A NEW APPROACH TO FASTER RETAIL SERVICE AND CUSTOMER SATISFACTION:

How NFC and RFID technologies may improve current retail business performance

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                How NFC and RFID technologies may improve current retail
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ABSTRACT

NFC (Near field communication) and RFID (Radio-frequency identification) integrated systems provide an insight as to how information technology is changing society. Despite purchasing at ease, shoppers simply need to wave their mobile phone in front of an NFC reader to complete the transaction, which is extremely simple and fast. RFID technologies allow an RFID reader to scan multiple items simultaneously around a designated perimeter, and unlike a barcode, it does not require scanning the products one by one. As a new approach to faster retail service and customer satisfaction, NFC and RFID integrated system would improve the performance of a business.

The goal of the study was to analyze customers' acceptance towards the new payment system, find out who are the target customers, how to reach the full acceptance in the market and how long does it take. The viewpoint of this study stands fully in information technology as well as in business communication. This study offers a preview of the future direction of retail business.

For the purpose of this study, two research methods were taken. In Order to identify user opinions, a survey was conducted. In January 2012 a questionnaire survey was carried out on 4000 customers in a supermarket during a weeks' time. The response rate was around 51% and the respondents represented the target group very well.

The result pointed out that most customers think that it's necessary to improve the efficiency of the supermarket payment process based on their busy lives. The survey also showed that a big group of participants has or is planning to get a smart phone soon, and they are eager to experience NFC technology. The facts explain that the smartphone market is mature in China; it's time for NFC technology for the next decade.

Keywords: RFID, NFC, retail payment system, customer satisfaction.

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1   INTRODUCTION

Retail business is closely related to people's basic needs. With the accelerated pace of life, the efficiency of retail service industry has become increasingly important. As our survey noted, nearly 50% respondents think that it's very necessary to increase the speed of payment process in the supermarket (He, 2011). The reason stems from the fact that no one wants to waste their valuable time queuing on the checkout lines anymore; likewise, retailers are facing a variety of "survival of the fittest" ordeals in order to just stay at a profitable margin; thus the reason for the importance of such a study. In order to enhance the performance of retail business and improve customer satisfaction, we can look at how new technologies may improve customer satisfaction and business efficiency, in this case how NFC (Near field communication) and RFID (Radio-frequency identification) may be applied to reach the latter end.

New technologies dictate the market leader and this can be said of NFC and RFID. Much of the success of an enterprise depends on the timing of such. It is for that reason that this study includes in its research supporting data that shows NFC and RFID as being at the right time for implementation on models such as the one being offered in this study. NFC and RFID integrated systems provide an explanation as to how information technology is changing society. NFC technology allows for simplified transactions, data exchange, and wireless connections between two devices in proximity to each other. It is very simple to make payments with NFC on a mobile device; shoppers simply need to wave their mobile phones in front of an NFC reader to complete a transaction, which is surprisingly simple and fast. RFID is another technology that uses radio waves to transfer data from an electronic tag attached to a product called RFID tag, to a reader for the purpose of identifying and tracking an object tagged with an RFID chip. The checkout point of the system allows an RFID reader to scan multiple items simultaneously around a designated perimeter, and unlike a barcode, it does not require the scanning of products on a one by one basis. Such an integrated system would aid faster retail service and customer satisfaction, NFC and RFID integrated systems would provide excellent performance and profit maximization through the application of such in retail business.

The start point for this thesis is the survey conducted on the Carrefour supermarket, located in Xiaogan, China where a strong purchasing power exists. This study bases itself on customer acceptance and adoption of the said technology. Customer acceptance towards the new system will be analyzed; in addition, the adoption life cycle of the new system will be examined as a product into the current market. In detail, the process of this study, I shall put forward, is to find out who the target customers are, and how to reach full acceptance in the market. Before analyzing the collected data, it is fundamental to define the role and state of the current payment system in the current market, in order to identify service flaws, advantages and weaknesses. This integrated payment system study took place in the beginning of 2012 and all the information presented in this study represents the situation at that time. This thesis ponders whether to set up an integrated payment system or not in order to match future market demands and achieve better customer satisfaction. The starting point is an existing target supermarket that requires improvement in the area mentioned above. The viewpoint stands fully in information technology as well as sales management, and professional system design that concerns software; hardware lies beyond the scope of this study.

For the purpose of this study, a paper formatted survey and a design sciences research were conducted in order to clarify the user habits, the needs, and the attitudes as well as to estimate the future demands; on top of which there is the amount of smartphone usage, users' opinion on usability and pleasantness of the phone, which are the key background factors of this study. In addition to the questionnaire, we also conducted interviews with some of the respondents. The research was also aimed to troubleshooting the current shortcomings, faults and others the system may lack. The paper questionnaire for collecting data from customers' acceptance and attitudes towards the new system was handed out in Carrefour Xiaogan, to approximately 4000 customers. The participants of the survey included students, businessmen, teachers, office staff, and unemployed, with an overall turnover of 2047 out of the 4000 send out to which makes the response rate around 51%. The statistical results were processed by MS office Excel.

The research problem was twofold and consisted of two questions. The first question was "How could an efficient payment system serve customers better?" and it aimed to map out the state of the current supermarket payment system, especially keeping the users' satisfaction in mind, comprise the identification of the strength and the weakness of the current payment system as well as the construction of the new NFC integrated system. The second question was "How this integrated system could adapt to the market?" by answering this question, we would have unraveled a key part of our research and fully fulfill our aim.

During the process of this study, three theories have been scrutinized: the SWOT Analysis, Technology Acceptance Model (TAM) and the Diffusion of Innovation (DFI), respectively. The theories are introduced in chapter 3 and conducted in chapter 5. The NFC integrated payment system concept, purpose, benefits and weaknesses are identified and described in chapter 5 as well. The acceptance and adoption of the system has been analyzed along the planned implantation of such. The last chapter is reserved for conclusions.

2   RESEARCH METHODOLOGY

2.1   Scope and limitation of the study

A crucial step of the thesis process is to state in a clear manner the scope and limitations of the study. The scope of this thesis uses an integrated approach to the design of an NFC & RFID integrated payment system and its diffusion process forecast. It is important for the reader to understand that the study leans towards the diffusion process forecast of such a payment system. The study does not cover detailed information regarding software and hardware components or operations of the payment system. Our focus will fundamentally study how such an integrated system could generate value for the targeted business (Carrefour, Xiaogan, China) included in this study. Although, there are different sources to support our findings, the study focuses mainly in the Chinese market.

2.2   Research problem

This study examines the current retail store payment system; defines its role, functionality and potential flaws. The research problem consists of two questions:

1. How could an efficient payment system serve customers better?
2. How this mobile-oriented system could adapt to the market?

The first question aims to map out user habits and the payment system role in a supermarket. How does it currently benefit the user? What is preventing the usage? How could mobile technology help the payment system be developed, in order to benefit its users most efficiently? Find out the flaws and weakness of the current payment system. The second question aims to analyze the adoption and acceptance of this system, and how well does this system suit the market. After identifying the strengths and weakness, the purpose is to realize the study results in praxis and on their basis to amend the payment system.

2.3   Research strategy and methods

Tarvainen states that research is both mapping and explanatory in nature. It is both aiming to find new viewpoints and describe a target, as well as to find an explanation and solution to the problem (Tarvainen, 2003). In order to get valid results and find solutions to the research questions, both qualitative and quantitative methods had to be involved.

Gradually, two different research methods were chosen: design sciences and quantitative survey. In addition to these, the proportion of informal discussions, meetings and observation was fairly extensive, and had an impact on the final result. The methods used are presented in the following sections.

2.3.1   Design sciences

The Design Sciences paradigm seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts. It is an outcome based information technology research methodology, which offers specific guidelines for evaluation and iteration within research projects.

Design science research focuses on the development and performance of (designed) artifacts with the explicit intention of improving the functional performance of the artifact. Design science research is typically applied to categories of artifacts including (but not limited to) algorithms, human/computer interfaces, design methodologies (including process models) and languages. Its application is most notable in the Engineering and Computer Science disciplines, though is not restricted to these and can be found in many disciplines and fields (Vaishnavi & Kuechler, 2011).

The design sciences contributions of this research are the design principles and grounded theories such as TAM and diffusion of innovation. It initiated the project and was continually repeated during the project. A survey as well as the informational discussions and observations were supported and guided the design sciences research.

2.3.2   Survey

 A survey was chosen for as the second research method in this paper. This was so as the purpose is to identify the end user's interest, behavior, habits, attitudes and opinions about the new payment system with mobile technology. The survey was seen as the most cost-and time-effective option to gather the required data to be analyzed in order to fulfill the needs of this research.

A survey allows for a large group of respondents and provides the data that is suitable for precise analysis. Survey methodology seeks to identify principles about the design, collection, processing, and analysis of surveys in connection to the cost and quality of survey estimates. It focuses on improving quality within cost constraints, or alternatively, reducing costs for a fixed level of quality. Since survey research is always based on a sample of the population, the success of the research is dependent on the representativeness of the population of concern.

The survey was conducted by using a standardized, paper-questionnaire. The aim was to make the questionnaire accurate, clear and visually attractive. The font, structure and wording of the survey supported this goal, and were kept as clear as possible. The questions were time-efficient (it takes about 2 minutes to finish all the questions) and were concerned with people's daily lives. The questionnaire was designed to be quick and easy to answer with multiple choices applied; these as people are usually busy with their daily work and most likely have a negative attitude towards questionnaires. The questions were placed in logical order in the manner that background questions took the last place in the questionnaire; it was considered that this would reduce the likelihood of people answering in a way that would be socially acceptable and suitable for their background, and they would not answer simply on how they feel. Because the questionnaire was short it was assumed that people would not leave it unfinished and the necessary background information would be gained. During the design process the further processing needed of the data was also taken into consideration.

2.3.3 Informal interviews

Besides the design sciences research strategy and statistical survey, research interviews and discussions are also applied to this thesis study. The qualitative research interview seeks to describe and the meanings of central themes in the life world of the subjects. The main task in interviewing is to understand the meaning of what the interviewees say (MacNamara, 1999). Interviews are particularly useful for getting the story behind a participant's experiences. The interviewer can pursue in-depth information around the topic. Interviews may be useful as follow-up to certain respondents to questionnaires, e.g., to further investigate their responses. (MacNamara, 1999) The interview data is mainly used in Chapter 5. The answer of the interviews had a broad impact in the final result. During the research, several web-interview questionnaires had been send to related companies, such as, Carrefour, etc. The target participants consisted of the sales department of Nokia, the NFC technology specialist, sales manager of Carrefour and the cashiers of the Carrefour supermarket. Several informal phone interviews were arranged with certain customers and the employees who work as cashiers at the surveyed supermarkets. These interviews and meetings were important regarding overall data collecting, deeper research, and technical issues. They could provide in-depth information about the target group's attitude, habits and detail of relevant technologies.

3   BACKGROUND THEORIES

There are several background theories that have been applied during this study. As for every new business, carrying out a SWOT analysis is an essential tool in order to identify a strategic aspect that differentiates the model. We have also implemented DFI (diffusion of innovations) and TAM (technology acceptance model) into this study, in order to analyze the data and collect the results. The Technology Acceptance Model is a key concept on how users come to accept and use technologies; it aims to find out what factors influence user's decision on how and when they will use the technology. This solid model has a grounded theory supporting this study and the result; it explains how well this new system would get accepted by users. Diffusion of innovations is the process by which an innovation is communicated through certain channels over time among members of a social system. The theory seeks to explain how, why, and at what rate new ideas and technologies spread through cultures. Based on this theory we can get an estimated number on how long it would take for this system to get adapted into the market in a practical way and how to achieve this goal.

3.1   SWOT Analysis

A SWOT analysis is a business strategy analysis method, internal and external conditions were analyzed in order to identify the advantages, disadvantages, and where core competitiveness lies. Among them, the S stands for strength (advantage), W for weakness (is weak), and O stands for opportunity (opportunities), in which T represents threat (threat). Used in a business context, a SWOT Analysis helps you carve a sustainable niche in your market. It is a useful technique for understanding your Strengths and Weaknesses, and for identifying both the Opportunities open to you and the Threats you face. (Manktelow & Carlson, 2011)

A SWOT analysis in most business and marketing situations may be held in two categories of selection: internal and external affairs. Strengths and Weaknesses tend to be regarded distinctly as internal factors, while Opportunities and Threats, and tend to be regarded distinctly as external factors.

3.2   Technology acceptance model

Continuous developments in the fields of knowledge and technology compel rapidly changing business environments, thus an organization is forced to change their way of doing business and adopt new technology at an increasingly faster rate. This results in a high rate of ongoing technological change in the working environment, with the effect of an increased interest in understanding user technology acceptance. Despite a large number of theories, the success of a technology amongst its users remains hard to understand and ranges from enthusiastic endorsement, to intermediate variations, all the way to open rejection (Hillmer, 2009, s. 24). In order to apply a multi-and cross-disciplinary consciousness about how users accept a new designed system, solid theory is necessary for building the base of this research study.

In 1985, Fred Davis proposed the Technology Acceptance Model (TAM) in his doctoral thesis at the MIT Sloan school of Management. He proposed that system use is a response that can be explained or predicted by user motivation, which, in true, is directly influenced by an external stimulus consisting of the actual system's features and capabilities (Davis, Bagozzi, & Warshaw, 1985).
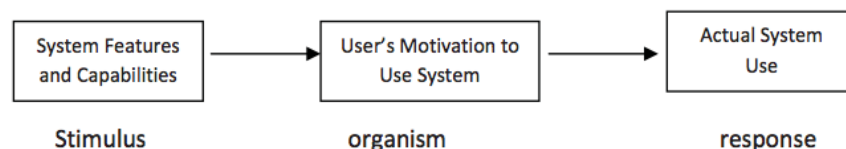
Figure 3.1: Conceptual model for technology (**Davis, Bagozzi, & Warshaw, 1985, p. 10**).

The Technology acceptance model is an adaptation of the Theory of Reasoned Action (TRA) specifically in the field of information systems. The theory of reasoned action started out as the theory of attitude, which led to the study of attitude and behavior, and both of them have strong behavioral elements. People are free to act without limitation when they form intent to act. Technology Acceptance Model replaces many of TRA's attitude measures with the two-technology acceptance measure: ease of use and usefulness:

- Perceived usefulness (PU) - This was defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance his or her job performance".

- Perceived ease-of-use (PEOU) - Davis defined this as "the degree to which a person believes that using a particular system would be free from effort".
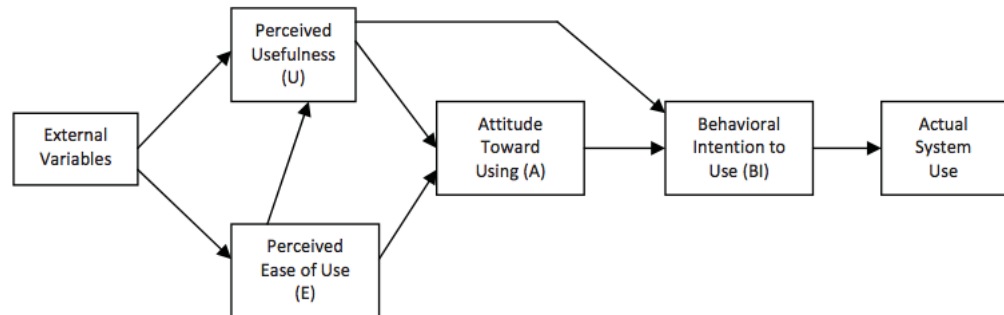
Figure 3.2: Final version of TAM **(Davis, Bagozzi, & Warshaw, 1985, p. 985)**.

Figure 3.2 is the final version of the Technology Acceptance Model, created by Davis, Bagozzi and Warshaw. They have used previous models to conduct a longitudinal study with 107 users to measure their intention to use a system after a one-hour introduction to the system, and again 14 weeks later. In both cases, their results indicated a strong correlation between reported intention and self-reported system usage with perceived usefulness responsible for the greatest influence on people's intention (Chuttur, 2009). The main finding was that both perceived usefulness and perceived ease of use were found to have a direct influence on behavioral intention, thus eliminating the need for the attitude construct from the earlier models.

The final version of the Technology Acceptance Model suggests that when users are presented with a new technology, easy to use and usefulness directly influence user's decision and how and when they will use it. The actual system use is resulted in studying about users attitudes towards using and their behavioral intention to use the system.

3.3   Diffusion of innovation

Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the message is concerned with new ideas. Communication is a process in which participants create and share information with one another in order to reach a mutual understanding (Rogers, 2003).

Diffusion has a special characteristic because of the newness of the idea in the message content. Thus some degree of uncertainty and perceived risk is involved in the diffusion process. An individual can reduce this degree of uncertainty by obtaining information. Information is a difference in matter energy that affects uncertainty in a situation where a choice exists among a set of alternatives (Rogers, 2003).

Alternative research approach to post hoc data gathering on how an innovation has diffused should be explored. It is possible to investigate the diffusion of an innovation while the diffusion process is still on going. Data can be gathered in two or more points, during the diffusion process, rather than only after the diffusion process is completed. In figure 3.3, Diffusion of innovations according to Rogers, with successive groups of consumers adopting the new technology (shown in black), its market share (shown in grey) will eventually reach the saturation level. In mathematics the S curve is known as the logistics function. Getting a new idea adopted, even when it has obvious advantages, is difficult. Many innovations require a lengthy period of many years from the time when they become available to the time when they are widely adopted. Thus, how to speed up the rate of diffusion of an innovation becomes a common problem for many individuals and organizations. The S curve explains to us that in order so that the idea is adopted into the market, we should focus on the early adopters, study them to find out their common characteristics. Rogers claims that "The S curve of diffusion "takes off" once interpersonal net workers become activated in spreading individuals' subjective evaluations of an innovation from peer to peer in a system. The part of the diffusion curve from about 10 percent adoption to 20 percent adoption is the heart of the diffusion of a new idea, even if one wished to do so."
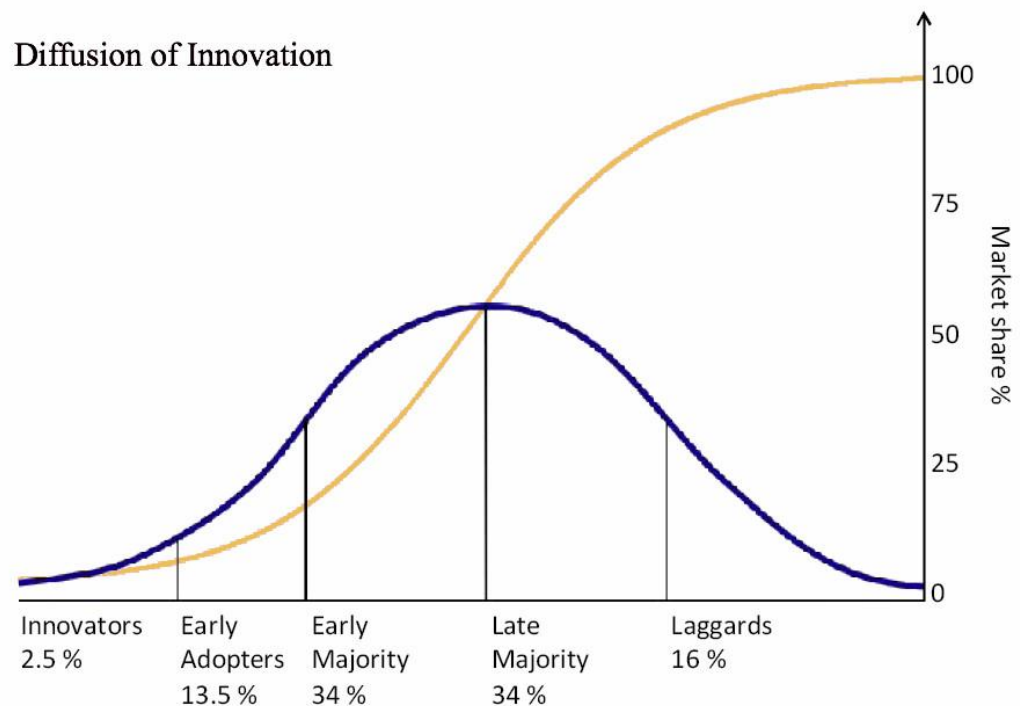
Figure 3.3 Diffusion of innovation (**Tungsten, 2009**).

The usual diffusion study gathers data from adopters after the innovation has diffused widely by asking respondents to look backward in time. In the book Diffusion of Innovations by Everett M. Rogers, he believes that "Mass media channels are relatively more important than interpersonal channels for earlier adopters than for later adopters. At the time innovators adopt a new idea, there is almost no one else in their system who is experienced with the innovation. Later adopters do not need to reply so much on mass media channels because an ample storehouse of interpersonal, local experience has accumulated in their system by the time they decide to adopt. " Everett thinks that interpersonal influence is not necessary for the earlier adopters to make positive decision on an innovation. Mass media message stimulus is enough to move them over the mental threshold to adoption. But less change-oriented later adopters requires a stronger and more immediate influence, such as that from interpersonal networks and especially from peers.

3.4 Adoption life cycle of the NFC payment system

New technology presents risks for many customers. They react differently toward the risks based on their innate characteristics, the wants and needs of their companies, and the behavior or other buyers. Designed by Joe M. Bohlen, George M. Beal and Everett M. Rogers, Technology Adoption Lifecycle model describes the adoption or acceptance of a new product or innovation, according to the demographic and psychological characteristics of defined adopter groups. The model indicates that the first group of people to use a new product is called "innovators" followed by "early adopters." Next come the early and late majority, and the last group to eventually adopt a product is called "laggards". This model helps high-tech marketers build the best strategy for each phase of a product's life. Graphic 3.4 show the markets that develop along the Technology Adoption Life Cycle and the types of customers that dominate them. In Geoffrey Moore's book, he suggests that for discontinuous or disruptive innovations, there is chasm between the first two adopter groups and the early majority (Moore G. , 1991).
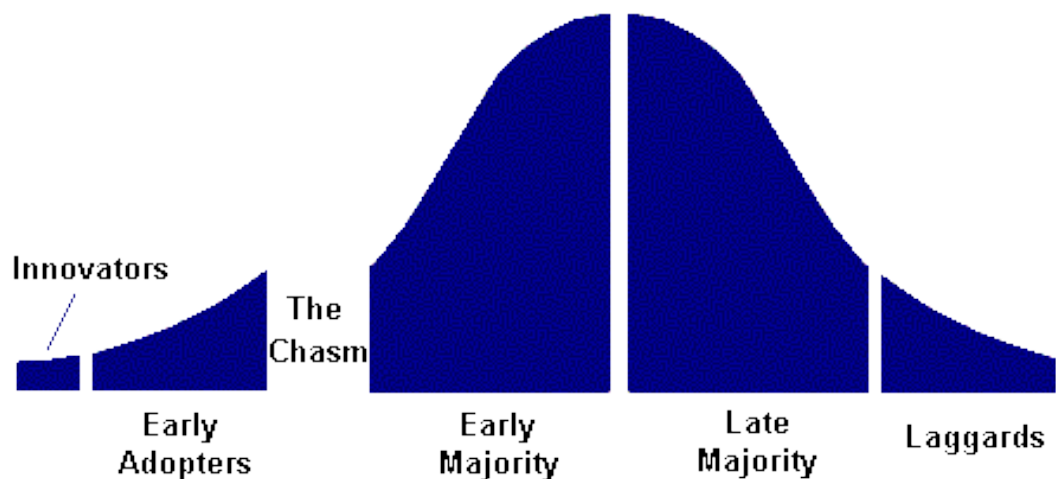
Figure 3.4 Bell curve (**Moore G. A., 2011**).

3.4.1 Early Market

The market at this stage consists of visionaries and technology enthusiasts. The technology enthusiasts (often referred to as "innovators") fundamentally believe that new technology is better than existing technology and will therefore always be amongst the very first to adopt new products. Visionaries on the other hand believe in technology as a path to competitive advantage and thus aggressively adopt any new technology to further their business. (MaRs, Technology adoption lifecycle , 2011)

3.4.2 The chasm

As we can see in the "bell curve" (figure 3.4), there is a gap between early market and early majority. The Chasm represents the gap between the Early Market and the next phase: the Bowling Alley. As one very important period, the chasm is the essential verification as well as the testing phrase of every product. The success of passing the chasm strengthens the possibility of one product adapting into the market. In the chasm the product category encounters a pause in market development. The length of this pause depends on how radical the disruptive innovation is, thus the length of this market lull is uncertain. It develops when there are few if any remaining visionaries to sell to, often as a result of weak or incomplete value chains and because pragmatists do not see a complete solution to their problem, plus there is no group of references that have formed that they trust. In addition, they want to see the solution working live at customer sites. Revenue growth ceases or even recedes in the Chasm. The success of the product category depends on the pragmatists' view of the outcomes of the pilot projects initiated by the Early Market. In this phase, entrepreneurs need to analyze current projects and developments to understand how an improved offering can serve niche markets in order to gain momentum in the next phase of market development. (MaRs, Technology adoption lifecycle , 2011)

3.4.3   The bowling alley

Once the Chasm is crossed, the Bowling Alley phase begins; it represents the early majority. The creation of the whole product to fulfill the needs of a niche market requires an additional strategy beyond product leadership: customer intimacy. Once the whole product satisfies the needs of a niche market, pragmatists embrace the technology, and a "pin" is knocked over. In our case of study, once NFC integrated payment method dominated the market; several more mobile application like account manager, shopping reminder, balance checker, etc. These applications may be modified to address customer support on the Internet.

In this phase of the lifecycle, the innovation appeals to customers within narrowly defined market niches, who are conservative but open to new ideas, and who are influential and active in the community. The product category now appeals to specific niche markets. The sales to these niche markets are predictable and provide high margins. However, outside of the niche markets, sales are opportunistic and may require mass product customization to meet individual client needs. At this point, industry analysts and media may begin to follow the development of the product category. (MaRs, Technology adoption lifecycle , 2011)

The key to success in this period is to provide a complete solution for one segment while identifying closely aligned segments that could benefit from a similar solution. When the momentum from success fully capturing a market share in the first segment is felt, this momentum is leveraged into adjacent segments. By dominating several segments, the company may start to emerge as a sector leader (ChasmInstitute , 2011).

3.4.4   The tornado

This is the most exciting phase of the technology adoption life cycle for an investor, because the investment opportunities can lead to market-thumping returns. From Bowling Alley to the Tornado phase, the technology has proven itself in several niche markets. When enough pins have been knocked down, the product begins to look attractive to mainstream pragmatic buyers. The Tornado is a period of hyper

growth when the pragmatic buyers flock en masse to adopt the technology as the standard. The product focus has also shifted away from the problems of the end user and toward the infrastructure buyer that can implement the technology to solve their problems (xerohype, 2001).

3.4.5 Main street

This is where market enters the mature stage of its lifecycle, company experiencing declining growth rates, as we can see in the "bell curve" (figure 3.4). The declining prices appeal to the late majority consumers. These customers tend to be more risk-averse than previous segments. The reason why they purchase the product is to avoid a competitive disadvantage. At this point, to secure a viable future within niche markets, some competitors modify their offering while others compete solely on price. The focus of the media changes from discussing the product category and its players to the market itself (MaRs, MaRs, 2007).

4   DESIGN OF AN INTEGRATED NFC SYSTEM

A smartphone is a high-end mobile phone, which combines the function of a personal digital assistant and a mobile phone. Today's models typically serve as portable media players, camera phones with high-resolution touchscreens, web browsers that can access and properly display standard web pages, GPS navigation, Wi-Fi and mobile broadband access. Many big cellphone brands such as Huawei, Nokia, HTC, and Samsung, have already launched their NFC smartphones, and it is estimated that 1/5 phones will have NFC technology in 2014 (Juniper, 2011). From the statistics we can see that the number of people using smartphones is increasing and NFC will be the core technical matter of next generation smart phones. This technology changes people's way to think and do things and many services will have to update their functions in order to match these users' needs. Thus NFC integrated systems for retail use or other service use will be needed logically.

4.1   Definition of an integrated NFC system

Near field communication as its name is, it's a method of communication that usually takes no more than a few centimeters to operate between two devices. It allows simplified transactions, data exchange, and wireless connections between two devices in close proximity to each other. It is a technology that based on radio-frequency identification, or RFID. RFID allows a reader to send radio to a passive electronic tag for identification and tracking. The purpose of NFC is to make life easier and more convenient for consumers all around the world by making it simpler to make transaction, exchange digital data, and connect to other device. With NFC technology shoppers can make purchases through their mobile phone with or without the cashier's existence. It's expected to become a widely used system of making payments in the United States.

The acronym NFC first appeared around the year 2004; Nokia, Philips and Sony established the Near Field Communication Forum. In 2006, Nokia created the 1st NFC phone, Nokia 6131. Because of the immature mobile network at that moment, Nokia 6131 was not showing its proper advantage. It takes quite long to access personal bank account and requires the third parties to install its NFC application so

that the trade can go through. Starting from 2010, Samsung developed first Android NFC phone, a year after NFC support become part of the Symbian mobile operating system with the release of Symbian Anna version within Nokia. Nowadays, many smartphones currently on the market already contain embedded NFC chips that can encrypt data to a reader located through a short distance. For example, shoppers who have their credit card information stored in their NFC smartphones can pay for purchases by waving their smartphones near or tapping them on the reader, rather than bothering with the actual credit card.

4.2   Roles of an NFC integrated system

NFC system can obtain a variety of different roles and they can be used for a variety of purposes. The times that a phone is designed for mainly calling and text messaging have already past, in order to catch up with the diversity of life, many new practical functions have been developed. It's just like our life first moved from paper to computers, now we're experiencing a period in life that moves from computers to smaller devices, such as smartphones. There are many different types of tasks that can be performed through smartphones nowadays, besides the basic function of a normal phone, making calls, text messaging, sending emails, smartphones now enables you to install different applications to your phone, such as twitter, weather, GPS, games, messenger, video, online free calls, etc. As we know that a NFC smartphones give us an even more advanced set of choices other than a normal smartphone, such smartphone's added functions broaden and maximize their operations.

For instance, NFC allows users to transfer data, file or picture between 2 devices with a simple wave to another device nearby or simply tapping them on their readers. Without NFC, this process can be achieved through either email or Bluetooth: Compare to email, NFC smartphones reduce the steps to sending an email to a simple wave; similarly, compare to Bluetooth, NFC doesn't require pairing, which is more efficient. In addition, it can be used as an electronic business card; users tap on an NFC device to share instantly, for example business cards or resumes to another party. For the game players, it allows them to tap on one NFC

device to another to enter a multiplayer game. It also has Friend-to-Friend function, which means that you could touch NFC devices together to Facebook friend each other or share a resume or to "check-in" at a location. However, such functions as friend-to-friend, data sharing of NFC technologies are beyond the scope of this thesis study, our focus in this study on NFC data exchange.

There's nothing you can't do with NFC technology, all it takes is an active imagination. Even so, the most important use of an NFC system is the mobile wallet, which is also the focus in this thesis study. If you want to pay a friend, you could tap the devices and enter the amount of the payment. It allows flexible interaction and a smartphone can also turn into an electronic wallet where you save your ID card, driving license, and bankcards. If the electronic wallet is properly used, it has a large number of advantages. NFC payments save a lot of time in processing a payment, and shoppers will not need to queue anymore to purchase. Whereas a retailer, the technology reduces labor costs and improves logistical chain management. Globally, there are already 104 million people using a mobile payment system around the world (eMarketer, 2011).

4.3   Element of NFC integrated system design

In this case study, NFC integrated payment system contains two parts, one part focus on data transferring between the bank and the receiver through NFC mobile, another part focus on data transferring between RFID reader to POS (point of sale) machine, and these two parts are cooperating with each other during the process. However, the fundamental design goal, efficiency should constantly be kept in mind. Generally, the most valued system starts with a clear understanding of how the system will improve the business both in structure and layout, simplicity and consistency are vital. In the long run, system request, system architecture, database and user interface are the most important elements of system design. However, at the stage of this study, only system request and database structure are within the scope.

4.3.1   System architecture

An information system can consist of thousands of process that are connected together with logical links. System architecture can be defined simply as: the conceptual model that defines the structure, behavior and more views of a system. An architectural description is a formal description and representation of a system. Obviously, without a solid and logical basic structure, no system will function well. A logical system organization allows users to make successful predictions about where to find things. If the users are led astray with a structure that is neither logical nor predictable, they will get frustrated.

The structure of the system cannot be designed before the features are properly organized. Figure 4.1 shows the five basic steps in organizing information. The features must be analyzed carefully and divided logically into units in order to reach the best result.

Table 4.1 Five basic steps in organizing information (Lynch & Horton, 1997)

1.Divide your features of the system into logical units
2.Establish a hierarch of importance among the units
3.Use the hierarch to structure relations among units
4.Build a system that closely follows your information structure
5.Analyses the functional and aesthetic success of your system

4.3.2   Database design

Database design is the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a Data Definition Language, which can then be used to create a database. A data flow diagram is a graphical representation of the "flow" of data through an information system, modeling its process aspects. Often they are a preliminary step used to create an

overview of the system that can later be elaborated. Data flow diagram can also be used for the visualization of data processing (Azzolini, 2000).

A data flow diagram has been designed, in order to explain what kind of data will be input to and output from the system, where the data comes from, where it goes to and where it will be stored in the system.
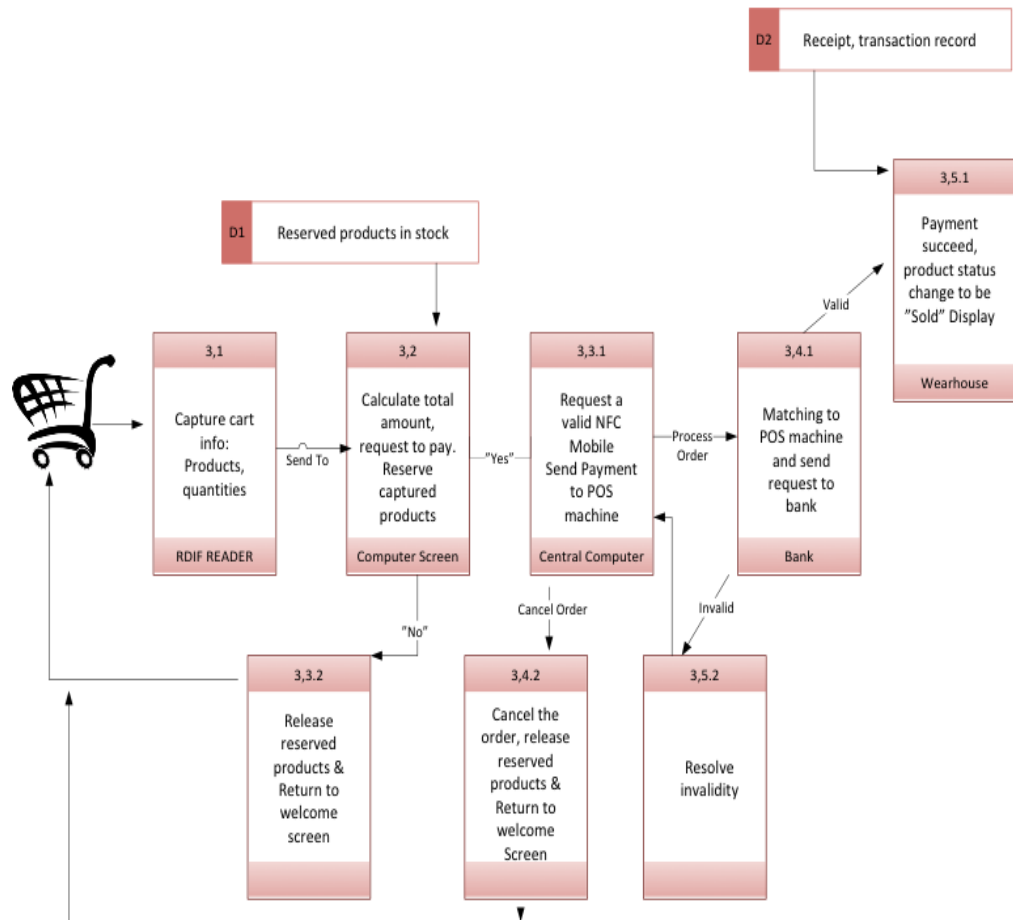
Figure 4.1 Data flow diagram of integrated system

Figure 4.1 explains the data flow of the designed NFC payment system. It describes how data flows in this system, what kind of input the system requires and what output it would get as well as where it would be stored. On basis of a data flow diagram, user is able to visualize how does the system will operate, what the system will accomplish, and how the system will be implemented. The old system's data-flow diagram can be drawn up and compared with the new system's dataflow diagram to draw comparisons to implement a more efficient system.

5 ANALYSIS AND IMPLEMENTATION OF THE NFC PAYMENT SYSTEM

Trough out this chapter we will analyze the different aspects of such an integrated payment system and its projected implementation. The model is mainly targeted to large supermarkets around the world with a daily turnout rate of at least 10,000 customers per day. We have conducted a survey on a supermarket matching our criteria and that is the Carrefour Supermarket in Xiaogan, China. The data from the survey will be used as supporting grounds for our conclusions. The survey form can be found in Appendix 1 of this paper. In order to achieve a thorough analysis of this system we will implement a SWOT analysis on the model using data from the survey to augment our finds. This shall also help us in better understanding the diffusion-process and the adoption-lifecycle tools. Furthermore, Acceptance of the technology analyzes the data from the survey and sorts the reason why user would accept and come to use NFC payment method. In this part, the user of the integrated payment system covers both customers and shop owners. Adoption lifecycle of the technology analysis aims to divide customers into different categories, analysis the data and find out common characters of the early adopters, estimate how well customers would accept the new payment method and how long it would take for the current market to accept the NFC payment system. Accurately identifying the different points that the SWOT analysis, diffusion process and adoption lifecycle tool provide us, gives us the opportunity to see the business opportunity and the value it brings to it.

5.1 Survey in Carrefour - Xiaogan

By taking into account the scale of the enterprise, its turnover, and its geographical location together with other factors, the hypermarket chain Carrefour is comparatively more suitable in our case study than any other retail enterprises. The results of this survey have shown a grand showcase of opportunities to implement the system designed in this study. These opportunities will be better analyzed in the S.W.O.T analysis of the next section of the analysis. As for the criteria of the survey venue, Carrefour met our criteria of at least 10,000 customers per day having itself

15,000 customers per day. The latter information was obtained through a phone interview with Ms. Cheung, Sales manager of Carrefour, Xiaogan

Carrefour Group is an international hypermarket chain headquartered in France. It is the second largest hypermarket chains in the world, which holds 9,564 stores in 32 countries. (Group, 2011) In March 2012, a qualitative survey was conducted in the city of Xiaogan, in China, with a population of about 500, 000. Carrefour Xiaogan is located in the center commercial area of the city, with 20,000-m2-business area. The questionnaire form was placed on paper and has been carried out in the form of a win a prize survey scheme in the supermarket Carrefour Xiaogan, China. The average turnover is of between 300,000 and 500,000 RMB (36000 – 60,000 euro) per day. (Cheung, 2012) A total number of 4000 questionnaires were handed out to customers. From the received answers 2047 were eligible to be counted as valid. The survey was giving out in a win a price promotion in the supermarket, which lasted a week long from January 2nd to January 8st. This was done on purpose since the shopping time may vary from person to person, full week coverage could maximize, enhance the statistical result, reliability and validity.

The survey contains 9 questions, separately and comprehensively covers the background of participants, role of retail stores (supermarkets) in customers' daily life, efficiency of the current payment system, customers' satisfaction and current situation of the mobile user.

5.2   SWOT Analysis of the integrated system

An integrated payment system offers unique benefits, which can be divided into two categories: internal and external. These in turn can be seen as the two subdivisions found in an S.W.O.T analysis with the S.W. being internal and O.T. being external. The area of this study will look upon such categories in order to better aid the business model at hand. The latter tools will make use of the survey data collected to the ends of cementing a stronger understanding of the model and its different noted attributes.

5.2.1 Strengths

The NFC payment system has a range of strengths that proves the viability of the system as a safe investment to an enterprise. These strengths are complimented by the findings of the survey data the which sustain that the customer of today and tomorrow demands not only a good shopping experience but also a swift one when it comes to checking out goods purchased. The following is a layout of the basic strengths this system posseses:

Safe and Fast, that is in short an NFC integrated paymet system. As shown in chapter 4, the system can cut down on transaction and customer processing time at the counter significantly. This brings value to the business in both customer satisfaction and the amount of sales that can be made in a day. The survey that was conducted in Carrefour showed us that 42% of respondents have a busy life style (as shown on Figure 5.1), bringing us to the conclusion that the average customer is quite busy if not very busy.
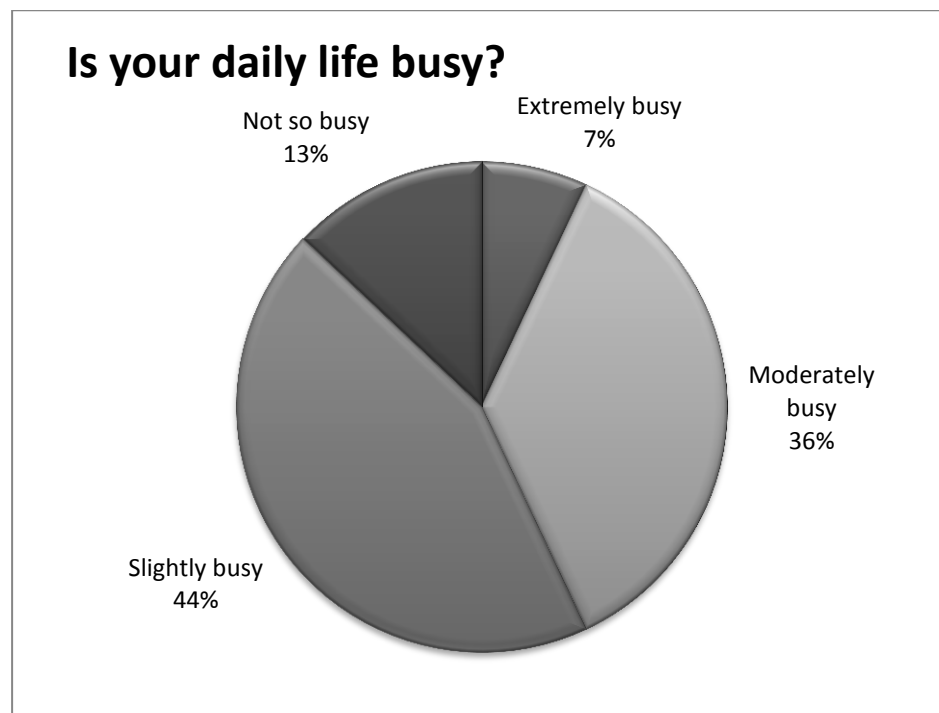

Figure 5.1 Speed of life (%) - all customer groups

Integrating NFC with RFID not only increases speed but also realibility on an automated supply chain. The technology is safe and robust enough to maintain an

inventory as big as WalMart's. The NFC payment system could be used as a medium to enhance and augment marketing in generating value in consumer amnities and perks trough the use of the NFC interface. The system also has the advantage of being a very new thing and as such could provide a new experience excellerating in shopping with a different type of model and interface than the ones they are usually use to. This generates value in the services being provided by the store and leave room for more aggressive marketing campings that could aim the NFC payment interface.

Flexibility may benefit other types of businesses in such a model. The more businesses become NFC capable the more type of services that may sprout from them. NFC could turn into a bridge between the internet world and the real world enabling fast payment of internet services such as music, game, entertainment and productivity application purchases. For instance one could walk into a convenience store and approach the entertainment stand to listen to new song releases or test out game apps and if one desires may purchase the such at the same spot trough his or her NFC device without the need of queing in front of the paying counter. This may be one of the greatest strengths of an NFC payment system, flexibility in a nowadays versatile world.

5.2.2 Weakness

The model at hand has its weakness like any other model out there. These weakness can be listed as the following:

Unfamiliar: despite the large number of benefits an NFC integrated system may bring into a business, the reality today is that an NFC is still a system not widespread in the world except in areas such as Japan and Turkey. There is still a large market of customers who are unfamiliar with the way an NFC payment system would work and many who, if the model is not done the right way, would not bother to try a different way.

Payment System: unlike countries where an NFC payment system has thrived many countries pose barriers to such a system for othe apparent lack of feasibility in interconnecting most bank payment systems into a new type of payment system which would involve other entities other than the bank itself.

Costs: Althought there is the promise of increased number of customers and the outlook of better revenue, there will always be the fact that an initial investment is needed in order to start up the process. This stands as a barrier to getting an NFC integrated system operational in mainstream supermarkets. But one of the biggest obstacles to the system up to this day must be the price tag on individual RFID tags. At 0.03 cents per unit (ade in China, 2011), it is still a costly tool. Investment in this system would take careful consideration by various departments of a company and managers bold enough to take the next leap forward. Such a call may not be one that every manager may be ready to make. Therefore we can expect that the model will be adopted first by experienced managers and chains that will understand the short and long term benefits of such an investment.

5.2.3   Opportunities

There is a wide range of opportunities available to those who adopt and those looking to adopt an NFC payment system. In our case there are a number of opportunities that can be clearly seen trough the Carrefour Survey. In this section we will aim to properly catalog such opportunitie to the NFC payment system model in a supermarket chain. The following will lay out the various opportunities that are available to the model:

Customers nowadays are becoming more demanding in the way services operate around them. This can be expected as a normal evolution of the industry. But as technology becomes readily available to customers so do the ways in which a customer may make their purchases. In other words a business must match the new customer trends if its to survive in the market. In the survey we can find that 76% (as shown in figure 5.2) of respondents believe its necessary to improve the speed of the payment process in the supermarket. This can be capitalized on in a various

of ways one being the application of a system that reduces checking-out times and another by setting up a business that at its core is the speedy processing of customers. In a customer oriented world this racks up immensely as a winning factor.
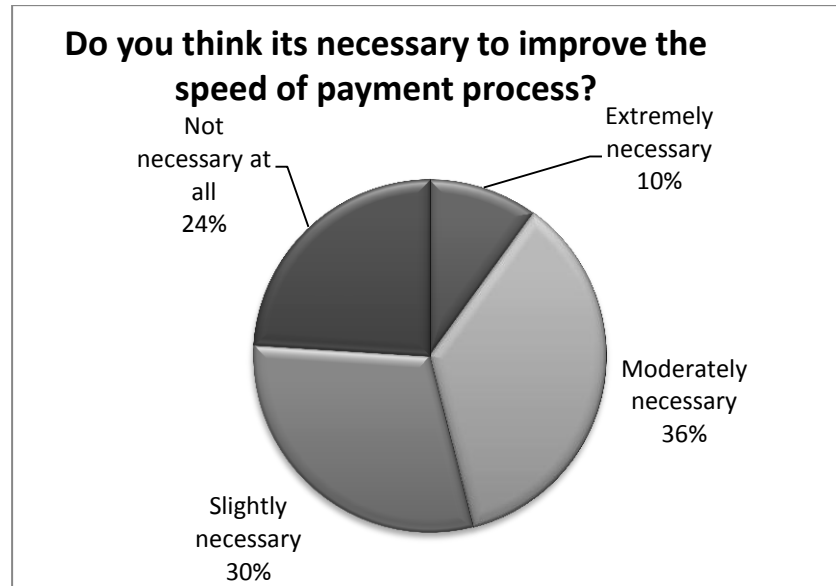
Figure 5.2 Necessity of improvement - the speed of the payment process in the supermarket

The market environment greatly favors the endeavor at hand. We can find this by the number of respondents in our survey who have mobile phones, 67% who owne one and 20% who are looking forward to getting one. We can not account that all of those smartphones are NFC capable but at the current product replacement rate in the market and the rate in which new products come to the market, we can expect NFC to become a feature available in most smartphones within the next years. In fact mobile smartphone producer Nokia has already rolled out various models with NFC readers on them. The trend is expected to continue towards NFC enabled phones. (Near Field Communication, 2011)

One crucial aspect conducted by the survey had to be the age distribution of visitors to the supermarket. As shown in Figure 5.3, the age distribution of visitors to Carrefour falls between young individuals and adults. This data is important to this study since technology adtoption falls directly under these two groups. Numbers below and above the ages between 15 and 40 are negligent to the study.
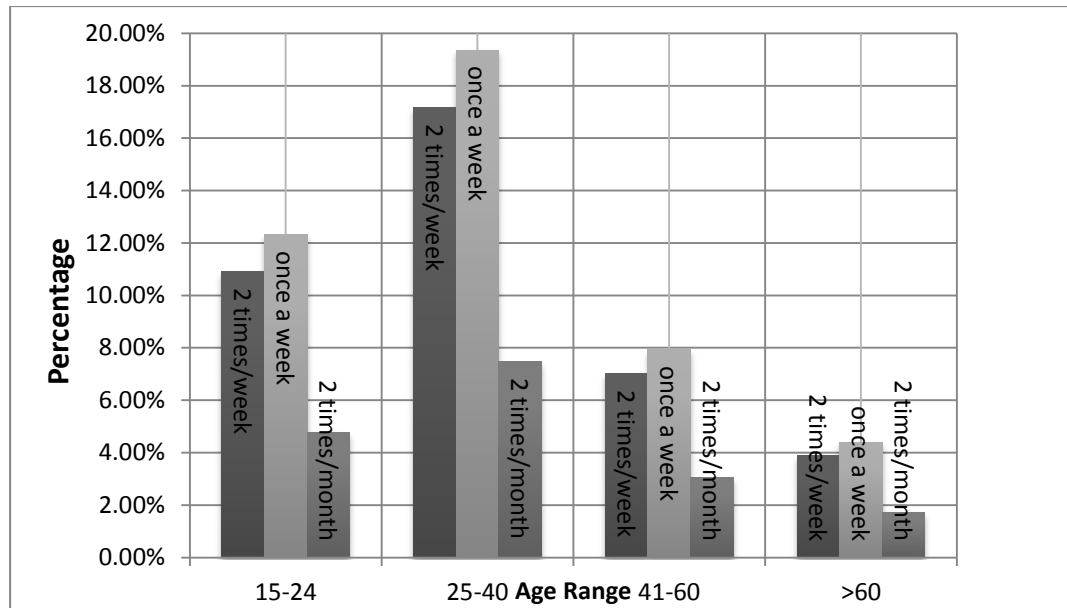
Figure 5.3 Carrefour visiting frequency (%) – Participant groups

The latter data shows us that there is a great demand for a system that will enhance and speed up the shopping experience of an individual customer. This represents one of the biggest opportunities to a business that decides to adopt an integrated NFC system. The current system is slow and outdated and the data gathered shows this; 88% of respondents admitted that they had left a supermarket due to the long queue. (as shown on figure5.4) This may seem a little too extreme to readers of other countries but in a city like Xiaogan, China, it is very common to find another supermarket either next to or across from each other. We can say that this model is more likely to be efficient in sprawling cities around the world like Xiaogan, China. In the end whomever gets the upperhand will be the one that leads the market.

Have you ever left a supermarket because of the long queue?

No, I never left a supermarket because the queue
12%

If the queue is long, I will come back some other day
35%

If the queue is long, I will go to another shop
53%
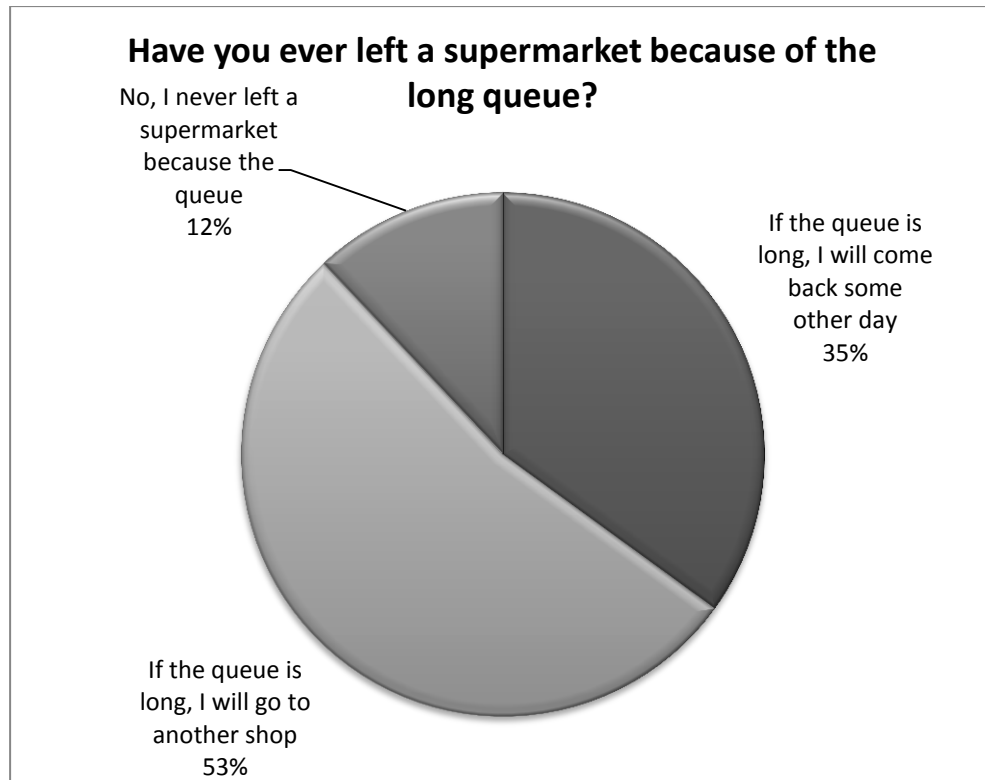
Figure 5.4 Customers' attitude towards queuing - Have you ever left a supermarket because of the long queue?

In a different note of the most important opportunities available to our NFC payment system is closely related to our strengths spelled out earlier in this chapter. And that is the fact that an NFC payment system proves flexible and adaptable in a world that is still missing that physical link between the real world and the internet world. This has been placed as a key opportunity due to the impact the system would have on the one who adopts such a system. However, the latter serves as a good reference to the sheer magnitude of business opportunities available and the strength of an NFC payment system, further analysis goes beyond the scope of this study.

5.2.4   Treats

The threats to this integrated system are not many but they do exist. These do in the form of schemes meant to improve and squeeze as much productivity and efficiency out of current payment systems. There are also other models that could attempt in exploting this segment in the market with technologies other than the integrated system we have focused on. Customer trends are also important

eventhought they do not necessarily converge with the aims of this system. A key issue to keep in mind are labor unions. The latter threats will be laid out for the benefit of this study.

Certain schemes can, to a degree, reduce queing time. This has been the case in supermarkets where special lanes are open for cash only, bank card only, self checkout or express check out. Systems that already possess this system but already depleted their capacity are our target market. The threat here would lie on those who have not implemented such a system and their management whom would refuse to see the need of our integrated system.

Other payment models could make use of mobile technology in a different way than our integrated system. This could be done in the manner of online payment trough ones mobile phone and with an specially arranged lane to checkout the user.

Labor unions could prove cumbersome if management does not implement such a system in a coordinated effort between staff and machine. The system tempts companies to erradicate such job posts as cashiers in a supermarket. This threat is necessary for management to carefully ponder about. Therefore the system could not reach its full potential if the human resource element is not taken into account.

Another important threat comes from customers themselves. This can be manifested in the form of environmental activists that if they do happen to find flaws in our supply chain or suppliers of RFID and NFC technology, could potentially distrupt the adoption of the technology by early users. Privacy advocates have many times criticized RFID microchips and questioned how private and safe they can be.

The latter threats are real and something a manager or director should take in mind carefully when considering the use of our integrated system.

5.3   Acceptance of the NFC payment system

We have chosen the Technology Acceptance Model for analyzing the acceptance of the NFC payment system. As mentioned earlier, TAM is an information system theory that models how users come to accept and use a technology. Several number of factors influence users' decision about how and when they will use it, notably are Perceived usefulness and Perceived ease-of-use. In order to analyze the data in a comprehensive manner, as a payment system serves not only shoppers, but also the shops, banks or even other related organizations, this study will analyze the acceptance of NFC payment system in two different end-user groups, shoppers and shops. After all, shops, are the main users of the system. Therefore, the analysis will be divided into two parts, perceived usefulness from end-users' point of view, and perceived ease-of-use from end-users points of view.

5.3.1   Perceived usefulness

Perceived usefulness is the degree to which a person believes that using a particular system would enhance his or her job performance. Several respondents of the survey have been interviewed regarding to the usefulness of the NFC payment method, from the answer we received, we have summarized them to the following points. (The interview data can be found in Appendix at the end of this paper)

From the customer point of view:

- Tap and go is fast and convenient
- Simplified of managing personal stuff
- Mobile phone becomes a useful tool in life
- Mobile phone become an essential tool for people to carry daily

From the company point of view:

- RFID tracking would improve the warehouse management and logistics supply chain
- Decreasing the loss of the missing products is decreasing the cost
- Faster service makes less complain
- Less personnel cost reduce yearly budget

Like mentioned earlier in chapter 4, an NFC payment system allows customers to purchase with their NFC phones, all customers need to do is to wipe the mobile in

front of the reader and tap. It is very convenient and fast, which greatly reduces queuing time for next customer. Some customers think that it is a new technology, something they had never thought about before, it provides more options to customers and how they want to pay. For example, one's bank card is not working or one left money at home, then the person can make necessary purchases through his or her mobile phone, thus more options are always better. Some users like to keep their stuff in order, it is a very good way to keep track of one's expenses; many useful applications could be easily created in order to serve the user better. For example a user can set up a limit on how much he or she would like to spend for a month, the mobile would alarm the user when the expenses exceed the set amount. Every transaction will be recorded and displayed by mobile phone and it only takes very little effort to access one's record whenever one feels like to, instead of logging into one's net bank by inputting the account number and pin code, user can access the same result by tapping "show my past transactions". Mobile payment integrates the cumbersome steps and simplifies the process.

From the company point of view, in Carrefour Xiaogan, the survey showed us that among the 2047 respondents, 87% of them have a busy life and more than 84% of the respondents visit Carrefour at least once a week. The data explains that as for these people in the city of Xiaogan, the Carrefour supermarket is their main supply of necessities, and most of the respondents claimed that they are having a busy life. It would benefit customers' life if the supermarket could provides good and fast service. From the feedback that we have received from the customers (respondents) that most of them are not satisfied with the speed of the payment process. The survey showed that more than 76% of the participants think that it's necessary to improve the speed of payment processing in Carrefour, and over 46% of them voted for the option "very necessary". This fact shows us that there is a serious necessity of improving the speed of payment processing in the supermarkets. Even though many big supermarkets have implemented advances in customer queuing systems in order to reduce the queuing time, such as Multiple-Server-Exponential Service Time Model, queuing wait time is still a big issue in supermarkets like Carrefour. Furthermore, figure 5.5 perhaps is the worst result we have received in this survey. Nearly 88% of the respondents admitted that they had left a supermarket because the long queue, some of them will come back later when there are less people, but

some of them will never come back again. Such data suggests that in order to have a better role in customer management we must also take good care on customer retaining data for the better of the whole business.

With the NFC integrated payment system offering the user a possibility to pay through their mobile phone while they shop, this function realizes zero queuing (of course every machine has its reaction time, but it is very fast compared to human processing time) because every customer checks out their own chart through the RFID reader. The reader collects the information of the products in the chart and sends the payment information to a POS machine; the customer waves his phone in front of the POS machine to carry out the payment. RFID security checks the validity of the purchase by the exit. In this way the supermarket can reduce the amount of cashiers as well as the printing costs. The RFID tag helps the shop have better control of their goods. It efficiently prevents stealing and loss of goods, which reduces unnecessary expenses for the company. Meanwhile, more customers can be served in the same time period in a more comfortable way.

5.3.2   Perceived ease-of-use

As mentioned in Chapter four, an integrated payment system is comprised of NFC technology and RFID technology. From the shopper's point of view, it allows them to check-out their cart without scanning the products collected one by one, instead of scanning barcodes, RFID readers which would be by the exit of the cashier, scans each shopping chart once to access all the products inside, system calculates the amount of the payment and requires customer to pay. This change greatly reduces shoppers queuing time, meanwhile, the shop provides a smoother shopping environment for all customers. After the system calculates the amount of the payment, system requires users to pay, there will be an option called mobile payment, all the shopper needs to do is to wipe his or her phone in front of the NFC reader and tap PAY, which is extremely easy and convenient. This can be supported by the respondent's attitude towards the use of a payment system in their mobile phones, which was 78% positive. The system is easy to understand by the users and easy to

be manipulated for both shoppers and the company itself, which satisfies the point perceived ease-of-use.

From the company point of view, an integrated payment method is one more option for shoppers and it doesn't require extra effort from the company's side to install NFC readers. This fast payment process allows the companies to serve more customers in a shorter period of time. Installing RFID tags to their products instead of barcodes could greatly enhance their control on their products. In the research of this study we found various entities that had already adopted RFID technology, one of them L-Fashion group, has already implemented RFID technology in its supply chain. Through an interview, we found that the group benefitted from lower costs in their supply chain making them more competitive in the international marketplace. Another good example of this would be Wal-Mart's case. Wal-Mart tapped RFID technology with the aim to increase the efficiency of its supply chain. This is because RFID implementation enhances transparency of the supply chain and hence helps minimize cost and labor and strengthens inventory control. With less labor and less complications, RFID provides automatic management for the warehouse. The increase in efficiency is evident from the news article at Breitbart.com, where it states that implementation of RFID tags in Wal-Mart's inventory has helped boost sales by keeping shelves better stocked. Usage of RFID has reduced out-of-stock merchandise by 16% at the stores that have implemented RFID tags for more than a year. The CIO at Wal-Mart stated that, "Wal-Mart has been able to restock RFID-tagged items three times as fast as non-tagged items" (Foxnews, 2005).

5.4   Adoption lifecycle of the integrated system

For the purpose of this thesis, a company has been analyzed based on its business strategy and marketing principals. This shall be presented in the manner of a project taking in mind certain aspects of example companies. The new integrated payment system is targeted mainly to such retail companies such as Carrefour, who target middle class consumers as well as high customer satisfaction. This project should help us analyze the adoption lifecycle of the new checkout system. In theory, the same rule should apply to most companies who adhere to this purpose of high

customer satisfaction as well as high quality of performance in retail business. The reader should keep in mind that this analysis does not aim to find exact values as to development dates nor it tries to calculate the actual life cycle values, if such a system were to be implemented.

5.4.1   Marketing forecast

It is difficult to predict the actual adoption process and length of it, as we do not have all the necessary data to make a detailed forecast of the model. However, we can attempt to give a rough idea on the estimated length that the product could reach early majority by doing a short analysis on the smartphone adoption lifecycle. Apple's continuous lead in the smartphone market gives us a predictable trend towards the adoption of new technology. This can be seen from Apple's break through introduction of its new iPhone line in 2007, as marking the beginning of immense growth in this market. If we take into account the rate at which the smartphone market has been growing since the introduction of the new iPhone back in 2007, then we can predict (for the Chinese market) that the smartphone market will reach early majority (50%) by 2014. (Sullivan, 2011) Now taking this information into account, we can place the same model on our integrated system through the adoption cycle of NFC technology. We can expect a shorter time period than the 7 year period that it took for smartphones to reach early majority in China. This is due to NFC being more of a feature than an actual device that the smartphone is. In late 2012, Apple will release their new iPhone with NFC integrated into it. Using the information above, we can predict that Apple will lead the market forward as it back in 2007. Already, many smartphone manufactures are preparing the roll out of a new line of smartphones with NFC integrated into them. From the smartphone penetration analysis by Frost & Sullivan, we can deduce that there will be 12% growth on smartphone users in mainland China during the next 2 years. (Sullivan, 2011) This in turn can give us the starting penetration rate of NFC enabled smartphones. In all we can predict a very quick succession to NFC, in an allotted time of less than 7 years.

5.4.2 How to adopt integrated payment system into the market

New technology presents risks for many customers. Customers react differently toward the risks based on their innate characteristics, the wants and needs of their companies, and the behavior or other buyers. As we mentioned earlier in chapter three, there are five main stages, which are presented in the technology adoption life cycle. In order to estimate the adoption of integrated payment system to current market, first we need to divide the customers into different groups based on Bell's curve which has been introduced earlier in Chapter three, and sort customers' common characteristics towards the new integrated system. By knowing who the target group is, certain marketing strategies could be designed in order to meet the market needs. With the support of the first target group, a company can adjust its position and strategy for the next target group.

5.4.2.1 Early market

An innovator is the adventurer, as well as the tester of a new product in its early market; they are the opinion leaders. Most of these studies show a common pattern in adoption of new ideas. They are accepted first by the innovators, who seldom make up more than 2-3 percent of the larger group. (Berry, 2008) At the early stage of a new product, the public would consider innovators' opinion together with their experience towards the new product as the main elements, which lead them to a decision. On the basis of the data that we have received from the survey, we can find that candidates that range from the ages of 15 to 40 are the ones most likely to adopt the technology as shown earlier in the study. The possible reason for this phenomenon could be that students and office staff visit supermarkets often, and they are interested in new things as well as willing to try mobile payment if it is safe. These people have a common way of thinking that it does not hurt to try new things, which shows that they are quite open-minded and they would not give judgment without understanding or experiencing the object itself. Based on these respondents' answers, we can classify the main characters of the potential "innovator". Table 5.1 displays the main characters of the innovators with brief explanations.

Table 5.1 Innovators' common characters

Characters	Explanation
Age group: 24-40 years old	Not too young, not too old, have their own view towards technology, which relate them closer to new things.
Visit supermarkets often	At least once a week, they are the major purchasing power of the supermarkets
High level education	Does open-minded, have basic understanding towards new things.
Smartphone user	Eager to experience new technology, fashion follower
Employed	Have limited free time and certain income

With the help of these clear characteristics, a company knows who would be their first customers and provide certain services in a way that fits these customers best. Once the company provides such a payment option, with the help of advertisement, "innovators" would notice this new technology and start trying them with their mobile phones; a company could provide certain discount or bonuses to the customers who make purchase through their mobile phones. Several marketing strategies could be considered:

- Special offers to NFC payment users
- Discount on purchasing price
- Extra bonus stored
- Various types of campaigns targeted to corresponding demographics
- Update to royal customers (ex. free parking)

This aims to advertise the NFC payment options from peer to peer; friends tell their friends, in the end brings more customers to complete the early market.

5.4.2.2   The chasm

Several management skills are possible to implement a successful management during the chasm. The success of the product depends on the pragmatists' view of the outcomes of the pilot projects initiated by the Early Market. In this phase, en-

trepreneurs need to analyze current projects and developments to understand how an improved offering can serve niche markets in order to gain momentum in the next phase or market development. The company should select a target market, so that the company mainly focuses on the chosen market, in a way of avoiding unnecessary effort and expense. Middle-class consumers and young people could be the early target market for Carrefour new payment system, which is our designed NFC and RFID, integrated system. When one bring a new product to the market, advertising of the product is also considered important. The company should understand the overall concept of the product and be able to present the product in a way that is clear and comprehensive to the customers. Each product should know its position in the market; No matter it is a practical product that offers well price-oriented as well as excellent functionality, or luxury. An accurate product positioning plus a correct target market builds a solid foundation for a great marketing strategy, which leads the company to a beneficial path.

To be more practical, Carrefour could organize certain events to universal people on NFC mobile payment, or as an alternative, company could also address several feedback surveys, which require customer feedback of the mobile payment system. The company could prepare an amount of attractive prize for the lucky customers. These methods support good communication between the company and the market, draw customers' attention to the product and get them to know about the NFC mobile payment in more detail. Furthermore, by going through these steps helps the company access how their customers' mind is and adjust their marketing strategy towards the market needs.

5.4.2.3   The bowling alley

The products enter the early majority at this stage of the development of technology adoption life cycle, which means that the product already has a positive number of stable customers. In this group, people are practical buyers, which mean that these people usually do not buy useless stuff, nor love new technology like those who are obsessed technology enthusiasts. Everything the early majority buys is carefully selected. These people believe in evolution rather than innovation, thus they do not

enjoy showing off as much as the innovators. These people might be shy to new technologies, but they are sure enough interested in how to improve the efficiency of their performance in their work place. When they acknowledge that the product could actually improve their performance of work while they hear a positive comment on the product from the people they trust, they would be able to accept the product.

The company should be able to catch the opportunity of spreading the products reputation during this stage of the technology adoption life cycle. Meanwhile, the company should also pay attention to the customer management to avoid the possible risks of losing loyal customers. For the purpose of having a smooth transition from this stage to the next one, the company should move its focus from marketing to customer management side slowly, for a steady increase of the number of customers.

5.4.2.4   The Tornado

Successful companies with technology in the Tornado stage "just ship" the product. In this phase, it is possible to focus less on the customers because this is a hyper growth phase where market share is determined and leadership is established. The ones who purchase the product in this stage are the late majority, so called conservatives. This group of people are not willing to pay extra for a better product, thus their needs seldom can be served fully. Even though they are picky and tricky towards each new product, the company should not ignore their market share, which is quite big. It would ensure a bright future for the product, if the company could find a way to attract this late majority to the new product.

This could be a challenging stage for the system. The head of the company needs to create stability in the market, and the company that sets the standard for the technology will reap tremendous financial rewards. In this phase, the company creates value by balancing product leadership and operational excellence. To be as simple as the basic marketing strategy, Carrefour could arrange several events that bring special offer to the public, for instance children's painting competition, which aims

to catch attention of the parents and offer the product as prize to the winner at the same time. The conservative would be happy to try getting something for free and experience the gift that has the newest technology at the market. Several marketing strategies could be implemented in this stage along with bringing the product to the last phase, which is the mature stage of its lifecycle.

5.4.2.5 Main Street

Like we mentioned earlier in our previous stage, after the Tornado, the product enters its mature stage, likewise, after the late majority comes laggards. Laggards are the ones who are against new technology or product; they are more critics than adopters. These people are not the potential customers; instead, they are waiting to see the new technology fail. Thus they are not our target market, and the decision is on their own hands. At this stage of the development, the company should pay attention on customer loyalty, as the range of Carrefour's customers is middle-high-class, who is able to afford a good price and strongly consider the quality of service. The company should improve the customers' loyalty by offering intimate service; meanwhile adjust the selling price according to the market. Some after sale service offered by the company would provide lingering revenues. However, a new technology category has begun elsewhere to capture the market. By this stage, technology life cycle is getting close to the end. The interests of the media and analysts have changed and evolved.

Conclusion: The analysis perpetrated in contrast to Carrefour's operations can lead us to the conclusion of 5 types of customers, which are innovators, early adopters, early majority, late majority and laggards. As a brief conclusion, our marketing strategy could be explained as an advanced model such as to:

1) Offer free gift cards to the technology enthusiasts, who are helpful in attracting market visionaries.
2) Once the visionaries get interested in the NFC integrated payment system, the company should be sure to try to meet their demands, so that these people would be a very good influence to practical customers.

3) By serving the practical customers, the company would get a good profit on both income as well as reputation. It would help the company become the market leader.

4) The company should subtract some attention along with efforts from the practical customers market to satisfy conservatives, by offering qualified service of the integrated system with a good price.

5) To the laggards, let them decide for themselves.

6 APPRAISAL OF THE RESEARCH QUALITY

Appraisal of quality defines how well the research results can be trusted. It also measures how correctly the information collected and the results, represent the actual target group. Errors may garble the results. These might be for example measuring errors, sampling errors or coincidental errors. Quality is divided into reliability and validity.

6.1.1 Validity

Validity discusses whether the data is a true reflection of what actually was intended to measure. In a survey, the questions have a great impact in validity. Were the questions good enough to provide an answer to the research question? In general, the more conceptual and abstract the matters measured are, the more difficult the validity issues are to measure correctly.

In this survey the matters measured are: the division of participants, amount of smartphone usage, usefulness, reason of enhancing the efficiency of payment process and easiness of use – were concrete and concerned users' daily life. The questions of the survey were answered anonymously and the questions were not delicate in nature. Therefore it can be assumed that the respondents have not embellished their replies, not at least consciously. Five people have been chosen to test the questionnaire before distributing. Although it is hard to control whether or not the questions were correctly understood, in this case the questions were very easy and simple, and did not leave much chance for different interpretations.

The feedback from participants is quite positive, most of the respondents found that it's an interesting topic, which closely concerns their daily life, and most of them showed an interested face to the new technology and smartphone. The staff of Carrefour Xiaogan was friendly and helpful; their professional and comprehensive feedback was a big hand in our study. The thesis analyzed perceived usefulness and perceived ease of use of the system based on the theory of Diffusion of the Innovation, the answer from the respondents are chosen randomly according to the catalogue they belong to. However, quick and easy questions from a public shop-

ping distribution channel might have resulted in rather superficial information. It's still necessary to keep this in mind when we process the results that the respondents may not have taken the questions very seriously and some of them may have answered without deep thinking.

6.1.2   Reliability

Reliability describes the quality of the measuring instrument and considers whether the data collection procedures can be repeated with the same results.

In order to obtain a ccomprehensive as possible reflection of the performance of the supermarket, we decided to have a 7 days long survey process, which covers from Monday to Sunday. The questionnaire was been giving out in the shopping area of Carrefour Xiaogan from 7am to 9pm. Hopefully, this way has taken us closer to the truth.

The questions and the instructions were designed to be as clear and easy to understand as possible. This was already taken into consideration in questionnaire design reliability. Everyone had an equal chance to answer for all the participants, the response rate was satisfactory, and the respondents represent the whole target group very well. The result was recorded with extreme carefulness and accuracy, most of the results had been transferred automatically from the website to excel format, so there is very little chance for mistaken records.

More than 50% of the participants filled the questionnaire in Carrefour Xiaogan, with a win a price promotion in the supermarket. In our case, this is the most convenient way and it's most likely to result in higher response rates than other channels. Most of the questionnaires have been delivered face-to-face, it has less chance for the respondent to refuse to answer and get them answer right away is always better than leave the questions to them and it may never come back again. As a result, people had a possibility to answer the questionnaire more than once, even though it's quite unlikely.

However, as one limitations of the survey, our collected data can only represent our sample population. Several factors may affect the accuracy of the results. For instance, we cannot overcome the limitation of the accessibility to the whole population, neither we can place a random sampling as we planned, the obstacles is that answering the questionnaire is mainly up to the customer, we cannot force the customers.

The analysis of the technology acceptance is strictly based on TAM model and theory of Diffusion of Innovation. It has been divided into two main parts, acceptance of the new system and adoption lifecycle of the product. Each part of the analysis is built on the structure of the theory and combination of the case reality. Hence, here would have very little chance for mistakes in the theory.

Please do keep in mind that this study provides only the information of the supermarket Carrefour Xiaogan, and all the analysis are based on this particular shop as well as the survey that has been processed in this shop.

7 CONCLUSIONS

The purpose of this study was twofold. Firstly, the aim was to define the state and role of current supermarket payment systems and compare the advantages an integrated payment system has over the latter. Secondly, the aim was to identify how could an efficient payment system serve the customer better and analyze how well this integrated system could adapt to the market.

7.1 Study result

NFC has not started to trend but is expected to as in the data provided in the study. We have found that the market is preparing for NFC as the newest hot thing for consumers to have. Based on this data we can safely predict that NFC will be a valuable technology in the long run as its adoption life cycle starts to kick in with the predicted introduction of it by major market player Apple late 2012.

The result of the survey indicated that there is a great need for improvement in the speed of payment processes in the supermarkets, and the respondents of the survey generally have positive attitudes towards a new integrated payment system. From the general point of view, most of the respondents as well as the manager of the company have understood the value of the integrated payment system and the acceptance of the integrated payment system is seen as positive.

In principle, based on the Technology Acceptance Model, the respondents find that the integrated payment system would enhance the efficiency and quality of their lives, and using the integrated payment system would be free from effort, it is as simple as a wipe and a tap on your mobile. However, from the data that has been retrieved from the respondents of the survey, the integrated system (mobile check-out system) seems to benefit professionals and employed customers better than any other group. Office staffs that make up the majority of the respondents seem most dissatisfied towards the current payment system in the supermarket. In other words, the current payment system in the supermarket does not service its main customer group as well as it should. This must be most of the customers

between 24 years old to 40 years old are currently working busily as this duration is the main career period for most people. However, for most people between 24 and 40 years old, have their own family and children to take care of, they have to manage between work and the care of their children. Thus they would not want to waste their life queuing in crowded shops.

Once the research results had been obtained, they were put into analysis. The goal was to estimate the acceptance of the integrated payment system for the future market. Several theories have been applied, based on the Technology Acceptance Model; the result shows that NFC technology is interesting to most of the respondents. There is a group of them who would like to experience it. These customers from the early market will help the product expand its market for the future and more customers would join in the community. Diffusion of Innovation theory supervised the adoption lifecycle of the integrated payment system and the result of the study is that the innovators bring the product to the market and give feedback to the product. With the help of several marketing strategies that the study provided in early chapters, the integrated payment system will adapt to the market at a faster speed. In the end the result of the analysis showed that the integrated payment system is perceived as useful and perceived as easy to use. From the company point of view, RFID tags help increase the efficiency of its supply chain. This is another major weakness of a current supermarket supply chain model, low efficiency and low transparency, which caused difficulties managing the stock, especially when one product is out of stock, it is hard to ensure that the system would notice and replenish the stock. RFID implementation enhances transparency of their supply chain and hence minimizes cost and labor and will strengthen inventory control, with less labor and less complication.

7.2   Challenges and Future studies

Although the acceptance and adoption of the NFC integrated payment system seems to be positive, there are two notable challenges that the mobile payment system is about to face in the near future. The first is the transaction agreement between banks and mobile operators, probably the mobile operator would not want

to give up the profit of this payment method, and this is the main reason why most of the countries in Europe do not support mobile payment. Japan and Turkey are the only two countries in the world, in which mobile payment has been widely used. The second challenge is that some people who are strongly concerned about their privacy, with RFID tags, what you have purchased can be easily read by others, since RFID tags are durable. In this future project, a good deal for both bank and mobile operator is necessary to be considered and more work needs to be done with RFID information control. This study may be directed to a wider research to find the financial and quantitative factors a board of investors would wish to have access to when proving the potential return on investment ratio and other aspects of such an enterprise.

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APPENDICES

Data Collection of the Survey:

Questions	Percent
1. Participants	
Student	27%
Entrepreneur	< 1%
Office staff	37%
Housewife	24%
Retirees	7%
Others/Unemployed	6%
2. Age range	
Between 15 to 24	28%
Between 25 to 40	44%
Between 41 to 60	18%
Above 60	10%
3. How often do you visit supermarket?	
Every Day	< 1%
About 2 times per week	39%
Once a week	44%
About 2 times per month	17%
Once a month	< 1%
4. Is your daily life busy?	
Extremely busy	7%
Moderately busy	36%
Slightly busy	44%
Not so busy	13%
5. Have you ever left a supermarket because of the long queue?	
If the queue is long, I will come back some other day	35%
If the queue is long, I will go to another shop	53%
No, I never left a supermarket because the queue	12%
6. Do you think it's necessary to improve the speed of the payment processing in supermarket?	
Extremely necessary	10%
Moderately necessary	36%
Slightly necessary	30%

Not necessary at all	24%
7. Which payment method do you prefer?	
Cash payment	33%
Card payment	67%
8. Do you have a smartphone? Do you want one?	
Yes, I have a smartphone.	67%
I don't have a smartphone yet, but I'm going to get one	20%
No, I absolutely don't need one	13%
9. Would you like to pay through your mobile phone one day, if its 100% safe?	
Of course, it makes life easier	15%
It doesn't hurt to try.	63%
No, I won't	22%

Survey Form:

	1. You are a ___ ?					
(_____)	A: Student	B: Office staff	C: Entrepreneur	D: Housewife	E: Retirees	F: Others

	2. What's your age range? (years old)			
(_____)	A: 15 - 24	B: 24 - 40	C: 41 – 60	D: Above 60

	3. How often do you visit supermarkets?				
(_____)	A: Everyday	B: About 2 times/week	C: Once a week	D: About 2 times/month	E: Once a month

	4. Is your daily life busy?			
(_____)	A: Extremely busy	B: Moderately busy	C: Slightly busy	D: Not busy at all

	5. Have you ever left a supermarket because of the long queue?		
(_____)	A: If the queue is long, I will come back some other day	B: If the queue is long, I will go to another super-market	C: No, I never left a super-market because of the long queue

	6. Do you think it's necessary to improve the speed of the payment process in the supermarket?			
(_____)	A: Extremely necessary	B: Moderately necessary	C: Slightly necessary	D: Not necessary at all
	Why: _____ _____			

	7. Which payment method do you prefer when you shop?	
(_____)	A: Card payment	B: Cash payment

	8. Do you have a smartphone? If not, do you want one? Why?
(_____)	
	Why: _____ _____

(_____)	**9. Would you like to pay through your mobilephone one day, if it's 100% safe?**
	Why: _____ _____
	  Contact Information
	Phone number: _____
	Email: _____

Important Interview Questions and Answers:

On February 6th, 2012 interview with sales manager of Carrefour:

How many customers does the supermarket serve on a daily base?

"On average, we serve 10,000 customers per week, but lately our customer turnout rate is around 20,000 per week due to the spring festival. Many customers have arrived from the rural area."

What is the monthly turnover of the shop?

"I'm sorry but I cannot disclose this information due to company policy."

What are you trying to do when it comes to reducing customer queuing time?

"We have set up buttons at each cashier that allows us to know when a queue is too long. The buttons alarms management and management in response opens the next queue line."

Have you heard about NFC and RFID technologies?

"I have heard of RFID tags, but other than that I don't know so much about it. And as for NFC, I don't know what that is."

Would you be interested in testing a new payment system that cuts down the cost on both supply chain and customer queuing time?

"Of course, as long as it doesn't cut down on employees' work time."

On November 18th, 2011 interview with Sales staff of Nokia

I have heard about that Nokia is the founder of NFC technology as early as year 2004; do you think this technology is ready for the market?

"We have founded the NFC forum with three other companies in 2004, and till august 2011, the forum had 135 member companies. The technology itself is mature already in 2004, as a fact that we had produced a few models with NFC enabled, but the market was not ready for such a technology, there was just not the right elements in the mix. Today, most phone manufactures are lining up to deploy a range of NFC enabled devices, hailing the beginning of the NFC era. As for Nokia,

we have already deployed our new lumia line that is NFC capable."

What's Nokia's future in NFC?
"Nokia is looking to work with windows and other third parties to bring NFC to the main stream. At this moment, I cannot say so much about our future plans with NFC."

On September 27, 2011 interview with CEO of L-fashion Group
In 2009, the company has applied RFID technology into the supply chain management, has it been successful?
"Yes, the company has installed RFID tags on each product instead of the barcode, the process has started in 2009, now in each of our shop, customer can search for the products information, includes stock details. The technology seems been working well, it helped especially in our warehouse management, now we have already moved our warehouse from Nastola, Finland to Suzhou, China. RFID technology certainly increased warehouse efficiency by reducing labor and logistic costs that are otherwise skyrocketing and provides ever-increasing pressure on profit margins in today's competitive environment."