helps in understanding the concept of unit of adoption and rate of adoption. Unit of adoption refers to members of the population in which an innovation is diffused. Each unit of adoption have different rates with which they make the decision to adopt or not to adopt; this is the rate of adoption. The decision of a unit of adoption depends on their perception of an innovation; literature on technology adoption is typically concerned with studying factors that affect this perception in order to speed up the rate of adoption.

#### 4.1.1 Rate of adoption

The reason why there is such interest in a higher rate of adoption can be explained by the diffusion s-curve.



Figure 12 illustrates what researchers refer to as "typical diffusion s-curves". Numerous studies on technological innovation adoption have induced a pattern in the way that technologies are diffused. Technologies experience a slow adoption rate at first, then more rapidly, and then slowly again. This pattern is illustrated in Figure 12 by the straight-lined scurve. (Rogers, 1995) has divided units of adoption according to their adoption rate, place within the diffusion lifecycle, and percentage of the targeted market (innovators, early adopters, early majority, late majority and laggards). These groups are defined by the adoption factors that they perceive as relevant or important. Figure 12 also illustrates a dotted S-curve; this is the failed diffusion curve of a technology. This technology has not managed to "take-off" and reach the accelerated adoption rate which follows the slow adoption rate in "successful" diffusions curve. It does not mean that it has not been adopted at all, but using Rodger's categorization, it means that only innovators and early adopters have adopted the technology. Other ways to describe this curve is that it has not managed to reach "critical mass" or the "tipping point", as discussed in section 1.4 as part of the problem description of this thesis. While there are valuable knowledge to be extracted from such innovations, it is not the desired scenario for the developers, as it means that they will not receive the desired return on investment on the technology. This is why the literature is so concerned with studying adoption factors to accelerate the adoption rate.

#### 4.2 **CRITICISM OF EXISTING ADOPTION THEORIES**

Critics of innovation adoption studies have argued the majority of research focus solely on the adoption phase and on measures such as "intent to adopt" or a more dichotomous "adoption vs. non-adoption" (Fichman, 2000). These studies are strongly based on Roger's Diffusion of Innovation model and on the characteristics of innovation. Further criticism is on studies that have relied too much on the Technology Organization Environment (TOE) framework, uses the context within which an organization operates to study adoption decisions (L. G. Tornatzky, Fleischer, & Chakrabarti, 1990). The suggestion is that a study incorporating both theories will be able to provide a more comprehensive insight into adoption (Lai & Chuah, 2010).

#### 4.3 FOUR-PHASED DIFFUSION PROCESS IN ORGANIZATIONS

(Bouwman, van den Hooff, van de Wijngaert, & Van Dijk, 2005) developed a four-phased model that illustrates the diffusion of a technological innovation inside an organization. As reasoned by (Rogers, 1995), diffusion in organization are different than diffusion in the general population as there are two levels of unit of adoption instead of one. The first unit of adoption being the organization, and the second being the employees of the organization who then have their own right to decide whether or not they will adopt the innovation. In the case of this thesis the first unit of adoption is the retailer as an organization, and the second unit of adoption on the individual can be the cashiers but also customers visiting the retailer store location. This is the first difference from other adoption theories which may not distinguish between levels of unit of adoption, or the contingent nature of the adoption decision in organizations. The authors then extend on Roger's model by incorporating elements of models by other authors such as Andriessen, Cozijnsen, Vrakking and Van den Hooff. The final model by the authors starts with the adoption phase, followed by implementation, use and effects. In the next section discusses each phase and reasons for their inclusions in a model that describes diffusion.

#### 4.3.1 Adoption

The adoption phase is defined as "the phase of exploration, research, deliberation and decision-making to introduce a new system in the organization" (Andriessen, 1989). This phase is identical to what (Rogers, 1995) defines as the "initiation" phase, a phase that consists of the gathering of information and planning that leads to an eventual decision. The adoption phase is the first step in the diffusion of m-payment system. In this phase, the retailer actively explores the market for solutions that meet their needs, determines what gains it hopes to achieve by adopting the system and finally decides to adopt or not. As discussed earlier, this model embraces the concept of two units of adoption. The decision taken by the retailer to adopt NFC m-payment takes place in this phase. The second unit of adoption, the cashiers or customers, make this decision later on in the model, after NFC m-payment is in place and ready to be used. The authors therefore argue that the Use phase,

discussed in section 4.3.3, is the phase in which these unit of adopters make their adoption decision. In the adoption phase however it is all about the retailer as an organization and their assessment whether available NFC m-payments meet their organizational needs. This assessment is based on their perception of the characteristics of the innovation and other considerations such as cost-benefit analysis, relative advantage, perception of critical mass, and strategic orientation of the retailer. (Treacy & Wiersema, 1997) have identified three types of strategic orientations that market leaders have: operational excellence, product leadership and customer intimacy. Operational excellence implies that a retailer is concerned with making operations as lean and efficient as possible. Those with product leadership are concerned with providing state-of-the-art products and/or services. This requires creativity, fast time-to-market, and constant pursuit of new opportunities. Those that embrace customer intimacy value customer relationship more than anything and are not afraid of investing now if it means a long-term relationship with the customer. The value of discussing strategic orientation in the context of this thesis is to see if this has any bearing on retailer's adoption decision, with the benefits of NFC m-payment in mind.

In essence this phase is what most research focus on looking past this phase. Because of rapid technological developments, retailer may decide against adoption (effectively a non-decision), or on the other extreme take the jump-on-the-bandwagon approach in fear of being left behind by competition. In the end this phase is concluded with decision, often based more intuition and experience rather than rational evaluation, which brings us to the first post-adoption phase.

#### 4.3.2 Implementation

The implementation phase follows the decision by the retailer to adopt m-payment. It is the first "post-adoption" phase, but only for the retailer as an organization as customers or employers have not yet had to make the adoption decision, as discussed in the previous section. The implementation phase is defined as "the phase of internal strategy formulation, project definition and activities in which an adopted application is introduced within the organization, with the aim of removing reservations and stimulating optimum use of the application. (Bouwman et al., 2005)". In other words the implementation phase concerns taking into the organizational requirements and consequences of adoption. This is led by an implementation strategy which aims to direct and manage the process between the decision to adopt and the actual use of m-payment. Primarily a phase focused on the technical aspect of installing the required infrastructure, the implementation phase is also concerned with the organizational aspect of preparing employees and customers for the use of NFC m-payment. The implementation phase is worthy of consideration and inclusion as a post-adoption phase because it encourages thinking about the retailer's capacity and readiness to implement(Lai & Chuah, 2010).

#### 4.3.3 Use

The use phase is defined as "the phase in which members of an organization start applying the ICT application in their daily operational activities (Bouwman et al., 2005). As discussed in section 4.3.1 this phase is effectively the adoption phase for the cashiers and customers of a retailer. Just as with retailers in the adoption phase, the degree to which cashiers and customers use NFC m-payment depends highly on their perception of its usefulness and how it fits with their needs and demands. This is preceded by proper execution of the implementation phase as discussed in the previous section which enhances the ability of cashiers to operate the NFC terminal and offer support to the customer when and if desired. As this thesis is more concerned with the adoption decision of retailers as an organization and this phase is more concerned with the individual unit of adoption, this phase is underrepresented in this thesis. It should be clear however that this is the perfect gap complemented by the vast amount of studies on customer adoption factors.

#### 4.3.4 Effects

The effects phase is defined as "the phase in which the consequences of the use of an ICT application for the organization become manifest- consequences for the individual execution of tasks within the organization, for communication processes and structures within and between organizations, and for the position of the organization within its environment". (Bouwman et al., 2005). The effects phase is in essence the initial reason why retailers would adopt NFC m-payment. It is the benefits or advantages that entice the retailer into adopting. We can also refer back to (Treacy & Wiersema, 1997) and the typology of strategic orientations and what retailers are looking for in NFC m-payment. In the adoption phase it is the expected or hoped for effects that suit their strategic orientation, in the effects phase it is the actual effects. It is therefore not an issue of factors affecting the Effect phase, but a categorization of what the effects are. Other authors advocating the study of post-adoption phases often refer to this phase as the phase of value-creation(Cooper & Zmud, 1990; Fichman, 2000; L. Tornatzky & Klein, 1982).

These are the four phases of the Four-phased diffusion process as proposed by (Bouwman et al., 2005). In section 4.2 the criticism of existing adoption theories have been discussed and how they fail to go past adoption, and employ either innovation characteristics or the TOE framework when studying adoption. The four-phased model described above clears the first criticism by including post-adoption phases. The second and third criticism are cleared by the inclusion of what the authors refer to as "perspectives" (hereafter referred to as 'themes' to avoid confusion). These are: organizational, technical, economical and user. The researcher uses these themes as guidelines but makes small adjustments in order to fit better with the context of this study. The themes are: Technology, Ecosystem, Organization and Individual. The themes are still very much alike, with the concept of 'ecosystem introduced to capture the multi-actor nature of mobile payment ecosystems. The economic theme as proposed by (Bouwman et al., 2005) is covered partly by Ecosystem and partly by Organization.

# 5

### **METHODOLOGY**

As discussed briefly in Chapter 1, Q-methodology (Q) is a research method designed to systematically study subjectivity of respondents. 'Subjectivity' in the context of Q-methodology is defined as a respondent's viewpoint, opinion, attitude or perspective of a particular topic (S. Brown, 1993). The name "Q-method" originates from the attempt to differentiate from conventional factor analysis, i.e. the "R method" ("R" is a reference to Pearson's product moment correlation: r). In R method factor analysis the aim is to find correlations between variables across a sample of respondents(McKeown, 1990). This in contrast with Q method, where the aim is to look for correlations between respondents. By correlating respondents, clusters of similar or distinct perspectives on a particular topic can be extrapolated. In this present study, Q was employed as a means to extrapolate the retailer perspectives on the adoption of NFC m-payment.

#### 5.1 WHAT IS Q?

English psychologist William Stephenson first developed Q in the early 1930's with the goal to demonstrate that subjectivity could be examined in a systematic and objective manner. According to Stephenson, "subjectivity" can mean "either inner experience or the opposite of scientifically objective" (Stephenson, 1953, p. 23). The term "objective" is often used to mean "as observed by others" (Stephenson, 1953). This means that Q allows researchers to "observe" subjectivity in a scientific manner. Stephenson's concept for Q came at a time where behaviorism was dominant in psychology. Behaviorism is an approach to psychology that maintains that human behavior can be described scientifically / objectively without considering inner experiences such as thoughts or beliefs. Stephenson opposed this school of thought, and believed that inner experience, i.e. subjectivity played a part in human behavior, and that this could be studied and analyzed in a scientific manner. With this in mind he decided to design and publicize Q methodology (Q).

There is some debate when it comes to the origin of the name Q methodology. Some argue that "Q" was selected because of its position in the alphabet relative to the letter "R". Ideally a Q study should be conducted to explore perspectives before using R methodology to measure frequency of identified perspectives and reach level of generalizability (Webler, Danielson, & Tuler, 2009).

Q is based on the fundamental reasoning that while subjective opinions may be constantly varying and heterogeneous, they do have structure and pattern that can be examined for observation and study(S. Brown, Berry, & Lewis-Beck, 1986). Q does this by presenting participants (P-set, as described in section 5.3.3) with a set of statements (Q-set, as described in section 5.3.2) derived from all information available on the topic of study (the concourse, as described in section 3). By placing each statement through a process called Q-sorting on a quasi-normal distribution participants reveal their subjective viewpoint, or sometimes referred to as personal profile (Brouwer, 1999). What sets Q apart from more traditional research methods such as Likert scale in surveys, is that it asks participants to rank and prioritize statements in relation to one another. By doing so it requires participants to think about the topic of research holistically, and not independently as each statements comes along (Akhtar-Danesh et al., 2008). After collecting the Q sort of each participant, by-person factor analysis is applied in order to systematically compare among other participants. As briefly described earlier, the method is named "Q" in an attempt to differentiate from traditional factor analysis, commonly referred to as the "R" method. In R methodology the researcher looks for correlation between test items, such as education and salary, across a sample of participants(McKeown, 1990). Q methodology, on the other hand, looks for correlation between the respondents.

Table 6: Comparison R methodology and Q methodology						
R Method Q Method						
Variable	Survey question	Q-sort				
Subject	Respondent	Q-statement				
Population	All possible respondents	All possible Q-statements				
Factor Analysis Normal Inverted						

Source: (Webler, Tuler, & Krueger, 2001)

From a data analysis point of view this means that the data matrix is inversed; the respondents are the variables, and the statements are the projects. Q factor analysis reduces all Q-sorts to a few "Factors", which are considered a model representation of how respondents think about the topic, in this case retailer NFC m-payment adoption.

"Subjects" of a Q study are Q statements and the "variables" are the Q-sorts. Researchers in Q are interested in patterns across Q sorts for each Q-statement. The Q-statement position on the grid of one Q-sort is compared to the position of the same statement on another Q-

sort. Participants sort statements according to their beliefs and attitude on the topic. When patterns are found, the conclusion is drawn that there are beliefs that are shared among people, which leads to the notion of "social perspectives".

Although it has its origins in psychology, Q has now been applied a wide range of research areas. Example of such research areas include professionals attitude towards health-related issues((Risdon, Eccleston, Crombez, & McCracken, 2003), various patient concerns with health issues (Barker, 2008; Newman, 2005; Wong, Eiser, Mrtek, & Heckerlong, 2004) public opinion(Webler et al., 2001), communication(Carlson & Trichtinger, 2001), policy analysis(Durning, 1999), environmental concerns(Addams & Proops, 2000; Barry & Proops, 1999), and education (Falchikov, 1993; Jurczyk & Ramlo, 2004; Ramlo & Mcconnell, 2008). Despite this wide range, Q has not been applied frequently in the technology adoption literature. To the researcher's knowledge, (Valenta & Wigger, 1997) is among one of the very few publications where Q has been used to study technology adoption. Other more recent studies include the adoption of instructional technology(Bowe, 2011), and the exploration of staff, students and managers views of technology supporter learning (Deignan, 2005).

#### 5.2 STRENGTH AND LIMITATIONS

The initial resistance to Q methodology that Stephenson experienced back in the 1930's is still evident today despite advances in psychology that incorporate subjectivity(e.g. cognitive psychology) and the application of Q methodology in fields outside of psychology. This resistance can be attributed to the difficulty or reluctance in classifying Q as a quantitative or qualitative method(Cordingley, Webb, & Hillier, 1997). The process of asking respondents to order statements to statistically derive perceptions and viewpoints on a topic is critiqued by qualitative method enthusiasts. Traditionally, one of the most popular research method for analyzing perceptions or viewpoints is the Content/Discourse Analysis- a purely qualitative method based on perceptions that have been elicited through interviews, existing literature and focus group discussions. The popularity of this method in qualitative research shows that the use of statistics is not a requirement when aiming to explore perspectives on a topic. Yet it is the statistical element that is one of Q's strength because it adds an element of transparency and replicability. Replicability is the most important type of reliability for Q. Brown (1980) argues that only a limited number of distinct viewpoints exist on any topic. This clarifies why Q requires only a small but diversified sample of respondents, which leads to the criticism that quantitative researchers have of Q. Quantitative research methods require a high sample size because the most important statistical reliability is the ability to generalize sample results to the general population. However as discussed earlier, Q aims to describe a population of viewpoints, and not a population of people (Risdon et al., 2003). A common quantitative method used to describe a population is the Likert attitude scale. Ten Klooster, Visser, & de Jong (2008) conducted a study in which they compared the results of Q with the

Likert attitude questionnaire when studying the product image of beef. Their results indicate that Q is an appropriate tool to apply when aiming to take an exploratory approach to a topic, i.e. to get rich insight into the various perspectives. Likert can also be used to explore perspectives by using segmentation, but this is typically done on the basis of demographical characteristics of the respondents, while Q reveals perspectives on the basis of functional, content-specific criteria. They conclude their study by suggesting that Q can be used to explore perspectives, and then use Likert in a follow up study structured around the revealed perspectives by Q to examine demographic characteristics and reach an acceptable level of generalizability. In order to test reliability/replicability of Q, one would have to conduct a follow-up study using the same statements (Q-set) with a similar group of respondents (P-set). This study should generate similar Factors. This was seen in Watts(2008) who compared two studies using the same Q-set 8 years apart in 2 different geographic locations. Despite these differences in time and space, he identified a similar first Factor. With this finding he demonstrated the "reliability" of Factor, but also the presence of structured and shared "body-of-knowledge" or viewpoints.

#### 5.3 CONDUCTING Q

This section describes the steps that constitute the application of Q in a research study. The choice for a research method depends highly on the type question that the researcher aims to. In this study the research question reads: "Which perspectives represent the different groups of retailers when it comes to NFC m-payment adoption?" This question is exploratory of nature, with a keen interest in the psychological concept "attitude" of retailers. As illustrated in Figure 13, Q consists of 6 steps that need to be applied. Each of these steps will be discussed in more detail in the following sections.



#### 5.3.1 The concourse

The concourse refers to all that is said about a particular topic at any given time(S. Brown et al., 1986). The concourse is divided into two main type of sources: naturalistic and quasinaturalistic. Naturalistic sources are oral or written communication such as interviews or essays designed specifically for the creation of a Q-set(Cordingley et al., 1997). Quasinaturalistic sources, also known as "secondary sources" are oral or written communication that are external to the study, i.e. they have not been created with the creation of this specific study's Q-set in mind. The concourse for this study was based on an iterative process of reviewing quasi-naturalistic sources on the adoption of m-payment. Chapter 3, and more specifically Table 5, illustrates the final concourse for this study.

#### 5.3.2 Determine Q-set

The next step is to draw the Q-set (also called Q-sample) from the concourse. The Q-set refers to the set of items (statements, images, audio) that are representative of the concourse. This set of items can occur in a random and unstructured manner, or by using a structure. An unstructured sampling process selects the Q-set without explicit consideration for adequate coverage of the concourse. Herein lies a high chance that certain aspects of the concourse are being over- or under sampled, thereby introducing bias into the Q-set. A structured sampling process on the other hand aims to overcome this bias. This can be done deductively, inductively, or using both methods (S. R. Brown, 1996). A deductive method is based on priori theoretical considerations, while an inductive method uses a framework developed in the process of examining the concourse. Regardless of which structure or method is chosen, determining a Q-set that covers all aspects remains an unrealistic objective since different items are interpreted differently by different people(Stainton-rogers, 1991). The benefit from a structured sampling is less chance of researcher bias imposed on the Q-set, and the fact that the chosen framework provides a justifiable subset of the concourse (Akhtar-Danesh et al., 2008).

The Q-set for this study was drawn using a structured deductive approach. The theoretical framework developed for this study, as outlined in section 4.3 is based on the premise that the process of innovation diffusion in organizations (in this case retailers) consists of more phases than the adoption phase alone. Zhu & Kraemer(2005) support this notion with empirical evidence in a study in which they evaluated the importance of including the implementation, use and effects phases when studying the adoption of innovation. These phases are often referred to as "post-adoption" phases and are typically studied separate from the adoption phase. By including all adoption and post-adoption phases (implementation, use and effects) it is possible to gain a more holistic picture. Bouwman et al (2005) describe a model that takes into account all these phases, and this model has been used in this study as a guideline.

The factors listed in Table 5 representing the concourse was reviewed in several iterations in order to come to the final set of Q statement. In each iteration it was considered in which of

the Four-phased model the factor would fit according to the description and purpose of each phase given by the authors, and under which theme the factor can be categorized. An English version of the final set of 24 Q statements can be found in Appendix D.

#### 5.3.2.1 Translating Q-statements

For this study, Q-statements were extracted from an English concourse (literature review) and then translated to Dutch in an attempt to eliminate any potential reluctance to participate due to language barrier. There is some debate among Q researchers as to the validity of translating Q-statements to facilitate communication with different cultural groups. (Webler et al., 2009) argue that if the translation is overseen by an expert with a thorough understanding of the cultural groups then the benefits of including additional populations outweighs any concerns about translation reliability. Translation in this study was overseen by an expert with thorough knowledge on the Dutch population and Dutch terms and jargon of m-payment.

#### 5.3.3 Determine P-set

People who fill in surveys in R studies are referred to as respondents, whereas people that complete Q-sorts in Q studies are referred to as participants. Respondents in R studies are sampled with the purpose of being as representative of the population as possible. Participants in Q are also sampled with the best representation of a population in mind, but for a different type of population.

When determining the P-set or P-sample (population sample), the emphasis shifts from number of participants to the likelihood that they can offer a perspective linked to the research question. In order to do this the researcher must consider how many perspective exist, rather the amount of people that share these perspectives (Mrtek, Taesse, & Wigger, 1996). This rule stems from the argument that on any topic, a limited range of perspectives exist(S. Brown, 1980). The ideal respondents are respondents with strong, well-formed perspectives.

Researchers have developed various guidelines as to the ideal amount of respondents. Two of the most used guidelines are listed below:

- 1. Tradeoff between the minimum/maximum rules of thumb (Webler et al., 2009)
- 2. P-set matrix formed by theoretical considerations (S. W. Brown, 2010)

The minimum/maximum rules of thumb are based on consideration of ratio between perspectives, statements and respondents. The minimum rule stipulates that at least 2 respondents have to share a similar perspective in order to make a valid conclusion on the existence of such perspective. This makes it a 1:2 ratio between perspective and respondents. The maximum rule adopts a reverse of the ratio of the minimum rule. It stems from traditional R research that indicate that it is wise to have more observations than variables in a study

where statistics are used to analyze results. In a Q study the observations are the Q statements, and the variables are the Q-sorts. This makes it a ratio of 2:1 between statements and respondents Table 7 illustrates an example of a minimum/maximum guideline.

Table 7: P-set example using minimum/maximum rules of thumb					
Minimum (1:2 ratio) Maximum (2:1 ratio)					
2 perspectives = 4 respondents	24 statements = 12 respondents				
3 perspectives = 6 respondents	30 statements = 15 respondents				
4 perspectives = 8 respondents	36 statements = 18 respondents				

Because it is difficult to predict how many perspectives will be revealed, researchers using the minimum/maximum approach tend to oversample to ensure that they comply with the minimum rule. (S. W. Brown, 2010) branded the use of this approach as too formulaic and originating from R factor analysis logic. Instead he suggests sampling based on a P-set matrix.

The P-set matrix is formed using theoretical considerations as characteristics that form the matrix. Using the research question as a guideline, the researcher carefully determines the kinds of respondents who might have well-informed opinions on the relevant issue or topic. By defining the characteristics of respondents and the possible values of these characteristics a matrix is formed. The total amount of desired of respondents then constitutes of all possible combinations of these characteristics. (S. W. Brown, 2010) stresses that the matrix serves merely as a guideline, since it could be difficult to find respondents meeting the characteristics of each possible combination. Ultimately the focus of the P-set should be on diversity and not on numbers.

For this study the P-set was determined using Brown's recommended matrix approach in order to assemble a diversified group of respondents. The characteristics of the matrix were drawn from theoretical considerations, as recommended by Brown (2010). The first characteristics (product offering) was determined based on the consideration that the general term 'retailer' can be subdivided into several other subcategories, based on the productservice and variety and assortment continuum as discussed in section 1.1.1. A retailer that offered finished products without the need of personnel intervention (service) might have a different perspective on NFC mobile payment then those that required service intervention or employee assistance. In retailer stores that offer common products, customers their hands on the desired product and waiting lines grow quickly. However where intervention by the personnel is needed in order to get access to the product, the buying process is largely dependent on the interaction between customer and personnel and not so much on the POS. The second characteristic (mobile payment experience) was selected on the premise that past experience with mobile payment pilots or project are likely to influence the perspective that a retailer has on NFC mobile payment. The final characteristic (branch) was included in order to try and capture the role of transaction volume on the retailer perspective. Initially this characteristic was defined as transaction volume but pre-tests suggested that retailers are reluctant to provide such information.

A matrix was designed yielding twelve  $(3 \times 2 \times 2 = 12)$  possible combination as illustrated Table 8. Since the aim was to have at least three participants representing each combination (12 x 3 = 36), a total of thirty-six respondents was the desired minimum amount of respondents.

Table 8: P-set using characteristic matrix						
A. Product offering Groceries Specialty store Vending + ticketing						
B. Mobile Payment Experience	Yes	No				
C. Branch Centre Rural						

Guideline:				
3*2*2=12 possible combinations				
3 participants for each combination yields				
36 participants				

#### 5.3.4 Data collection

#### 5.3.4.1 Recruitment approach

The first round of recruiting respondents started in October 2014. Potential respondents were identified, based on the P-set as discussed in section 5.3.3 using an online directory of retailers in the region. Preference was given for retailers in the region in order to facilitate potential follow-up interviews with retailers. The researcher then phoned the identified retailers and briefly explained the objective of the study and desired contribution of the retailer. If the retailer showed interest in taking part in the study then a short information sheet (see Appendix A) describing the study and with a link to the online tool was sent to them via email. An informed consent document was also sent to the retailer; this was a brief document requiring a signature by the retailer to ensure validity and authenticity of data entry. Once signed the retailer could send the informed consent via email or request the researcher to pass by and pick it up. The effectiveness of this approach is hard to measure as various variables come into play such as the timing of the phone call, the various outcomes possible from the phone call, the presence of a manager at the time of calling, the possibility of the follow-up email being bounced around in the service desk and the possible time gaps in between phone call, email reaching the desired respondent and the actual completion of the Q sort. Nevertheless, in the timeframe of 2 weeks when 31 phone calls were made, only 1 confirmed data entry was registered within this timeframe, making the response rate during this period a meagre 3.2 %.

Despite being somewhat cumbersome, the above described recruitment approach was a costeffective and time-efficient approach. However with such a low response rate the decision was made to go out on the streets and hand out the information sheets and informed consent to retailers, hoping to avoid peak hours so that the retailer could complete the Q-sort on location. This approach was costly with regards to time and location, but in doing so the researcher had hoped to improve the willingness of retailers to participate by means of familiarity between retailer and researcher. This however proved to be counterproductive as none of the 19 hardcopy resulted in confirmed data entry within a time frame of 2 weeks.

After a month the decision was taken to make the Q sort an anonymous process, replacing the field requesting the retailer name with a field requesting a general description of the industry they are active in. In addition the informed consent was removed, as the researcher tried to identify and remove potential barriers and resistance in participating. In removing the need to fill in the informed consent however, the researcher exposed the study to potential fraudulent responses as there no longer was a post-data entry control over the authenticity of the respondent, as discussed in (Lefever, Dal, & Matthíasdóttir, 2007). The decision was made regardless, considering the low response rate and the timeframe of the study in mind.

The information sheet to the study was then posted on various social media in an attempt to get respondents. In addition the "snowball" recruitment approach was embraced. In the snowball approach the researchers asks one respondent central to the issue to recommended several other suitable candidates he or she may have in their network circle. The advantage of this approach is the stronger sense of reciprocal obligation- at first between the researcher and the central respondent, and then between this respondent and other suitable respondents he or she may have in their network. Bimler and Kirkland(2002) discussed how such a reciprocal obligation is preferred to financial incentives offered to respondents, as when financial incentives are offered the respondent will be more likely to enter data randomly and in a hurried manner in order to get the reward. In this study the researcher exploited the network circle of a family member with an adequate position in the retail industry. While the snowball approach is susceptible to a selection bias by relying on the central respondent's suggestion, it was emphasized that a diversified pool of respondents was desired.

Overall the recruitment approach was adjusted as time passed, starting with the most desired and structured manner of recruiting using the theoretical P-set matrix and with the informed consent as a means of personal identification, and resorting to an anonymous, informed consent-free snowball approach as a last resort. During the whole recruitment process each approach remained active (a majority of contacted respondents promised to eventually complete the Q sort), and because of the switch to an anonymous Q sort it is impossible to indicate which completed Q sort came from which approach, i.e. the final response rate of each approach. In the end a total of 37 respondents were acquired.

#### 5.3.4.2 Q-sort

#### 5.3.4.2.1 Grid Design

AS previously described, a Q-sort is the process of ranking Q-set statements and placing them onto a grid. The grid takes the form of a quasi-normal distribution, i.e. an upside down bellcurve ranging from one extreme on the left side to the opposite extreme to the right side. The exact shape and number of columns of the grid is left to the researcher's discretion, although there are some general, albeit controversial guidelines on the design of the distribution. Van Exel (2005) reasons that in case the researcher expects the interest or knowledge of respondents to be low, or if a small part of the statements are expected to be distinguishing, then the distribution should be steeper and narrower in order to leave room for ambiguity and indecisiveness in the middle of the distribution. On the other hand if the researcher expects respondents to be strongly opinionated and well-versed on the topic at issue, then the distribution should be flatter and broader in order to provide room for stronger (dis)agreement with statements. This consideration, in addition to the number of statements determines the eventual shape of the grid. Brown (1980) indicates the typically Q-sets with 40 to 50 statements employ a relatively flattened and broad distribution with a range from -5 to +5.

With 24 statements selected for this study, a range of -5 to +5 could still be achieved, but the choice has been made for a steeper and narrower grid of -3 to +3. In hindsight the choice proved justified as there was some difficulty in finding strong and well-informed respondents. Figure 14 illustrates the design of the grid.



#### 5.3.4.2.2 Sorting instruction and neutrality

The sorting instruction or condition of instruction is the researcher's instruction for the participating regarding how to complete the Q-sort. The sorting instruction determines what labels to put to the extreme columns of the grid. The majority of Q studies ask the participant to sort from 'disagreement' to 'agreement' (Durning, 1999). This allows the opportunity for a midpoint of zero 'salience', i.e. standout opinion on the topic. However with such sorting

instruction a scenario may occur where a participant agrees with all statements. In this scenario the participant will then be forced to sort a statement as "disagreement", which distorts the subjectivity of the participant. Therefore a better condition of instruction is to sort Q statements from least how they think on the subject to the most how they think on the topic. This leaves room for the midpoint of zero salience but does not force the participant into disagreeing or agreeing with any statement. For this study the condition of instruction reads:

#### 5.3.4.3 Q-sorting tool

The Q sort tool can be in hard copy or digital format. Lower costs of distribution is the major benefit of having the design in digital format as opposed to hard copy. Within the digital spectrum it is possible to do the Q Sort offline or online. In an offline environment the researcher would install the software on a laptop and arrange face-to-face meetings with respondents in order to allow them to complete the Q sort on the laptop. In an offline environment the researcher would make use of webservers to configure the software in order to make it accessible through the internet. Convenience and a potential to reach a wider range of respondents are the two main advantages of online as opposed to offline Q sorting. A web search of the available software that could enable online Q sorting has resulted in the software listed in **Table 9**.

Table 9: Comparison available online Q Sort software					
ТооІ	Price	User friendliness	Customizability		
WebQ	+ + +		-		
Q-Software(QSW)	+ +	-	+		
POETQ	+	-	-		
Q-Assessor		+ + +	+		
Hotspot Online Analysis Package		+ +	+ +		
FlashQ	+++	++	+++		

Price, user friendliness and customizability were used as criteria in determining the most feasible software package. The researcher gave each criteria a value relative to the other after trying out each software and contacting developers asking for further clarification when required. In the end FlashQ was adjudged to be the most feasible software to use since it was open-source, relatively user-friendly and allowed a reasonable degree of customizability.

The entire Q sorting process using FlashQ was divided into 4 main (plus 2 introductory) steps aimed at guiding the respondent through the process and eliminate as much as possible the need for the researcher to be present during the process. A help button was one click away at any point during the process, providing the respondent with information regarding their progress and their desired contribution during a step. Upon visiting the web address the

respondent received an introductory screen summarizing the information that was provided to them through the information sheet, i.e. the purpose of the study and the desired contribution. Respondents would then be asked to go through the 24 statements and presort them into three piles: those they found relevant, those they found irrelevant and those they had no strong opinion towards. The next step allowed them to go through the three piles again and give each statement a position on the grid. Once all statements were placed they were invited to explain their choices for the two most relevant and the two most irrelevant statements. Although this step does not provide as rich information as a post-interview would, it did allow some insight into the thinking behind four of the respondent's choices. Upon completion of this step, the respondent was invited to provide background information such as industry, formal job function, strategy, transaction size and past mobile payment experience. Finally an open textbox was provided for additional comments, again aiming to get as much qualitative data as possible. Once this information has been entered it was possible to submit the data to a database, email or print out. The default option was for data entry into the database, as this was convenient with regards to data analysis that was to follow. In case there was a technical problem with the connection of the database at the time of data entry, the fallback options of email or print out would be suggested to the respondent. The total of 37 respondents that were gathered during this study all came from the database entry, with the fallback options not required.

#### 5.3.5 Factor analysis and interpretation

#### 5.3.5.1 Factor extraction

This first procedure as part of data analysis in Q is the factor extraction. The factor extraction uses correlation and inverse factor analysis in order to identify patterns among the Q-sorts. The outcome of these two analysis are "Factors" which are in essence "idealized sorts" since they represent how a certain group of respondents think about an issue. There are two algorithms that can be used in factor extraction: the centroid method or principal component analysis (PCA). Statistically the difference between the two algorithms is that in determining the correlation coefficients, centroid places average correlations on the diagonal of the correlation matrix, while PCA places a perfect inter-sort correlation estimate (1.0) on the diagonal of the correlation matrix. While there is some debate about which of the two to use, (S Watts & Stenner, 2005) have argued that in general there is little difference in the two outcome of the methods. This supports the notion that on any topic only a limited number of perspectives exist, and that any study should reveal more or less the same perspectives. Nevertheless the tendency is that the centroid method is most favored among experienced Q-methodologist as it enables further exploration of theoretical hunches, while many novice Q-researchers employ PCA, which provides eigenvalues (Donner, 2001). For this study the choice has gone for PCA after considering the researchers existing acquaintance and familiarity with Q.

A software package is required in order perform such analysis on the gathered data. In Q Research a popular software package used for this purpose is PQMethod. Although more common statistical software (such as SPSS) can also be used, PQMethod produces outputs that are readily geared towards the Q context. PQMethod offers both PCA and centroid analysis, but as discussed in the previous paragraph the choice has gone for PCA factor extraction. After entering all Q-sorts into PQMethod, a PCA factor extraction is performed by selecting the corresponding option. The results are a list of Factors with their respective eigenvalues, relative percentage of all listed Factors and cumulative percentage.

#### 5.3.5.2 Factor rotation

Factor rotation is the analysis that follows, and is used to optimize the separation between Factors (Kitzinger & R., 1985). Two common factor rotation methods are judgmental rotation ('hand rotation) or varimax rotation. A pattern has been noted in literature linking the use of centroid factor analysis with hand rotation, and judgmental rotation, and PCA with varimax rotation (Hegedus, P., Kramer, Hegedus, & Gravina, 2003). This link stems from judgmental more flexible and less statistically grounded properties, something which it shares with centroid and which can be exploited by more experienced Q researchers. Varimax on the other hand is more statistically grounded and is typically preceded by a PCA factor analysis. Varimax produces the factor solution that maximizes the amount of variance explained on as few factors as possible. Because Varimax is statistically grounded it is considered as more straightforward and transparent than other factor rotation. Following on from the choice in this study for PCA as factor analysis, the choice goes to Varimax factor rotation.

Factor rotation aims to give the researcher a better vantage point of the data. It alters the reference points of the coordinate system in order to provide a better fit of the data. No changes are made to the data itself, but merely the manner in which the researcher looks in on the Factors and their relations to one another. When performing Factor rotation an important consideration is how many Factors to rotate and keep. Unfortunately there is not mathematical answer, but there is some statistical guidelines to go by. Factors with Eigenvalues of less than 1 are often regarded as too minor and are therefore disregarded from the analysis. The software program PQMethod was used to rotate the Factors using Varimax and it resulted in four Factors.

#### 5.3.5.3 Factor loadings

The desired outcome of a factor rotation is to maximize the amount of Q-sorts that are linked or 'loaded' to one Factor and to mark or 'flag' those Q-sorts. Different guidelines exist as to the requirements for one Q-sort to be flagged to a Factor. The software program provides a "pre-flag" which gives suggestion as to the flagging. The algorithm behind its choices is as follows(Schmolck, 2015):



Another guideline for flagging is by using a pre-determined correlation coefficient, also referred to as the "cut-off" point. In Q factor analysis this cut-off point is determined by using:



Some researchers have also used the cut-off point of traditional R factor analysis (0.5) for determining which loadings(Akhtar-Danesh, Baxter, Valaitis, Stanyon, & Sproul, 2009; McKeown & Thomas, 1988). Regardless of which guideline is followed, there is always the possibility that the requirement for the factor loading of a Q-sorts is satisfied on multiple Factors. This Q-sort is then referred to as 'mixed', as it does not exclusively load on one Factor. Q literature is divided on what to do with mixed Q-sorts. Including mixed Q-sorts results in difficulty in Factor interpretation as they load on multiple Factors, leading to highly correlated Factors that are too similar to distinguish (Akhtar-Danesh et al., 2008). One way to deal with mixed Q-sorts is to adjust the cut-off point; raising the cut-off point might lead to a Q-sorts loading only on one Factor. However this may also result in the amount of Q-sorts retained being drastically reduced. Nevertheless, existing literature on Q shows little coherence on which guideline to use to determine the desired cut-off point for factor loading.

In this study the first guideline used was PQMethod's pre-flagging. Using this guideline resulted in 32 of the 37 Q-sorts loading exclusively on their respectively Factor, with the other 5 Q-sorts loading on multiple Factors. In an attempt to increase the amount of Q-sorts that would load exclusively on 1 factor, a cut-off point according to the formula as depicted in Equation 2 was considered. This equation leads to a cutoff point of 0.53 ( $2.58(1/\sqrt{24})$ ). Using this guideline instead of the pre-flagging results in the same flagging with the exception of 3 Q-sort. Figure 15 illustrates how the existing factor loadings for the 3 Q-sorts and illustrates what effect changing to a cutoff point of 0.53 would have.

Figure 15: Affected factor loadings							
Respondent	Factor 1	Factor 2	Factor 3	Factor 4			
R11	0.6393X	0.2132	0.1104	0.5576			
R13	0.6856X	0.1051	0.2248	0.5562			
R21	0.5405	0.0667	0.4395	0.4674			

Figure 14 on the previous page illustrates that R11 and R13 would load on Factor 1 and Factor 4 instead of solely on Factor 1, thereby contributing to a loss of definition and separation of the Factors. The benefit of switching to a cutoff of 0.53 is found in R21 which would load on Factor 1 exclusively. As this switch would lead to more mixed Q-sorts instead of exclusive loadings, it is not advised to switch to this cutoff. The same holds if the standard cutoff of 0.5 would be applied. While it is possible to achieve a 100% exclusive factor loading for each Q-sorts by simply flagging the highest factor loading, this would take away from the uniformed theoretical consideration and thought behind the flagging guideline. For this reason the choice has been made to stick with the pre-flagging as suggested by PQMethod.

#### 5.3.5.4 Factor arrays and interpretation

Now that Q-sorts are flagged to their respective Factors, the next step is to use weighted averages of the Q-sorts to determine the factor arrays, i.e. the 'model' Q-sorts. Factor arrays are the Z scores representing the average scores of all statements of the Q-sorts that have loaded on that Factor. For a better visual representation, the Z-scores are converted to column numbers (i.e. -3 to 3) and thereby creates the 'model' Q-sort. This Q-sort represents how "a hypothetical respondent with a 100% loading on that Factor would have ordered the items in the Q-sort" (Van Exel, 2005, p. 9). Factor arrays are typically listed as a list of statements with their corresponding Z-scores. The statements that are most characteristic for a Factor is listed at the top, while the least characteristic is listed at the bottom; these statements are called characterizing statements (Van Exel, 2005). Statements that are statistically significant are categorized as either "distinctive" or "consensus" statements. A statement is regarded as distinctive when respondents loaded on that Factor have placed the statement in a statistically different than respondents on other Factors. Consensus statements are statements that all respondents have placed in a statistically significant similar position. These statements do not distinguish any Factor from one another and represent statements that all respondents have agreed upon.

The four Factors identified in this study were identified using factor arrays (Z-scores), distinct and consensus statements, and additional explanatory comments that respondents have provided when completing the Q-sort. The characterizing statements placed at the extreme ends of the grid were also essential as they gave insight into the most valued statements and issues for those that loaded on that respective Factor. Distinctive statements helped separate Factors from each other, and consensus statements gave insight into statements and issues that all respondent s agreed upon. Additional comments provided by the respondents helps in providing narrative depth to the final four Factors. The narratives for each Factor are discussed in the next chapter.

# 6

### **FINDINGS**

This chapter discusses the results of the factor extraction conducted on thirty-seven Q-sorts collected from October to December 2014. As discussed in the previous chapter, FlashQ was used as the online tool to collect data, and the software program PQMethod was used to analyze the data. Principal Component Analysis (PCA) was used to extract the four Factors, and Varimax was used as the factor rotation method to get a better interpretation of each Factor. The following section provides statistical characteristics of the four Factors, and section 0 discusses the model Q-sorts and provides narratives for each Factor. Section 0 discusses the consensus statements between the four Factors.

#### 6.1 FOUR FACTOR SOLUTION

As discussed in section 5.3.5, four Factors were determined to be the best representation on the perspectives of the respondents in this study, based on their Eigenvalues. The thirty-seven respondents loaded on the Factors in the following percentage: Factor D1 (19 / 37 = 51.4%), Factor D2 (2 / 37 = 5.4%), Factor D3 (2/37 = 5.4%), D4 (9/ 37 = 24.3%) with the remaining 5 respondents (5 / 47 = 13.5%) not loading on one single Factor. The next section discusses some statistical characteristics of the Factors before presenting the narratives for each Factor.

Table 10 illustrates the statistical characteristics for each Factor. The composite reliability in Q refers to repeatability or consistency. The more respondents load on a Factor the higher the reliability, and the lower the magnitude of errors associated with that Factor.

Table 10: Factor characteristics							
Characteristics	D1	D2	D3	D4			
No. of Defining Variables	19	2	2	9			
Average Rel. Coef.	0.8	0.8	0.8	0.8			
Composite Reliability	0.987	0.889	0.889	0.973			
S.E. of Factor Z-Scores	0.114	0.333	0.333	0.164			

Table 11 on the next page lists the Factor loadings for each Q-sort. The first column indicates the Q-sorts of the respective respondent, the second column indicates to which Factor the Q-sort has loaded, followed by the factor loadings for each Factor. The last row illustrates the percentage of variance explained by the Factors.
Table 11: Factor Matrix with an X Indicating a Defining Sort						
Resp.	Factor	D1	D2	D3	D4	
R1	D3	0.1139	-0.071	0.9493X	0.0673	
R2	D1	0.5556X	-0.3939	-0.0225	0.305	
R3	D2	0.1041	0.9008X	-0.0473	0.1018	
R4	D4	0.4555	-0.0337	0.0269	0.8213X	
R5	D4	0.2308	0.1772	-0.1968	0.7691X	
R6	D1	0.6827X	0.0297	-0.0459	0.1468	
R7	D4	0.33	0.1322	0.3564	0.6126X	
R8	D4	0.2236	-0.2104	0.3138	0.7476X	
R9	D1	0.8019X	0.1983	0.0762	0.2462	
R10	D1	0.7422X	-0.1886	0.1558	0.3128	
R11	D1	0.6393X	0.2132	0.1104	0.5576	
R12	D1	0.8707X	-0.0373	0.0739	0.3202	
R13	D1	0.6856X	0.1051	0.2248	0.5562	
R14	D4	0.3903	0.0395	0.0665	0.7052X	
R15		0.6153	0.1091	-0.0247	0.6238	
R16		0.5376	0.3144	-0.1476	0.5469	
R17	D1	0.7148X	0.2286	0.3418	0.2858	
R18	D4	0.4954	0.3898	0.1479	0.6733X	
R19	D1	0.4407X	0.1188	0.1789	0.3719	
R20		0.5301	0.121	0.2814	0.5508	
R21		0.5405	0.0667	0.4395	0.4674	
R22	D1	0.6304X	0.2014	0.0685	0.4633	
R23	D1	0.5835X	0.1592	0.0693	0.5196	
R24		0.5838	0.2937	0.0019	0.5603	
R25	D1	0.5773X	0.2046	0.3654	0.2668	
R26	D1	0.6420X	0.2361	0.1154	0.3402	
R27	D1	0.8707X	-0.0373	0.0739	0.3202	
R28	D1	0.8019X	0.1983	0.0762	0.2462	
R29	D4	0.2236	-0.2104	0.3138	0.7476X	
R30	D1	0.6510X	0.1431	0.2757	0.3541	
R31	D4	0.4555	-0.0337	0.0269	0.8213X	
R32	D3	0.1139	-0.071	0.9493X	0.0673	
R33	D2	0.1041	0.9008X	-0.0473	0.1018	
R34	D1	0.7422X	-0.1886	0.1558	0.3128	
R35	D4	0.134	0.1927	0.0779	0.4699X	
R36	D1	0.7148X	0.2286	0.3418	0.2858	
R37	D1	0.8707X	-0.0373	0.0739	0.3202	
% expl.Var.		33	8	8	23	

## 6.2 FACTOR NARRATIVES

This section describes the Four Factors using narratives to explain the model Q-sort and the placement of the statements on the grid. A graphical illustration of each Factor is given before the narrative of each Factor, to give the reader an idea of how respondents might have sorted the statements. After this illustration the table of distinguishing statements is given, their column placement and respective Z-scores.

## 6.2.1 Factor D1: Relies on customer demand and ease of use for customer

Factor D1 is defined by 19 respondents active in a broad range of industries. These industries can be classified using general typologies of retailers as discussed in section 1.1. Eleven of the 19 respondents (58%) are classified as specialty retailers, five of the 19 are classified as convenience stores or supermarkets (26%), and three are active in the service industry (16%). All of the 19 respondents identified themselves as the manager of the respective company, in either Dutch or English, with no further specifications. Eight of the 19 respondents (42%) have indicated that they have a strategy focused on customer orientation, while ten of the 19 respondents (53%) indicated that their strategy is more geared towards cost effectiveness. The remaining respondent indicated that his company follow a strategy focused towards product innovation. When it comes to transaction size, four of the 19 respondents (21%) indicated that their business model centered on average transaction size that exceed €25. Fifteen of the 19 respondents (79%) indicated that an average transaction size did not exceed €25.

Factor D1 represents retailers that are only enticed to adopt NFC mobile payment when they perceive that customers are fully onboard and are comfortable with the system. Easier and faster payment (19; +3) and the amount of customers using NFC m-payment (#9; +3) are deemed as the most relevant issues for this Factor. A few examples of clarifying comments on the high placement of these statements are given below:

"The crucial aspect is that the customer is able to use m-payment with more ease than the "pinnen" system (debit card at POS)."

"With no customers, i.e. no demand there is no need to provide NFC mpayment as a payment alternative."

"Whether a majority of customers use NFC m-payment depends on the availability of NFC enabled smartphones."

The last comment points to the availability of NFC smartphone as an enabling factor to the amount of customers that use NFC m-payment. The relevance of this statement (#1) is supported by the entire Factor, as it was ranked as the 4<sup>th</sup> most relevant statement with a Z-

score of 1.203. Another supportive comment on this link read: "... the fact that Apple now supports NFC is encouraging for m-payment", indicating that retailers are aware of developments regarding NFC m-payment.

Upon clarifying his high placement of "ease of use", one respondent commented: "...when one customer perceives a system as easy to use, not only will he start using the system more, but he will also entice others in his circle to start using the system." This comment is supported by statement #21 which loaded as the most distinguishing relevant statement for Factor 1.

The two least relevant, or most irrelevant statements for in this Factor are statements 7 and 8. One clarifying comment on the choice of statement #8 being deemed as irrelevant reads:

*"If and only if we see that competitors are reaping benefits from NFC mpayment then we will considering adopting NFC m-payment."* 

Whilst there is no further explanation as to which specific benefits the respondent is referring to and how he will be able to measure or notice this, the assumption here is that one of the benefits is the customer retention and acquisition, possibly noted through word-of-mouth. The importance of this statement is supported by the fact that it has loaded as one of the most distinguishing irrelevant statement for Factor 1. The other distinguishing irrelevant statement is statement is statement #4. Table 12 on the following page summarizes the statements that have defined Factor 1, with some comments that have also been used to get deeper insight into the placements and to link certain placements with one another.

Table 12: Characterizing statements for Factor D1					
Asterisk (*) Indicates distinct statement with significance at P < .01)					
Grid position	State	ement			
Relevant (+3)	19	Ease of use of payment for customers(faster, more convenient)			
Relevant(+3)	9	There are sufficient customer using or demanding NFC			
Other relevant distinct statements:					
(+1)	21*	The opportunity to attract new customers			
Irrelevant (-3)	7	NFC is adopted by the government			
Irrelevant (-3)	8*	Partner or competitor companies have adopted NFC			
Other distinct statements:					
(-1)	4*	Knowledge on NFC adoption as the result of pilot participation			
Quetes					
Quotes:		m-payment with more ease than the "pinnen" system (debit card at POS)."			

"With no customers, i.e. no demand there is no need to provide NFC m-payment as a payment alternative." "When one customer perceives a system as easy to use, not only will he start using the system more, but he will also entice others in his circle to start using the system."
<i>"Whether a majority of customers use NFC m-payment depends on the availability of NFC enabled smartphones."</i> <i>"The fact that Apple now supports NFC is encouraging for m-payment"</i>
<i>"If and only if we see that competitors are reaping benefits from NFC m-payment then we will considering adopting NFC m-payment."</i>

#### 6.2.2 Factor D2: Enticed by financial subsidization

Factor D2 is defined by two retailers, both classified as being a specialty retailer, using typology as discussed in section 1.1. The respondents identified themselves as managers at their respective retail stores. One had a strategic orientation centered on cost efficiency, an average transaction size of *less* than  $\pounds$ 25, and no previous mobile payment experience. The other had a strategic orientation of customer orientation, an average transaction size of *greater* than  $\pounds$ 25, and no previous mobile payment experience.

Factor D2 emphasizes on the ease of use of the m-payment system for its employees, i.e. its cashiers that have to operate the payment system. One respondent commented "...For us it is important to know how the system works, in order to provide support for the customer when needed ".The second most relevant issue for this Factor is a sufficient numbers of customers that are using or are interested in using NFC m-payment, similar to Factor D1. The other two relevant statements distinguishing this Factor from other Factors are statement #10 and statement #13. Statement #10 concerns pricing strategies and cross-subsidization and loaded on average on grid +2 for this Factor. Statement #13 concerns the need for a separate budget when implanting NFC m-payment; this statement loaded on average on grid +1.

When it comes to issues that this Factor perceived as irrelevant, statements #5 and #7 were perceived as most irrelevant. Statement #5 concerned the stakeholders involved in the ecosystem of m-payment, i.e. the supported banks, mobile phones and mobile network operators. The perceived irrelevance of this statement was surprising, considering the researcher's theoretical considerations and hunches behind this statement. This Factor's belief concerning this statement is further consolidated however when looking at other distinctive irrelevant statements that have set it apart from other Factors. The availability of NFC enabled smartphones (s1) is placed in a considerably lower grid (-1) compared to how other Factors have placed this statement. A placement on the grid of (-2) for statement#3(technological precautions such as security, confidentiality and anonymity also suggest that the nature of this Factor is somewhat more adventurous when it comes to adopting a new system. **Table 13** summarizes the characterizing statements of Factor D2.

Table 13: Characterizing statements for Factor D2				
	A	sterisk (*) Indicates distinct statement with significance at P < .01)		
Grid position	State	ement		
Relevant (+3)	9	There are sufficient customer using or demanding NFC		
Relevant(+3)	18	Ease of use for cashiers		
Other distinct relevant				
statements:				
(+2)	10*	Financial subsidization for adopting NFC m-payment		
(+1)	13	Dedicated budget for implementation		
Irrelevant (-3)	5*	The supported banks, smartphones and mobile network operators		
Irrelevant (-3)	7	NFC is adopted by the government		

Other distinct irrelevant statements:		
(-1)	1*	Availability of NFC enabled smartphones
(-2)	3*	Technical concerns such as security, reliability and anonymity
Quotes		"For us it is important to know how the system works, in order to provide support for the customer when needed." "The government can assist in raising awareness of m- payment by providing as a payment alternative at government offices, but for us the other issues raised are of much greater relevance."

## 6.2.3 Factor D3: Enticed by technical superiority

Factor D3 is defined by two retailers, both classified as being a specialty retailer, using typology as discussed in section 1.1. One of the respondents identified with 'owner', whilst the other identified with 'online content manager'. Both described their strategic orientation as customer oriented, with both transaction sizes averaging as *less* than €25, and with neither of them having previous mobile payment experience. The online content manager did remark however that mobile payment was currently being considered by her company.

Factor D3 emphasizes on the availability of NFC smartphones (s1) and technological precautions (s3). Two comments that support the importance of these issues reads:

"Customer distrust as a result of poor network communication or security is not desired."

"Customer need support of NFC enabled smartphones in order to make use of NFC m-payment."

This Factor is different from other Factors in the sense that they place great value on the adoption of NFC m-payment by the government, placing it on the +2 spot on the grid. It also differs from other Factors in the sense that it has no strong feeling towards the need for sufficient customers that are already using NFC m-payment. The Factor also sees little value in having a separate budget for implementation, explained by one respondent as follow: "…"If an m-payment solution works well then retailers have no choice but to tag along.". The irrelevant statement that distinguishes this Factor from other Factors is the need for

Table 14: Characterizing statements for Factor D3					
Asterisk (*) Indicates distinct statement with significance at P < .01					
Grid position	State	ement			
Relevant (+3)	1	Availability of NFC enabled smartphones			
Relevant(+3)	3	Technical concerns such as security, reliability and anonymity			
Other distinct relevant statements:					
(+2)	7*	NFC is adopted by the government			
Neutral distinct statements:					
(0)	9*	There are sufficient customer using or demanding NFC			
Irrelevant (-3)	14*	Unaffected service uptime during implementation			
Irrelevant (-3)	13*	Dedicated budget for implementation			
Other distinct irrelevant statements:					
(-2)	20*	Increased efficiency of POS			
Quotes		<ul> <li><i>"If an m-payment solution works well then retailers have no choice but to tag along."</i></li> <li><i>"Customer distrust as a result of poor network communication or security is not desired."</i></li> <li><i>"Customer need support of NFC enabled smartphones in order to make use of NFC m-payment."</i></li> </ul>			

optimization of their Point-of-Sale, with it being placed on the -2 position on the grid. Table 14 summarizes the characterizing statements for Factor D3.

#### 6.2.4 Factor D4: Loyal to pinnen, enticed by customer demand

Factor D4 is defined by nine retailers active in several industries. These industries can be classified using general typologies of retailers as discussed in section 1.1. Five of the 9 respondents (56%) are classified as specialty retailers, two of the 19 are classified as convenience stores or supermarkets (22%), and two are active in the service industry (22%). Three of the 9 respondents (33%) describe their strategic orientation as customer oriented, while the remaining six (67%) have a cost efficient strategy orientation. Four of the 9 respondents (44%) have an average transaction size exceeding  $\in$ 25, while the remaining five (56%) have transactions sizes smaller than  $\notin$ 25. All 9 respondents indicate that they have no previous mobile payment experience.

Factor D4: beliefs that the optimization of POS and the availability of NFC smartphones are the most relevant issues when considering adoption. The high relevance of optimization is stressed by this comment "...*The pinnen system just works in the Netherlands. The major benefit of m-payment over this system for me is the speed of payment and thus fewer queues, possibility for more sales*". The Factor sees little to no relevance the need to adopt NFC mpayment for the sake of maintaining a positive imago (s24) or for marketing purposes (s23). Respondents commented:

"We are a small store with a relatively small range of products. Most products are products that customers are already familiar with. No need for additional marketing."

"Our focus is not on being innovative, but rather on cost efficiency."

"We sell regular products"

Table 15 summarizes the characteristics of Factor D4.

Table 15: Characterizing statements for Factor D4						
		Asterisk (*) Indicates distinct statement with significance at P < .01)				
Grid position	Stat	Statement				
Relevant (+3)	20	Increased efficiency of POS				
Relevant(+3)	1	1 Availability of NFC enabled smartphones				
Other distinct relevant						
statements:						
(+1)	2* My current POS is able to integrate or upgrade to NFC ready					

Neutral distinct statements (0):	7*	NFC is adopted by the government		
Irrelevant (-3)	24	Enhancement of company innovative image		
Irrelevant (-3)	23	In-store marketing opportunities		
Other distinct irrelevant statements:				
(-2)	4*	Knowledge on NFC adoption as the result of pilot participation		
Quotes		"We are a small store with a relatively small range of products. Most products are products that customers are already familiar with. No need for additional marketing." "Our focus is not on being innovative, but rather on cost efficiency." "We sell regular products" "The pinnen system just works in the Netherlands. The major benefit of m-payment over this system for me is the speed of payment."		

## 6.3 **DIFFERENCES BETWEEN FACTORS**

Table 16 illustrates the correlations between the four Factors. (Cohen, 1988) suggested guidelines as to how to interpret correlations; a correlation smaller than 0.1 is trivial, between 0.1 and 0.3 is small, between 0.3-0.5 is greater than 0.5 is moderate, and greater than 0.5 is large. Using this guidelines all correlations are small with the exception of D2-D3 which is trivial, and D1-D4 which is large.

Table 16: Correlations Between Factor Scores							
Factors	D1	D2	D3	D4			
D1	1	0.1901	0.2685	0.7492			
D2	0.1901	1	-0.1176	0.1552			
D3	0.2685	-0.1176	1	0.2234			
D4	0.7492	0.1552	0.2234	1			

The trivial correlation between Factor D2 and D3 indicates that there is a big difference in how they placed the statements. Table 17 illustrates the three statements with the biggest differences as to how D2 and D3 placed them.

	Table 17: Differences Between Factors D2 and D3						
No.	Statement	Type 2	Type 3	Difference			
13	Dedicated budget for implementation	0.582	-1.745	2.326			
9	There are sufficient customer using or demanding NFC	1.745	0	1.745			
10	Financial subsidization for adopting NFC m-payment	1.163	-0.582	1.745			

Similarly the large correlation between Factor D1 and D4 indicates that they have sorted some statements in very similar manner to each other. Table 18 illustrates the three statements with the biggest differences as to how D1 D4 D3 placed them.

	Table 18: Differences Between Factors D1 and D4							
No.	Statement	Type 1	Type 4	Difference				
19	Ease of use of payment for customers(faster, more convenient)	1.683	0.57	1.113				
11	NFC m-payment fits our business model(transaction volume/size)	0.639	-0.299	0.938				
21	The opportunity to attract new customers	0.475	-0.31	0.784				

Table 19: Overview perspectives per type of retailer							
D1 D2 D3 D4 Total per retailer type							
Convenient stores / supermarkets	11			5	16		
Specialty stores	5	2	2	2	11		
Service	3			2	5		
Total per Factor	19	2	2	9	32		

Table 19 serves to illustrate which Factor each type of retailer loads on or the converse of this statement. Convenient stores and supermarket apparently only load on Factors D1 and D4, suggesting that they prefer to exhibit a wait and see behavior until there are enough customers using NFC m-payment. Specialty stores show no strong preference towards any preference, suggesting that the variety of products alone does not determine attitude towards NFC m-payment adoption. Service retailers only load on Factors D1 and D4, exhibiting the same wait-and-see behavior as convenient stores and supermarkets.

Table 20: Overview strategic orientation per Perspective							
D1 D2 D3 D4							
Customer intimacy	42%	50%	100%	33%			
Operational excellence	53%	50%	-	67%			
Product leadership	5%	-	-	-			

Table 20 provides an overview of the strategic orientations per Factor. The relatively equal percentage distribution of D1 means that no definite statement can be made whether those with customer intimacy are more willing to adopt NFC m-payment.

Table 21: Overview transaction size per Perspective					
	D1	D2	D3	D4	
<25 EURO	79%	50%	-	56%	
>25 EURO	21%	50%	100%	44%	

# 6.4 CONSENSUS STATEMENTS

Across all Factors there has also been some statements that all Factors have ranked evenly. These factors are listed in Table 22.

Table 22: Statements That Do Not Distinguish Between ANY Pair of Factors.										
All Listed Statements are Non-Significant at P>.01, and Those Flagged With an * are also Non- Significant at P>.05.										
	Factors									
			D1		D2		D3	C	D4	
No.	Statement	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	
16*	Previous experience with POS upgrades	-1	-0.61	0	0	0	0	-1	-0.44	
18	Ease of use for cashiers	2	1.29	3	1.74	1	0.58	2	1.26	

Previous experience with POS upgrades is ranked as comparatively irrelevant by all Factors. Although perhaps surprising, this can be explained by a previous study in which retailers have indicated that they are overwhelmed by the speed with which the payment industry is developing (Detailhandel Nederland, 2014, p. 10). Because of this retailers may discard any previous experience with POS upgrades as irrelevant since they are uncertain of the value of such experience in a rapidly moving industry. The second statement is the ease of use for cashiers which is ranked as relevant by all Factors. This is not as big a surprise since they are the ones who will be using/operating the point of sale. This underlies the need to study adoption in terms of post-adoption phases as the Use phase is critical in ensuring that the desired Effects phase is reached.

# 6.5 **Relevance of Post-Adoption Phases**

The use of an alternative adoption theory is instigated from critics suggesting that postadoption phases need to be taken into account if one were to fully understand the adoption decision of retailers. With this in mind, it is useful to provide an overview of the normalized Z-scores of the phases, as illustrated in Table 23 below.

Table 23: Overview of relevance of phases across all Factors				
Phase	Sum of Z-Score			
Adoption	7.9			
Use	3.1			
Effects	-3.85			
Implementation	-7.2			

Since each statement was linked to a phase of the four-phased diffusion model, it was possible to sum up the Z-scores of statements according to the phase they belonged to and use this to indicate the relevance of each phase. Something which immediately catches the eye when studying Table 23 is the negative Z-scores for the Effects and Implementation phases. As in Q methodology Z-scores correspond to their position on the grid (positive Z-score indicates greater relevance / placement on the right of the grid, negative Z-score indicates lesser relevance / placement on the left of the grid), this raises questions as to the relevance of the Effects and Implementation phases. A closer inspection of the Effects and Implementation phases is required.

	Table 24: Z-scores of Effects phase across all Perspectives						
No.	Statement	Z-Sco	re				
19	Ease of use of payment for customers(faster, more convenient)	2.98					
20	Increased efficiency of POS	1.04					
21	The opportunity to attract new customers	-1.23					
22	The opportunity to offer new services for customer retention	-3.11					
		0.32	-1.68	-0.35	-1.4		
23	In-store marketing opportunities	-2.4					
24	Enhancement of company innovative image	-1.13					

Table 24 illustrates the total of Z-scores of each statement linked to the Effect phase. The Zscore of the statement ranked as least relevant is highlighted in red and is broken down per Perspective in the row below. It is clear that the opportunity to for customer retention is ranked has a strong negative Z-score, contributing significantly to the overall negative rating of the Effects phase. Looking at this the Z-scores of this statement for each Perspective individually we can see that Perspective D2 and D4 in particular have ranked this statement as irrelevant. Considering this statement's link to strategic orientations, it is useful to look at the strategic orientations of these two Perspectives. Table 20 indicates that Perspective D2 is divided half by customer intimacy and half by operational excellence. Perspective D3 is has a greater share of operational excellence (67%), possibly supporting (Treacy & Wiersema, 1995) in claiming that those that embrace operational excellence are less interested in customer retention and more enticed by ease of use and efficiency.

	Table 25: Z-scores of Implementation phase across all Perspectives						
No.	Statement	Z-Score					
13	Dedicated budget for implementation	-1.12					
14	Unaffected service during implementation	-1.31					
		-0.05	0.28	-2.21	0.67		
15	Support from partners during implementation	-2.22					
16	Previous experience with POS upgrades	-0.89					
17	Support from top management	-1.66					

As for the even lower Z-score of the implementation phase, it is notable that not one statement has managed to reach an overall normalized positive Z-score. An interesting observation from Table 25 is that the unaffected service during implementation scored both the lowest individual Z-score and highest individual Z-score, indicated with a red and green highlight respectively. Gathered data during this project can offer no explanation for this disparity. Appendix F providers a comprehensive overview of all Z-scores and T-scores of the Q statements.

# 7

# **CONCLUSION AND DISCUSSION**

This research study was instigated out of an identified lack of study on retailer adoption factors in the light of rejuvenated hopes for m-payment and the general feeling that there is a sense of market readiness. This chapter revises findings of this study and critically assesses choices taken on the way to achieving the research objective. The chapter also discusses limitations of the study and offers recommendations for follow up studies.

# 7.1 REVISITING RESEARCH QUESTION AND OBJECTIVES

The problem description of this study concerned a lack of understanding of retailer NFC mpayment adoption factors that could hamper the chances of m-payment crossing the chasm, reach critical mass and become adopted by the mainstream market. From this problem description arose the question: *"Which perspectives represent the different groups of retailers when it comes to NFC m-payment adoption? "* 

Answering this question would accomplish the following objectives:

- 1. To identify the retailer adopter groups that have a shared perspective of factors that influence NFC m-payment adoption.
- 2. To examine the underlying factors for each perspective

Q methodology was considered to be the appropriate methodology to answer the research question and accomplish the two objectives due to its ability to identify perspectives (objective1) while using transparent statistical techniques to show the range of factors for each identified perspective (objective2). Chapter 5 explains the procedure and Chapter 6 answers the research question and thereby achieves objective #1. Section 0 in particular is aimed at achieving objective #2 in detail. A summary is given below of the Perspectives:

	Description
Perspective D1	Relies on customer demand and ease of use for customer
Perspective D2	Enticed by financial subsidization
Perspective D3	Enticed by technical superiority
Perspective D4	Loyal to pinnen. Will only "tag along" if customer demand is high

In other words Factor D1 and D4 rely heavily on cross-side network effects and a pull comes from the customer side. The majority of participants defined Factor D1 but this does not have further implications as Q does not make claims of generalizations but is purely concerned with the exploration of perspectives. Therefore although Factor D2 and D3 loaded with as little as 2 and 1 respondents respectively these Factors are as valid as the others that have been defined by more participants.

# 7.2 CONTRIBUTIONS

Section 1.7 has discussed the expected contributions of this thesis. This section revises these expectations and discusses to what extent they have been met.

#### 7.2.1 Academic – adoption literature gaps

As indicated in the beginning, this thesis aimed to incorporate post-adoption phases when studying adoption decision, thereby contributing to an apparent underrepresented approach to adoption literature. The chosen model was the four-phased model by (Bouwman et al., 2005). Section 6.5 has already used statistical information to evaluate the relevance or added value of including post-adoption phases. A peculiar observation was the very low Z-scores for the Effects and Implementation phases, suggesting that participating retailers ranked statements related to these phases as less relevant to the Adoption phase and Use phase. Upon closer inspection of the low Z-score for the Effects phase it became clear that one statement contributed significantly to the low Z-score of the phase. The implementation phase brought even more interesting observation, with no statement achieving an overall positive Z-score. In many other studies these findings might have suggested implications for the implementation phase to be deemed as trivial and unneeded, but for this study the implications are different for two reasons: The first reason being the fact that Q methodology was employed, as opposed to other methodologies in which participants may not have been forced to sort statements/factors within a limited number of spaces. The fact that Q was employed means that the implementation is not completely irrelevant, but merely LESS relevant than other phases. The second reason why the implementation phase cannot be discarded as irrelevant and trivial is the numerous previous payment systems which have failed to reach mainstream market. As the authors of the four-phased-model argue, the implementation phase plays a crucial intermediate role between the retailer's decision to adopt and the actual use of the m-payment system. While previous literature focused on mpayment characteristics as potential culprits for failed diffusion, this finding suggests that the problem may lie with the retailer's insufficient consideration for implementation planning and strategy. While the researcher is unable to make definite claims on whether other adoption theories and models would have come up with the same findings, the researcher can claim that the inclusion of post-adoption phases have produced some interesting insight that the researcher himself was not expecting. A second advantage of using the four-phased model is its division of the units of adoption into the retailer's decision and the customer and employees decision. The Use phase, otherwise known as the individual adopter's adoption phase, provides the perfect space for complementary studies on factors that affect customer adoption. All in all the researcher believes that the use of the four-phased model has brought a comprehensive insight into the adoption decision of retailer's, as suggested by critics of other adoption models. Taking into account the researcher's relative inexperience in the field of research, no claims can be made on how much more comprehensive or detailed these insights are; this is best left to the better judgment of others.

It is useful to refer back to the findings of the work of the authors mentioned in the literature review and see how it relates to this study. Core to Van der Heijden's work as one of the first to study adoption on modern day "mobile payment systems" was the suggestion that retailer and customer requirements are distinct yet, if met, positively influence each other's acceptance. The present study shows consistency with his findings in a two-fold manner: the use of the four-phased model allows the recognition of the two distinct adoption decisions with corresponding perceptions. The resulting D1 and D4 perspective's reliance on customer demand is also consistent with his suggestion that retailer and customer acceptance are positively related. Teo et al (2005) suggest that retailers are put off by uncertainty about required time for return on investment. This indicates unwillingness to investment without some level of guarantee of return on investment. His finding corresponds with perspective D2 which represents retailers that will be enticed with financial subsidization. Mallat& Tuunainen(2005,2008) builds on Van der Heijden's suggestion that small value industries where the relative advantage is higher are more likely to consider mobile payment. While Table 21 does indicate a far greater percentage of participants having transaction sizes of less than 25 euro, this study is unable to support Mallat& Tuunainen claim. Lai & Chuah(2010) include post-adoption phases and implementation in their study and suggest that these phases have an influence on retailer adoption decision. Table 23 illustrate that the Use phase in particular has scored high on relevance. As discussed in section 6.5 and earlier in this section, although the implementation phase scored as less relevant than other phases, this does not indicate that the phase is trivial. This study is therefore in line with the findings of Lai & Chuah(2010).

#### 7.2.2 Academic – ecosystems and network effects

Contribution to concepts of ecosystems and network effects was best given in the form of a detailed overview of previous NFC implementations in the Netherlands (section 2.4). The researcher discussed past (mobile payment) systems in the Netherlands and how the majority of them have been discontinued for failure to reach critical mass or complications in the ecosystem. The biggest pilot SixPack is also discussed and how complications arose and the different paths taken by the stakeholders during or after the pilot. This contribution does not come in the form of theorization or extensive analysis, but rather in a practical discussion and representation of the works of ecosystems and network effects. The reader is therefore also encouraged to use it as a practical example and recognize or identify the different concepts at play.

#### 7.2.3 Academic- a case for Q

As discussed in section 1.6.1, other methodologies (quantitative and qualitative) might have been used to accomplish both objectives and answer the researched question posed in this thesis. However qualitative methods such as discourse analysis or interviews will not have been able to back the perspectives with the statistical transparency nor replicability that Q methodology offers. Quantitative methods such as surveys could have also been used. However the statistics employed by these type of R methods would have discarded 'minor' perspectives such as D2 and D3, considering the very low loading on these two perspectives. The limitations of Q have been discussed in section 5.2. One of these is its reliance or preference on a small sample of participants. Obviously this can also be seen as a strength or advantage, but it can also be a weakness in the sense that requires careful consideration beforehand of participants who may have well informed and strong opinions on NFC m-payment. As discussed at length in section 7.3, this was a problem for the researcher. Regardless, as stated in section 7.2.1, it did contribute to some interesting findings for objective #2, and laid the basis for objective #1, which will be discussed in the next section.

#### 7.2.4 Practical contributions

Providers of NFC m-payment are concerned with how they must market their product or service. What is referred to in section 4.1.1 as innovation tipping point, take-off point, lack of critical mass, failed diffusion curve, is referred to in marketing terms as the crossing of the chasm. It remains the same concept of accelerating the rate of adoption, but with a marketing spin to it. Marketers do not speak of adopter groups, but rather of market segments. The results of this study cannot be used directly as market segments. Market segments need to be specific, defined by demographical characteristics so that providers know who to target and how to target them. In this study few demographical details have been recorded of participants, meaning that the elicited Perspectives cannot be used as market segments. After all, Q is not concerned with generalization, but rather replicability and finding the existing perspectives in the population sample. Providers of NFC m-payment can therefore use the findings of this study to either improve their product based on the factors tested in this study(objective #2), or by using the perspectives (objective#1) as input to other methodologies such as surveys in order to gather more demographic information of retailers and define the market segments. For retailers that have participated in this study, the practical contribution is an encouragement in thinking about issues that may arise in the near future as NFC m-payment gathers pace.

## 7.3 LIMITATIONS OF STUDY

This study is limited in the fact that it has only considered retailers in the Netherlands. This limitation is defined by different retailing policies, existing payment alternatives, and different mobile payment solutions with their respective ecosystems. The difference for example with the Netherlands and the United States is apparent already in the fact the retailers in the

United States have developed their own mobile payment using QR and are strenuously resisting NFC payment. As also discussed the widespread use of the OV chip card in the transportation in the Netherlands means that the public is used to the idea. The fast paced developments in the payment industry also implies that the domain as described in this study will very quickly be outdated, meaning that the results of the study may have a very limited time window of practical validity.

# 7.4 IN RETROSPECT

The methodological challenges have already been touched upon in chapter 5, this section reflects on certain decisions taken during the study. The outcome of any Q study depend on:

- What set of Q statements are used
- Who completes the Q sorts; and
- How the data analysis is done

Which makes these three point a good framework to evaluate the study on. As discussed in section 5.3.2 the statements were selected using a theoretical framework as guideline to pick factors found in the literature that were to be used as statements. An experienced Q researcher will argue that the choice of 24 statements is unusual as most Q studies use between 40-60 statements (Van Exel, 2005). The decisions to bring down the amount the statements to 24 in total was based largely in consideration for the participants who might find difficulty in sorting 40 statements. The small range in statement is reflected in the much narrower grid design which normally spans from -5 to -5 instead of -3 to 3 as in this study. Such design has consequences for results of the study as it does not allow distinguishing and strong responses to be given. One possible counterargument to this is the relatively low correlation scores found in the resulting Factors.

The second point to evaluate a Q study on is the P-set, i.e. the participants who complete the Q-sort. Section 5.3.3 is tasked with illustrating the procedure of forming the P-set in this study. The section also discusses the difficulties experienced in finding responses in accordance to the idealized P-set matrix. A good P-set matrix contains a varied set of respondents. The eventual P-set matrix for this study however was in imbalance as no respondents were found with previous experience in mobile payment. Q studies rely on strong and well-informed opinions and respondents well informed in NFC mobile payment will have contributed to strong and well-informed opinions. As participants in this study had to be people with management positions in retail organizations this also added to the difficulty in finding participants. Finally, (Webler et al., 2009) reasons that language and culture differences may pose as difficult barriers to overcome and will require persistence from the researcher.

The third and final point which forms the basis for good Q research is the manner in which the data analysis was done. The quality of data analysis starts with data collection, which in this study was done online. Online data collection has the benefits of not being limited to geographical boundaries, but since this study was scoped to retailers in the Netherlands one might question this particular benefit of online data collection. Another potential benefit of online data collection is the easier and more convenient distribution of the Q-sort. The participant is able to complete the Q-sort at their most convenient time, which considering that participants in this study were retailers is an important benefit. Tied to this benefit however is the risk that a participant either indefinitely postpones the completion of the Qsort or does not feel the same incentive to feel as if the researcher had approached him in person. Another danger of online data collection is bad data resulting from feeble Q-sorting or from people impersonating others. The gathering of qualitative data which would have been possible through interviews had the data collection happened in person is now also limited to textboxes in which participants are kindly asked to explain their choices. As for the data analysis this was done using the most common methods or otherwise methods that novice Q researchers commonly use. Replicability is one of the strengths of Q and therefore little room for error is possible in this particular part of conducting Q. The quality of the data analysis comes forward in the manner in which the data is interpreted, and this is a matter not left for the judgment of the researcher himself.

#### 7.5 SUGGESTION FOR FUTURE RESEARCH

As discussed earlier the payment industry is constantly changing, especially in the Netherlands. The researcher is aware of big developments that have occurred during the time-lapse of the first problem description of this study and the writing of the conclusion of the study. NFC mobile payment is taking off at a very rapid pace with the Netherlands believed to be the frontrunner of NFC mobile payment in Europe (Emerce, 2015).

It is fascinating to see developments and how they relate to the four identified Factors in this study. Recall that Factors D1 and D2 relied on customer demand and ease of use for customers. Related to these Factors is the development that banks have issued EMV contactless payment cards(van Miltenburg, 2015). Recall from the discussion in section 2.1 that NFC mobile payment can be conducted using the smartphone but also contactless cards. By using payment cards which the customers are already comfortable with, banks avoid complications with secure element, handset compatibility or availability etc. Ease of use for the customer is as high if not higher than pinnen. As for Factor D2 who are concerned with the financial aspects of adoption, reports now claim that NFC mobile payment transaction costs are on par with transaction costs of the popular pinnen system (Roels & Beerman, 2014). Factor D3 represents retailers concerned with the technological aspects surrounding NFC mpayment. One researcher claims that NFC m-payment is technologically sound and more secure than the OV chip card which has had been hacked in the past (Koopmans, 2014). These developments in tandem with the four Factors can go some way in explaining that rapid pace with which NFC m-payment seems to be taking off in the Netherlands. Does this mean that the four perspectives and the identified factors have become obsolete? Absolutely not. If anything, it confirms the correctness or presence of the four perspectives in the Dutch market. The researcher can give suggestion for two follow-up studies based on the findings of this study. The first interesting study is the use of surveys based on the four perspectives identified in this study in order to find the generalizability of these perspectives in the Dutch market. Recall that Factor D2 and D3 were loaded by only 2 and 1 participants respectively. It should be interesting to gather demographical information in order to form concrete market segments that can be used by providers of NFC m-payment. The second potential follow-up study is based on the replicability of Q. As discussed before, validity of Q comes in the form of replicability and not generalizability. In theory, Q studies should yield the same results if the same design is used, separated by any particular timeframe. However considering the rapid developments, one must wonder if a study using the same design would indeed yield the same results.

As for the design of such a study, considering the researcher's difficulty in finding participants, a suggestion might be to start immediately with the snow-ball recruitment approach. While the P-set matrix is a well-grounded system to go about determining the P-set, considering the type of participants required (retail managers with limited availability) and the time constraints of a thesis project, snow-ball approach gives faster access albeit with a higher probability of bias. While cultural and ethnic differences may have played a significant part in the recruitment process, the researcher refuses to resort to such simplistic and judgmental reasoning for the less than ideal time taken to recruit participants. The nature of the participants can be taken, with or without the theoretical grounding of a P-set matrix. The researcher is confident that should he have had faster access to such contact person, that the whole recruitment process would have been a far less troublesome process.

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Delft, 11-10-2014

#### Geachte winkelier,

Mobiel betalen komt eraan als nieuw alternatief voor pinnen en cash betalen. Wat betekent dat voor u als winkelier? Welke problemen en uitdagingen voorziet u voor mobiel betalen? Vaak wordt de winkelier over het hoofd gezien door aanbieders. Oplossingen worden bedacht zonder dat duidelijk is hoe winkeliers hiermee om moeten gaan. Dit onderzoek is een uitzondering.

#### Waarom zou u mee willen doen aan het onderzoek?

Het onderzoek moet inzicht geven in wat winkeliers belangrijk vinden bij mobiel betalen. Mobiel betalen zijn betalingen waarbij gebruikt wordt gemaakt van geavanceerde telefoons in combinatie met een terminal. Door een mobiele telefoon bij een terminal te houden wordt de betaling uitgevoerd. Welke problemen ziet U, welke zorgen heeft u als deze nieuwe technologie, ook wel NFC payments genoemd, ingang zou vinden. Door deel te nemen helpt u om duidelijk te krijgen wat winkeliers verwachten van mobiel betalen. Zodat aanbieders daar beter op kunnen inspelen.

#### Wat houd deelnemen in?

Het toegepaste onderzoeksmethode is Q-methodologie, waarbij wij u vragen om 24 belangrijke factoren te ordenen volgens hun relevantie op uw besluit om mobiel betalen in te voeren. Ter afronding wordt u gevraagd om informatie te geven over uw bedrijf en uw zelf. Het totale proces zal **tussen de 10-20 minuten duren**. Bij ieder stap in het onderzoek krijgt u uitgebreid uitleg. Het onderzoek is te vinden op:

http://www.Q-sortsed-nfcmerchant.nl

#### Wat gebeurt er met mijn gegevens?

Het onderzoek vereist geen persoonlijke of vertrouwelijke informatie. Achtergrond informatie die aan het eind van het onderzoek aan u gevraagd zullen worden dienen uitsluitend om uw bedrijfsprofiel op te kunnen stellen. Alle data word daarna in een beveiligd database opgeslagen. Noch uw naam noch uw bedrijfsnaam zal gepubliceerd worden. Daar staat de Technische Universiteit Delft garant voor.

#### Bij wie kan ik terecht voor meer informatie?

Het onderzoek wordt uitgevoerd door de Technische Universiteit Delft binnen de onderzoeksgroep die zich bezighoudt met mobiel betalen, onder leiding van Prof Dr. Harry Bouwman, Dr. Patrick van der Duin, en Dr. Ir. Mark De Reuver. Mocht u nog vragen of opmerkingen hebben, aarzelt u dan niet om contact te nemen. Uw deelname aan deze studie wordt hoog gewaardeerd.

Met vriendelijke groet,

Jeremy Lourens | <u>j.j.lourens@student.tudelft.nl</u> | 068...... Prof dr Harry Bouwman | <u>w.a.g.a.bouwman@tudelft.nl</u> | 015 ......

# APPENDIX B: INFORMED CONSENT (DUTCH)

#### Toestemmingsverklaringformulier (informed consent)

#### Titel onderzoek:

Exploring merchant perspectives on Near Field Communication mobile payment adoption

#### Verantwoordelijke onderzoeker:

Jeremy Lourens Graduate student Management of Technology Section Technology Policy and Management Delft University of Technology

#### In te vullen door de deelnemer

Graag verzoeken wij u om de onderstaande punten door te nemen en het formulier te tekenen indien alles voor u duidelijk is en u hiermee akkoord gaat.

- A) Ik stem geheel vrijwillig in met deelname aan dit onderzoek.
- B) Ik verklaar op een voor mij duidelijke wijze te zijn ingelicht over de aard, methode en doel van het onderzoek.
- C) Ik begrijp dat al mijn verstrekte gegevens anoniem gepubliceerd zullen worden.

Naam bedrijf:	Naam vertegenwoordiger:
Datum:	Handtekening vertegenwoordiger:

#### In te vullen door de uitvoerende onderzoeker

Ik heb schriftelijke en mondelinge toelichting gegeven op het onderzoek. Ik zal resterende vragen over het onderzoek naar vermogen beantwoorden. Ik verklaar om op een vertrouwelijke wijze met alle gegevens om te gaan.

Datum:

Handtekening onderzoeker

.....

.....

# APPENDIX C: Q-SET (DUTCH)

#Q	Q-Set
Q1	Beschikbaarheid van NFC smartphones
Q2	Het huidig POS systeem staat integratie met NFC toe
Q3	Technologische voorzorgen zoals veiligheid, betrouwbaarheid, anonimiteit
Q4	Kennis en kunde opgedaan door middel van betrokkenheid bij pilots of andere studies
Q5	Het aantal ondersteunende betalingalternatieven(bank,mobiel,abbonement)
Q6	Financiele kosten van adoptie ten opzichte van andere betalings alternatieven
Q7	Mate waarin standaarden breed geaccepteerd zijn door overheid en/of brancheorganisaties
Q8	Adoptie door concurrentie en/of mede bedrijven
Q9	Voldoende afnemers die gebruik maken van mobiel betalen
Q10	Aangeboden subsidies voor het adopteren van het systeem
Q11	Geschiktheid van mobiel betalen binnen ons huidige business model (qua transactie volume etc.)
Q12	Mobiel betalen past binnen onze strategie
Q13	Apart budget voor implementatie van mobile betalen
Q14	Een werkomgeving dat innovatie stimuleerd en aankan zonder normale service te beinvloeden
Q15	Beroep kunnen doen op partners en/of branche organisaties bij het implementeren
Q16	Eerdere ervaring met het implementeren van soortgelijke projecten
Q17	Draagvlak vanuit topmanagement
Q18	Gebruiksgemak van systeem voor cashieres
Q19	Gemak van afrekenen aan de POS voor de klant
Q20	Optimaliseren rendement van POS en werknemers
Q21	Verhogen van klantenwerving
Q22	Directe koppeling met loyalty programma's voor creëren van nieuwe verkoopmogelijkheden
Q23	In-store marketing door middel van NFC tags
Q24	Een positief en innovatief imago van uw bedrijf

# APPENDIX D: FULL FACTORIAL TABLE

#Q	Statement	Phase	Theme	Issue
Q1	Availability of NFC enabled smartphones	Adopt	Technology	Availability of NFC mobile phones
Q2	My current POS is able to integrate or upgrade to NFC ready	Adopt	Technology	Technological feasibility
Q3	Technical concerns such as security, reliability and anonimity	Adopt	Technology	Technological risks
Q4	Knowledge on NFC adoption as the result of pilot participation	Adopt	Ecosystem	Knowledge on NFC mobile payment
Q5	The supported banks, smartphones and mobile network operators	Adopt	Ecosystem	Dominant design enriched with more stakeholders
Q6	Financial costs of adoption relative to other payment systems	Adopt	Ecosystem	Lower costs of adoption
Q7	NFC is adopted by the government	Adopt	Ecosystem	Coercive pressure
Q8	Partner or competitor companies have adopted NFC	Adopt	Ecosystem	Same-side network effects(mimetic pressure)
Q9	There are sufficient customer using or demanding NFC	Adopt	Ecosystem	Cross-side network effects
Q10	Financial subsidization for adopting NFC m-payment	Adopt	Ecosystem	Cross-subdization
Q11	NFC m-payment fits our business model(transaction volume/size)	Adopt	Organization	Volume and value of transactions
Q12	NFC m-payment suits our business strategy	Adopt	Organization	Strategy orientation
Q13	Dedicated budget for implementation	Impl.	Organization	Dedicated budget
Q14	Unaffected service during implementation	Impl.	Organization	Test/sandbox environment
Q15	Support from partners during implementation	Impl.	Organization	External support
Q16	Previous experience with POS upgrades	Impl.	Organization	Previous experience / knowledge management
Q17	Support from topmanagement	Impl.	Organization	Management support
Q18	Ease of use for cashiers	Use	Individual	Ease of use
Q19	Ease of use of payment for customers(faster, more convienent)	Eff	Organization	Enhanced customer service - easier payment
Q20	Increased efficiency of POS	Eff	Organization	Reduced transactions costs or payment processing
Q23	The opportunity to attract new customers	Eff	Organization	New customers
Q21	The opportunity to offer new services for customer retention	Eff	Technology	New service- Loyalty programs
Q22	In-store marketing opportunities	Eff	Technology	New service - Proximity marketing
Q24	Enhancement of company innovative image	Eff	Ecosystem	Enhanced company image(normative pressure)

# APPENDIX E: SCREENSHOTS OF Q-SORTING PROCESS

This appendix is meant to illustrate the first three steps of the online tool participants encountered. For a first-hand experience of the online tool feel free to visit:

# http://qsorted-nfcmerchant.nl

		:::: ×
		-
	Welkom bij dit onderzoek	
	Wij danken u voor uw deelname aan ons onderzoek naar concepten die voor de Nederlandse winkelier van belang zijn bij het invoeren van NFC mobiel betalen.	
	Het onderzoek wordt uitgevoerd door de Technische Universiteit Delft binnen de onderzoeksgroep die zich bezighoudt met mobiel betalen. Mocht u nog vragen of opmerkingen hebben, aarzelt u dan niet om contact te nemen.	
	Uw deelname aan dit onderzoek wordt zeer gewaardeerd. Met vriendelijke groet,	
	Jeremy Lourens Student Msc Management of Technology j.j.lourens@student.tudelft.nl	
	Prof dr Harry Bouwman Delft University of Technology Faculty Technology Policy and Management	
Volgende	w.a.g.a.bouwman@tudelft.nl	•

#### Welcome to this study.

We appreciate your participation to this study on concepts that are of importance for the Dutch retailer when it comes to the adoption of NFC mobile payment. The study is carried out by the Delft University of technology within the research group concerned with mobile payment. Please do not hesitate to use either contact information below in case of uncertainties or suggestions. Your participants is appreciated. Best regards..



#### Introduction: a short explanation

NFC enabled mobile payment encompass the use of a smartphone in the payment process. A payment is conducted by holding the smartphone in front of a terminal; similar to the way the Dutch transport OV chipcard is used. Providers of NFC mobile payment in the Netherlands are very keen to push NFC mobile payment, and have conducted a pilot period in 2013-2014. The results of this pilot period have been labeled as positive by the providers, but we are keen on your perspective on possibility of NFC m-payment adoption. We intend to grasp this by presenting you with concepts that have been identified in previous studies. We then ask you to sort these concepts based on their relevance on your decision to adopt NFC m-payment.



#### Step 1 of 4: Pre-sorting

Please go through the 24 concepts carefully. Use your judgment in deciding how relevant they are in your decisions to adopt NFC m-payment. You have the choice to divide them in the following stacks:

- The right stack for relevant concepts
- The left stack for irrelevant concepts
- The stack in the middle for concepts on which you have no strong opinion

The ratio of concepts in each stack is entirely up to you; one stack may contain more concepts than the other. Sorting a concept in a stack can be done in one of the following ways:

- 1) By using your mouse to drag a concept to a stack
- 2) By using the numbers 1,2 and 3 on your keyboard(left on your keyboard)

<u>Please note</u>: It is not possible to navigate to a previous screen. Clicking the back button of your browser will lead to data loss. Therefore please review your choices before proceeding to the next step.

You can recall this instruction screen at any moment by pressing the help-button on the right of your screen.
## APPENDIX F: EXACT FACTOR SCORES AND IN Z-SCORE AND T-SCORE

Exact Fa	ictor Scores (á	la SPSS) in	Z-Score and	T-Score units	<b>i</b>									
No.	Statement	itatement					D1		D2		D3		D4	
Adopti	on													
1	Availability of NFC enabled smartphones				0.54	55	-0.48	45	1.8	68	1.06	61	2.92	
2	My current POS is able to integrate or upgrade to NFC ready					-0.51	45	-1.89	31	-0.7	43	1.73	67	-1.37
3	Technical concerns such as security, reliability and anonimity						61	-0.12	49	1.31	63	0.36	54	2.68
4	Knowledge on NFC adoption as the result of pilot participation						46	1.41	64	0.59	56	-1.61	34	-0.03
5	The supported banks, smartphones and mobile network operator					0.83	58	-1.71	33	-0.46	45	0.01	50	-1.33
6	Financial costs of adoption relative to other payment systems					-0.32	47	1.31	63	0.21	52	1.57	66	2.77
7	NFC is adopted by the government					-2.01	30	-1.85	32	0.99	60	0.61	56	-2.26
8	Partner or competitor companies have adopted NFC					-2.14	29	0.2	52	1.25	63	0.12	51	-0.57
9	There are sufficient customer using or demanding NFC					1.43	64	0.9	59	-0.12	49	0.6	56	2.81
10	Financial subsidization for adopting NFC m-payment					-0.56	44	1.44	64	-0.34	47	0.45	55	0.99
11	NFC m-payment fits our business model(transaction volume/size					1.01	60	-0.17	48	0.1	51	-0.83	42	0.11
12	NFC m-payment suits our business strategy					0.57	56	0.1	51	1	60	-0.49	45	1.18
														7.9
Implen	entation													
13	Dedicated budget for implementation					-0.1	49	0.63	56	-1.69	33	0.04	50	-1.12
14	Unaffected service during implementation					-0.05	49	0.28	53	-2.21	28	0.67	57	-1.31
15	Support from partners during implementation					-0.88	41	0.33	53	-0.78	42	-0.89	41	-2.22
16	Previous experience with POS upgrades					-0.72	43	0.13	51	0.03	50	-0.33	47	-0.89
17	Support from topmanagement					0.55	55	-0.41	46	-0.94	41	-0.86	41	-1.66
LICO														-7.2
18	Ease of use for cashiers					0.75	57	0.87	59	0.54	55	0.94	59	3.1
														3.1
Effects														0
19	Ease of use of payment for customers(faster, more convienent)					1.75	68	0.09	51	1.27	63	-0.13	49	2.98
20	Increased efficiency of POS						46	0.59	56	-0.79	42	1.66	67	1.04
21	The opportunity to attract new customers						59	-0.55	45	-1.11	39	-0.52	45	-1.23
22	The opportunity to offer new services for customer retention						53	-1.68	33	-0.35	46	-1.4	36	-3.11
23	In-store marketing opportunities					-0.76	42	-0.43	46	0.15	52	-1.36	36	-2.4
24	Enhancement of company innovative image					-0.95	41	0.98	60	0.24	52	-1.4	36	-1.13
														-3.85