OV-Chip card: User adoption short after abolition of the previous transport system in The Hague

Erasmus School of Economics

Master Thesis Economics & Informatics

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Abstract

This research is based on the adoption of the OV-Chip card in the city of The Hague and surroundings. The OV-Chip card is a required RFID tagged smart card, that should be used for travelling by public transport in the Netherlands. The OV-Chip card system is in the phase of being implemented in the Netherlands and The Hague is third major area (after Rotterdam and Amsterdam) that abolished the previous transport tickets ('strippenkaart') and switched to this new system. In this research the factors that influence OV-Chip card adoption are explored.

Firstly, literature review is performed on adoption models/theories and past researches on the implementation of the OV-Chip card system. Simultaneously, we observed customers and employees during our job at the service desk of HTM (the biggest public transport organization that serves in The Hague area). Hereafter, a research model is developed and hypotheses are formulated. The hypotheses are tested by information that is collected from (potential) users by making use of questionnaires. To analyze our dataset, SEM technique Partial-Least-Squares is been used.

The results support that external influence, subjective norm, relative advantage, compatibility, perceived ease of use, trust, perceived usefulness, voluntariness and intention to use have a significant effect on OV-Chip card adoption in The Hague. Perceived behavioral control and observability represent insignificant effects. Furthermore, in this research we searched for moderating effects. The variables race, gender, age, type of card used, experience and frequency of use have a significant moderating effect on the causal relationships.

Acknowledgements

First of all, I would like to thank Prof. Dr. Ir. Uzay Kaymak for being my supervisor during this graduation research. I also want to thank Agapi-Thaleai Fytraki MSc. for her help with the statistical part of my research and to be my co-reader.

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Chapter 1
– Introduction –

1.1 Research Background

The OV-Chip card system is a new travelling system in the process of being implemented in the Netherlands on all public transport. By using a smart card passengers are allowed to travel by train, metro, tram and bus. In 2005, RET had started introducing this new system in Rotterdam. Since 2008, organizations such as NS (Dutch Railways), Connexxion (Buses), GVB (Amsterdam) and HTM (The Hague), which are at least 80% responsible for public transport offered in the remaining parts of the Netherlands, have introduced this new system in their own operating area.

In 2005, the Dutch government gave step by step all public transport organizations orders to switch from the traditional (`strippenkaart`) system to this new OV-Chip card system. Public transport organizations, were expected to perform separately the implementation of the OV-Chip card in their own area and because of this, decentralization of public transport had been saved. This decision is influencing transport organizations on different ways in The Netherlands. For instance, due to competition differences in price between organizations using a nationwide centralized system are remarkable (Cheung, 2007).

To organize and implement the OV-Chip card five major organizations (NS, RET, GVB, Connexxion and HTM) established a joint venture, which is known as 'Trans Link Systems' (TLS). Main purpose of this establishment is to function as single OV Chip payment system that serves independently and should be used by all kinds of public transport in the Netherland. Nowadays, TLS also provides services for many other public transport organizations, which are implementing OV- Chip card system in their own operating area (i.e. GVU, Arriva, Qbus, Veolia and some others).

RET (Rotterdam) and GVB (Amsterdam) are the first two distinct areas, which had been totally switched to the OV- Chip card system. Both organizations do not accept travels on the old method in their own operating area. Passengers should travel by using an OV- Chip card (or another new special ticket). The Hague (majorly HTM, and in less extents Connexxion and Veolia) is third major area, which had been totally switched to the OV Chip Card system. On May, 19th 2011, the province of Zuid- Holland (The Hague and Rotterdam are both located here) stopped accepting the old tickets in their operating area.

However, the remaining public transport organizations in the Netherlands have been started the implementation of the OV- Chip Card system in their own operating area, but they still work with the previous system nowadays. This means that they accept two traveling systems, which counts for the provinces Noord-Brabant, Utrecht and Groningen in The Netherlands.

This research considers the adoption of OV - Chip card in The Hague area by potential and current users. We want to know the user`s perceptions and beliefs about the OV-Chip card. As mentioned in section 2.3 in the past nation-wide research short after the introduction of the OV- Chip card in Amsterdam was done by Meijers (Meijers, 2009). In a scientific manner, we want to study OV- Chip card adoption short after abolition of the previous public transport system in The Hague area.

1.2 Scope of the research

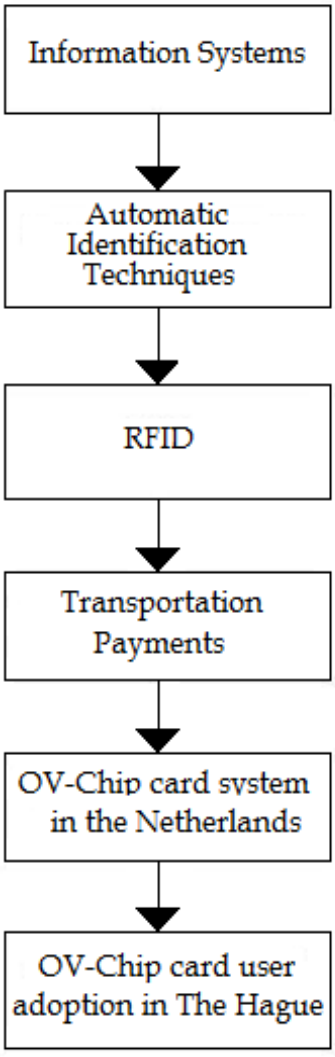

Figure 1:
Breakdown of our scope

An information system is the set of people, resources, procedures and regulations that produces information. Aim of this set of components is to collect, process, save and distribute information to support decision making, coordination and control within an organization. In this sense, the term is used to refer not only to the information and communication technology (ICT) an organization uses, but also to the way in which people interact with this technology in support of business processes (D.M. Kroenke 2007).

In this research we aim on an automatic identification technique, which is known as RFID (Radio Frequency Identification). In section 2.2 different application areas of RFID are explained, and transportation is a kind of that uses this specific technique. In many different countries a chip system is implemented as new public travelling method and in this research we base our study on the implementation of this new nation-wide system in the Netherlands. Because, local public transport organizations from different regions had to implement this new system separately, we decided not to focus on all the public transport organizations in The Netherlands. However, because of its actuality we want to study the adoption process by current and potential users in The Hague area.

1.3 Importance of Research

In The Netherlands, public transport organizations serve as independent organizations, but they are driven by the government. Due to the fact that the OV-Chip card system is a new public transport system in the Netherlands, limited literature is available about OV-Chip card adoption within the borders of the country. In the past, research was done by Meijers Research (Meijers, 2009). This agency studied OV-Chip card adoption among current (and potential) users in the Netherlands, short after the implementation of the OV-Chip card in Amsterdam (at that time The Hague had started the implementation of OV-Chip system in their own operating area), but we explain more about this later on in section 2.3. Meijers` research had briefly two purposes: (1) to serve as a reference for future researches that make proper adjustment possible on crucial moments and (2) to measure current *knowledge* and *expectations* among passengers of public transportation and non-passengers, and resulting from there the OV-Chip card adoption. After expanding our scope to a broader area more similar examples related to our topic and about information systems are made available, from abroad. Especially, from the governmental sector (M.M. Kamal, 2006) or the mobile commerce sector (Pedersen, 2009) (Mallat et all, 2008) show many examples, but these researches do not really fit for the Netherlands. Reason is that local (and nation-wide) inequalities play a role and differ per area and influences the user. Also, prices per area differ drastically, which makes comparisons more difficult. In this study we aim on the same goals as Meijers` did, but on our own manner. We make use of scientifically verified adoption theories and apply these on a local area where the rules are the same and count for the whole area.

Besides this, better understanding of the individual perceptions and beliefs of customers, is considered as very valuable information for the organizations. However, these organizations should decide whether they want to use this information or not, because investing will never be costless. On the other hand, ignoring these problems can relatively lead to much more negative effects for these companies (Heerikhuizen.,et all. 2009). For instance, customers talk earlier about negative experiences with each other than about the positive, which in turn damages the image of an organization and could decrease the number of customers. Positive effects can return in many positive ways to the organization. For instance increasing customer satisfaction can results in higher revenues for the company, an increasing number of customers and a much better image of the organization (Ittner and Larckner, 1997). But, proper and effective innovations need adoption crucially (Pijpers, 2002).

1.4 Research Questions

To reach our defined goals in the previous section our main research question is stated as follows:

- *Which factors influence adoption by (current and potential) users to make use of an OV-Chip card in The Hague area?*

And more specifically, in order to answer the research question the following sub questions are made:

- *Which theories and/or models can be found from literature to understand and explain OV-Chip card adoption?*

  In general, to understand and explain adoption several verified models and theories from literature should be used and discussed. This increases our knowledge and brings us closer to the main question.

- *What have been the results of previous research regarding OV-Chip card adoption?*

  With this question we aimed on a clear view on the results of earlier researches on OV-Chip card adoption in the Netherlands. Together, with the previous question a new model should be developed after discussing the information that is obtained.

- *Which variables have a moderating effect and how do they affect the research model?*

  We want to know whether qualitative and quantitative characteristics (like age, gender, race, experience etc.) affect the strength of the relation between the latent variables. Finding an answer to this question leads to better understandings and interpretations of the research findings.

1.5 Methodology

This research could be characterized as a kind of quantitative research, but has some qualitative research features. To start with, an extensive literature study is performed in the field of adoption theories and the implementation of the OV-Chip card system in the Netherlands. Simultaneously, we performed some observations at the HTM Service desks (at the main office and two train stations) in The Hague. Observations were done during our working period at HTM service desks as a Service Desk employee. During our working times, some colleagues are asked to give their personal

perceptions about the contemporary changes in the public transport-system in The Hague. Next to this, we asked what they hear from customers regarding the OV-Chip card at the desks. The observations are collected and used to have better insights in the user's perceptions.

After completing our literature study, a general model is formulated and we used this model as base for this research. Simultaneously, hypotheses are formulated between the constructs in the model. The hypotheses and observations are used for setting up good preliminary questionnaires in the next phase. The preliminary questionnaire is conducted among a small group of 12 OV-Chip card user in The Hague. We used the final questionnaire to test the hypotheses. Users are asked to give their opinion about different statements on a 7 point Likert scale from 'Extremely Unlikely' to 'Extremely Likely'. Hereafter, the final questionnaire is conducted among bigger representative sample in Dutch and English. In the succeeding phase, analyses are done by making use of statistical analysis software SPSS v. 19.0 and Smart PLS v. 2.0. Finally, conclusions are made and the research questions described in section 1.4 are discussed in the final part.

1.6 Thesis Structure

The outline of this thesis consists of six chapters, which can be described as follows:

The first chapter contains an *introduction* to our study. In this chapter the research background, the scope, the importance of this research, the research question and sub questions and briefly the research methodology are made clear.

The second chapter captures the theoretical part of our research. This chapter consists of the *literature review*, which in turn consists of an introduction into automatic identification techniques, the implementation of OV-Chip card in the Netherlands, an exploration of many known and verified adoption models and theories and an overview of public transport organizations in the area of The Hague. Finally, the adoption models/theories and their core constructs are summarized.

In the third chapter, we describe broadly the *methodology* of our research. This part contains the research model and definition of its constructs, an explanation of our data collection method, the questionnaire development and formulation of the research hypotheses. Hereafter, we end up with a summary of the hypotheses.

In the fourth chapter we explain our *analysis design*. In this chapter we provide theoretical background information about the analyses. In this part an introduction to structural equation modeling is given, hereafter the most important calculations by SEM are described and is explained how the research hypotheses are tested.

The fifth chapter contains the *analysis & results*, which is performed by using statistical analysis software SPSS and Smart PLS. We used SPSS to obtain an overview of the descriptive statistics, the

structure and measurement model are analyzed by using Smart PLS. Hereafter, we tested for moderator effects. Finally, the results are summarized.

The final chapter contains the *conclusions* part of this research. Here the main findings and limitations of this study are discussed and recommendations for further researches are given. Finally, the research question and sub questions are answered.

Furthermore, in the *bibliography* our reference list is made available and finally *Appendix A* and *Appendix B*, represent the main questionnaire and the output by our software program SPSS and Smart PLS respectively.

Chapter 2
– Measuring OV-Chip card user adoption in – the Netherlands

2.1 Introduction

In this chapter we explore literature that we have found and used for building up this research.
We start with a brief introduction to automatic identification techniques in the first section. In the succeeding part we discuss a nation-wide research done about the OV- Chip card adoption in the Netherlands, which was performed a couple of years ago. Hereafter, many different adoption theories are studied and discussed. In the following section, public transport organizations in the area of The Hague are described. Finally, core constructs of adoption models and theories are summarized.

2.1.2 Literature search method

Literature that is used in this study is collected from several sources. Main source that is used is "Web of Science", which is available via the Library (UL) of Erasmus University Rotterdam. For instance, by searching on topics like 'consumer', 'adoption', 'acceptance`, transportation', 'innovation', 'chip', `RFID`, `transport`, 'information' and combinations of these and other keywords (like: 'consumer adoption', `TAM model`, 'user acceptance', 'forced adoption', 'The Netherlands', 'information systems', 'Diffusion of innovation theory' and 'critical success factors') literature is found, which we could use for performing this research. Another source, which we made use of by entering the same topics as mentioned above, is "Google Scholar", which is available through the link scholar.google.com. Last source that is used is the Erasmus Thesis Repository, which is available via the link www.eur.nl/ub. By reading and studying work of co-students, who studied adoption earlier, relevant information is found.

2.2 An introduction to automatic identification techniques

Automated identification (Auto ID) involves the automated extraction of the identity of an object (McFarlane and Sheffi, 2003). This identification technique includes a variety of devices, such as bar codes, magnetic strips, optical memory cards, and radio frequency tags. The latter, radio frequency identification (RFID) has been around for more than half a century. It is only in recent years that RFID has begun to attract a lot of attention, due to the convergence of lower cost and increased capabilities of RFID tags (Sheng et all, 2010). Today RFID is a generic term for technologies that use radio-waves to automatically identify people or objects and is mainly used in the field of transportation, logistics, manufacturing, processing and security (Roberts, 2006). Examples of typical applications of RFID, are shown in Table 1.

Payments by mobile phones	Promotion tracking
Transportation payments (toll roads, public transit)	Libraries
Asset management and retail sales	Passports
Product tracking (casino chip tracking, IT asset)	Schools and Universities
Transportation and logistics	Museums
Animal identification (track and trace for meatpackers)	Social Retailing
Inventory systems	Race timing (lap scoring)
Hospital operating rooms	Ski resorts
RFID mandates (Wal-Mart, department of Defense mandate)	Human implants

Table 1: Examples of RFID applications

As already mentioned in section 1.2, this research falls in the category of 'RFID', which is a kind of an 'automated identification technique'. Based on our research topic, 'RFID' in turn falls into the category of 'transportation'. In the succeeding sections we will explore deeper our scope (see fig. 1).

2.3 Implementation of the OV-Chip Card in the Netherlands

In 2009, Meijers Research (Meijers, 2009) studied and monitored OV chip adoption by consumers in the Netherlands. This nation-wide study has two purposes; (1) to serve as reference for future researches that makes proper adjustment possible on crucial moments and (2) to measure *knowledge* and *expectations* among passengers by public transportation and non-passengers, and resulting from here OV Chip Card adoption by passengers.

Meijers distinguishes 3 different phases in the implementation process:

- Before implementation of the OV Chip Card
- Short after the introduction of the OV Chip Card
- After a couple of month (when users get used to the OV Chip Card) after introduction

Meijers` research is based on the first phase and was done before Amsterdam (next in order after Rotterdam) implemented the OV-Chip Card.

Research is done by a nation-wide sample and Meijers (Meijers, 2009) measured adoption by four dimensions, which lead to a 'score of adoption'. This score could be described as *the opinion from(1) individuals and (2) more* general improvement or deterioration through OV chip card, *(3) user intention* while the strippenkaart is still in use and *(4) emotional impression* generated by OV chip card.

Scores of adoption are calculated over these four dimensions and participants are divided into 5 categories: Enthusiasts, Adopters, Neutrals, Non-adopters and High -Rejecters.

According to Meijers` research (Meijers 2009), next to properties of the OV- Chip card some other factors are identified that influence adoption by consumers. These are:

- **User experience**: consumers who used the card just a couple of times reject the card much more than others who are more experienced.
- **Satisfaction by current tickets (`strippenkaart`)**: consumers are rarely dissatisfied with these tickets.
- **Image of public transport**: consumers who are positive about public transport earlier adopt the chip card.
- **Interest**: consumers who adopted OV Chip card show much more interest than others.
- **Knowledge about the card**: knowledge and adoption are not directly linked with each other. In between, increased interest should lead to adoption. Consumers who have more interest own more knowledge than others.
- **Expectations about effects of the card**: consumers with positive expectations, adopt the card much earlier.
- **Judgment of information about the OV-Chip card**: consumers with positive perceptions and beliefs about the information offered concerning the card, adopt the OV-Chip card earlier.
- **Information by media**: Also information from media creates negative pictures about the OV Chip system, which lowers in turn adoption among users.

By consumers, positive features of the OV Chip card are the opportunity to block their card after theft or loss, direct possibility to entrain into vehicles, no more thinking about the number of stripes needed, number of charge opportunities (shops, machines and online) and cut off of stations. On the other hand, consumers are less satisfied with immediate calculations after the trip, checking in and out necessarily every time, recordings of the trips saved in a system (privacy issues) and keeping in mind that the card must be loaded on time. Current and non-OV passengers rarely think that use of public transport, affects their future usage (less or more) of public transport after implementing OV chip. Meijers concludes that after spending effort on *guidance* (especially by assisting new users and decreasing mistakes of current users who can have influence on these new users), *positioning* (which consists of the phase of accepting the role of the Chip card, which should be performing as “the Dutch new travelling method for public transport passengers”, and the succeeding phase; increasing OV chip adoption among non-passenger of public transport who are not rejecting OV chip) and *public relations* (which is more negative about this system and should support to built up trust among users) OV Chip card adoption should increase.

This research by Meijers is been used as a guideline in this research, reason is that adoption research concerning the OV-Chip card is limited in the Netherlands.

2.4 Verified user adoption models and theories from literature

In the past, many theories/models described and explained acceptance of innovations by end-users. Some of these are Theory of Reasoned Action (TRA) (by Fishbein and Ajzen 1975), Technology Acceptance Model (TAM, by Davis 1989) and some further extensions (i.e. TAM 2 by Davis & Venkatesh 2000), Theory of Planned Behavior (TPB by Ajzen 1991), Motivational Model (MM by Davis), Combined TAM and TPB (C-TAM-TPB by Taylor and Todd, 1995), Diffusion theory (IDT by Rogers 1995) . In this section we explore what we have found from literature about these theories.

2.4.1 Theory of Reasoned Action (TRA)

In 1975, Fishbein and Ajzen developed TRA that we would like to explore first in this chapter. This model was developed to explain behaviors of individuals based on situation specific combinations of personal beliefs and attitudes and the effects of beliefs of others close to them (Figure 2) and is a base for many succeeding models/theories .

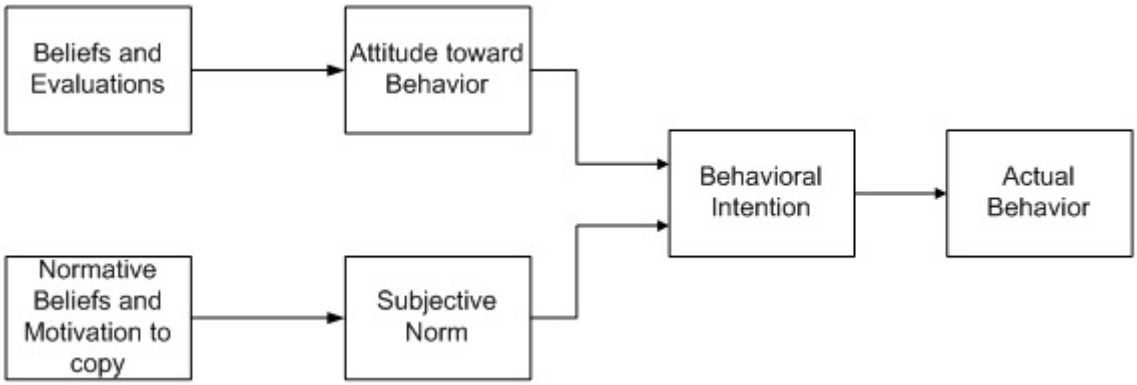

Figure 2: Theory of Reasoned Action (TRA by Fishbein and Ajzen)

According to this model by Ajzen and Fishbein, a person's performance of a specified behavior is determined by his/her **behavioral intention** to perform **the actual behavior**, while behavioral intention is jointly determined by the user's **attitude** and **subjective norm**. In this context, attitude can be defined by an individual's positive or negative feelings about performing the target behavior, while Subjective Norm can be defined by the person's perception that most people who are important to him or her think he or she should or should not perform the behavior in question. (Fishbein and Ajzen, 1975). Furthermore, TRA maintains that individuals would use technology if they perceive that there would be positive benefits (outcomes) associated with using them (Compeau and Higgins, 1995).

2.4.2 Technology Acceptance model (TAM)

In 1995, TAM (Figure 3) was developed and used TRA as theoretical backdrop. With some additions this model aims to provide a basis for understanding the impact of external factors on internal beliefs, attitudes and intentions (Davis et all, 1989). TAM theorizes that an individual's behavioral intent is determined by two beliefs: **Perceived Usefulness (U)** and **Perceived ease of use (E)**. Perceived Usefulness has been defined as the extent to which a person believes that using a system will enhance his or her job performance, while perceived ease of use has been defined as the extent to which a person believes that using a system will be free of effort. According to this model, perceived usefulness is also influenced by perceived ease of use because, keeping other things equal, an easy system to use, make it more successful (Davis et al, 1989).

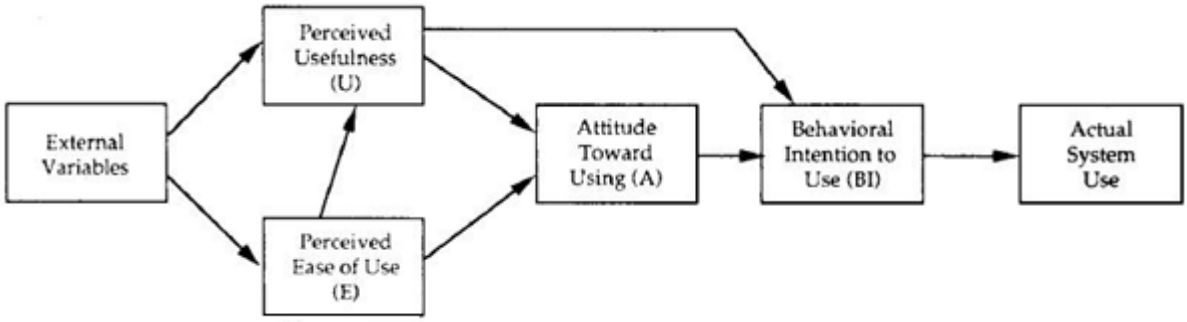

Figure 3: Technology Acceptance Model (TAM by Davis)

In 2000, Venkatesh and Davis added extensions to TAM and developed TAM2 (Figure 4). The additions can be divided into social influence processes (subjective norm, voluntariness and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability and perceived ease of use).

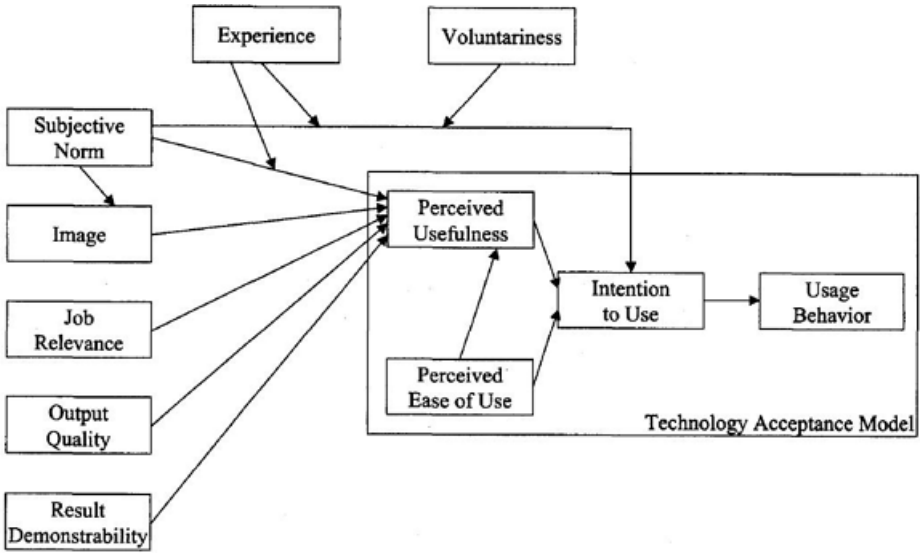

Figure 4: Technology Acceptance Model 2 (TAM 2by Venkatesh & Davis)

2.4.3 Theory of Planned Behavior (TPB)

Theory of Planned Behavior (Ajzen 1991) is another model, which is an extension of TRA. Again, like in TRA core factor in this theory is the individual's **intention** to perform a **behavior**. The intention is an indication of how hard somebody is willing to try, of how much of an effort they want to spent, in order to perform the behavior. In general, the stronger the intention to engage in a behavior, the more likely should be its performance.

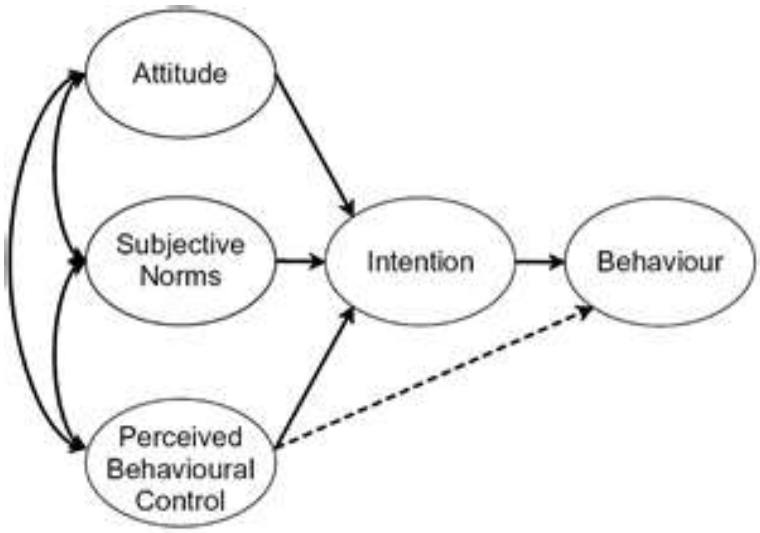

Figure 5: Theory of Planned Behavior (TPB by Ajzen)

Another factor with greater psychological impact in this model is the perception of behavioral control. In fact, TPB differs from TRA in its addition of this factor. **Perceived behavioral control** refers to people`s perception of the ease or difficulty of performing the behavior of interest can vary across situations and actions. Whereas locus of control is a generalized expectancy that remains stable across situations and actions, perceived behavioral control can, and usually does, vary across situations and actions. Thus, a person may believe that, in general, her outcomes are determined by her own behavior (internal locus of control), yet at the same time she may also believe that her chances of becoming a commercial airplane pilot are very slim (low perceived behavioral control).

2.4.4 Motivational Model (MM)

Extrinsic motivation could be described by the perception that users will want to perform an activity 'because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions'. While **intrinsic motivation** could be described as the perception that users will want to perform an activity 'for no apparent reinforcement other than the process of performing the activity per se' (Davis et al, 1992)

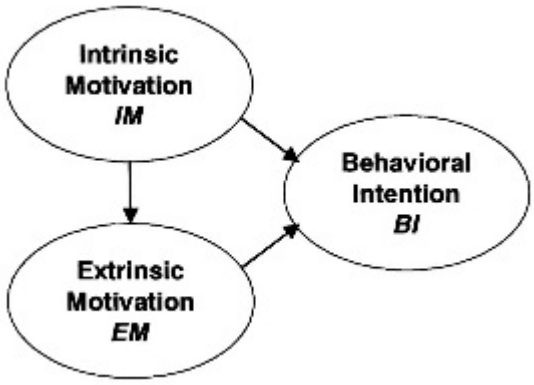

Figure 6: Motivational Model (MM by Davis)

For instance, perceived usefulness is an example of extrinsic motivation, whereas enjoyment is an example of intrinsic motivation (Davis et all, 1992).

2.4.5 Combined TAM and TPB (C-TAM-TPB)

In 1995, Taylor and Todd (Taylor and Todd, 1995) developed Combined TAM and TPB. This model combines the three predictors **Attitude toward behavior**, **Subjective Norm** and **Perceived Behavioral Control**, which are adapted from Theory of Planned Behavior (TPB) and Theory of Reasoned Action with **perceived usefulness** which is adapted from Technology Acceptance Model (TAM). This model is a good example that proves how combinations between different adoption models/theories are made possible.

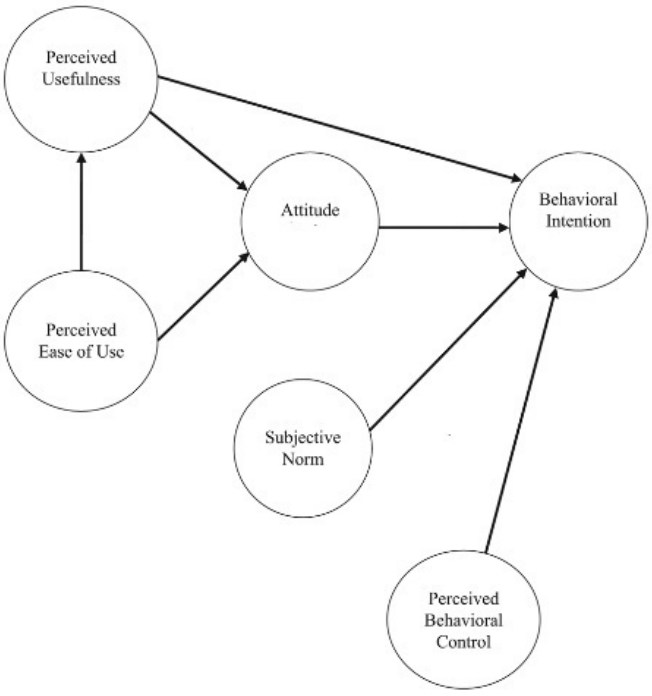

Figure 7: Combined TAM and TPB (C-TAM-TPB by Taylor and Todd)

2.4.6 Diffusion model (IDT)

In his book, Rogers describes diffusion as the process by which (1) an innovation (2) is communicated through certain channels (3) over time (4) among the members of a social system. This makes diffusion a special type of communication, in which new ideas give diffusion its special character (Rogers 2003).

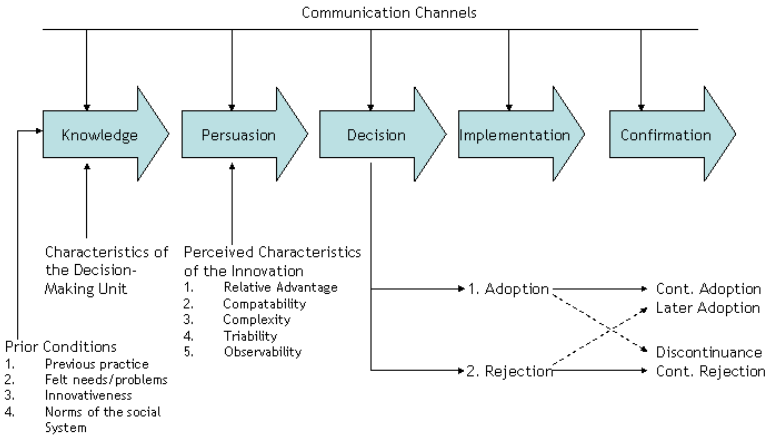

Figure 8: Innovation-decision process (by Rogers)

The innovation decision process consists of five stages. In the first stage knowledge occurs when the user is exposed to the existence of the innovation and gains some understanding of the working method. In the second stage the user forms an attitude (favorable or unfavorable) toward the innovation. In the decision stage the user chooses whether to adopt or reject the innovation and in the fourth stage the user puts an innovation into use. In the final stage the user seeks reinforcement of an innovation-decision already made. The user may reverse this previous decision (Rogers 2003).

Rogers (2003) described the innovation-decision process as "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation". The attributes of innovations consist of the following characteristics and differs per individual:

- **Relative advantage**: the degree to which an innovation is perceived as being better than the idea it supersedes (elements are the cost and social status motivation aspects of innovations).
- **Compatibility**: the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters (what the innovation is called should be meaningful and what the innovation means be clear to the adopter).
- **Complexity**: the degree to which an innovation is perceived as relatively difficult to understand and use
- **Image**: the degree to which use of an innovation is perceived to enhance one`s image or status in one`s social system.

- **Trialability**: the degree to which an innovation may be experimented with on a limited basis. The more an innovation is tested, the earlier the adoption takes place.
- **Observability**: the degree to which the results of an innovation are visible to others.
- **Voluntariness of Use**: the degree to which use of the innovation is perceived as being voluntary, or of free will.

Rogers (2003) defined the adopter categories as "the classifications of members of a social system on the basis of innovativeness". This classification includes innovators, early adopters, early majority, late majority, and laggards.

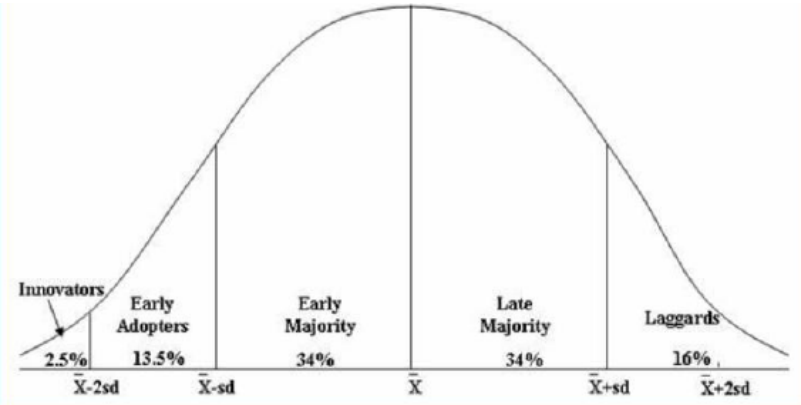

Figure 9: Classification of members of a social system

2.4.7 Social Cognitive Theory (SCT)

Social Cognitive Theory (Bandura, 1986) relies on the premise that environmental influences (such as unique situational characteristics), personal factors (such as personality) and behavior (actions) are reciprocally determined as in the "triadic reciprocality" shown below.

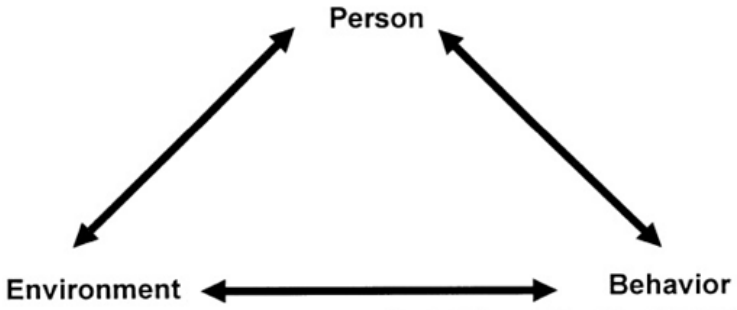

Figure 10: Triadic reciprocality

Thus, individuals choose the environment in which they want to exist in addition to being influenced by those environments. Furthermore, behavior is affected by environmental characteristics, which are in turn affected by behavior itself. Finally, behavior is affected by personal factors and affects those same factors. Bandura advances two sets of expectations as the major cognitive forces guiding behavior: The first set relates to outcomes and the second to self-efficacy, which can be defined by beliefs about one`s ability to perform a particular behavior (Compeau and Higgins, 1995).

By referring to the Social Cognitive Theory literature and the existing base of research in the information systems literature a newer model was developed (Figure J)

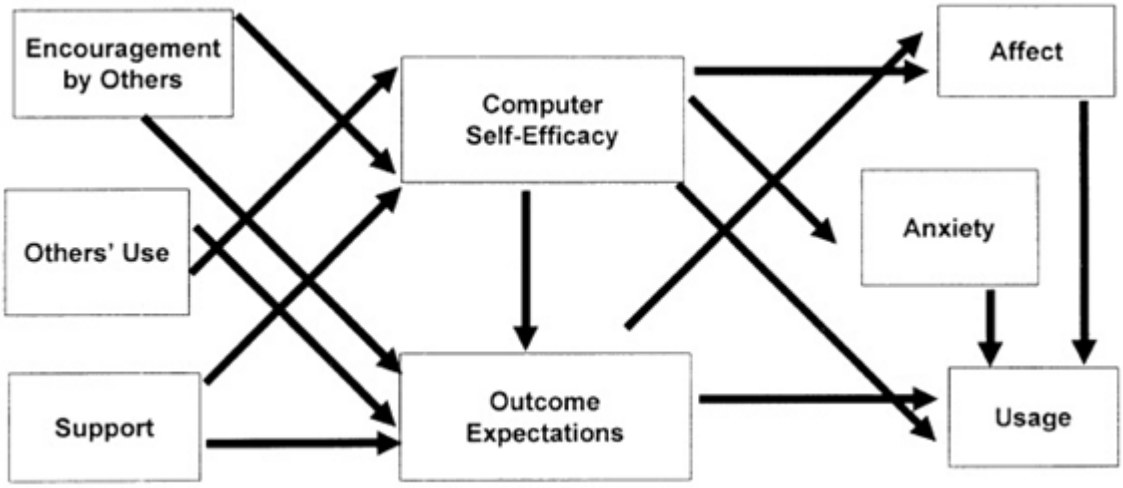

Figure 11: Social Cognitive Theory (SCT by Compeau and Higgins)

The terms can briefly be described as follows:

- **Encouragements by others** within the individuals reference group can be expected to influence both self-efficacy and outcome expectations. For instance, individuals rely, in part, on the opinions of others in forming judgments about their own abilities. Thus, encouragement from others influences self-efficacy, if the source is perceived as credible (Bandura,1986). And if others in the reference group encourage the use of computing technology, the individuals judgments about the likely consequences of the behavior will be affected which means that encouragement by others also on outcome expectations.
- **Others` use** is a further source of information used in forming self efficacy and outcome expectations. Learning by observations, has been shown to be a powerful means of behavioral acquisition.
- **Support** by the organization for computer users can also be expected to influence individual's judgment of self efficacy. Availability of assistance to individuals who require it should increase their ability and their perceptions of their ability.
- **Computer Self-efficacy** represents an individual's perception of his or her ability to use computers in the accomplishment of task (i.e. using a software package for data analysis,

writing a mail merge letter using a word processor) rather than reflecting simple component skills (i.e. formatting disks and booting up a computer).

- **Outcome Expectations** are an important precursor to usage behavior. According to SCT, individuals are more likely to engage in behavior they expect will be rewarded (or will result in favorable consequences).
- **Affect** (or liking) by individuals can, under some circumstances, have a strong influence on their actions.
- **Anxiety** has an expected negative influence on computer use. People are expected to avoid behaviors that invoke anxious feelings.

2.5 Public transport organizations in The Hague area

In the introduction of this research we mentioned that HTM is one of the five major organizations in the Netherlands that contributed to the establishment of the joint venture Trans Link System (TLS). Nowadays, next to HTM some other public transport organizations offer public transport services in the area of the Hague. These organizations are providing public transport services especially by busses. By name this organizations are Connexxion and Veolia. In this section serving public transport organizations in The Hague area are described.

In 1864, The Hague started offering public transport services. The Dutch Railway Company constructed a connection between the city centre of The Hague and the beach area, which is called Scheveningen. Passengers were allowed to travel by a stage coach or omnibus, which is a carriage drawn by several horses. A couple of years later, the Dutch 'N.V. Haagsche Tramweg Maatschappij' (HTM) was founded but in the beginning phase the organization was controlled by a Belgian organization, which was known as La Société Anonyme des Tramways de la Haye (TH). TH was performing very well between the years 1873 – 1887. Because of large pressure by the Dutch governmental, HTM took over control and started steering this organization as a Dutch organization again in 1887. Nevertheless, a major part of the organization shares kept abroad (Kamp, 1988). Around 1887 HTM introduced the steam trams and after a couple of years the first electronic trams arrived (1890). The first electronic tram drove on electricity, which was generated from batteries. Those trams made trips of approximately 75 km without recharging possible and their maximum speed was around 20 km per hour. These trams had to switch their batteries after 75 km, which were charged at special locations. On August 6, 1904 these kind of electronic trams were replaced by another electronic trams. The new electronic trams were fed by a electricity line above the railway. Short after this introduction in 1904 , the number of omnibuses, steam trams and electronic trams fed by batteries rapidly decreased, while the number of electronic trams fed by lines above the rails

rapidly increased. In 1927, ‘Haagse Tramweg Maatschappij’ (HTM) changed into ‘N.V. Gemengd Bedrijf Haagse Tramweg Maatschappij’ (GBHTM). This new organization was majorly owned by the municipality of The Hague, the old organization HTM owned the remaining part (Block, 2009). From 2002 until now, this organization operates as ‘N.V. HTM personenvervoer’. This organization is an independent organization in public transport, of which the municipality of the Hague owns one hundred percent of the shares. Nowadays N.V. ‘HTM personenvervoer’ employs approximately 2400 employees and serves transportation for 137 million passengers annually. More detailed, HTM transports approximately 350.000 passengers by tram (and light rail) and 100.000 by bus per day. Nowadays, N.V. HTM personenvervoer operates in The Hague, Rijswijk, Leidschendam – Voorburg, Delft, Zoetermeer, Wateringen and Nootdorp, the so-called Conurbation Haaglanden.

Fig. 12: Overview of The Hague area

Next to HTM, we mentioned that Connexxion and Veolia are also offering public transport services in The Hague and surroundings. Connexxion serves with ‘Interliner’ buses, which are buses that serve between cities across whole the Netherlands. For instance between The Hague, Zoetermeer, Delft etc. Veolia offers public bus transport services in the areas The Hague, Delft, Leidschendam-Voorburg, Mid-Delfland, Pijnacker-Nootdorp, Rijswijk, Wassenaar, Westland, Zoetermeer and Delft. Connexxion and Veolia are founded in 1999 and 2009, respectively.

2.6 Summary of adoption models and theories

Model/Theory	Core construct
Theory of Reasoned Action	*Attitude Toward Behavior* *Subjective Norm*
Technology Acceptance Model	*Perceived Usefulness* *Perceived Ease of Use* *Subjective Norm (in TAM2 only)*
Theory of Planned Behavior	*Attitude Toward Behavior* *Subjective Norm* *Perceived Behavioral Control*
Motivational Model	*Extrinsic Motivation* *Intrinsic Motivation*
Combined TAM and TPB	*Attitude toward Behavior* *Subjective Norm* *Perceived Behavioral Control* *Perceived Usefulness*
Innovation Diffusion Theory	*Relative Advantage* *Compatibility* *Complexity* *Image* *Trial ability* *Observability* *Voluntariness of Use*
Social Cognitive Theory	*Outcome Expectations - Performance* *Outcome Expectations - Personal* *Self-efficacy* *Affect* *Anxiety*

Table 2: An overview of several adoption models and theories

Chapter 3
– Research Methodology –

3.1 Introduction

In this chapter the methodology of this research is explained. This part can be used by other researchers if wanted for future researches. The succeeding section (3.2) contains an explanation of the research model and definitions of the constructs. The research model is developed by using existing constructs from different adoption theories and models. Also information by Meijers, who studied adoption of the OV-Chip card in the Netherlands is used. Furthermore, we used the observations (described in section 3.4). In the succeeding section (3.3) the data collection method is described. Hereafter, in section (3.4) questionnaire development is explained. The final paragraph (3.5) gives an overview of the hypotheses that are formulated.

3.2 The research model and definitions of its constructs

The research model is combined by findings from the literature review, conversations with colleagues and a preliminary questionnaire among 12 users (we describe this in more depth in the next section). The research model (Figure 13) is mainly adapted from the Technology Acceptance Model (TAM) by Davis (Section 2.4.2) and the Innovation Diffusion Theory (IDT) developed by Rogers (Section 2.4.6). Furthermore, some other constructs i.e.: 'Trust', 'External Influence' and 'Perceived Behavioral Control' (by Ajzen) are adapted from known other adoption models. In the figure below, the rectangles represent the constructs, the arrows the connections between them and H1 to H14 are the hypotheses formulated. We describe these in more detail in section 3.5.

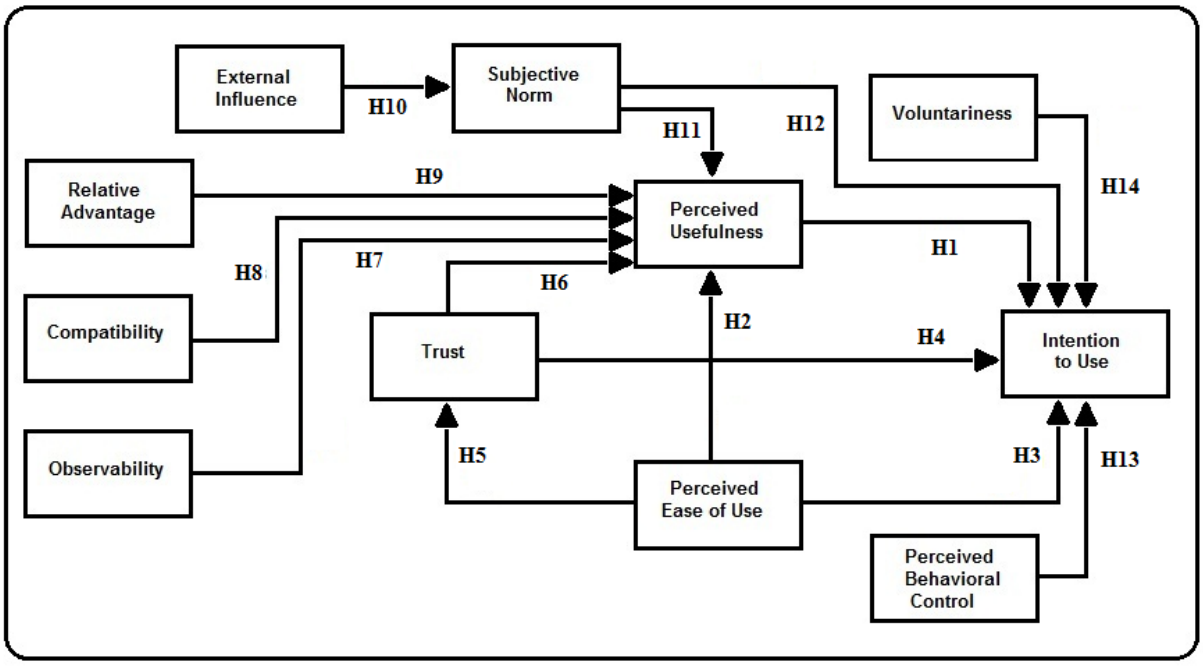

Figure 13: The research model

An explanation of the constructs that are used in the research model is as follows:

External influence is based on the influence of the media that affects the perception of (potential and) current users concerning the OV-Chip card. In his past research, Meijers (see section 2.3) mentioned that in the Netherlands publications by the media concerning news about the OV-Chip card creates negative pictures in the mind of (potential) users.

- **External influence:** an individual`s perception of non-personal information`s beliefs that the OV-Chip card system is doing well or not.

Venkatesh and Davis described in their TAM2 model, like Ajzen did in the theory of planned behavior, the importance of the term subjective norm.

- **Subjective Norm:** an individual's perception of relevant others' beliefs that he or she should or should not make use of an OV-Chip card (Ajzen, 1991)(Venkatesh & Davis, 2000).

The importance of trust among users to make use of a certain technology has been examined many times before in many researches. Especially, past researches that are related to governmental systems (Warkentin, 2010) or transportation systems (Mallat et all, 2008) describe the construct trust as how we do in this research.

- **Trust:** The belief that the public transport organizations will behave as expected in a socially responsible manner, and in doing so, it will fulfill the users` expectations.

Perceived Behavioral Control reflects beliefs regarding the access to resources and opportunities needed to perform a certain behavior. It can encompass two components (Ajzen, 1991)(Taylor & Todd, 1995). The first component represents the availability of resources needed (for instance money and time) and the second component, self-confidence in the ability to conduct the behavior by the user.

- **Perceived Behavioral Control:** the extent to which resources are available and the control one has over using the OV-Chip card (Ajzen, 1991).

In the Technology Acceptance Model, Davis describes the constructs perceived usefulness and perceived ease of use as:

- **Perceived Usefulness:** the extent to which an user believes that using the OV-Chip card will enhance his or her task performance (Davis et all, 1989).

- **Perceived Ease of Use:** the extent to which a person believes that using a system will be free of effort (Davis et all, 1989).

Rogers identified seven constructs that a variety of diffusion studies had shown to consistently influence adoption (Moore and Benbasat, 2001). In this study we used as many constructs defined by Rogers as possible. The two constructs 'Image' and 'Trialability' by Rogers` theory are eliminated, because they are not relevant to our research. Complexity, is another construct that is defined by Rogers, but which is also not used in this research. Our reason is that the explanation has similarities with the construct 'Perceived ease of use' (Moore and Benbasat, 1991). We used the construct `Perceived ease of use' and an explanation of this construct is given before.

- **Relative Advantage:** the degree to which the OV-Chip card is perceived as being better than its precursor (strippenkaart) (Rogers, 2003).

- **Compatibility:** the degree to which making use of the OV-Chip card is perceived as being consistent with the existing values, needs and past experiences with the organization of current and potential adopters (Rogers, 2003).

- **Observability:** the degree to which the results of using the OV-Chip card are observable by others (Rogers, 2003).

The construct voluntariness of use is also described by Rogers` IDT. It should be noted that the definition is based on perceptions of the innovations itself and not on perceptions of actually using the OV-Chip card. Venkatesh and Davis also made use of the same construct in TAM2.

- **Voluntariness of Use:** the degree to which use of the OV-Chip card is perceived as being voluntary, or of free of will (Venkatesh & Davis, 2000)(Rogers, 2003).

The definition of 'Intention to use' the OV-Chip card is clear and described in many models in the past.

- **Intention to Use:** the probability that an user is going to use the OV-Chip card (Davis et all, 1989)(Venkatesh and Davis, 2000).

3.3 Questionnaire Development

The research model and associated hypotheses H1 – H14, which are shown in Figure 13 are tested in chapter 5 by making use of questionnaires. Before the main questionnaire is conducted (see Appendix A), observations (the personal beliefs of colleagues at HTM) are collected to develop the main questionnaire. Current (and potential) OV-Chip card users and colleagues at HTM are asked to give a reasoned opinion about the OV-Chip card system. From here, the following positives and negatives are made clear about the OV-Chip card:

Positives:

- In general, an OV-Chip card is easy to use and useful (when it works properly!)
- In general, users think that they will keep using OV-Chip card in the future
- In general, users believe that the OV-Chip card system will reach its goal (an easier way to travel by tram, bus, metro, train and boat nation-wide) in the near future
- The results of the system are visible, which means that people know and hear from each other what they think about the system (positive and negative aspect)

Negatives:

- In general, the media is not publishing positive news about the OV-Chip card in the Netherlands.
- In general, personal knowledge and control over the OV-Chip card among users are both limited
- The number of missing checkouts are high. Because of this users value the OV-Chip card as very expensive (the system charges users €4,- for every missing check-out). Due to the fact that users frequently don`t know where the problem lies, they often don`t know that it is possible to get money repaid by their public transport organization.
- When users want to take advantage of discounts (seniors above the 65 years and children between the 4 and 11 years old deserve a discount of 34%), they are forced to use a personal OV-Chip card. This is often in discrepancy with their privacy, because personal information will always be registered. Due to this, many users do not want a personal OV-Chip card.
- The results of the system are visible, which means that people know and hear from each other what they think about the system (positive and negative aspect)

After developing the questionnaire a preliminary questionnaire is set up and conducted among a group of 12 users. All users made use of an OV-Chip card in The Hague area and passed the age of 12. The preliminary questionnaire contained 32 items, while ten (10) constructs consisted of maximum three items (questions) each. ‘Perceived Usefulness’ and ‘Trust’ were the only two constructs containing three items, but due to the similarity of a question in both constructs, one question from ‘Perceived usefulness’ is eliminated and ‘Perceived Usefulness’ remained with two items. All other constructs are

represented by two items. To keep the willingness to fill in the final survey high, the number of total questions in the questionnaire is decreased to 28. The construct 'Perceived financial cost' is omitted entirely, because almost all participants valued the system as very expensive. Because of this, 'Perceived financial costs' is not considered to have a significant effect on the adoption of the OV-Chip card.

Item	Wording
Perceived usefulness	
PU1	Using OV-Chip card would make it easier to travel by public transport
PU2	I would find OV-Chip card useful for travelling by public transport
Perceived ease of use	
PEOU1	Learning to operate OV-Chip card is easy for me
PEOU2	My interaction with OV-Chip card is clear and understandable
Perc. Beh. Control	
PBC1	I have control over using the OV-Chip card
PBC2	I have the knowledge necessary to use OV-Chip card
Trust	
TRUST1	Based on my experience with the organization in the past, I know it cares about customers
TRUST2	I think that using OV-Chip card will not disclose my account and personal information
TRUST3	OV-Chip card is a trustworthy ticket provider
Observability	
OBS1	I would have no difficulty telling others about the results of using an OV-Chip card
OBS2	The results of using an OV-Chip card are apparent to me
Compatibility	
COMP1	Using OV-Chip card is compatible with my style and habits
COMP2	I think that using OV-Chip card fits well with the way I like to make use of public transport
Relative advantage	
RADV1	The advantages of my using the OV-Chip card far outweigh the disadvantages
RADV2	Using OV-Chip card enables me to accomplish tasks more quickly (checking in and out is much faster)
External Influence	
EXTINF1	Media is full of reports, articles and news suggesting OV-Chip card is a good idea
EXTINF2	Media and advertising consistently recommend using OV-Chip card
Subjective Norm	
SUBN1	People whose opinion I value prefer me to use OV-Chip card
SUBN2	People around me have encouraged me to use OV-Chip card
Intention to use	
INT1	I will definitively keep using OV-Chip card
INT2	I expect that public transport organizations will make everything easier in the near future
Voluntariness of Use	
VOLUN1	My use of OV-Chip card is voluntary
VOLUN2	Although it might be helpful, using an OV-Chip card is certainly not compulsory for transportation

Table 3: Overview of the items

In the final questionnaire, the beliefs and perceptions of respondents are measured on a seven point Likert scale, with a range from “Extremely unlikely” to “Extremely likely” (i.e. Figure 14 shows this scale). The final questionnaire is available in Appendix A.

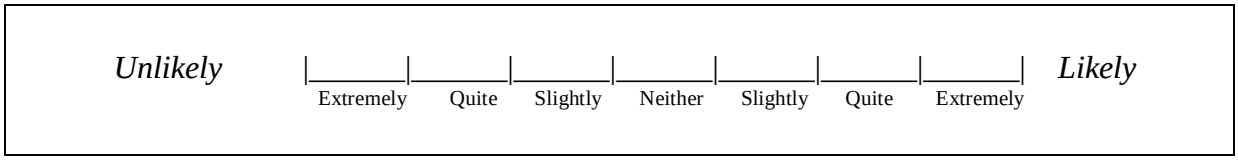

Figure 14: Answer possibilities on the questionnaire

3.4 Data collection method

SPSS and Smart PLS are statistical analysis software programs that are used to analyze the data, but we explain more about this in the succeeding chapters. Concerning data collection, the majority of the questionnaires is conducted in the field. Our purpose is to gather a representative sample of passengers, that uses public transport in The Hague area. Therefore, current and potential OV-Chip card users are asked to fill in the questionnaires at offices of HTM Service desks. These desks are located in the city centre of The Hague and at two train stations in The Hague (The Hague Central Station and The Hague Holland Spoor). A smaller quantity of the questionnaires is collected through the internet by e-mails (in total 26 respondents). The final surveys are conducted during three (3) weeks (week numbers 28, 29 and 30 of 2011) and saved in the same period as data file (csv) in SPSS.

The respondents in our questionnaire are selected by two main (2) criteria: At least they must have reached the minimum age of 12 years old and they must be a (potential) user of the OV-Chip card. The final questionnaires are printed in Dutch and English. We tried to have as much as variety as possible in the sample (i.e. after asking a young woman to participate a young man is asked and hereafter, an older woman and an older man etc.) to achieve the representative sample. Next to inhabitants of The Hague and surroundings, several tourist and inhabitants of other regions from Holland are also asked to participate in this survey. The surveys conducted in the field are completed under supervision. Because of this we had no missing returns. Through the internet some questionnaires are not completed, but these are omitted from the data set.

3.5 Research hypotheses

The research model (Figure 13 on page 27) defines the constructs used and the relationships between them. The relationships between two construct are formulated into hypotheses. In this section we explain our hypotheses.

In past researches, the linkages between the TAM constructs 'Perceived ease of use', 'Perceived Usefulness' and 'Intention to Use' are empirically verified many times. These researches suggest that Perceived ease of use is significantly linked to Intention to use an innovation, both directly and indirectly via its impact on perceived usefulness (Davis, et al., 1989)(Venkatesh & Davis, 2000).

Also as described in section 2.4, perceived ease of use has a positive influence on perceived usefulness because, keeping other things equal, an easy system to use, make it more successful (Davis et al., 1989). According to Davis (Davis, 1989) an application perceived to be easier to use than another is more likely to be accepted by users. Therefore the following three hypotheses are forwarded:

H1: Perceived usefulness of the OV-Chip card will have a positive effect on the intention to use the OV-Chip card.

H2: Perceived ease of use of the OV-Chip card will have a positive effect on perceived usefulness of the OV-Chip card.

H3: Perceived ease of use of the OV-Chip card will have a positive effect on the intention to use the OV-Chip card.

A factor which is crucial in businesses with whom the customers are economically engaged is 'Trust' (Gefen et al., 2003). It is one's belief that the other party will behave in a dependable, ethical and socially appropriate manner. Trust deals with the belief that the trusted party will fulfill its commitments (Rotter, 1971) despite the trusting party's dependence and vulnerability (Rousseau et al. 1998). Past studies, verified that 'Trust' has direct and positive influence on 'Perceived usefulness', 'Perceived Ease of Use' has direct and positive influence on 'Trust', and 'Trust' has a direct and positive influence on 'Intention to Use' (Gefen et al., 2003). We expect the same result and due to this following hypotheses are formulated:

H4: Trust will have a positive effect on the intention to use the OV-Chip card.

H5: Perceived ease of use will have a positive effect on the user`s trust in the OV-Chip card.

H6: Trust will have a positive effect on perceived usefulness of the OV-Chip card.

As described in the innovation diffusion theory by Rogers: 'the higher observability, compatibility and relative advantage, the more (and faster) it leads to adoption of the innovation' (Rogers, 2003).

Observability consists of both visibility and result demonstrability (Rogers, 1983). If a potential user is informed about the benefits of the OV-Chip card before adoption, then he or she has a better chance of understanding its usefulness (Oh, et al, 2003). In the past, researchers included compatibility in their research and hypothesized that compatibility affects perceived usefulness positively (Chau and Hu, 2001)(Argarwal, et al, 2000). When an individual has prior compatible experiences, he or she is in a better position to perceive the usefulness of new technology if he or she found the previous technology to be useful (Oh, et al. 2003). Finally, as Meijers (Meijers, 2003) concluded, passengers are rarely dissatisfied by the previous tickets in the Netherland. However, we expect that relative advantage affects perceived usefulness in a positive way, because OV-Chip card users value the system much more over time, because the system makes travelling easier. Therefore, the following hypotheses are proposed:

H7: Observability will have a positive effect on perceived usefulness of the OV-Chip card.

H8: Compatibility of the OV-Chip card will have a positive effect on perceived usefulness of the OV-Chip card.

H9: Relative advantage of the OV-Chip card will have a positive effect on perceived usefulness of the OV-Chip card.

According to Pedersen (2009), who focused on the importance of individuality and the relation between individuality and social pressure and the relation between them as both a determinant of mobile service use, social pressure should be included as determinant of subjective norm. Based on this, the following hypothesis is suggested.

H10: External influence will have a positive effect on social influence of (current and potential) users of the OV-Chip card.

Subjective norm is not generally included in TAM. In TRA (Fishbeijn and Ajzen, 1975), TAM2 (Venkatesh and Davis, 2000), TPB (Ajzen, 1991) and C-TAM-TPB (Taylor and Todd, 1995) the influence of subjective norm on intention to use is theorized. For our study, closest friends, family or peers are likely to have influence on potential adopters and users of the OV-Chip card, thus Subjective Norm is included in the research model. For instance, if a close friend suggests that the OV-Chip card might be useful, a person may come to believe that it actually is useful, and in turn form an intention to use it. Therefore, the following hypotheses are tested:

H11: Subjective norm will have a positive effect on perceived usefulness of the OV-Chip card.

H12: Subjective norm of current and potential OV Chip users will have a positive effect on the intention to use the OV-Chip card.

The more resources and opportunities individuals think they possess, and the fewer obstacles or impediments they anticipate, the greater should be their perceived control over the behavior (Ajzen and Madden, 1986). Bandura (Bandura, 1986) has provided evidence showing that people's behavior is strongly influenced by their confidence in their ability to perform it (i.e., by perceived behavioral control). Hence, the following hypothesis is suggested:

H13: Perceived Behavioral Control will have a positive effect on the intention to use the OV-Chip card.

Because of the fact that using an OV-Chip card is mandatory for travels by public transportation, some adopters may in fact feel a degree of compulsion. It is often not actual voluntariness which will influence the intention, but rather the perception of voluntariness (Moore and Benbasat, 1991). In this research we expect that, the higher the voluntariness to use the OV-Chip card, the higher the intention to use the OV-Chip card. Therefore the following hypothesis is formulated:

H14: Voluntariness of use will have a positive effect on the intention to use the OV-Chip card.

3.5 Summary of the hypotheses

	Wording
Hypothesis 1	*Perceived usefulness will have a positive effect on the intention to use the OV-Chip card*
Hypothesis 2	*Perceived ease of use will have a positive effect on perceived usefulness of the OV-Chip card*
Hypothesis 3	*Perceived ease of use will have a positive effect on the intention to use the OV-Chip card*
Hypothesis 4	*Trust will have a positive effect on the intention to use the OV-Chip card*
Hypothesis 5	*Perceived ease of use will have a positive effect on the user`s trust in the OV-Chip card*
Hypothesis 6	*Trust will have a positive effect on perceived usefulness of the OV-Chip card*
Hypothesis 7	*Observability will have a positive effect on perceived usefulness of the OV-Chip card*
Hypothesis 8	*Compatibility will have a positive effect on perceived usefulness the OV-Chip card*
Hypothesis 9	*Relative advantage will have a positive effect on perceived usefulness of the OV-Chip card*
Hypothesis 10	*External influence will have a positive effect on social influence of (current and potential) users of the OV-Chip card*
Hypothesis 11	*Subjective norm will have a positive effect on perceived usefulness of the OV-Chip card*
Hypothesis 12	*Subjective norm of current and potential OV-Chip card users will have a positive effect on the intention to use the OV-Chip card*
Hypothesis 13	*Perceived Behavioral Control will have a positive effect on the intention to use the OV-Chip card*
Hypothesis 14	*The voluntariness to use the OV-Chip card will have a positive effect on the intention to use an OV-Chip card.*

Table 4: Overview of the hypotheses

Chapter 4
– Analysis design–

4.1 Introduction

This chapter serves as an introduction to the succeeding chapter (Chapter 5), which explains the theory behind our analysis. We used two statistical analysis software programs, which are SPSS and Smart PLS. SPSS is just used to print an overview of the descriptive statistics, which is quite simple. Section 4.2 of this chapter describes the PLS method, which is a kind of structural equation modeling technique (SEM). Hereafter in section 4.3, the most important statistic are given. The succeeding section (4.4) describes how the hypotheses are tested.

4.2 An introduction to structural equation modeling (SEM)

SEM is a statistical second generation data analysis technique for simultaneously testing and estimating causal relationships among multiple independent and dependent constructs (Gefen et al. 2000). First generation regression models such as linear regression, ANOVA and MANOVA can analyze only one layer of linkages between independent and dependent variables at a time. SEM analysis covers, next to the structural model (the relations among a set of dependent and independent constructs), an evaluation of the measurement model (loadings of observed items on their expected constructs, which we call latent variables). Because of this, SEM measures errors of the observed variables as an integral part of the model and combines factor analysis in one operation with the hypotheses testing. Furthermore, SEM techniques also provide fuller information about the extent to which the research model is supported by the data than in regression techniques (Gefen, 2000).

Figure 15 gives an overview of the formal structure of a structural equation model. The model combines formative and reflective indicators that represent exogenous and endogenous construct, which we can describe as latent independent (ξ) and dependent (η) constructs. Formative indicators occur when the construct is the result of a multiple regression on its indicators. The relationship between the indicator and the construct is characterized by π, which has a residual error term δ. In the case of reflective indicators, the relationship is turned around, which means that the indicator value becomes a function of the construct value. Accordingly, the relationship between the construct and indicators is characterized by λ, which has also a residual error term ε used for endogenous constructs and δ for exogenous constructs. Relationships between the constructs are described by path coefficients (γ for relationships between exogenous and endogenous constructs and β for relationships between endogenous constructs). These coefficients indicate the degree of correlation between

dependent and independent constructs. The error term ξ captures the unexplained deviations in the dependent variable.

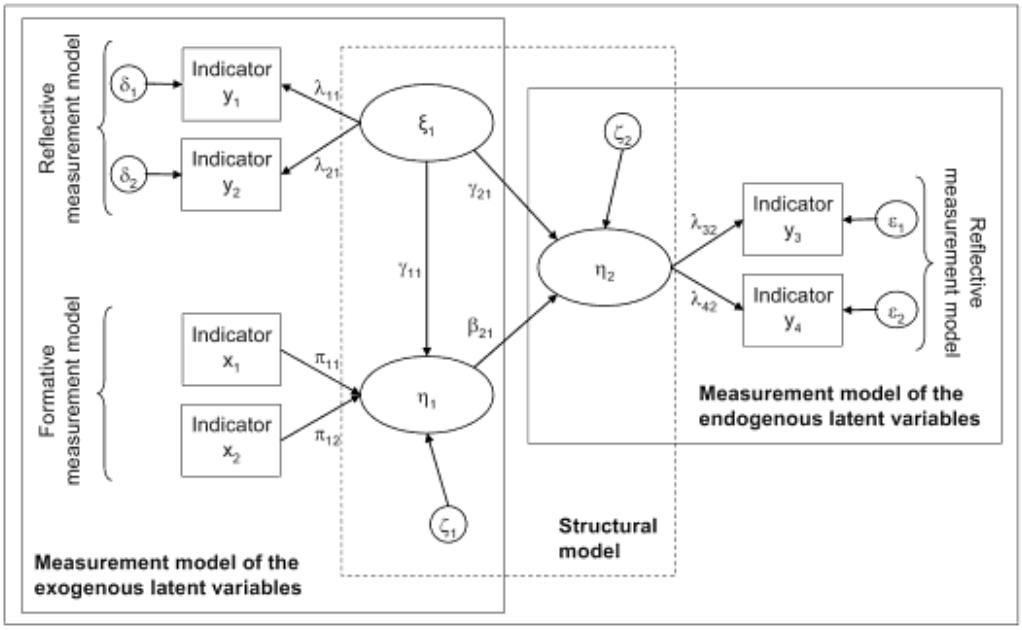

Figure 15: Formal structure of a structural equation model (by Wiedenfels, 2009)

Most common techniques of SEM are PLS and LISREL, while other tools such as EQS and AMOS are used less often. In this research we applied the PLS technique. PLS represents the technique of partial-least-squares and LISREL is a covariance based SEM technique. PLS is designed to explain variance, i.e., to examine the significance of the relationships and their resulting R2, as in linear regression. PLS is more suited for predictive applications and theory building, in contrast to covariance-based SEM (Gefen, 2000).

Using OLS (Ordinary Least Squares) as its estimation technique PLS performs an iterative set of factor analyses combined with path analyses until the difference in the average R2 of the constructs becomes insignificant (Thompson et al., 1995). Once the measurement and structural paths have been estimated in this way, PLS applies either a jackknife or a bootstrap approach to estimate the significance (t-values) of the paths (Gefen, 2000).

In comparing the bootstrap to the jackknife, you need to consider the trade-off between computational time and efficiency. Jackknife estimation tends to take less time for standard error estimation under the joint assumption that the bootstrap procedure utilizes a confidence estimation procedure other than the normal approximation and the number of resamples are larger than those of the jackknife. Conversely, the jackknife is viewed as less efficient than the bootstrap because it can be considered as an approximation to the bootstrap (Efron & Tibshirani, 1993). Therefore, we made use of bootstrap in our research.

4.3 The most important calculations by SEM

Before we explain how we test the research hypotheses, we provide some background information about statistical terms that are related to our analysis:

Cronbach's alpha is a coefficient of reliability. It is commonly used as a measure of the internal consistency or reliability. By convention, alpha should be greater or equal to .80 for a good scale, .70 for an acceptable scale, and .60 for a scale for exploratory purposes. As Cronbach's alpha is biased against short scales of two or three items, this small failure to meet the cutoff would usually be ignored.

Composite reliability is a preferred alternative to Cronbach's alpha as a measure of reliability because Cronbach's alpha may over- or under-estimate scale reliability. Underestimation is common. For this reason, composite reliability is now preferred and may lead to higher estimates of true reliability. The acceptable cutoff for composite reliability would be the same as the researcher sets for Cronbach's alpha since both measures attempt to measure true reliability. In an adequate model for exploratory purposes, composite reliabilities should be greater than .6 (Chin, 1998) and greater than .70 for an adequate model for confirmatory purposes.

AVE stands for average variance extracted. It reflects the average communality for each latent variable and is used to establish convergent validity (we explain this term in section 4.4). In an adequate model, AVE should be greater than .5 (Chin, 1998), which means factors should explain at least half the variance of their respective indicators. AVE may also be used to establish discriminant validity (also we explain this term in section 4.4).

R-square. This is the overall effect size measure, as in regression, indicating here that a certain percentage of a variable is explained by the model. No R-square is shown for variables as these are exogenous latent factors. Chin (1998) describes results to be “substantial”, “moderate” or “weak”, respectively. Absolute R-square values above the .5 are considered as strong, between .3 and .49 as medium and below .29 are considered as weak.

Furthermore, PLS requires a *sample size* of at least 10 times the number of items in the most complex construct (Gefen, 2000). Based on our research our sample must contain at least 80 rows (our variable ‘Perceived Usefulness’ or the variable ‘Intention to use’ has two items and six arrows pointed from other constructs, so by quick calculation 8 times 10 makes 80 rows, which is the required sample size).

4.4 Testing the research hypotheses

This section contains the description of the method to test the thesis hypotheses. We made a distinction into the measurement model and the structural model.

4.4.1 Assessing the measurement model

To analyze the measurement model, we have to define the terms convergent validity and discriminant validity in advance. Convergent validity refers to the degree to which different measurements reflect the same construct (i.e., are positively correlated). In this research we test convergent validity by assessing the following three criteria (Chin, 1998)(Höck & Ringle, 2006):

- AVE (average variance extracted) should be equal or greater than 0.5
- CR (composite reliability) should be equal or greater than 0.7
- Outer loadings should be greater than 0.7

To get the AVE and CR outcomes we have to make use of the following steps: Report / PLS / Quality criteria / Overview. Outer loadings are made visible by clicking on Report / PLS / Quality criteria / Cross loadings. Some researchers recommend eliminating reflective indicators from measurement models if their outer standardized loadings are smaller than 0.4 (Churchill, 1979). One should be careful when eliminating indicators. Only if an indicator`s reliability is low and eliminating this indicator increases composite reliability it makes sense to discard this indicator (Henseler et all, 2009)

Discriminant validity is achieved when there is a divergence between measures of one construct and a related but conceptually distinct construct. Next to convergent validity, to test whether discriminant validity is met we make use of the following two assessments

- All correlations should be lower than the AVE squared root.
- The outer loading of each indicator should be greater in its LV and lower in the other variables

To obtain our results we make use of Report / PLS / Quality criteria / Latent Variable Correlations. AVE squared root is measured by calculating the root squares of AVE, which results are known from the convergent validity. To test for outer loading the same table as for the convergent validity can be used (Cross loadings) and results can be compared to check whether the second condition of discriminant validity is met.

Hereafter, bootstrapping shows whether the results obtained are adequate significant. Like Chin, (Chin, 1998) we opted to use bootstrap resampling (500 resamples) throughout this study for

significance testing of path estimates. All t-values should be greater than 1, 96 (p-value = 5% two tail). This report can be obtained through Report / Bootstrapping / Bootstrapping / Outer loadings (Mean, standard deviation, T-values).

4.4.2 Assessing the structural model

In PLS R^2 results are shown in the blue balls and on the arrows between the variables the path coefficients are given. Also, the same results can be obtained through Report / PLS / Calculation results / Path coefficients.

Again, to obtain adequate significant results we made use of the bootstrapping method and 500 resamples are made. Our report is obtained via Report / Bootstrapping / Bootstrapping / path coefficients (Mean, STDEV, T-values) and all t values should be greater than 1.96 (p-value = 5%, two tail). The same results are shown in our model after clicking on bootstrapping.

Chapter 5
– Analysis & Results –

5.1 Introduction

This chapter contains the data analysis results. In section 5.2 descriptive analysis are described by means of statistical analysis program SPSS 19.0. The succeeding section (section 5.3) describes the PLS analyses to test the research hypotheses. Finally, the analyses results in this research are summarized in section 5.4.

5.2 Descriptive Statistics

Based on age, the youngest participants are 15 years old, while the eldest participant was 87 years. The average age of the sample is 40, 44 years old. As you can see from Figure 16 below, the majority lies on the left side and represent the younger participants. Especially, the group between the 19 years and 25 years are much more represented in comparison with the rest part. Also, there is a small peak in the group of beginning 40`s remarkable. The elderly people (age of at least 65) cover 11, 9 % of the sample (Appendix B 1).

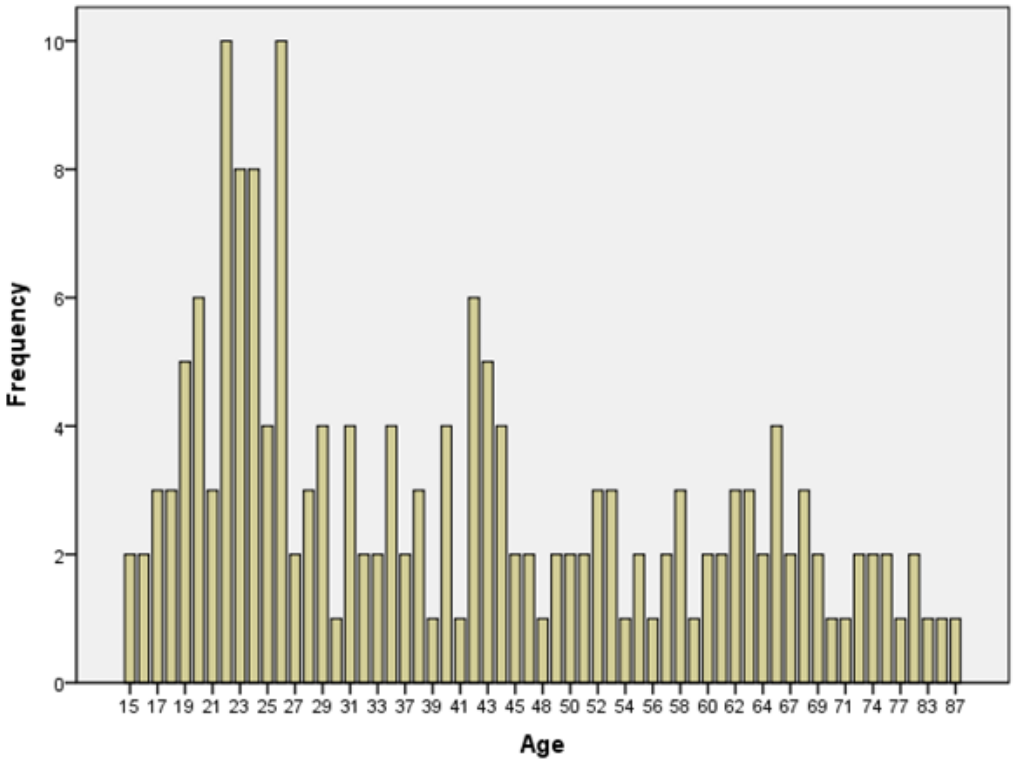

Figure 16: Distribution of age by frequency (SPSS v. 19.0)

In total 176 respondents completed the questionnaire (see Appendix A), which was conducted majorly at HTM Service points. Out of this sample, 84 of the participants are male (47, 7%), while 92 are female (52, 3%). Based on race, native participants (51, 7%) are slightly in majority against foreign participants (48, 3%). Considering the student OV-Chip card as personal OV-Chip card we can see from below that personal cards are represented majorly (43, 2% + 20, 5 % = 63, 7 %). On experience level, the majority (55, 7 %) is using an OV-Chip card more than 6 months, while 10 OV-Chip card users are experienced less than one month. The biggest group has experience with the OV-Chip card between two and five months (30, 7%). Based on usage, the majority is using an OV-Chip card between the 2 and 10 times a week (47, 7 %). 25% uses at least 10 times a/week the OV-Chip card.

	Frequency	Percentage
Gender		
Male	84	47,7
Female	92	52,3
Race		
Native	91	51,7
Foreign	85	48,3
Type of card used		
Not (yet)	1	0,6
Personal OV-Chip card	76	43,2
Anonymous OV-Chip card	63	35,8
Student OV-Chip card	36	20,5
Experience		
Not (yet)	1	0,6
Less than 1 month	9	5,1
1 - 2 months	14	8,0
2 - 5 months	54	30,7
6 - 12 months	35	19.9
1 -1,5 year	31	17,6
More than 1,5 year	32	18,2
Usage		
Not (yet)	3	1,7
Less than 2 times a month	25	14,2
About once a week	20	11,4
2 - 10 times a week	84	47,7
More than 10 times a week	44	25,0

Table 5: Descriptive Statistics (SPSS v. 19.0)

5.3 Partial-Least-Squares hypotheses testing

In statistical terms our initial model by the PLS algorithm (see figure 17) consists of 11 latent variables. The yellow rectangles in this figure represent the questions that are used to measure the latent variables, which are represented by the blue balls. All latent variables are measured through 2 indicators (y_1 and y_2), except the latent variable 'Trust', which has 3 indicators (y_1, y_2 and y_3). In between the latent variables the relations are shown. All relations are formulated into hypotheses and explained earlier in chapter 3.

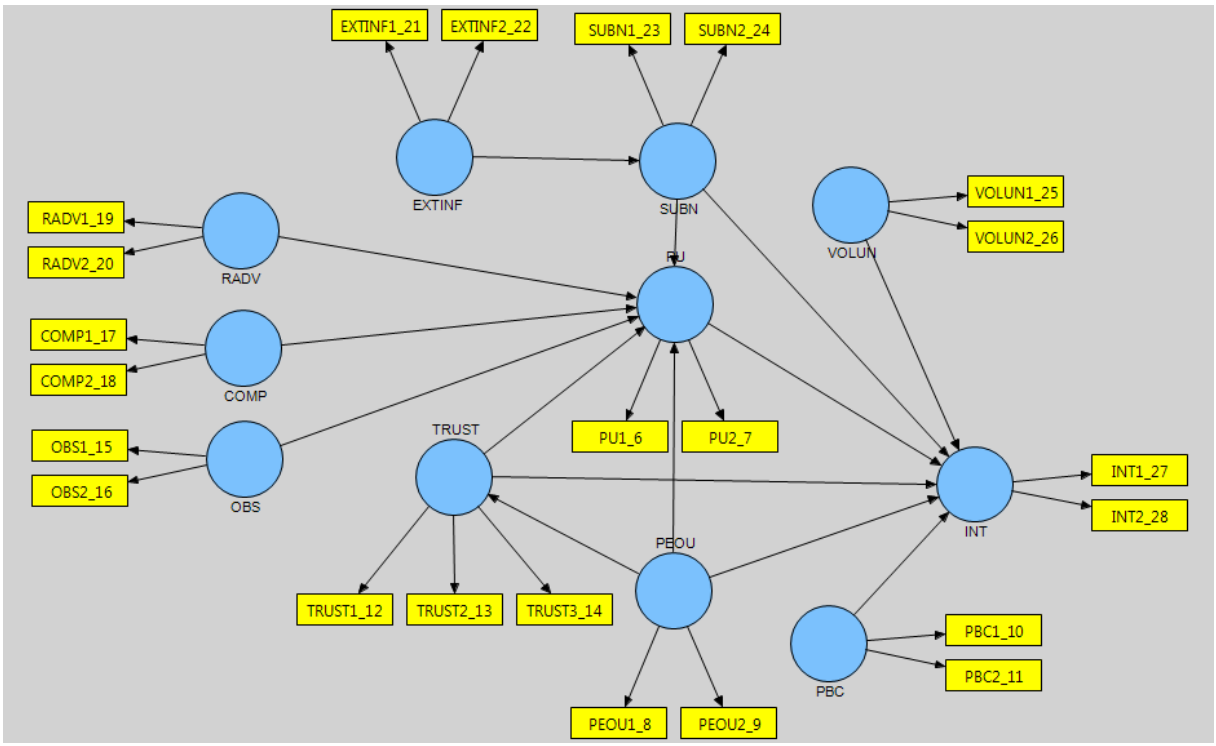

Figure 17: Initial calculation of the research model by the PLS algorithm (Smart PLS v. 2.0)

As you can see the names of the latent constructs are abbreviated. The variable 'Relative Advantage' is abbreviated by RADV, 'Compatibility' by COMP, 'Observability' by OBS, 'External Influence' by EXTINF, 'Subjective Norm' by SUBN, 'Perceived Usefulness' by PU, 'Voluntariness' by VOLUN, 'Perceived ease of use' by PEOU, 'Perceived Behavioral Control' by PBC and 'Intention to use' by INT. From here we use these abbreviation more frequent in this research.

To test our model fit, convergent and discriminant validity tests are applied and both, the measured and structural model are tested in this section. Hereafter, the significance of the obtained results are checked by bootstrap and hereby, the formulated hypotheses are tested.

5.3.1 Testing the measurement model

As described in the previous chapter we test whether convergent and discriminant validity are met.
An important condition that tests for convergent validity is based on the (cross) loadings. With outer loading results, the reliability of the questionnaire is assessed and both, convergent validity and discriminant validity, can be assessed. In Table 6, the green rectangles show that all items score above 0.7, except one item (marked in red). Item 'TRUST2_13' that belongs to the variable 'Trust' scores far below this expectation (0,2927).

	COMP	EXTINF	INT	OBS	PBC	PEOU	PU	RADV	SUBN	TRUST	VOLUN
COMP1_17	0,953112	0,283131	0,416797	0,458838	0,432012	0,376338	0,608706	0,602323	0,339220	0,469144	0,198651
COMP2_18	0,957748	0,359717	0,454979	0,424865	0,420093	0,374843	0,640469	0,591574	0,402391	0,455592	0,176273
EXTINF1_21	0,328887	0,850734	0,151282	0,189991	0,180838	0,158459	0,187341	0,268275	0,386878	0,225572	0,168707
EXTINF2_22	0,271064	0,904137	0,211037	0,176665	0,155501	0,106154	0,231854	0,230728	0,475945	0,228111	0,148872
INT1_27	0,461535	0,163442	0,876126	0,399635	0,385676	0,334520	0,532378	0,343079	0,310930	0,369450	0,327561
INT2_28	0,328727	0,201336	0,861435	0,308350	0,356983	0,282732	0,490226	0,446889	0,303163	0,338569	0,336569
OBS1_15	0,261141	0,105999	0,313674	0,750503	0,298251	0,246627	0,214170	0,261671	0,165049	0,250776	0,109669
OBS2_16	0,479061	0,220682	0,383530	0,946583	0,616124	0,467923	0,438924	0,531700	0,175221	0,416978	0,244302
PBC1_10	0,480383	0,223503	0,412845	0,541061	0,919243	0,684868	0,496523	0,471988	0,243391	0,419434	0,248691
PBC2_11	0,316071	0,112334	0,358727	0,508316	0,891470	0,623076	0,327700	0,342470	0,197388	0,298895	0,196932
PEOU1_8	0,374357	0,168519	0,321974	0,362759	0,640423	0,892713	0,441884	0,286020	0,120255	0,278131	0,237318
PEOU2_9	0,300167	0,078037	0,292525	0,420086	0,612550	0,836277	0,332387	0,277869	0,151171	0,241842	0,258970
PU1_6	0,616154	0,276590	0,551013	0,368936	0,465815	0,451534	0,930511	0,607645	0,335566	0,515936	0,301664
PU2_7	0,598812	0,169435	0,543166	0,400430	0,390193	0,388508	0,927195	0,588994	0,216647	0,546725	0,287458
RADV1_19	0,607056	0,269627	0,412864	0,376915	0,380740	0,264216	0,591870	0,902968	0,372901	0,511327	0,247673
RADV2_20	0,512503	0,234686	0,400394	0,528751	0,436542	0,321844	0,564540	0,892770	0,333628	0,443955	0,227268
SUBN1_23	0,412043	0,444687	0,377724	0,221928	0,305757	0,199164	0,323076	0,395180	0,943710	0,281632	0,104348
SUBN2_24	0,312749	0,486469	0,280662	0,139585	0,146104	0,085694	0,231479	0,341129	0,931462	0,227954	0,123594
TRUST1_12	0,315250	0,136986	0,245362	0,259043	0,287703	0,281611	0,389626	0,384776	0,238915	0,792577	0,174172
TRUST2_13	0,117545	-0,103634	0,126175	0,035300	0,121750	0,064915	0,120801	0,021670	-0,019624	0,292715	-0,006743
TRUST3_14	0,490460	0,324147	0,421447	0,438502	0,381826	0,247738	0,572171	0,539835	0,254485	0,901658	0,378480
VOLUN1_25	0,106245	0,094444	0,243039	0,102691	0,147620	0,224757	0,232808	0,176480	0,098167	0,183857	0,776725
VOLUN2_26	0,208722	0,192725	0,384333	0,254574	0,255719	0,259141	0,299539	0,261234	0,108387	0,342645	0,917258

Table 6: Initial convergent validity: (cross) loadings (Smart PLS v. 2.0)

The red marked item refers to question 13 of the questionnaire (Appendix A):

"I think that using OV-Chip card will not disclose my account and personal information"

We decided to omit this item from the analysis to increase the reliability of the questions. Hereafter, the loading results are shown in table 7.

	COMP	EXTINF	INT	OBS	PBC	PEOU	PU	RADV	SUBN	TRUST	VOLUN
COMP1_17	0,953111	0,283131	0,416783	0,458842	0,432011	0,376052	0,608704	0,602323	0,339220	0,466836	0,198651
COMP2_18	0,957749	0,359717	0,454957	0,424867	0,420093	0,374677	0,640482	0,591575	0,402391	0,453874	0,176272
EXTINF1_21	0,328887	0,850734	0,151282	0,189992	0,180838	0,158206	0,187376	0,268275	0,386878	0,254304	0,168706
EXTINF2_22	0,271064	0,904137	0,211048	0,176667	0,155500	0,105774	0,231894	0,230728	0,475945	0,246618	0,148872
INT1_27	0,461535	0,163442	0,876056	0,399632	0,385676	0,334119	0,532390	0,343079	0,310930	0,364905	0,327561
INT2_28	0,328727	0,201336	0,861508	0,308353	0,356983	0,283074	0,490217	0,446889	0,303163	0,332238	0,336569
OBS1_15	0,261141	0,105999	0,313641	0,750487	0,298251	0,246407	0,214143	0,261670	0,165049	0,252648	0,109669
OBS2_16	0,479061	0,220682	0,383530	0,946590	0,616124	0,468507	0,438920	0,531700	0,175221	0,427661	0,244301
PBC1_10	0,480383	0,223503	0,412837	0,541066	0,919241	0,685066	0,496534	0,471988	0,243392	0,411680	0,248691
PBC2_11	0,316071	0,112334	0,358729	0,508319	0,891472	0,622946	0,327745	0,342470	0,197388	0,296645	0,196932
PEOU1_8	0,374357	0,168519	0,321957	0,362760	0,640423	0,890701	0,441921	0,286020	0,120255	0,269966	0,237318
PEOU2_9	0,300167	0,078037	0,292533	0,420091	0,612550	0,838706	0,332390	0,277869	0,151171	0,251988	0,258970
PU1_6	0,616154	0,276590	0,551005	0,368940	0,465815	0,451006	0,930620	0,607645	0,335566	0,519670	0,301664
PU2_7	0,598812	0,169435	0,543165	0,400433	0,390192	0,388338	0,927083	0,588994	0,216647	0,543870	0,287458
RADV1_19	0,607056	0,269627	0,412877	0,376920	0,380739	0,264440	0,591880	0,902969	0,372901	0,521495	0,247673
RADV2_20	0,512503	0,234686	0,400409	0,528754	0,436541	0,321687	0,564542	0,892769	0,333628	0,461697	0,227268
SUBN1_23	0,412043	0,444687	0,377721	0,221929	0,305757	0,199155	0,323126	0,395181	0,943711	0,284740	0,104348
SUBN2_24	0,312749	0,486469	0,280664	0,139583	0,146104	0,086049	0,231518	0,341129	0,931462	0,250109	0,123594
TRUST1_12	0,315250	0,136986	0,245348	0,259045	0,287703	0,281537	0,389638	0,384776	0,238915	0,809072	0,174172
TRUST3_14	0,490460	0,324147	0,421451	0,438504	0,381825	0,247781	0,572148	0,539835	0,254485	0,908425	0,378479
VOLUN1_25	0,106245	0,094444	0,243044	0,102692	0,147619	0,224805	0,232795	0,176480	0,098167	0,205132	0,776727
VOLUN2_26	0,208722	0,192725	0,384332	0,254577	0,255719	0,259343	0,299555	0,261234	0,108387	0,347093	0,917256

Table 7: Final convergent validity: (cross) loadings (Smart PLS v. 2.0)

The lowest loading result belongs to item OBS1_15 (0,7505), which meets the expectation of at least 0,7 and means that all other loadings have passed the condition. After our removal of the item TRUST2_13 our model in PLS contains of 11 latent variables, that consist of 2 items.

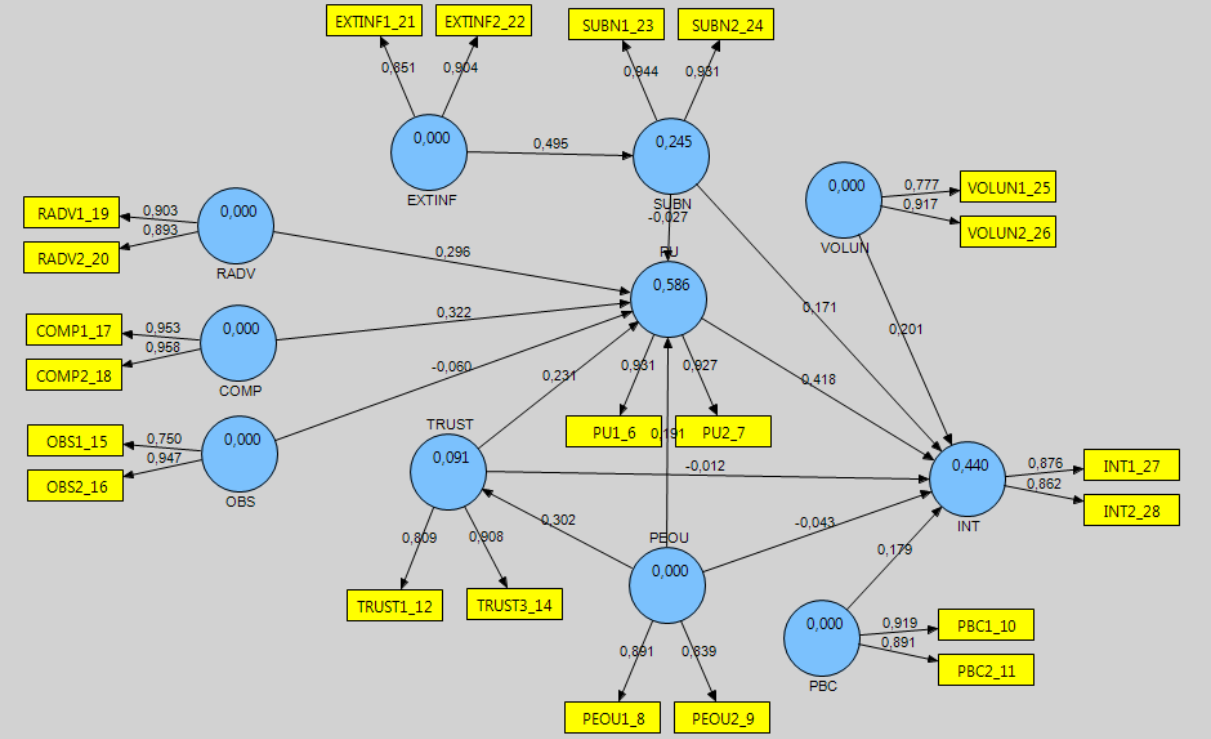

Figure 18: Final calculation of the research model by the PLS algorithm (Smart PLS v. 2.0)

Next to outer loadings, we have to explore the reliability outcomes to assess convergent validity. As mentioned in the previous chapter the most important reliability measures are R^2, Cronbach`s alpha, Average variance extracted (AVE) and Composite reliability. The results are shown in Table 8.

Based on R^2 'Perceived Usefulness' explains 58,6 % of our model, which effect can be characterized as substantial or strong. The variables 'Trust' and 'Subjective Norm' show less powerful effects, 9,1% and 24,5 % respectively. Finally 'Intention to use' has a moderate effect that explains 44,0% of our model.

Cronbach`s alpha must reach at least 0, 70 to obtain an acceptable scale. Almost 1/2 of the constructs (5 of all) score below this value. The variable 'Trust', has three items, while all other constructs consist of two items. Due to the fact that composite reliability is preferred above Cronbach`s alpha and may lead to higher estimates of true reliability we ignore the unacceptable scores obtained by Cronbach`s alpha, which are obtained by INT, OBS, PEOU, TRUST and VOLUN.

As we explained in Chapter 4, composite reliability is a better scale to assess convergent validity. 'Trust' again, represents the lowest result (0, 7399), however, all variables meet the expectation of at least 0.7.

Next to obtaining adequate composite reliability results, AVE must be at least .5. The lowest AVE belongs to the latent variable 'Voluntariness' (0, 8379), however, this result is far above the expectation.

	AVE	Composite Reliability	R Square	Cronbachs Alpha
COMP	0,912852	0,954441		0,904594
EXTINF	0,770606	0,870339		0,705185
INT	0,754836	0,860284	0,439827	0,675401
OBS	0,729632	0,841927		0,664270
PBC	0,819863	0,900995		0,781308
PEOU	0,748388	0,855978		0,666200
PU	0,862768	0,926329	0,586307	0,840963
RADV	0,806195	0,892697		0,759731
SUBN	0,879105	0,935661	0,245378	0,862785
TRUST	0,739917	0,850095	0,091161	0,657079
VOLUN	0,722332	0,837854		0,631632

Table 8: Overview of the reliability outcomes (Smart PLS v 2.0)

In Appendix B 2, the initial reliability outcomes are added, which represent our reliability results before the item TRUST2_13 were removed from the dataset. Comparing the initial results with the final reliability outcomes (represented in table 8), we can see that AVE increases from 0,5089 to 0,7399 and composite reliability also increases remarkably from 0,7283 to 0,8501. These improvements show that the removal of the item has been a good choice.

Furthermore, to test for discriminant validity we start checking the correlations. The square root of every AVE is supposed to be larger than the correlation of the specific construct with any of the other constructs in the model (Gefen and Straub, 2005). The square root of the AVE is obtained by calculating this for each variable separately. We used the obtained AVE results from the convergent validity test (see Table 8).

	AVE Squared Root
COMP	0,9554
EXTINF	0,8779
INT	0,9275
OBS	0,8541
PBC	0,9055
PEOU	0,8650
PU	0,9288
RADV	0,8979
SUBN	0,9377
TRUST	0,8602
VOLUN	0,8499

Table 9: AVE Square root calculations

Comparing AVE squared root calculations (Table 9) and the latent variable correlations (Table 10), it is clear that the model fits the first condition of discriminant validity testing. All correlation have values that are lower than the AVE squared root.

	COMP	EXTINF	INT	OBS	PBC	PEOU	PU	RADV	SUBN	TRUST	VOLUN
COMP	1,000000										
EXTINF	0,337417	1,000000									
INT	0,456683	0,209329	1,000000								
OBS	0,461986	0,207502	0,408725	1,000000							
PBC	0,445741	0,189574	0,427747	0,580187	1,000000						
PEOU	0,392832	0,146882	0,355887	0,448470	0,724001	1,000000					
PU	0,654112	0,240780	0,589028	0,413940	0,461264	0,452212	1,000000				
RADV	0,624614	0,281261	0,453002	0,502280	0,454327	0,325602	0,644255	1,000000			
SUBN	0,388920	0,495356	0,353461	0,194819	0,244947	0,154918	0,298015	0,393912	1,000000		
TRUST	0,481628	0,284102	0,401616	0,419674	0,395216	0,301929	0,572333	0,548228	0,286017	1,000000	
VOLUN	0,195897	0,179240	0,382002	0,226858	0,247841	0,285070	0,317208	0,264715	0,121032	0,338540	1,000000

Table 10: Latent variable correlations (Smart PLS v. 2.0)

To assess the second condition of discriminant validity the outer loading of each indicator must be greater in its LV and lower in the other variables. Again, we make use of the table cross loadings (Table 7 on page 45) and search for outer loading variables of other variables that exceed the LV. We analyzed each row (horizontally) separate and did not find outer loading of other variables that exceeded the outer loading of the LVs. Because of this, the second condition of discriminant validity is also satisfied.

Also, the indicators used in our model are tested on their significance level (5%) by bootstrapping. All values meet the expectation, because they are all above 1.96 (p-value of 0,05) and 2.58 (p-value of 0,01). Item 'OBS1_15' has the lowest score which is 4,7227.

	T-Value (|O/STERR|)	P-Value
COMP1_17 <- COMP	72,259226	< 0,01
COMP2_18 <- COMP	95,596737	< 0,01
EXTINF1_21 <- EXTINF	12,262192	< 0,01
EXTINF2_22 <- EXTINF	23,269125	< 0,01
INT1_27 <- INT	27,663280	< 0,01
INT2_28 <- INT	20,217634	< 0,01
OBS1_15 <- OBS	4,722697	< 0,01
OBS2_16 <- OBS	24,432695	< 0,01
PBC1_10 <- PBC	31,963099	< 0,01
PBC2_11 <- PBC	19,040790	< 0,01
PEOU1_8 <- PEOU	22,905824	< 0,01
PEOU2_9 <- PEOU	15,235225	< 0,01
PU1_6 <- PU	50,280393	< 0,01
PU2_7 <- PU	38,389366	< 0,01
RADV1_19 <- RADV	38,567696	< 0,01
RADV2_20 <- RADV	39,697575	< 0,01
SUBN1_23 <- SUBN	59,815662	< 0,01
SUBN2_24 <- SUBN	39,644169	< 0,01
TRUST1_12 <- TRUST	11,163412	< 0,01
TRUST3_14 <- TRUST	35,222977	< 0,01
VOLUN1_25 <- VOLUN	6,865349	< 0,01
VOLUN2_26 <- VOLUN	19,383015	< 0,01

Table 11: Significance test of the measurement model (Smart PLS v. 2.0)

5.3.2 Testing the structural model

Path coefficients can be obtained by running the PLS algorithm (as in Fig. 18) or by printing a report as shown below.

	INT	PU	SUBN	TRUST
COMP		0,321783		
EXTINF			0,495356	
INT				
OBS		-0,060495		
PBC	0,179239			
PEOU	-0,042972	0,191241		0,301929
PU	0,418369			
RADV		0,295694		
SUBN	0,170817	-0,027447		
TRUST	-0,012486	0,230744		
VOLUN	0,200672			

Table 12: Path coefficients (Smart PLS v. 2.0)

These results represent the relations between the constructs in our research model, which we have formulated into hypotheses (Chapter 3). T-statistic tests should show whether these result are significant or not.

Negative relations occur four times in between the relationships: Perceived Ease of Use → Intention to Use, Trust → Intention to use, Observability → Perceived Usefulness and Subjective Norm → Perceived Usefulness. The corresponding values are -0,0430, -0,0124, -0,0605 and -0,0274 respectively. The remaining ten relationships show positive relations with each other. The highest path coefficients are remarkable in the relationships: External Influence → Subjective Norm and Perceived Usefulness → Intention to Use, which are 0,4954 and 0,4184 respectively. In order, the relations Compatibility → Perceived Usefulness (0,3218), Perceived Ease of Use → Trust (0,3019) and Relative advantage → Perceived usefulness (0,2957) show positive moderate relations with each other. The path Subjective Norm → Intention to Use has the lowest positive coefficient (0,1708), while Perceived behavioral control and voluntariness have a slight better correlation with intention to us, which is also weak (0,1792 and 0,2007 respectively). Trust → Perceived Usefulness is higher correlated (0,2307) but is also considered as weak positive correlation. Finally, Perceived ease of use has also a weak positive correlation with Perceived Usefulness (0,1912).

Whether the positive or negative relations represent an adequate significant effect, can be determined after using bootstrap in Smart PLS. We measured these statistics as standardized as coefficients. All

According to the results from Table 13, five relations do not pass the significance test: Observability → Perceived Ease of Use, Perceived Behavioral Control → Intention to Use, Perceived Ease of Use → Intention to Use, Subjective Norm → Perceived Usefulness and Trust → Intention to Use. These relations reflect respectively H7, H13, H3, H11 and H4, which can be rejected. The remaining coefficients all show positive relations in our model, which means that all other hypotheses are accepted.

	T-Value	P-Value
COMP -> PU	2,933318	< 0,01
EXTINF -> SUBN	5,649203	< 0,01
OBS -> PU	0,605335	-
PBC -> INT	1,102787	-
PEOU -> INT	0,344226	-
PEOU -> PU	2,041121	< 0,05
PEOU -> TRUST	2,715780	< 0,01
PU -> INT	4,656396	< 0,01
RADV -> PU	2,626883	< 0,01
SUBN-> INT	2,098845	< 0,05
SUBN -> PU	0,349332	-
TRUST -> INT	0,122505	-
TRUST -> PU	2,084717	< 0,05
VOLUN -> INT	2,135553	< 0,05

Table 13: Significance test of the structural model (Smart PLS v. 2.0)

5.4 Moderating effects

A moderator variable is a variable that alters the strength of the causal relationship between two constructs. In this section we test whether the variables race, gender, age, type of card, experience and the frequency of use have a moderating effect on the causal relationships (hypotheses). Our reason for choosing these variables is simply because the implementation of the OV-Chip card affects certain groups in a positive or negative way, and we think that using these variables we reflect the groups on the most proper way. By the first five questions in the questionnaire the variables gender, age, type of card, experience and the frequency of use are measured and the sixth variable race is measured by asking the origin of the respondent afterwards.

To check for moderating effects, we started splitting our main dataset into two separate samples for each variable. The variable race is split into natives and foreign, gender into males and females, age into young and old, type of OV-Chip card into personal and anonymous OV-Chip card, experience into low and high and frequency of use also into low and high.

To obtain our results we made use of the following formula (Hair, et all 1995):

$$t = (B_{sample\_1} - B_{sample\_2}) / \sqrt{(SE_{sample\_1}^2 + SE_{sample\_2}^2)}$$

- B_{sample_1} = unstandardized regression coefficient of sample 1
- B_{sample_2} = unstandardized regression coefficient of sample 2
- SE_{sample_1} = standard deviation of B_{sample_1}
- SE_{sample_2} = standard deviation of B_{sample_2}

The significant results after our calculations are shown in table 14. We can conclude that all variables have a significant moderating effect on the relationships. Some of the results are expected, while others are not so evident. At first sight, it is remarkable that the experience moderator influences five and frequency of use four relationships, which means that experience is an important factor in our research. We discuss the results from table 14 in more depth:

On the relationship 'Subjective norm → Intention to use' we see that the effect of race is stronger for natives than foreign OV-Chip card users. An explanation can be that foreign OV-Chip card users have a lower intention to use the OV-Chip because of external factors, which are not tested in our model. Based on the moderator variable gender, on the relationship 'PEOU → PU' we can conclude that females have a much stronger effect than males. Age has an obvious weakening effect for the older OV-Chip card user on the relationship 'Compatibility → Perceived Usefulness'. This means that young users have much more the feeling that the OV-Chip card is compatible with their style and habits and otherwise, older users do not know what they have to expect from new technology. On the relationship 'Relative advantage → Perceived Usefulness' the older group OV-Chip card users score

much higher. This is a little bit in contrast with the expectations, but an explanation could be that older people started earlier using an OV-Chip card, which means that they probably are more experienced.

Type of card used, is another variable that has significant moderating effects on two causal relationships. On the relationship 'Perceived Behavioral Control' it is remarkable that anonymous card users have a stronger effect than the personal card users (student OV- chip cards are included here). An explanation should be that anonymous OV-Chip card users are much more aware of the transactions and have much more control over it. In turn, reason for this could be that anonymous OV-chip cards do not have the option of automatic reloads by bank. Next to this relationship, on the relationship 'Perceived ease of Use → Perceived Usefulness' we can see that anonymous users have a stronger effect.

As mentioned before, the moderator experience affects the most relationships (5) in our research. On the relationship 'External influence → Subjective Norm' we can conclude that the more experienced users have a weaker effect. Again, on the relationship 'Perceived Behavioral Control → Intention to Use' the more experienced users group has a weaker effect. An explanation can be that the low experienced OV-Chip card users have higher expectations than more experienced users. Experience has also a moderating effect on the relationships 'Perceived Ease of use → Perceived Usefulness'. The more experienced the OV-Chip card users, the stronger the effect on the relationship. This reconfirms the relationship between the two constructs that are defined by Davis (Davis, 1989). The third relationship that is influenced by the moderating variable experience is 'Relative Advantage → Perceived Usefulness'. The low experienced group have a stronger effect than more experienced users. This again, can be explained by the fact that low experienced OV-Chip card users expect much more from the system, while the high experienced users know how the real situation is. The fifth and last relationship, which is significant and moderated by experience is 'Trust → Perceived Usefulness'. Remarkably, the high experienced users trust the OV-Chip card much more than the low experienced users.

The final moderating variable that has a significant effect on our causal relationships is frequency of use. On the relationship 'Compatibility → Perceived Usefulness' the more frequent OV-Chip card users have a stronger effect. This means that they feel that the card fits their lifestyle, which makes sense, because people who do not have that feeling seek for alternatives. Based on the relationship 'Perceived behavioral control → Intention to use' low use of the OV-Chip card has an obvious stronger effect. This can be explained by the fact that the lower the use, the more control one has over the card (their account balance). On the relationship, 'Perceived Ease of Use → Intention to Use' more frequent users have a stronger effect. Reason can be that users who have a low frequency of use make more use of alternatives. The final relationship that is affected by the moderator frequency of use is 'Trust → Intention to Use'. The more the frequency of use, the more trust in the system.

Moderator	*Relationship*	*Group 1*		*Group 2*		*Significance*	
		B	*St. dev.*	*B*	*St. dev.*	*T-Value*	*P-Value*
Race							
group 1 = Native group 2 = Foreign	SUBN -> INT	0,343	0,082	0,044	0,083	2,563	*<0,05*
Gender							
group 1 = Male group 2 = Female	PEOU -> PU	-0,040	0,109	0,243	0,076	-2,130	*<0,05*
Age							
group 1 = Young group 2 = Old	COMP -> PU	0,423	0,103	0,053	0,106	2,503	*<0,05*
	RADV -> PU	0,132	0,085	0,599	0,137	-2,897	*<0,01*
Type of card							
group 1 = Personal group 2 = Anonymous	PBC -> INT	-0,004	0,174	0,455	0,155	1,970	*<0,05*
	PEOU -> PU	0,298	0,081	0,038	0,081	2,270	*<0,05*
Experience							
group 1 = Low group 2 = High	EXTINF-> SUBN	0,622	0,075	0,360	0,088	2,266	*<0,05*
	PBC -> INT	0,555	0,177	0,025	0,133	2,394	*<0,05*
	PEOU -> PU	-0,006	0,088	0,313	0,078	-2,713	*<0,01*
	RADV -> PU	0,523	0,112	0,168	0,076	2,623	*<0,01*
	TRUST -> PU	0,037	0,107	0,342	0,098	-2,102	*<0,05*
Frequency of Use							
group 1 = Low group 2 = High	COMP -> PU	0,089	0,111	0,396	0,102	-2,037	*<0,05*
	PBC -> INT	0,738	0,155	0,034	0,174	3,021	*<0,01*
	PEOU -> INT	-0,425	0,148	0,047	0,121	-2,469	*<0,05*
	TRUST -> INT	-0,275	0,101	0,052	0,107	-2,222	*<0,05*

Table 14: Moderating effects

5.5 Chapter summary

In this chapter we started checking the reliability of the questions that are used for measuring the latent variables. After analyzing the outer loading results we decided to remove item 'TRUST2_13'. This item belongs to the latent variable trust and scored far below the expectation. After removal all items passed the reliability tests.

To test the hypotheses we made use of the bootstrap method. Figure 15 gives an overview of the results. Five hypotheses are rejected, while the latent variables 'perceived behavioral control' and 'observability' do not play a role in our model.

Hypothesis	***Descriptive***	***Rejected/ Accepted***
H1	*Perceived Usefulness → Intention to Use*	*Accepted*
H2	*Perceived ease of Use → Perceived Usefulness*	*Accepted*
H3	*Perceived Ease Of Use → Intention to Use*	*Rejected*
H4	*Trust → Intention to Use*	*Rejected*
H5	*Perceived ease of Use → Trust*	*Accepted*
H6	*Trust → Perceived Usefulness*	*Accepted*
H7	*Observability → Perceived Usefulness*	*Rejected*
H8	*Compatibility → Perceived Usefulness*	*Accepted*
H9	*Relative Advantage → Perceived Usefulness*	*Accepted*
H10	*External Influence → Subjective Norm*	*Accepted*
H11	*Subjective Norm → Perceived Usefulness*	*Rejected*
H12	*Subjective Norm → Intention to Use*	*Accepted*
H13	*Perceived Behavioral Control → Intention to Use*	*Rejected*
H14	*Voluntariness of Use → Intention to Use*	*Accepted*

Table 15: Summary of hypotheses findings

After the hypotheses tests, we tested whether the variables race, gender, age, sex, experience and frequency of use have a moderating effect on the causal relationships between the latent variables. All variables have a significant moderating effect. The significant outcomes are shown in Table 14 and all results are attached to appendix B.

Chapter 6
– Conclusions –

6.1 Introduction

This chapter contains the conclusions for this research. In the following section (6.2) the main findings are discussed. Hereafter, the research limitations (6.3) are given followed by suggestions for further researches (6.4). Finally, we end with the research conclusion in section (6.5). In this part we answer the research questions.

6.2 Main Findings

This study integrates constructs from the Technology Acceptance Model, Diffusion of Innovation theory, trustworthiness models and some constructs from other known and verified theories and models, into an insightful model of OV-Chip card users` adoption in the Hague. We combined in this study theoretical and empirical research to answer the research questions that are formulated in the introduction part of this thesis (section 1.4). We started our research with a literature study where we gathered information on past researches on the implementation and adoption of the OV-Chip card in the Netherlands, known adoption theories/models from literature that have been verified and public transport organizations that currently serve in the Hague area. Simultaneously, during our working period at HTM Service desks observations in the field are collected and have been used in this research. After combining personal and external observations with the information that is found from the literature review, a research model is created and used as base for this research. Earlier research performed by Meijers is also used to develop the constructs of this model. Meijers stated that many factors influence the adoption of the OV-Chip card (Meijers 2009) (Section 2.3), but in their research a scientifically verified method is missing, however, many factors are useful for scientific research. In this research some factors mentioned by Meijers are used and measured by kind of similar constructs from verified theories or models. For instance, *satisfaction by the strippenkaart* is measured by the IDT construct 'relative advantage', *knowledge about the card* by the construct 'perceived behavioral control' (TPB), *Image of the public transport organization* by measuring the 'Trust' factor, *Judgment of information about the card* by the construct 'subjective norm' and *information by media* by 'external influence'. *User experience* is also a factor by Meijers, which is measured in this research. The factors *interest* and *expectations about the effect of the card* are not measured directly, because those are not matching with an existing verified construct.

In the research model relationships between two latent variables that are connected with each other are formulated into hypotheses, and these are tested in the analysis part. Before the final questionnaire is

conducted among a big sample, the preliminary questionnaire is tested among a smaller group of 12 OV-Chip card users. Each construct in the questionnaire is represented by two or three items (questions) and their reliability is checked in the data analysis. To analyze the data statistical analysis software program Smart PLS is used, which applies the SEM analysis technique and is free to use. Furthermore, statistical analysis software program SPSS is used to obtain descriptives about the sample. The research model and its relationships are redrawn in Smart PLS, which calculates all results simultaneously. To test the reliability of the questionnaire, convergent validity tests are applied. Hereafter, bootstrap showed whether the results are significant or not. The results indicated acceptable results after deleting one question from the 'trust' construct. Besides those tests, discriminant validity tests are ran to check whether the model fits well. From the fourteen hypotheses five are rejected: H3 (PEOU → INT), H4 (TRUST → INT), H7 (OBS → PU), H11 (SN → PU) and H13 (PBC → INT). Exact explanations for these unexpected results are hard to give. However, the hypotheses numbered H3, H4 and H13 were all expected to predict intention to use, we think that due to extreme force to make use of the OV-Chip card the majority has not an alternative to choose, and because of this perceived ease of use, trust and perceived behavioral control do not play a significant role in the adoption of the card. Next to this, we think that observability and subjective norm do not have a significant effect on perceived usefulness, because passengers imagine the goal of implementing the OV-Chip system in the Netherland, but the system is clearly not performing as it should do. Due to this passengers create an individual believe about the usefulness of the OV-Chip card, which is in contrast with the results of Meijers` research. After the hypotheses tests, we checked whether some proposed variables have a moderating effect on the causal relationships. The results show that the variables race, gender, age, sex, experience and frequency of use have significant moderating effects. Remarkably, moderator variables experience and frequency, together, affect 9 causal relationships.

6.3 Research Limitations

In this research we made use of a sample size that consists of 176 passengers who travel by public transport in the Hague area. This sample size is sufficient in relation to the research model and our constructs. According to Gefen, the sample size must be at least 10 times the number of items in the most complex construct (Gefen et al. 2000). This means that the number of items affect the sample size and in this research we often made use of two, or at most three items per construct, which is relatively low. However, each item is represented by a question in the questionnaire, which means that the more the items and the constructs, the longer the questionnaire should be. In order to maintain the interest of the respondents to fill in the questionnaires, the right balance must be found.

6.4 Suggestions for further research

Aim of the decision by the Dutch government to switch to the OV-Chip card system, while passengers are highly satisfied by the previous (strippenkaart) system is been to make nation-wide public transport (by metro, tram, bus and train) much more easier by simply using a smart card. As Meijers distinguishes different phases of implementation (Section 2.3) in the next phases of the implementation in this country further researches are suggested. In this research we limited our study to the area of the Hague short after the introduction of the OV-Chip card (and abolition of the previous public transport system) , but after nation-wide abolishment of the strippenkaart system, further research that represents the whole Netherlands is recommended. Furthermore, the influence of constructs that are omitted (or could be relevant) in this research should be tested. For instance, the construct 'Perceived financial costs' is omitted, but after a certain period when people are more familiar with the OV-Chip card system (and understand that they often value the system as expensive because of their missing checkouts) the effect of this construct can be tested properly.

6.5 Research Conclusions

OV-Chip card adoption studies in the Netherlands are very rare. In this research we studied OV-Chip card adoption in The Hague, the Netherlands. We based our research on the question:

- *Which factors influence adoption by (current and potential) users to make use of an OV-Chip card in The Hague area?*

Except one respondent, all respondents have experienced the OV-Chip card for at least 1 month. According to the results that are obtained from data analyses the constructs 'External influence', 'Subjective Norm', 'Relative advantage', 'Compatibility', 'Trust', 'Perceived Usefulness' and 'Perceived ease of use' are factors that affect the adoption of OV-Chip card users in The Hague and surroundings. 'Subjective Norm' and 'Perceived Usefulness' both have a direct influence on the 'Intention to Use' the OV-Chip card, while all other factors mentioned have an indirect influence. Race, gender, age, type of card, experience and frequency of use are moderator variables. The results obtained by moderator variables experience and frequency of use indicate that both play a big role in the adoption process. However, it should be noted that research results may be affected due to research limitations.

Most remarkable regarding our results is that 'perceived behavioral control' and 'observability' do not play a role in the adoption of the OV-Chip card. This is in contrast with the literature reviews and the observations. OV-Chip card users often emphasize that personal knowledge and control over the OV-

Chip card among users are both limited and observing others while they make use of an OV-Chip card has both positive and negative advantages.

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Appendix A Questionnaire

Dear Sir/Madam,

From 19th of May 2011, all public transport organizations in the province of Zuid-Holland do not accept travels by tickets (strippenkaart) anymore. Currently, a study on the Erasmus University takes place about the new travelling method in this province, the OV-Chip card. In this study we would like to measure OV-Chip card adoption among (current and potential) users who make use of the card in the area of The Hague. This will be measured through surveys, which will be taken at HTM service points (their main office at Wagenstraat 35, Servicedesks at Central Station and Station Holland Spoor) in the area. I would like to invite you to participate. Approximately this survey will take 5 - 10 minutes. Please be assured that your responses will be kept confidential.

Thank you for your time and participation!

1. What is your gender? ☐ Male ☐ Female

2. What is your age? …..

3. What kind of OV-Chip card do you use?

☐ I don`t use OV-Chip card at all ☐ Anonymous OV-Chip card

☐Personal OV-Chip card ☐ Student OV-Chip card

4. When did you start using OV-Chip card?

☐ I don`t use OV Chip card at all ☐ less than a month ago ☐ 1 - 2 months ago (± may 19th)

☐ 2 to 5 months ago ☐ 6 to 12 months ago ☐ 1 to 1, 5 year ago

☐ more than 1,5 year ago

5. On the average, how often do you use OV-Chip card (count per single trip)?

☐ I don`t use OV-Chip card at all ☐ less than 2 times a month ☐ about once a week

☐ 2 - 10 times a week ☐ at least 10 times a week

This next part consists of beliefs and perceptions related to OV Chipcard. Please indicate the extent to which you like or unlike with each statement.

Perceived usefulness:

6. Using OV-Chip card would make it easier to travel by public transport

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

7. I would find OV-Chip card useful for travelling by public transport

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Perceived Ease of Use

8. Learning to operate OV-Chip card is easy for me

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

9. My interaction with OV-Chip card is clear and understandable

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Perceived Behavioral Control

10. I have control over using the OV-Chip card

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

11. I have the knowledge necessary to use OV-Chip card

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Trust

12. Based on my experience with the organization in the past, I know it cares about customers

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

13. I think that using OV-Chip card will not disclose my account and personal information

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

14. OV-Chip card is a trustworthy ticket provider

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Observability

15. I would have no difficulty telling others about the results of using an OV-Chip card

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

16. The results of using an OV-Chip card are apparent to me

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Compatibility

17. Using OV-Chip card is compatible with my style and habits

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

18. I think that using OV-Chip card fits well with the way I like to make use of public transport

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Relative advantage

19. The advantages of my using the OV-Chip card far outweigh the disadvantages

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

20. Using OV-Chip card enables me to accomplish tasks more quickly (checking in and out is much faster)

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

External influence

21. Media is full of reports, articles and news suggesting using OV-Chip card is a good idea

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

22. Media and advertising consistently recommend using OV-Chip card

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Subjective Norm

23. People whose opinion I value prefer me to use OV-Chip card

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

24. People around me have encouraged me to use OV-Chip card

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Voluntariness

25. Although it might be helpful, using an OV-Chip card is certainly not compulsory for transportation

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

26. My use of OV-Chip card is voluntary

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Intention to use

27. I will definitively keep using OV-Chip card

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

28. I expect that public transport organizations will make everything easier in the near future

Unlikely |_____|_____|_____|_____|_____|_____|_____| *Likely*
Extremely Quite Slightly Neither Slightly Quite Extremely

Thanks again for your time and filling in this questionnaire!!

Appendix B Statistics

In this part several statistics are presented, which are important in this research

1. Distribution of Age (by SPSS v. 19)

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
15	2	1,1	1,1	1,1
16	2	1,1	1,1	2,3
17	3	1,7	1,7	4,0
18	3	1,7	1,7	5,7
19	5	2,8	2,8	8,5
20	6	3,4	3,4	11,9
21	3	1,7	1,7	13,6
22	10	5,7	5,7	19,3
23	8	4,5	4,5	23,9
24	8	4,5	4,5	28,4
25	4	2,3	2,3	30,7
26	10	5,7	5,7	36,4
27	2	1,1	1,1	37,5
28	3	1,7	1,7	39,2
29	4	2,3	2,3	41,5
30	1	,6	,6	42,0
31	4	2,3	2,3	44,3
32	2	1,1	1,1	45,5
33	2	1,1	1,1	46,6
35	4	2,3	2,3	48,9
37	2	1,1	1,1	50,0
38	3	1,7	1,7	51,7
39	1	,6	,6	52,3
40	4	2,3	2,3	54,5
41	1	,6	,6	55,1
42	6	3,4	3,4	58,5
43	5	2,8	2,8	61,4
44	4	2,3	2,3	63,6
45	2	1,1	1,1	64,8
47	2	1,1	1,1	65,9
48	1	,6	,6	66,5

49	2	1,1	1,1	67,6
50	2	1,1	1,1	68,8
51	2	1,1	1,1	69,9
52	3	1,7	1,7	71,6
53	3	1,7	1,7	73,3
54	1	,6	,6	73,9
55	2	1,1	1,1	75,0
56	1	,6	,6	75,6
57	2	1,1	1,1	76,7
58	3	1,7	1,7	78,4
59	1	,6	,6	79,0
60	2	1,1	1,1	80,1
61	2	1,1	1,1	81,3
62	3	1,7	1,7	83,0
63	3	1,7	1,7	84,7
64	2	1,1	1,1	85,8
65	4	2,3	2,3	88,1
67	2	1,1	1,1	89,2
68	3	1,7	1,7	90,9
69	2	1,1	1,1	92,0
70	1	,6	,6	92,6
71	1	,6	,6	93,2
73	2	1,1	1,1	94,3
74	2	1,1	1,1	95,5
75	2	1,1	1,1	96,6
77	1	,6	,6	97,2
78	2	1,1	1,1	98,3
83	1	,6	,6	98,9
85	1	,6	,6	99,4
87	1	,6	,6	100,0
Total	176	100,0	100,0	

2. Initial reliability outcomes (before removing item TRUST2_13) by SmartPLS

	AVE	Composite Reliability	R Square	Cronbachs Alpha
COMP	0,912852	0,954441		0,904594
EXTINF	0,770606	0,870339		0,705185
INT	0,754833	0,860282	0,439757	0,675401
OBS	0,729637	0,841931		0,664270
PBC	0,819863	0,900995		0,781308
PEOU	0,748148	0,855801		0,666200
PU	0,862770	0,926330	0,587597	0,840963
RADV	0,806195	0,892697		0,759731
SUBN	0,879106	0,935661	0,245378	0,862785
TRUST	0,508949	0,728257	0,091100	0,484581
VOLUN	0,722332	0,837854		0,631632

3. Moderator effects

Moderator	Relationship	Group 1		Group 2		Significance	
		B	St. dev.	B	St. dev.	T-Stats	P-Value
Race	COMP -> PU	0,289	0,079	0,416	0,126	-0,854	*NO*
	EXTINF-> SUBN	0,475	0,109	0,480	0,063	-0,040	*NO*
	OBS -> PU	-0,009	0,072	-0,140	0,117	0,954	*NO*
	PBC -> INT	0,446	0,185	0,084	0,118	1.650	*NO*
	PEOU -> INT	-0,207	0,146	0,011	0,098	-1,240	*NO*
	PEOU -> PU	0,234	0,076	0,139	0,111	0,706	*NO*
	PEOU -> TRUST	0,344	0,109	0,246	0,110	0,632	*NO*
	PU -> INT	0,377	0,110	0,492	0,082	-0,838	*NO*
	RADV -> PU	0,281	0,087	0,245	0,115	0,250	*NO*
	SUBN -> INT	0,343	0,082	0,044	0,083	2,563	*<0,05*
	SUBN -> PU	-0,109	0,072	0,031	0,080	-1,301	*NO*
group 1 = Native	TRUST -> INT	-0,214	0,109	0,050	0,098	-1,801	*NO*
group 2 = Foreign	TRUST -> PU	0,317	0,097	0,170	0,117	0,967	*NO*
	VOLUN -> INT	0,196	0,074	0,229	0,100	-0,265	*NO-*

Moderator	Relationship	Group 1		Group 2		Significance	
		B	St. dev.	B	St. dev.	T-Stats	P-Value
Gender	COMP -> PU	0,389	0,117	0,270	0,097	0,783	*NO*
	EXTINF-> SUBN	0,467	0,083	0,527	0,088	-0,496	*NO*
	OBS -> PU	-0,159	0,118	-0.012	0,080	-1,031	*NO*
	PBC -> INT	0,284	0,159	0,097	0,195	0,743	*NO*
	PEOU -> INT	0,095	0,116	-0,144	0,165	1,185	*NO*
	PEOU -> PU	-0,040	0,109	0,243	0,076	-2,130	*<0,05*
	PEOU -> TRUST	0,431	0,094	0,204	0,125	1,451	*NO*
	PU -> INT	0,364	0,093	0,467	0,096	-0,771	*NO*
	RADV -> PU	0,358	0,127	0,245	0,091	0,723	*NO*
	SUBN -> INT	0,149	0,078	0,199	0,089	-0,423	*NO*
	SUBN -> PU	-0,083	0,075	0,019	0,073	-0,975	*NO*
group 1 = Male	TRUST -> INT	-0,040	0,115	-0,017	0,119	-0,139	*NO*
group 2 = Female	TRUST -> PU	0,191	0,130	0,288	0,084	-0,627	*NO*
	VOLUN -> INT	0,123	0,069	0,097	0,097	0,218	*NO-*

Moderator	Relationship	Group 1		Group 2		Significance	
		B	St. dev.	B	St. dev.	T-Stats	P-Value
Age	COMP -> PU	0,423	0,103	0,053	0,106	2,503	*<0,05*
	EXTINF-> SUBN	0,416	0,087	0,571	0,090	-1,238	*NO*
	OBS -> PU	-0,027	0,090	-0,062	0,089	0,277	*NO*
	PBC -> INT	0,071	0,142	0,465	0,161	-1,835	*NO*
	PEOU -> INT	-0,002	0,105	-0,213	0,149	1,158	*NO*
	PEOU -> PU	0,174	0,097	0,265	0,084	-0,709	*NO*
	PEOU -> TRUST	0,280	0,102	0,392	0,107	-0,758	*NO*
	PU -> INT	0,476	0,083	0,353	0,120	0,843	*NO*
	RADV -> PU	0,132	0,085	0,599	0,137	-2,897	*<0,01*
	SUBN -> INT	0,097	0,085	0,263	0,073	-1,482	*NO*
	SUBN -> PU	0,022	0,080	-0,040	0,077	0,558	*NO*
group 1 = Young	TRUST -> INT	-0,011	0,104	-0,072	0,112	0,399	*NO*
group 2 = Old	TRUST -> PU	0,266	0,117	0,111	0,106	0,982	*NO*
	VOLUN -> INT	0,243	0,096	0,169	0,084	0,580	*NO-*

Moderator	Relationship	Group 1		Group 2		Significance	
		B	St. dev.	B	St. dev.	T-Stats	P-Value
Type of card	COMP -> PU	0,286	0,087	0,433	0,108	-1,060	*NO*
	EXTINF-> SUBN	0,543	0,090	0,372	0,074	1,468	*NO*
	OBS -> PU	-0,157	0,085	0,004	0,090	-1,301	*NO*
	PBC -> INT	-0,004	0,174	0,455	0,155	1,970	*<0,05*
	PEOU -> INT	-0,022	0,136	-0,184	0,129	0,864	*NO*
	PEOU -> PU	0,298	0,081	0,038	0,081	2,270	*yes*
	PEOU -> TRUST	0,375	0,096	0,176	0,119	1,302	*NO*
	PU -> INT	0,453	0,109	0,396	0,102	0,382	*NO*
	RADV -> PU	0,300	0,109	0,332	0,087	-0,230	*NO*
	SUBN -> INT	0,206	0,090	0,198	0,070	0,070	*NO*
	SUBN -> PU	-0,038	0,076	0,000	0,065	-0,380	*NO*
group 1 = Personal	TRUST -> INT	0,017	0,107	0,019	0,100	-0,014	*NO*
group 2 = Anonymous	TRUST -> PU	0,274	0,109	0,155	0,085	0,861	*NO*
	VOLUN -> INT	0,182	0,103	0,166	0,062	0,133	*NO-*

Moderator	Relationship	Group 1		Group 2		Significance	
		B	St. dev.	B	St. dev.	T-Stats	P-Value
	COMP -> PU	0,304	0,123	0,304	0,083	0,000	*NO*
	EXTINF-> SUBN	0,622	0,075	0,360	0,088	2,266	*<0,05*
	OBS -> PU	-0,012	0,105	-0,065	0,082	0,398	*NO*
Experience	PBC -> INT	0,555	0,177	0,025	0,133	2,394	*<0,05*
	PEOU -> INT	-0,286	0,142	-0,009	0,103	-1,579	*NO*
	PEOU -> PU	-0,006	0,088	0,313	0,078	-2,713	*<0,01*
	PEOU -> TRUST	0,296	0,116	0,366	0,081	-0,495	*NO*
	PU -> INT	0,379	0,103	0,465	0,101	-0,596	*NO*
	RADV -> PU	0,523	0,112	0,168	0,076	2,623	*<0,01*
	SUBN -> INT	0,224	0,083	0,178	0,086	0,385	*NO*
group 1 = Low	SUBN -> PU	0,012	0,072	-0,015	0,065	0,278	*NO*
group 2 = High	TRUST -> INT	-0,147	0,095	0,053	0,111	-1,369	*NO*
	TRUST -> PU	0,037	0,107	0,342	0,098	-2,102	*<0,05*
	VOLUN -> INT	0,125	0,072	0,216	0,094	-0,769	*NO-*

Moderator	Relationship	Group 1		Group 2		Significance	
		B	St. dev.	B	St. dev.	T-Stats	P-Value
	COMP -> PU	0,089	0,111	0,396	0,102	-2,037	*<0,05*
	EXTINF-> SUBN	0,565	0,093	0,471	0,079	0,770	*NO*
	OBS -> PU	-0,170	0,091	-0,042	0,090	-1,000	*NO*
Frequency of Use	PBC -> INT	0,738	0,155	0,034	0,174	3,021	*<0,01*
	PEOU -> INT	-0,425	0,148	0,047	0,121	-2,469	*<0,05*
	PEOU -> PU	0,325	0,070	0,128	0,094	1,681	*NO*
	PEOU -> TRUST	0,475	0,102	0,236	0,113	1,570	*NO*
	PU -> INT	0,490	0,116	0,430	0,084	0,419	*NO*
	RADV -> PU	0,326	0,108	0,302	0,108	0,157	*NO*
	SUBN -> INT	0,173	0,079	0,146	0,090	0,225	*NO*
	SUBN -> PU	-0,129	0,091	0,033	0,066	-1,441	*NO*
group 1 = Low	TRUST -> INT	-0,275	0,101	0,052	0,107	-2,222	*<0,05*
group 2 = High	TRUST -> PU	0,361	0,120	0,202	0,089	1,064	*NO*
	VOLUN -> INT	0,143	0,090	0,210	0,109	-0,474	*NO-*